

**Intersectional Gender Analysis Approach on Women's
Empowerment and Food Security: A Case Study from Uganda**

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Abstract

Even before the COVID-19 pandemic, the world was not on track to achieve Zero Hunger by 2030 with one quarter (25.4%) of the world's population facing moderate or severe food insecurity. By 2021, a year after COVID-19 pandemic spread across the globe, the prevalence of food insecurity had increased to 29.3%. Similarly, the existing gender gap in food insecurity before the pandemic continued to increase worldwide during the pandemic. As a result of gender inequality and discrimination, women and girls were disproportionately affected by unequal patterns of economic recovery imposed during the pandemic. What is currently known about food security and gender is primarily based on empirical studies assessing the relationship between women's empowerment and food security. Although empirical evidence is growing, it is still inconclusive. Understanding how gender power relations are constituted and negotiated within the household and community can help uncover complex gender dynamics associated with the food security status of women and men, separately or jointly.

In this manuscript-based dissertation, secondary data sources at national, household, and individual levels were used. Although data were collected before the pandemic, research development and data analysis were conducted during the pandemic. To address the first objective, nationally representative Gallup World Poll data from 2019 were examined to determine the extent of gender differences in experiencing food insecurity at a macro level. An inaugural exploratory approach within an intersectionality framework was used to identify gender differences in experiencing food insecurity, and then the significance of such differences was tested. Results showed different layers of gender differences at socioeconomic positions and personal levels. Evidence affirmed the importance of including an intersectional lens when studying gender as a focal point in generating unequal experiences of food insecurity.

In the second objective, the focus shifted from macro to the micro-level. Gender was examined as a source of power relations at the individual and household levels assessing different experiences of food insecurity between women and men. Secondary data collected in six Ugandan fishing villages were analyzed, taking advantage of the larger gender- and nutrition-sensitive agriculture *NutriFish* project that was focused on gender and food security issues within the fish value chain. *NutriFish* data were collected in January/February 2020 using a cross-sectional household survey called the project-level Women's Empowerment in Agriculture Index (pro-WEAI). The role of gender-sensitive indicators in facilitating and hindering women's and men's food security status was examined using an intersectional gender analysis framework in two different contexts: fishing and non-fishing groups. Results showed that the magnitude and significance of the association between the aggregated score of women's empowerment and the food security status of women and men changed depending on the empowerment status of men in the household. An analysis of the associations between different domains of empowerment and food security revealed different patterns between and among women and men in fishing and non-fishing groups. Although results were mixed, most associations favoured improved food security outcomes in the domain of social norms and beliefs.

Drawing insights from the importance of women's empowerment in improving food security, the role of nutrition-sensitive indicators in this association were assessed in the third objective. Moreover, the linkages between women's empowerment in agriculture and women's agency in nutrition were examined. Results showed a lack of association between aggregated measures of women's empowerment and various indicators of women's agency in nutrition. Women's agency on food purchase strengthened the positive association between women's empowerment in agriculture and food security.

The results of this doctoral dissertation uniquely contribute to the current knowledge on the nexus of food security, gender, and women's empowerment. The analytical approach constituted a first attempt to conduct a gender analysis within an intersectionality framework to highlight the context-specific complexity of gender relations at various levels. Results suggested that promoting women's food purchase agency preceding other interventions can become an effective strategy for improving food security in future nutrition-sensitive programs. Results further confirmed those of previous studies about the importance of using gender transformative approaches (GTAs), namely sociocultural determinants, when striving for enduring long-term food security improvements in agricultural development programs. Regarding policy action on food security inequities, this research can support comprehensive policies integrating equity-based strategies to tackle food insecurity, especially considering the extra, lingering burden imposed by the COVID-19 pandemic.

Résumé

Même avant la pandémie de COVID-19, le monde n'était pas sur la bonne voie pour atteindre l'objectif Faim Zéro d'ici 2030, avec 25.4% de la population mondiale confrontée à une insécurité alimentaire modérée ou grave. Depuis 2020, année où la pandémie de COVID-19 s'est propagée à travers le monde, la prévalence de l'insécurité alimentaire est passée à 29.3% en 2021. De même, l'écart existant entre les sexes en matière d'insécurité alimentaire avant la pandémie a continué d'augmenter dans le monde entier pendant la pandémie. En raison de l'inégalité et de la discrimination entre les sexes, les femmes et les filles ont été touchées de manière disproportionnée par les modèles inégaux de reprise économique imposés pendant la pandémie. Les connaissances actuelles sur la sécurité alimentaire et le genre reposent principalement sur des études empiriques évaluant la relation entre l'autonomisation des femmes et la sécurité alimentaire. Bien que les preuves empiriques se multiplient, elles ne sont toujours pas concluantes. Comprendre comment les relations de pouvoir entre les sexes sont constituées et négociées au sein du ménage et de la communauté peut aider à découvrir des dynamiques de genre complexes associées à l'état de la sécurité alimentaire des femmes et des hommes, séparément ou conjointement.

Dans cette thèse constituée de trois manuscrits, des sources de données secondaires aux niveaux national, des ménages et des individus ont été utilisées. Bien que les données aient été recueillies avant la pandémie, le développement de la recherche et l'analyse des données ont été effectués pendant la pandémie. Pour répondre au premier objectif, des données représentatives au niveau national du Gallup World Poll de 2019 ont été examinées afin de déterminer l'étendue des différences entre les sexes en matière d'insécurité alimentaire au niveau macro. Une approche exploratoire inaugurale dans un cadre d'intersectionnalité a été utilisée pour identifier les

différences entre les sexes dans l'expérience de l'insécurité alimentaire, puis la signification de ces différences a été testée. Les résultats ont montré différentes couches de différences entre les sexes aux positions socio-économiques et aux niveaux personnels. Les preuves ont confirmé l'importance d'inclure une lentille intersectionnelle lors de l'étude du genre en tant que point focal dans la génération d'expériences inégales d'insécurité alimentaire.

Dans le deuxième objectif, l'attention s'est déplacée du niveau macro vers le niveau micro. Le genre a été examiné en tant que source de relations de pouvoir aux niveaux individuel et familial en évaluant différentes expériences d'insécurité alimentaire entre les femmes et les hommes. Les données secondaires recueillies dans six villages de pêcheurs ougandais ont été analysées, en tirant parti du projet NutriFish d'agriculture sensible au genre et à la nutrition, qui était axé sur les questions de genre et de sécurité alimentaire au sein de la chaîne de valeur du poisson. Les données de NutriFish ont été recueillies en janvier/février 2020 à l'aide d'une enquête transversale auprès des ménages appelée l'indice d'autonomisation des femmes dans l'agriculture au niveau du projet (pro-WEAI). Le rôle des indicateurs sensibles au genre dans la facilitation et l'entrave de l'état de la sécurité alimentaire des femmes et des hommes a été examiné à l'aide d'un cadre d'analyse intersectionnelle du genre dans deux contextes différents: les groupes de pêcheurs et les groupes non pêcheurs. Les résultats ont montré que l'ampleur et la signification de l'association entre le score agrégé d'autonomisation des femmes et l'état de sécurité alimentaire des femmes et des hommes changeaient en fonction de l'état d'autonomisation des hommes dans le ménage. Une analyse des associations entre les différents domaines de l'autonomisation et de la sécurité alimentaire a révélé des schémas différents entre et parmi les femmes et les hommes dans les groupes de pêcheurs et de non-pêcheurs. Bien que les résultats aient été mitigés, la plupart des associations ont favorisé l'amélioration des résultats

de la sécurité alimentaire dans le domaine des normes sociales et des croyances. Tirant des enseignements de l'importance de l'autonomisation des femmes dans l'amélioration de la sécurité alimentaire, le rôle des indicateurs sensibles à la nutrition dans cette association a été évalué dans le troisième objectif. De plus, les liens entre l'autonomisation des femmes dans l'agriculture et l'agence des femmes dans la nutrition ont été examinés. Les résultats ont montré un manque d'association entre les mesures agrégées de l'autonomisation des femmes et divers indicateurs de l'agence des femmes en matière de nutrition. L'agence des femmes pour l'achat de nourriture a renforcé l'association positive entre l'autonomisation des femmes dans l'agriculture et la sécurité alimentaire.

Les résultats de cette thèse de doctorat contribuent de manière unique aux connaissances actuelles sur le lien entre la sécurité alimentaire, le genre et l'autonomisation des femmes. L'approche analytique a constitué une première tentative d'effectuer une analyse de genre dans un cadre d'intersectionnalité pour mettre en évidence la complexité spécifique au contexte des relations de genre à différents niveaux. Les résultats suggèrent que la promotion de l'agence d'achat alimentaire des femmes avant d'autres interventions peut devenir une stratégie efficace pour améliorer la sécurité alimentaire dans les futurs programmes sensibles à la nutrition. Les résultats ont en outre confirmé ceux des études précédentes sur l'importance d'utiliser des approches transformatrices en matière de genre (ATG), à savoir les déterminants socioculturels, lorsque l'on s'efforce d'améliorer durablement la sécurité alimentaire dans les programmes de développement agricole. En ce qui concerne l'action politique sur les inégalités en matière de sécurité alimentaire, cette recherche peut soutenir des politiques globales intégrant des stratégies fondées sur l'équité pour lutter contre l'insécurité alimentaire, en particulier compte tenu du fardeau supplémentaire et persistant imposé par la pandémie de COVID-19.

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Dedication

This doctoral dissertation is dedicated to the brave Iranian people, especially women and girls,
who are facing a brutal regime in their quest for freedom.

For

Woman | Life | Freedom

Contribution to Original Knowledge

This dissertation provides theoretical and methodological contributions to the field of food security, gender, and women's empowerment. To date, the use of an intersectional gender approach in the food security literature is very limited. All manuscripts within this doctoral research project are among the first attempts to model intersectionality through testing interaction effects.

Within the literature review (Chapter 2), a standalone literature review manuscript was included (no manuscript number). The intent was to critically review the potential barriers and challenges in the pathways from women's empowerment to food security. This final review ($N=15$ articles) contributed to the overarching literature on women's empowerment and food security in Low and Middle-Income Countries by pinpointing a gap in conceptualizing and operationalizing food security and women's empowerment at different stages of agricultural development programs. Informed by the results of this extensive literature review, the candidate aimed to use this review to help identify and test gender differences in experiencing food security inequities within the intersectionality framework set out in Chapter 4.

The results of Manuscript 1 (Chapter 4) contributed to the current knowledge on the nexus of food security, gender, and equity and were guided by the Social Determinants of Health (SDH) framework. The analytical approach in this chapter went beyond identifying gender differences in experiencing food security. The candidate further quantified and tested the significance of gender differences in experiencing food insecurity. There is knowledge of no study in this area that has modelled gender differences between and within the underlying factors applying an intersectionality framework.

In Manuscript 2 (Chapter 5), the candidate conducted a gender analysis within an intersectionality framework to highlight the context-specific complexity of gender power relations. In so doing, the gendered and context-specific determinants of food insecurity were addressed, emphasizing tailored recommendations for the studied population. The study confirmed the findings of previous research about the importance of context-specific and multi-domain approaches, namely sociocultural determinants, to accurately measure gender dynamics and empowerment phenomena.

The analytical approach in Manuscript 2 (Chapter 5) accounted for the moderating effect of men's and women's empowerment on their food security status and tested the differences between patterns of intrahousehold empowerment. In addition to analyzing the aggregated empowerment score, the candidate investigated the disaggregated score to underline the differences between and among men and women. Previous studies have pointed out the prominence of assessing aggregated and disaggregated empowerment status in directing the interventions and policies in a way that does not cause unintended consequences and worsen existing gender inequalities. There has been little quantitative analysis of gender power relations on food security of men and women, particularly within the intersectionality framework. This was the first study using this approach in analyzing food security.

Manuscript 3 (Chapter 6) uncovered and identified the obstacles to women's agency in nutrition. The study provided additional evidence on the importance of assessing all 12 indicators of empowerment instead of focusing on top contributors to women's disempowerment in agriculture. Moreover, the results provided additional evidence with respect to the moderating effect of women's agency in nutrition in the association from women's empowerment in agriculture to food security.

Whereas the doctoral supervisors and co-authors provided substantive methodological and technical guidance, the conception, execution, and writing of this dissertation and its manuscripts are the original work of the candidate.

Published Abstracts

- **Barak, F.,** & Melgar-Quinonez, H. (2022). Gendered Determinants of Food Security Inequities Within Intersectionality Framework: a case study from Uganda. *Current developments in nutrition*, 6(Supplement_1), 548-548.
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Conference Presentations

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Contribution of Authors

This doctoral dissertation is a manuscript-based format in accordance with the Guidelines Concerning Thesis Preparation stipulated by McGill University; therefore, there is some repetition in the text. For all chapters, **Farzaneh Barak** is the primary author. **Hugo Melgar-Quíñonez**, **Peace Musiimenta**, **Jackson Efitre**, and **Robinson Odong** co-authored Chapters 4–6 (manuscripts 1, 2, and 3, respectively). As the first author, Farzaneh Barak designed the conception and development of the overall research plan, analyzed and interpreted the data, and wrote the first draft in all manuscripts.

Hugo Melgar-Quíñonez provided academic supervision, intellectual input, methodological and theoretical guidance, and writing support for all chapters.

Peace Musiimenta assisted with integrating local context in interpreting the results, conceptualizing the analytical approach, and writing support in Manuscript 1.

Jackson Efitre, the Principal Investigator (PI) of the NutriFish project, and **Robinson Odong**, the co-investigator (Co-I) in the NutriFish project, adapted the Project-level Women's Empowerment in Agriculture Index (pro-WEAI) questionnaire to the objectives of the NutriFish project, supervised data collection, and provided pro-WEAI data available for use in this doctoral dissertation, Manuscripts 2 and 3.

All authors read and approved the final manuscripts. All co-authors granted permission to reproduce the manuscripts in this dissertation; they will be submitted to agreed target journals for publication.

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List of Abbreviations

3DE	Three Domains of Empowerment
5DE	Five Domains of Empowerment
ANH	Agriculture, nutrition, and health
DHHs	Households with both a male and female adult
DHS	Demographic and Health Survey
ELCSA	Latin American and Caribbean Food Security Scale
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Association
FCS	Food Consumption Score
FDGs	Focus Group Discussions
FHHs	Female-adult-only households
FIES	Food Insecurity Experience Scale
FIES-SM	FIES-Survey Module
FVS	Food Variety Score
GBV	Gender-Based Violence
GPI	Gender Parity Index
GTAs	Gender Transformative Approaches
GWP	Gallup World Poll
H&N	Health and Nutrition
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HLPE-FSN	High Level Panel of Experts on Food Security and Nutrition
HRCF	Human Rights Campaign Foundation
IAEG-SDG	Inter-Agency and Expert Group on SDG Indicators
IFPRI	International Food Policy Research Institute
LGBTQIA	Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual
LMICs	Low- and Middle-Income Countries
MENA	Middle East and North Africa
OECD	Organization for Economic Cooperation and Development
OPHI	Oxford Poverty and Human Development Initiative
pro-WEAI	Project-level Women's Empowerment in Agriculture Index
SDGs	Sustainable Development Goals
SEM	Structural Equation Modelling
SOFI	State of Food Security and Nutrition in the world
SSA	South-of-Sahara Africa
UBOS	Uganda Bureau of Statistics
UDHS	Uganda's Demographic and Health Survey

UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WEA	Women's Empowerment in Agriculture
WEAI	Women's Empowerment in Agriculture Index
WENI	Women's Empowerment in Nutrition Index
WFP	World Food Program

Chapter 1: Introduction and Background

During the COVID-19 pandemic, the prevalence of moderate or severe food insecurity increased by 5.5% in Africa, from 52.4% in 2019 to 57.9% in 2021. This compares to 29.3% in the world in 2021 (Food and Agricultural Organization [FAO] et al., 2022). The COVID-19 pandemic is causing serious disruption to food systems worldwide, including in Africa, compounding with conflicts, climate change, persistent poverty, and inequalities (High Level Panel of Experts on Food Security and Nutrition [HLPE-FSN], 2020, 2022). The growing gender gap in experiencing food insecurity all around the world continues to be of great concern (FAO et al., 2022). In 2021, there was a 4.3 percentage point gender gap in food insecurity compared to 1.7 percentage point in 2019, with 31.9% of women and 27.6% of men presenting as moderately or severely food insecure (FAO et al., 2022). Gender inequality and women's persistent food insecurity may underpin adverse nutritional outcomes in the short and long term (e.g., women's anemia and child stunting and wasting) (CARE-USA & CFS, 2020).

Thus, investing in gender equality and women's empowerment must be front and center in any efforts to achieve goal 2 of the Sustainable Development Goals (SDGs) – Zero Hunger. The mandate of SDG 5 is expanding opportunities for women and girls through empowering them in society and the household. Fulfilling the 2030 Agenda through the advancement of SDGs 2 and 5 requires a profound understanding of the barriers and opportunities in the pathway from women's empowerment to food security (HLPE-FSN, 2020). Gender equality and women's empowerment in different domains can (a) substantially contribute to agricultural productivity and economic growth and (b) promote individual and household well-being and welfare (Global Health 50/50 et al., 2022).

In the Ugandan context (the focus of this study), despite economic growth, food insecurity keeps growing (FAO et al., 2022). According to the most recent reports on the State of Food

Security and Nutrition in the World in 2022, the prevalence of moderate and severe food insecurity increased by 9% in 2019-2021 in Uganda (FAO et al., 2022). The Global Hunger Index 2022, an aggregated index of undernourishment and child wasting, stunting, and mortality, reported the serious hunger situation in Uganda (von Grebmer et al., 2022). Similarly, the country's progress toward SDG 5 is not on track. The Gender Inequality Score in Uganda is 0.53, ranked 166th of 192 countries (United Nations Development Programme [UNDP], 2022). Uganda is a landlocked country, and most of the population reside in rural areas with virtually half of all men and women employed in the agricultural sector (Uganda Bureau of Statistics [UBOS] & ICF, 2018). Therefore, empowering women through various pathways, such as increasing their access to productive resources and their inclusion in household decision making, is a key strategy in development projects to promote food security.

That said, the evidence of a positive association between women's empowerment and food security is inconclusive. The women's empowerment and food security literature has overlooked including a gender lens in studying intrahousehold gender power relations in the process of empowering women. Most of the studies examined the empowerment of women and its association with food security outcomes isolated from the empowerment status of men in the household. As a result, researchers missed the opportunity to study the combined effect of the empowerment status of men and women in the pathway to food security and related intrahousehold gender power dynamics. This doctoral research aimed to address this research gap. The overall objective was to contribute to the current knowledge base on the association from women's empowerment to food security by applying an intersectional gender analysis approach and considering context-specific characteristics, using Uganda as a case study.

Two datasets were the basis of this dissertation. (a) The Gallup World Poll (GWP) data were collected in December 2019 and provided a representative population sample at the national level. The GWP data were used to study the first objective. (b) The Project-level Women's Empowerment in Agriculture Index (Pro-WEAI) household survey data were collected from January to February 2020 as part of a cross-sectional household survey on women's empowerment status in the context of a larger nutrition- and gender-sensitive intervention within the fish value chain in Uganda, called NutriFish. The implementation of NutriFish was informed by the results of the pro-WEAI data and was conducted after March 2020 and during the pandemic. Pandemic-related restrictions, such as strict lockdowns in Uganda, however, delayed the implementation of some of the planned interventions at the beginning of the pandemic. The candidate thus acknowledges that although the data used in this dissertation were collected before the COVID-19 pandemic, all phases of this doctoral research took place during the pandemic, using a pandemic lens: conceptualizing and developing research questions and the analytical approach, conducting analysis, interpreting results, and providing future directions.

This dissertation comprises the conventional components of an Introduction and Background (Chapter 1), Literature Review (Chapter 2), Methods (Chapter 3), and Discussion and Conclusion (Chapter 7) with a supportive reference list at the end of the document. Embedded within this manuscript-based dissertation are three additional chapters (4, 5, and 6), each containing a manuscript (with its own reference list) for the following three research objectives:

1. Identify and test the gender differences in experiencing food security inequities within the intersectionality framework (Chapter 4).

2. (a) Quantify the moderating effect of the empowerment status of men in households in the association from the empowerment of women to the individual food security of men and women, and (b) elucidate the effect of gender power in households on the food security status of women and men (Chapter 5).
3. (a) Examine the relationship between aggregated and disaggregated measures of women's empowerment in agriculture and (i) women's agency in nutrition, (ii) the food security status of women; (b) Quantify the moderating effect of women's agency in nutrition in the association from the empowerment of women in agriculture to their food security (Chapter 6).

Six research questions guided the study:

1. Are there any gender differences in food security status in Uganda?
2. What are the gendered determinants of food insecurity?
3. What axes of inequity intersect with gender to shape the food insecurity experiences of men and women?
4. Does the empowerment status of men change the magnitude and significance of the association between women's empowerment and food security in the household?
5. Which indicators of women's empowerment improve the food security status of men and women?
6. What are the barriers and facilitators of women's agency in nutrition?

Positionality Statement

As a woman who immigrated to Canada from Iran, a middle-income country known for its gender apartheid system, I am aware of how gender inequalities can affect everyday life experiences. Apart from the broader sociopolitical context of gender discrimination, I grew up in

a paternalistic environment that affected my agency and strategic life choices. But I lack any lived experiences of poverty and food insecurity and how they can worsen due to gender inequalities. At the same time, as a community nutritionist, I understand the importance of intrahousehold power relations in food access and dietary intake and have witnessed first-hand poverty in low-resource communities in Iran (2012-2014) and later in Malawi (2018) and Uganda (2019). I fully acknowledge that my personal and professional background shaped the research process, including developing the analytical plan, interpreting the results, and writing up the discussion section of each manuscript (Chapters 4, 5, and 6).

In conceptualizing gender throughout this dissertation, I used a social lens to study gender as a critical entry point of social hierarchies rooted in the broader context that significantly affects unequal experiences of food insecurity. The harsh Ugandan environment for non-binary gender expression was not unfamiliar to me as I grew up in a country, Iran, that brutally oppresses LGBTQIA communities through a death sentence. Similar to Uganda, the sociocultural context in Iran does not allow revealing a non-binary gender, and these individuals and communities often live in isolation.

Situating Myself in the Research

I started working on the NutriFish project in May 2019 and travelled to Uganda in November 2019. At that time, I developed a research proposal focused on household decision-making processes and related gendered power relations. I intended to conduct a mixed-methods study through household and key informant interviews in addition to participatory videos followed by community and policy dialogues.

During my field visit in Uganda, I had the opportunity of participating in a one-week workshop that aimed to train and support the NutriFish team about sex, gender, and pro-WEAI.

After that, I conducted informal key informant interviews with local experts to locally adapt the nutritional assessment tools, such as the Food Insecurity Experience Scale (FIES) and women's minimum dietary diversity score. I also participated in the qualitative data collection of pro-WEAI in two fishing villages via men's and women's focus group discussions about the local understanding of the concept of empowerment and individual interviews with women involved in fish processing.

During the last week of my field visit, I joined the enumerators' training sessions to be trained in collecting the quantitative component of pro-WEAI. I also connected with the local project's staff and colleagues and met with communities at different fishing villages with whom I was starting to establish rapport. The field visit helped me contextualize my research questions and data collection tools for the primary fieldwork in March 2020.

But once the pandemic hit in March 2020, I had to shift gears, adjust my research plan, and pull together the appropriate resources to help me move forward. Because I lacked access to the target communities in Uganda, I developed an alternative plan by using a secondary data analysis approach. To further adapt my research project to the changes caused by COVID-19, I adjusted my research objectives (previously introduced) but ensured they still aligned with the concepts in my initial research proposal, which focused on gendered household decision-making dynamics and their association with food security.

Chapter 2: Literature Review

Food Security

Definition and Framework

Food security exists “when all people, at all times, have social, physical, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2001, p. 49). The report on the State of Food Insecurity in 2001 slightly refined the World Food Summit’s (1996) definition by adding the word ‘social’. Introducing the social aspect of food access emphasized the challenges of vulnerable populations in accessing food and acknowledging food as a human right, as indicated by Sen (1981). Focusing on a person’s entitlement to food, Sen (1981) underlined the importance of an individual’s endowments of available resources within society (resources such as employment, social rights, and asset/land ownership, as the paths to food entitlement). If any of these paths fails, a person’s entitlement to food is affected even if food is available.

Anderson (1990) defined food insecurity as a condition “whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain” (p. 1576). Food insecurity in the severe stages can potentially lead to ‘hunger’ which is an “uneasy or painful sensation caused by a lack of food” (Anderson, 1990, p. 1576). Cohen (1990) argued that while hunger is a problem at the individual level, food insecurity is an issue in the broader context of the country, community, or neighbourhood connected to the available resources (Cohen, 1990). Like the Anderson’s (1990) argument, Cohen (1990) underlined that hunger is incorporated into food insecurity and solutions to food insecurity can also tackle hunger.

The definition of food security encompasses four dimensions: availability, access, utilization, and stability. Availability addresses sufficient quantities of food through domestic

food production, imports, and stock levels. Access emphasizes an individual's access to available recourses (entitlements) for securing a preferable and nutritious food. Food utilization is acquired when a person takes the optimum advantage of nutrients in the food. Food utilization requires a well-balanced diet, clean water, sanitation, and health care to meet a healthy and active life. Finally, food stability means having access to sufficient, safe, and nutritious food at all times without being influenced by sudden shocks like the COVID-19 pandemic or cyclic events like seasonal fluctuations (FAO, 2006).

The High-Level Panel of Experts on Food Security and Nutrition (HLPE-FSN), at the United Nations Committee on World Food Security (CFS), has proposed two additional dimensions to the current four-dimensional food security framework: agency and sustainability (Clapp et al., 2022; HLPE-FSN, 2020). The agency dimension emphasizes including the voice of individuals and groups in their own circumstances and having control over governance processes, especially in a context where this right is denied. This proposed dimension addresses broad inequities within the food system and aims for an equitable approach to reduce power imbalance in food systems. The sustainability dimension of food security refers to “food system practices that contribute to long-term regeneration of natural, social, and economic systems, ensuring the food needs of the present generations are met without compromising food needs of future generations” (HLPE-FSN, 2020, p. 10). The 2021 United Nations (UN) Food Systems Summit specified sustainability as a central goal to deliver progress on all 17 SDGs, which require “healthier, more sustainable, and more equitable food systems” (United Nations [UN], 2021, para. 1).

Measuring Food Security

The most widely accepted measurements of food security are experience-based food security scales. The origin of these scales is based on the findings of a mixed-methods research design carried out in the United States to understand and define the experience of hunger among 32 white and black women aged 18-55 in rural and urban areas of Upstate New York (Radimer et al., 1990). The studied phenomenon was later developed and conceptualized as food security with an emphasis on being aware of the social context in measuring it (Radimer et al., 1990). Some of the well-known experience-based food security scales are the Household Food Security Survey Module (HFSSM) developed by the United States Department of Agriculture (USDA) and used in the United States and Canada and some other developed countries; the Household Food Insecurity Access Scale (HFIAS) promoted by the Food and Nutrition Technical Assistance-II (FANTA-II) initiative; the Latin American and Caribbean Food Security Scale (ELCSA) from the Spanish Escala Latinoamericana y Caribena de Seguridad Alimentaria; and the Food Insecurity Experience Scale (FIES) developed and adopted by the Food and Agriculture Organization (FAO) (Cafiero et al., 2014, 2018).

To monitor global food security status, FIES is used as one of the indicators to measure the progress toward achieving SDG 2 (Zero Hunger). The SDG indicator 2.1.2 monitors the “prevalence of moderate or severe food insecurity in the population, based on FIES” (Inter-Agency and Expert Group on SDG Indicators [IAEG-SDG], 2017, p. 2). The FIES provides comparable cross-country prevalence of moderate and severe food insecurity that can be used to identify vulnerable groups and guide policy interventions to alleviate food insecurity (Cafiero et al., 2018).

The FIES comprises eight dichotomous questions that range from being worried about food to the most severe condition of being hungry the whole day (Cafiero et al., 2016). The scale has four categories: food *security*, and mild, moderate, and severe food *insecurity* (see Table 2.1). These categories are based on a theory tested by the Rasch model. In brief, the Rasch model provides validity information on the relative severity associated with the experience captured by different questions and the level of food insecurity experienced by respondents (Ballard et al., 2013). According to the Rasch model, the assigned questions in each category show that the probability of affirming the most severe item is always lower than the probability of affirming the least severe one (Ballard et al., 2013).

Table 2.1 Food Insecurity Experiences Scale (FIES) questions

FIES categories	During the last 12 MONTHS, was there a time when because of a lack of money or other resources (Yes/No/Do not know/Refuse to answer)
Food secure	No affirmative responses
Mild food insecurity	1) You were worried you would run out of food? 2) You were unable to eat healthy and nutritious food? 3) You ate only a few kinds of foods?
Moderate food insecurity	4) You had to skip a meal? 5) You ate less than you thought you should? 6) Your household ran out of food?
Severe food insecurity	7) You were hungry but did not eat? 8) You went without eating for a whole day?

Determinants of Food Security

Most well-known socioeconomic determinants of food insecurity at individual and household levels include residing in rural areas, low education and income, unemployment, age, marital status, household size, and overwhelmingly documenting the higher rates of food

insecurity among women compared to men (Aboaba et al., 2020; Broussard, 2019; FAO et al., 2022; Mokari-Yamchi et al., 2020; Sinclair et al., 2019; Smith et al., 2017; Wambogo et al., 2018). At the community level, social support is another well-studied determinant of food security across different contexts (Broussard, 2019; Dzanja et al., 2015; Hadley et al., 2007; Martin et al., 2004; Mokari-Yamchi et al., 2020). For instance, membership in farmers' organizations, household's network size, and engagement in voluntary activities improved household food security status in Malawi (Dzanja et al., 2015). Likewise, higher social support, in terms of less difficulty in borrowing money and food when needed, was associated with better food security in rural Tanzania (Hadley et al., 2007). Another strong community-level determinant of food security is sociocultural norms which often highly interact with gender norms. The role of gender and related sociocultural norms is addressed in the next section.

In the broader institutional¹ and political context, a review (between 1984–2018) of 124 countries in Asia, Africa, Europe, Latin America, and the Caribbean found corruption, conflicts, military expenses, tensions related to religion and ethnicity, and poor quality of bureaucracy as the main political and institutional factors affecting food security (Wang et al., 2020). Another analysis of 108 countries provided evidence of the role of better governance and political stability in promoting SDG2, Zero Hunger (Galabada, 2022). Similarly, other studies have shown that reducing corruption and promoting governance positively correlated with economic growth and food security (Helal, 2016; Nugroho et al., 2022; Olken & Pande, 2012; Sumaila et al., 2017; Uchendu & Abolarin, 2015). The FAO reported on the *State of Food Security and Nutrition in the world* (SOFI) in 2021 identified the following as major drivers and underlying

¹ According to Hodgson (2006), institutions are “systems of established and prevalent social rules that structure social interactions” (p. 2).

factors challenging food security and nutrition in the world: conflict (internal and external), climate variability and extremes, economic slowdowns and downturns, unaffordability of healthy diets, and poverty and inequality (FAO et al., 2021). Given the scope of this dissertation, the last factor is further expanded.

Poverty and inequality are considered structural determinants of food insecurity. They generate unequal levels of access to human, social, and economic resources such as income, education, health, productive assets such as land for small-scale farmers, and, more importantly, technology and digital literacy amidst the COVID-19 pandemic. Structural vulnerabilities that cause these inequalities include but are not limited to gender, age, ethnicity, race, religion, class, Indigenous Peoples status, and disability (FAO et al., 2021). It is argued that the pandemic has exacerbated existing inequalities (FAO et al., 2021, 2022).

Impact of the COVID-19 Pandemic on Food Security

The report of FAO's rapid assessment of food insecurity in twenty food-crisis countries between October 2020 to January 2021 showed that three quarters (75%) of food insecure people described their experiences as resulting from the COVID-19 pandemic (Boero et al., 2021). The adverse effects of the pandemic on the economy influenced food insecurity in several ways, and pandemic-related determinants of food insecurity emerged. Cañari-Casaño et al. (2021) conducted a study of social predictors of food insecurity during the lockdown in Peru. The authors reported that having relatives with COVID-19, losing weight during the pandemic, and increased processed-food prices were likely to increase moderate or severe food insecurity (Cañari-Casaño et al., 2021). In a Nigerian study, Amare et al. (2021) documented similar findings of the positive association between exposure to COVID-19 and food insecurity. They added that households struggling with poverty and living in remote and conflicted-affected

zones, e.g., civil war, experienced high food insecurity. Researchers in other studies have reported larger households, quarantine stay, exposure to Covid-19, and lack of access to information as determinants of food insecurity (Cordero-Ahiman et al., 2020; Dasgupta & Robinson, 2022; Shahzad et al., 2021).

The pandemic also imposed changes in already existing determinants especially income. Cañari-Casaño et al. (2021) showed that, in addition to those whose income was low before the pandemic, Peruvian citizens whose income reduced or whose savings ran out due to lockdowns were also more likely to experience moderate or severe food insecurity. As noted earlier, the pandemic widened the inequalities mostly in terms of income (FAO et al., 2021, 2022). For example, South African households with low levels of education were very affected by the adverse economic effects of the pandemic as they had to rely on labour income influenced by lockdown and quarantine policies (Arndt et al., 2020). Similar findings were shown in Kenya and Uganda, where poor households dependent on labour income had to use food-based coping strategies such as involuntarily changing dietary patterns (Kansiime et al., 2021). A Mali study showed a reduced gap between rural-urban during the pandemic in terms of experiencing food insecurity (Adjognon et al., 2021). They underlined that before the pandemic, mostly rural areas were food insecure, but urban areas ended up experiencing moderate levels of food insecurity during the pandemic.

Gender

Concept and Definition

Sex and gender are used interchangeably in health research and are unfortunately conflated when they are related but distinct constructs (Johnson et al., 2009). Sex refers to the biological or chromosomal characteristics defined as male, female, or intersex people (World Health

Organization [WHO], 2002). Although sex is assigned at birth, gender is socially constructed. Gender refers to socially attributed roles, behaviours, expectations, and opportunities considered appropriate for men, women, girls, boys, and non-binary individuals (Morgan et al., 2016; World Health Organization [WHO], 2002). Although gender is socially constructed, *gender identity* refers to individuals' internal feelings about their gender (LGBTQIA Resource Center, 2022). *Gender expression* is how individuals express their gender identity and present their gender in society (e.g., through clothes, hairstyles, behaviours, and jobs traditionally assigned to a specific gender). A person's gender identity or expression may differ from the sex assigned at birth.

Due to the social dimensions of gender, this concept is relational and influenced by the broader sociocultural, political, and religious context (Johnson et al., 2009; Krieger, 2003). As a result, gender is considered a social stratifier and an important driver of (dis)advantage that varies by context (Morgan et al., 2016). Consequently, the concept of gender is constantly evolving and affected by social changes over time (Johnson et al., 2009; Morgan et al., 2016; WHO, 2002). Gender, in interaction with other sources of vulnerability, such as class, income, education, and ethnicity, shapes people's different experiences of health outcomes, such as food security (Morgan et al., 2016).

Gender in Health Research

In most health surveys, such as Demographic Health Surveys (DHS) and Gallup World Polls (GWP), the variable *gender* is questioned by default, while the question's wording might mistakenly ask about the variable *sex*. For example, in the GWP questionnaire, these two variables are conflated; the question is *What is your gender?* with the binary response options of *male/female*, which represent *sex*. In the DHS survey, there is one question asking for the variable *sex* with the binary response options *male/female*. Gender is considered a derivative of

sex, and its difference from sex is distinguished by the studied outcome (Kishor, 2005). Where the investigation requires an examination of the biological/physical dimension, the term *sex* should be used, and where the social dimension is of interest, the term *gender* should be applied.

Commonly, in quantitative surveys of health research, sex and gender are interconnected, and the researcher decides how to conceptualize the variable depending on the research outcome or which information is needed (Johnson et al., 2009). In health research, gender is assumed to be highly correlated with sex at birth regardless of the wording used for the survey question. The respondents provide information on gender in a way that is perceived by others in their society (gender) and not themselves (gender identity). This challenge in collecting reliable data on gender identification may come from gender's connection to the sociocultural and political context in countries that do not allow non-binary gender expression. There are countries where revealing non-binary gender identity is a crime.

Apart from recognizing it as illegal, there are harsh sociocultural environments for lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) communities. For example, *Human Dignity Trust* (2022) reported that 69 countries have laws that criminalize same-sex sexual activity, and nearly half of these countries are in Africa. According to the *Human Rights Campaign Foundation*, there are currently 32 countries where same-sex marriage is legal (Human Rights Campaign Foundation [HRCF], 2022), and only 16 countries have a third-gender option on their passports (The Economist, 2022). Therefore, lack of considering non-binary gender in health research, including food security research, is a substantial limitation, particularly in studies like this one that focus on gender and related sociocultural barriers, regardless of using primary or secondary data.

Gender and Food Security

All over the world, food insecurity experienced by women is not equal to food insecurity experienced by men (Broussard, 2019; Harris et al., 2021; Kassie et al., 2015; Sinclair et al., 2019; Sraboni et al., 2014; Wambogo et al., 2018). In LMICs, gender inequalities in experiencing food insecurity have been primarily studied in the rural context and agricultural activities at the household level (Aryal et al., 2019; Gebre et al., 2021; Harris-Fry et al., 2020; Kassie et al., 2015; Lutomia et al., 2019; Sraboni et al., 2014).

For example, Aryal et al. (2019) found that Bhutan households headed by single, widowed, or divorced women were less likely to be food secure compared with households headed by men or households where there was a husband, but he was not physically present because of his off-farm work. The gaps in access to social, human, and financial resources (e.g., education, information, training programs, non-farm market) and gender norms were considered important drivers of the higher probability of food insecurity in households headed by single, widowed, or divorced women. Kassie et al. (2015) reported similar results in Malawi, with female-adult-only households (FHHs) experiencing higher rates of food insecurity than dual-adult households (DHHs –both a male and female adult) due to unequal access to different resources, namely technology adoption that affects farm productivity. They did argue however that reducing the gap in resource access was insufficient to improve FHHs' food security status and required instead policies that target structural determinants of food insecurity, such as discriminatory laws in land/asset ownership, or gender norms. Alonso et al. (2018) argued that gender is one of the critical sociocultural determinants of food security along with family, and decision-making power. Their review documented the direct and indirect impact of gender norms on women's food security at individual and household levels with examples including

restricted mobility for travelling to the market, division of household labour, dietary practices, and intrahousehold food distribution.

On the national or global scale, several studies assessed the relationship between food security and gender, mainly at the individual level (Abdi, 2018; Broussard, 2019; Sinclair et al., 2019; Smith et al., 2017; Wambogo et al., 2018). Nearly all studies provided evidence of higher food insecurity rates among women than men. A global comparative analysis showed that gender inequality was a strong predictor of food insecurity (Abdi, 2018). Further regional analysis revealed that gender inequality did not remain a significant predictor of severe food insecurity in Europe and Central Asia, the Middle East, North Africa, and South-of-Sahara Africa (SSA).² Abdi (2018) suggested other mitigating factors in explaining this insignificant association, such as health and climate change. Another regional analysis across the world showed a significant gender gap in mild to moderate food insecurity in most regions. Only in SSA and South Asia was there a significant gender gap in experiencing severe food insecurity (2.7% and 1.9%, respectively) (Broussard, 2019).

A significant gender gap in experiencing food insecurity was also reported in the SOFI 2022, with a worldwide growing gender gap in moderate or severe food insecurity for two years in a row from 2019 to 2021 (FAO et al., 2022). This increase reflected the disproportionate effect of the COVID-19 pandemic on women (FAO et al., 2022). Kalbarczyk et al. (2022) recently conducted a gender-focused analysis of the relations between the COVID-19 crisis, gender, and nutrition outcomes, including food security, by generating a gender-evidence map.

² Throughout this dissertation, the term South-of-Sahara Africa (SSA) is used for the African countries in the South of the Sahara. It is not referred to as “Sub-Saharan Africa” as this term is considered Eurocentric and colonial. For more information, see the following resources: a) <https://storytold.net/sub-saharan-africa-phrase-racist-origins-used-refer-much-continent/>; b) <https://www.herald.co.zw/rethinking-the-term-sub-saharan-africa/>

In more detail, they illustrated the impact of the pandemic on underlying inequitable norms, such as restricted access to financial resources, lessened power in decision-making, and unequal gendered job insecurity and division of labour (Kalbarczyk et al., 2022). They argued that the lack of accounting for gender power relations and gender norms in policies related to the pandemic management and recovery disproportionately affected women and girls. For example, due to the pandemic, women were disproportionately affected by job loss and income loss through different paths. One such path involved discriminatory inheritance and marital property laws in some countries (Doss et al., 2020). The result was women's decreased access to lands and properties in households after their husband's or a male family member's death. Financial and employment losses affected the household's investments and assets and consequently worsened women's food insecurity status (Kalbarczyk et al., 2022).

Women's Empowerment

Empowerment: Concept and Definition

Through measuring several targets, SDG Goal 5 monitors progress toward achieving gender equality and empowering all women and girls. Gender inequality results from gender inequity and, in general, social, and structural inequity. In brief, if there is equality, there is an absence of differences, variations, and disparities in individuals and groups' desired achievements (e.g., food security) (Arcaya et al., 2015). In contrast, equity is the "equal opportunity to achieve the desired outcome (e.g., food secure) for all population groups" through equitable distribution of resources between more- and less-advantaged social groups (Braveman & Gruskin, 2003, p. 257). In short, equality means everyone gets the same thing, while equity means they get the opportunity to achieve desired outcome. Equity is broadly recognized as an important policy goal to achieve equality in health systems. Gender inequalities in access to

social, human, and economic resources, due to unfair and unjust systems of discriminatory laws and social norms, adversely affect health outcomes such as food security. Therefore, achieving gender equality and empowering women are interdependent, requiring individual and structural changes.

Kabeer (1999) defined empowerment as “the ability to make strategic life choices where this ability has been denied” (p. 437). The process of exercising an ability of choice encompasses three interconnected dimensions: resources (pre-conditions), agency (process), and achievement (outcome). *Resources* are all forms of social, human, and economic assets, skills, and sources that facilitate the path for making strategic choices. This dimension considers institutional resource distribution and allocation in the broader context that enables an individual to claim resources in the present and the future. *Agency* is “the ability to define goals and act upon them” (Kabeer, 2012, p. 438). This dimension of empowerment is commonly operationalized as decision-making in the literature, but it can take other forms, including bargaining power and manipulation. *Achievement* is the desired outcome of the enabling resources and decision-making process. Kabeer (2012) emphasized that empowerment is a process of change and requires both individual and structural changes to challenge inequalities as all dimensions of empowerment at the individual level are formed by structures.

Empowerment Measurement

Empowerment is a complex and multidimensional concept, which makes it difficult to measure. Several attempts have been made to measure women’s empowerment, primarily through gender inequality indicators. Examples include the Social Institutions and Gender Index developed by the Organization for Economic Cooperation and Development (OECD) (2019); the Gender Development Index and Gender Inequality Index developed by the United Nations

Development Programme (UNDP) (2022); and the Gender Gap Index developed by the World Economic Forum (2022).

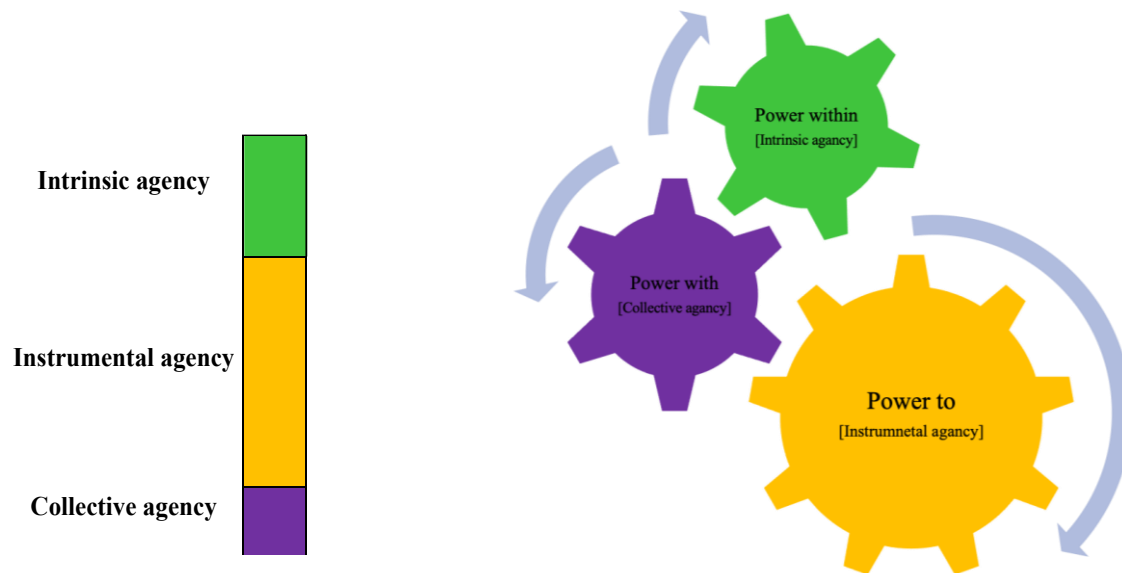
One broadly accepted measurement of empowerment specific to the agriculture and rural context is the Women's Empowerment in Agriculture Index (WEAI) (Alkire et al., 2013). This index was launched in 2012 by the International Food Policy Research Institute (IFPRI), the United States Agency for International Development (USAID), and the Oxford Poverty and Human Development Initiative (OPHI). The WEAI aimed to measure women's empowerment and inclusion in rural areas involved in agricultural and non-agricultural activities (Alkire et al., 2013).

To elaborate, WEAI is a household survey instrument that collects data from primary male and female decision makers in the same household. It encompasses two sub-indices: five domains of empowerment (5DE) and the Gender Parity Index (GPI). The 5DE include (a) decisions about agricultural production, (b) access to and decision-making power about productive resources, (c) control of the use of income, (d) leadership in the community and (e) time allocation. The GPI compares the 5DE score of men and women in the same household and generates a measure of intrahousehold inequality in the same household (Alkire et al., 2013).

Since its introduction, WEAI has been applied extensively in various settings and contexts to measure and monitor women's empowerment and intrahousehold gender inequality in programs and interventions. The WEAI provides individual-level data mainly measuring the agency dimension of empowerment. Many organizations and countries have used WEAI since it was launched, and most adapted the tool for their own project's use by removing some parts or adding more questions. To address this validity shortcoming of the original WEAI, IFPRI's team introduced project level-WEAI (pro-WEAI). Researchers and implementers can now measure

the impact of different agricultural interventions on women’s empowerment by tailoring the tool to a specific context. Aimed to address the gaps in the original WEAI, the pro-WEAI measure consists of three domains of empowerment (3DE) instead of 5DE (see Figure 2.1). The 3DE include three forms of agency: intrinsic agency (power within), collective agency (power with), and instrumental agency (power to). The 3DE are mapped into 12 indicators (Malapit et al., 2019).

Figure 2.1 Three Domains of Empowerment (3DE) in pro-WEAI



Adapted from Martinez (2019)

Conceptually, *power to* reflects acting and realizing one’s aspirations, which is directly related to the agency dimension of empowerment and is frequently measured in terms of skills, capacities, and self-confidence (Hillenbrand et al., 2015). *Power with* involves collaborative and collective power with others through mutual support, collaboration, recognition, and respect for differences. *Power within* refers to a person’s or group’s sense of self-worth, self-awareness,

self-knowledge, and aspirations, which are also related to agency. These contrast with the most addressed form of power – *power over*, which echoes control over people, resources, and others' lives. Power over is not included in the pro-WEAI measure because of the negative perceptions toward it that might affect the collaboration of the community, specifically men, with the agricultural development projects that aim to empower women (Malapit et al., 2019). Additional details of the pro-WEAI score and its indicators are included in the next chapter, where the study context and measurement tools are described.

Women's Empowerment and Food Security

The next section of this chapter is in the form of a standalone manuscript that focuses on the relationship between women's empowerment and food security in LMICs. It extends the literature review set out so far in this chapter by providing a thorough and critical overview of previously published research on the association between food security and women's empowerment. This review provided a general guide to what is already known about food security and women's empowerment, established a context for the present research, located existing patterns and trends, and identified the gaps.

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Review of Challenges and Barriers in the Relationship between Women's Empowerment and Food Security in Low- and Middle-Income Countries

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Abstract

Prior research has proposed women's empowerment in agriculture as one of the strategies to mitigate household and individual food insecurity within nutrition-sensitive agriculture interventions. Yet, the current evidence on this relationship is inconclusive and thus requires further research to elucidate the pathways through which women's empowerment is associated with food security. This literature review aims to draw insights from studies on women's empowerment and food security and identify the related challenges and best practices in this pathway within the context of low- and middle-income countries. Literature searches were performed using Scopus, PubMed, and Global Health. Additional searches were conducted by scanning the reference list of all articles ($N = 185$) identified in the search strategy. A final set of $N=15$ papers was included in the review. Findings suggested a mixed relationship between women's empowerment and food security. Findings highlighted a gap in conceptualizing and operationalizing of food security and women's empowerment measures at different stages of nutrition-sensitive agricultural programs, including design, data collection, data analysis, and interpretation. Findings further underlined the importance of context-specific and mixed-methods assessments embedded in gender transformative approaches to generate long-term food security outcomes. To achieve sustainable food security, particularly in the aftermath of COVID-19, researchers and other stakeholders must respond to the broader context of gender systems that restricts women's rights and access to productive resources.

Keywords: Food security, women's empowerment in agriculture, gender, low- and middle-income countries

Introduction

Globally in 2021, an estimated 2.3 billion people were moderately or severely food insecure, with an increased rate of severe food insecurity (11.7% of the global population) potentiated by the COVID-19 pandemic (Food and Agriculture Organization [FAO] et al., 2022). A growing gender gap in food insecurity has been identified with women and girls affected disproportionately by the pandemic's unequal economic recovery pattern resulting from gender inequality and discrimination (FAO et al., 2022). Food security refers to "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2001, p. 49). The Committee on World Food Security (CFS) (2021) emphasized that empowering women and girls in this challenging global context is imperative to achieve food security for all.³ Empowerment is about the process by which the ability of an individual to make strategic life choices is increased, especially in a context where acquiring such an ability is denied at any level, including the household, local communities, and national institutions (Kabeer, 1999, 2010).

There are various definitions for empowerment (Annas, 1993; Sen, 2014) and an emerging body of literature that is critical of the idea of empowerment in contemporary usage (Cornwall, 2016; McLaughlin, 2016). For example, Cornwall (2016) argued that the current operationalized definitions of empowerment have overlooked the relational aspect of empowerment. In its relational aspect, empowerment is conceptualized as a shift in power relations not only at the individual level but on the structural basis of gender inequalities (Cornwall, 2016; Galiè &

³ CFS was established in 1974 and reformed in 2009 as the foremost inclusive international and intergovernmental platform for all stakeholders to work together to ensure food security and nutrition for all.

Farnworth, 2019). By taking the relational aspect out of the picture, notions of empowerment have shifted away from measures of structural changes to a measure of access to external materials (e.g., resources, assets, or services) (Cornwall, 2016; Kabeer, 1999; Sen, 1997). It is thus critical to conceptualize empowerment as a process of change at individual and structural levels.

In the context of women's empowerment and food security, prior research argued that essential strategies for enhancing food security include empowering women through challenging the constraints they face and amplifying their access to resources and opportunities (Aziz et al., 2022; Verhart et al., 2016). For example, the report on *The State of Food Insecurity in the World* in 2021 included women's empowerment as one of the six pathways to transform food systems that are targeting structural inequalities and poverty (FAO et al., 2021). However, the relationship between women's empowerment and food security is complex and not fully understood. The current evidence on this relationship is still inconclusive thus requiring further study to elucidate the pathways through which women's empowerment is associated with food security. This review aims to draw insights from studies on women's empowerment and food security and identify the related challenges and best practices in this association within the context of Low- and Middle-Income Countries (LMICs).

Method

Literature searches were performed using the following databases: Scopus, PubMed, and Global Health (as a subject-specific database) up to September 5, 2022. The search terms used to search databases to identify relevant articles are listed in Table 2.2. Additional searches were conducted by scanning the reference list of all articles identified in the search strategy. After removing duplicates, the search returned $N=185$ publications. Studies were limited to LMICs

context, publication in English since 2010, studying populations >15 years, and journal articles. After screening titles and abstracts for relevance, $n=51$ articles were included for full-text assessment. Studies were included in the review if they met the additional criteria:

- Assessing the association between women's empowerment and food security, with food security as the primary outcome and women's empowerment as the main explanatory variable; and
- Providing a narrow and precise definition of women's empowerment and food security OR specific measurement OR a conceptual framework.

Thirty-six ($n=36$) studies were excluded if they focused on gender-related barriers to empowering women but did not specifically refer to the association from women's empowerment to food security. Some excluded studies included food security but not as their primary focus, and the rest did not refer specifically to food security. Some publications studied the impact of different agricultural interventions and programs on women's empowerment or food security without studying their relationship. Therefore, a final set of $N=15$ articles was included in the review reported in this chapter.

Findings

Characteristics of Reviewed Studies

The characteristics of the included studies are summarized in Table 2.3. Eight of the 15 articles presented data from Africa, and the remaining were conducted in Asia at the country or regional level. Most studies were cross-sectional, three applied a mixed-methods approach, and one conducted a longitudinal analysis (retrospective cohort study). One cross-country study had a cross-sectional design for two countries and a mixed-methods approach for the third country.

Most (80%) studies collected primary data; three conducted secondary analyses of available data sets.

Conceptualizing and Measuring Food Security

Seven tools were applied to measure food security at household or individual level with two more common than others. Five studies used the Household Food Insecurity Access Scale (HFIAS), either at the household or individual level (Aziz et al., 2020; 2021; Galiè et al., 2019; Sharaunga et al., 2016; Wei et al., 2021). Five studies used the Household Dietary Diversity Score (HDDS) (Bain et al., 2020; Kehinde et al., 2021; Murugani & Thamaga-Chitja, 2019; Sariyev et al., 2020; Sraboni et al., 2014) unaccompanied or accompanied with other tools. The five remaining studies used other tools such as the Food Insecurity Experience Scale (FIES) (Essilfie et al., 2021), the Household Food Security Survey Module (HFSSM) (Kehinde et al., 2021), a food consumption score (FCS) (Bain et al., 2020), and a food variety score (FVS) (Sariyev et al., 2020).

Among the 15 studies, five conceptualized food security using the World Food Summit's (1996) definition, five used other definitions, and five did not provide any narrow definition or conceptual framework for food security. These results show the variety of food security measurement tools and conceptualizations (or lack thereof) employed across different studies. Despite existing globally known and validated measurement tools for assessing food security (e.g., FIES and HFIAS), there remains a clear lack of consensus in current research.

To complicate matters, the lack of a conceptual framework or a narrow definition of food security in a study might result in applying tools that are not practically designed to measure food security. For instance, in some studies, HDDS was used as a proxy to measure food security, while in other studies, the same tool was used as an indicator of the nutritional status

prevalent in a household (Tanankem et al., 2017). This disagreement of what constitutes food security measurement tools can confound conclusions about the relationship between women's empowerment and food security. Moreover, employing different measurements limits the comparability of the results across different studies and contexts. Broader agreement is needed when applying a central measurement tool and conceptual framework in food security studies and programs. This consensus would better help identify barriers and facilitators in the pathway from women's empowerment to food security.

Another inconsistency concerning food security outcomes pertained to the unit of analysis. The empirical evidence underlined the importance of measuring such impact at the individual level along with the household level (Doss et al., 2018; D'souza & Tandon, 2019; Dumas et al., 2017). Among the reviewed studies, nine (60%) investigated the association between women's empowerment and food security at the household level. One study included both women's and household food security outcomes (Sraboni et al., 2014).

There was a dearth of evidence on studying the relationship between empowering women and their resultant food security. In a cross-country analysis of women's empowerment and food security, women's food security status was available in only one of three countries (Clement et al., 2019). Analyzing food security outcomes at individual level deepens our understanding of the mechanisms by which women's empowerment may positively impact food security. More importantly, it provides more information on *whose* food security status is most affected by women's empowerment. Unpacking the relationship between women's empowerment and food security could benefit from generating individual-level data.

Conceptualizing and Measuring Empowerment

In contrast to food security, less variation was found across the 15 studies in measuring women's empowerment. Eight (53%) of the studies used different versions of the Women's Empowerment in Agriculture Index (WEAI). The WEAI is a survey-based index that measures women's empowerment in agriculture directly (Alkire et al., 2013). It is based on individual-level data from primary male and female decision makers in the household. It evaluates mainly the agency dimension of empowerment through multiple domains and indicators, which are different in various versions of WEAI. The WEAI captures agency primarily through decision-making questions and evaluating women's voices in the household. Although other studies in the sample frame used different tools to measure women's empowerment, they all included questions related to decision-making as one of the prominent indicators to assess women's empowerment. This homogeneity in measurement tools and indicators simplified comparisons (across domains and indicators of women's empowerment) to determine which domains and indicators can better promote food security.

This measurement pattern was also observed in conceptualizing women's empowerment. Eleven (74%) studies adopted Kabeer's (1999) definition of empowerment either alone or in conjunction with other definitions. The remaining ($n=4$) studies used other definitions. Only two studies did not provide a narrow definition or conceptual framework of women's empowerment while using WEAI (Kehinde et al., 2021; Murugani & Thamaga-Chitja, 2019). Almost all measures of empowerment, including different versions of WEAI, overlooked including the broader context of structural factors in empowering women. Cornwall (2016) argued that there is a potential danger in operationalizing empowerment as a change at an individual level without considering the surrounding world. In most definitions of empowerment, it was conceptualized

as an iterative process in the interaction between the individual and structural characteristics mediated by socioeconomic and political context (Galiè & Farnworth, 2019; Kabeer, 1999; Solar & Irwin, 2010). Nevertheless, the measurement tools used in this sample frame neglected the transformative nature of empowerment. Most of the studies measured empowerment as a fixed state, mostly cross-sectional studies, without considering that empowering an individual is a *process* of change rather than an endpoint or endgame.

Link Between Women's Empowerment and Food Security

Overall, the findings indicated an inconclusive relationship between women's empowerment and food security. Studies that used WEAI's different versions included both aggregated and disaggregated empowerment measures such as overall WEAI scores, empowerment dimensions and indicators, or a mix of both. All three studies that assessed the overall WEAI score reported a positive association between empowering women and improving food security (Bain et al., 2020; Sraboni et al., 2014; Tsiboe et al., 2018). Across the studies that included WEAI domains in their analytical models, empowering women in the leadership and production domains showed a consistently positive association with different measures of food security, while decreased empowerment in the time/workload domain was associated with better food security (Aziz et al., 2021; Tsiboe et al., 2018). Women's disempowerment in the time domain suggests that increasing working hours (>10.5 hrs) had a positive relationship with food security.

On the contrary, the domains of access to income and other resources, such as agriculture, showed inconsistent results. Studies using the WEAI indicators showed a more subtle pattern in the association between each indicator and food security across different countries and contexts (Clement et al., 2019; Murugani & Thamaga-Chitja, 2019; Sraboni et al., 2014). For instance, an

analysis of the association between women's empowerment and food security in South Africa showed that input into decision-making and public speaking were positively related to food security, while better access to credit had an opposite direction (Murugani & Thamaga-Chitja, 2019). Other studies reported trade-offs among empowerment indicators (Quisumbing et al., 2021; Tsiboe et al., 2018).

Among the studies that used other measures of women's empowerment, autonomy in decision-making in various areas showed the most promising association with food security (Asitik & Abu, 2020; Aziz et al., 2020; Essilfie et al., 2021; Sariyev et al., 2020; Wei et al., 2021). For example, a mixed-methods study in Bhutan measured women's empowerment through their participation in household decision-making in a matrilineal context (Sariyev et al., 2020). Women were found to have nearly equal involvement and were even more considered than men in certain decision-making domains. Sariyev et al. (2020) provided a new perspective on intrahousehold decision-making and gender equality associations with food security through finding a non-linear relationship between women's empowerment and food security. That is, any imbalance in women's empowerment (less or more than men's) could distort the objectives of social programs in support of women's empowerment and nutrition and might result in undesired negative returns. A Ghanaian study showed women's autonomy, measured by their participation in household decision-making in the use of household resources, to be an important predictor of household food security (Essilfie et al., 2021).

Discussion

Fifteen research studies that focused on the impact of women's empowerment on food security were reviewed. Inconsistent applications of measurements and definitions of food security and women's empowerment were found, especially regarding food security outcomes.

As discussed below, the inconclusive impact of empowering women on food security could also be attributed to other shortcomings and challenges in the studies reviewed.

Gap in Studying Intrahousehold Gender Dynamics

Of the eight studies that used WEAI, only two reported the results of using gender parity index (GPI) data in analyzing the women's empowerment and food security nexus (Kehinde et al., 2021; Sraboni et al., 2014). Likewise, among the studies that used different women's empowerment measures, only one considered analyzing intrahousehold gender dynamics (Sariyev et al., 2020). All three studies showed a positive association between higher gender equity (i.e., people get the opportunity to achieve a desired outcome) in the household and food security.

Previous studies have highlighted the importance of adding a gender lens in studying women's empowerment by elaborating on how gender norms influence food security status through power dynamics within household and community (Doss et al., 2018; Ellena & Nongkynrih, 2017; Galiè et al., 2019). For example, a Nigerian study examined the relationship between women's empowerment and HDDS by analyzing the empowerment status of all family members instead of only women or senior adults (Tanankem et al., 2017). They showed that empowering women in the household improved household dietary diversity higher than when men were empowered. Similarly, households with more female members or headed by a female showed a better association between women's empowerment and HDDS. In their Bangladesh study, Sraboni et al. (2014) reported that women's group membership and access to credit, as empowerment indicators, were positively associated with their Body Mass Index (BMI).

In general, investigating intrahousehold patterns of empowerment has been overlooked in existing food security research. Understanding the empowerment status of primary male and

female members in the household and how their interactions affect each household member's food security status can depict a more comprehensive picture of what strategy works for whom to better target food security programs and pinpoint existing gaps. In this regard, more attention should be paid to data (e.g., WEAI) that provide records on both primary female and male decision makers in the household. These types of data provide an opportunity for a more profound gender-analysis approach when studying intrahousehold gender dynamics and gender parity status and their associations with food security.

Lacking an Intersectional Approach

Employing an intersectional framework was largely missing in women's empowerment and food security research. An intersectionality approach depicts the entire system of oppression and privilege at different layers, including individual, household, and community, within the broader institutional and structural context. It focuses on discrimination that occurs where various systems intersect (Collins, 1990; Crenshaw, 1989). Adoption of such an approach in analyzing the relationship between women's empowerment and food security helps to study the combined effects of various factors in generating unequal food security outcomes and, therefore, to better pinpoint the gaps (Bowleg, 2012; Hancock, 2007).

Of the studies reviewed, only one (a cross-country analysis) stressed the importance of applying an intersectional lens to address the structural barriers that lead to poorer food security status among disadvantaged groups (Clement et al., 2019). They argued, for example, that marginalized women in Nepal, from an inferior cast in their community, could not have equal access to land and water resources, which limited their ability to benefit from food security projects. Clement et al. (2019) underlined the fact that men's and women's capabilities to exercise their rights and benefit from available resources depended on the larger socioeconomic

context and from overcoming the structural barriers. Galiè et al. (2019) focused on considering governance issues in Tanzania around access to public forage sources in the livestock sector. The study found that socially marginalized livestock keepers' (characterized by gender, age, or marital status) compromised access to these public facilities affected their productivity and food security. Altogether, the findings from different studies drew the authors' attention to the importance of considering context-specific factors in program designs and interventions to avoid misguided results and resultant policies.

Need for Mixed Methods Approaches to Unpack Contextual Variations

Mixed methods studies (combining quantitative and qualitative approaches) are valuable for comprehending the contextual variations shaping local understanding of women's and men's empowerment. Mixed methods research designs enable researchers to understand the nuances in any sociocultural context, and they can overcome the shortcomings of quantitative measurements. Using merely the standardized quantitative measures of women's empowerment might not be sufficient to understand the complex sociocultural norms that shape values, meanings, and identities (Bonis-Profumo et al., 2022; Galiè et al., 2019; O'Hara & Clement, 2018).

Appreciating this possibility, while considering the essential role of context in understanding the nuanced nature of both gender and food systems, several studies highlighted the importance of qualitative data in interpreting quantitative results, or whether their studies could benefit from qualitative insights (Akter et al., 2017; Clement et al., 2019; Galiè et al., 2019; O'Hara & Clement, 2018). For example, in Nepal, although women showed a high WEAI score, namely in decision-making domains, qualitative interviews revealed that they perceived themselves as disempowered (Clement et al., 2019). Their qualitative findings further revealed

that the absence of male partners due to migration influenced intrahousehold decision-making patterns and resulted in higher WEAI scores for women.

In another mixed-method study in rural Timor-Leste, Bonis-Profumo et al. (2022) found contradictory findings between qualitative and quantitative assessments. Despite the high rate of reported joint livestock ownership and joint decision-making on production and income in the quantitative component, the qualitative interview findings showed women's low decision-making capacity. More specifically, joint decision-making for women was an indicator of their inability in sole decision-making requiring their husband's consent. Bonis-Profumo et al. (2022) further elaborated that social norms had a significant role in shaping women's lower agency in household bargaining.

In a study about determinants of women's empowerment in Nepal, opposite findings became apparent. Education was one of the most significant correlators of women's empowerment in quantitative analysis. However, it was not a good indicator of local understanding of women's empowerment as found in the study's qualitative component (Clement et al., 2019). Moreover, the importance of accounting for cross-cultural variations in the study of women's empowerment was argued in a qualitative study conducted in four Southeast Asian countries with dominant rice farming (Akter et al., 2017). Their findings added geographical insights by developing a domain- and context-specific tool to qualitatively measure women's empowerment. Akter et al. (2017) recommended applying a mixed-methods approach to overcome gender gaps in agriculture through developing country-specific gender intervention frameworks. They further asserted that this approach could complement the general frameworks on women's empowerment, such as WEAI, which were not applicable in the studied context.

Incorporating Gender Transformative Approaches

Analyzing the impact of empowering women on their food security in isolation from the role of their male partner, and, more generally, of their households and communities, might be another explanation for inconclusive evidence. Outside the literature review sample frame, a qualitative study in India used a variety of community-based and participatory techniques (e.g., participatory need assessment sessions), focus group discussions, and farmer-to-farmer training to empower women (Manjula, 2012). It was assumed that men's involvement in capacity-building strategies could accelerate the process of women's empowerment and the ultimate goal of improving food security. Given the patriarchal nature of society, men's involvement was integral to delivering the acquired knowledge by women to the household. As a result, this strategy led to better adoption of technologies and ideas. It facilitated the greater participation of women in decision-making related to agriculture and food security at the household level (Manjula, 2012).

Considering the complexity of gender systems, including context-specific sociocultural norms that perpetuate gender inequalities and inequities, applying gender transformative approaches (GTAs) has gained attention in food security studies. The GTAs are “programs and interventions that create opportunities for individuals to actively challenge gender norms, promote positions of social and political influence for women in communities, and address power inequities between persons of different genders” (Health Community Capacity Collaborative, 2014, p. 1; see also Hillenbrand et al., 2022).

Some studies have emphasized the effectiveness of GTAs in generating positive and long-term impacts on food security outcomes through women's empowerment pathways (Galiè & Kantor, 2016; Price et al., 2018). Advocates of GTAs focus on the importance of being aware of

gender relations and sociocultural norms in a society (FAO, IFAD, & WFP, 2022). This insight enables researchers and decision makers to carefully introduce culturally and gender-sensitive approaches for empowering women as a strategy to improve food security (Njuki et al., 2022). Empirical evidence also suggests that empowering women could result in shifting power dynamics, specifically in patriarchal communities, leading to conflict in the household and against women's benefit (Johnson et al., 2016; Njuki et al., 2022). For example, empowering women in livestock is viewed as a strategy that improves women's, children's, and household food security through both household consumption and selling the products. That said, results from different studies are mixed primarily because of the male domination of the livestock sector, and related gender norms (Bain et al., 2020; Dumas et al., 2017; Galiè et al., 2019). In a qualitative study in Tanzania, women generally perceived themselves as disempowered in the livestock sector due to the patriarchal culture surrounding it (Price et al., 2018). Participating women identified important barriers to entering the livestock sector, such as the male dominance nature of this sector, ownership issues, and constraining gender norms like market access. In their Ugandan study, Bain et al. (2020) used a mixed-methods approach and found that although women's empowerment as an outcome of cow ownership increased household food security, it also challenged social norms associated with household and agricultural gender inequality. Their findings highlighted that gender-blind interventions might create an additional burden by increasing labour or women's vulnerability to disempowerment through challenging gender power relations leading to conflicts and domestic violence.

Therefore, to maximize cooperation between genders, an inclusive approach - including both men and women- is fundamental to achieving sustainable food security outcomes. According to several studies that successfully applied GTAs, for translating data into action,

there should be formative gender analysis tools in place from the beginning of the project to transform the insights into program implementation (Galiè & Kantor, 2016; Hillenbrand, 2010; O'Brien et al., 2016; Ridolfi et al., 2019). To illustrate, Helen Keller International (HKI) conducted a three-phase gender analysis process for a nutrition-sensitive agriculture program in Cambodia (Ridolfi et al., 2019). The gendered-focused strategies enabled researchers to understand socioeconomic barriers to women's empowerment and consequently address gender disparities in the studied communities that could affect food security and nutrition in the implementation phase.

Similar studies shed light on how implementers failed to define, measure correctly, and bring about empowerment within their agriculture interventions without understanding gender systems in the given context (Galiè & Kantor, 2016; Hillenbrand, 2010; O'Brien et al., 2016). Designing and applying GTAs through developing a local definition of empowerment with tailored indicators and considering context-specific considerations can be the best approach to GTAs for long-term food security outcomes (Galiè & Kantor, 2016).

Barriers at the Entry Point

As noted earlier, gender transformative research is most successful in promoting food security when it considers the local context and people's everyday realities. Several of the studies excluded from the final review were focused on barriers to empowering women, which is the entry point of the association from women's empowerment to food security (Doss et al., 2018; Dumas et al., 2017; Ellena & Nongkynrih, 2017; Jones et al., 2017; Kiewisch, 2015; O'Brien et al., 2016; St. Louis & Oliveira, 2020). They are included here to develop this discussion point.

Most of these studies elaborated on social and gender norms as the main barriers to empowering women and therefore enhancing food security. It was argued that researchers and policymakers must work with gender-disaggregated and gender-specific data to facilitate women's path toward empowerment (Doss et al., 2018; Ellena & Nongkynrih, 2017). For instance, a review of the constraints of social protection programs in the agricultural sector showed that while these programs have a great potential to empower women, gender inequalities limit women's opportunities (Jones et al., 2017). They suggested that transforming gender constraints should be considered within the design and implementation of social protection programs to support women's empowerment, which in turn can promote their agricultural productivity and food security.

To continue, Sell and Minot (2018) found that Ugandan women's reduced access to paved roads and their remoteness were associated with their low empowerment, but not so for their male counterparts. These factors affected women's engagement in market access and income-generated activities. Not applying a gender lens hinders programs and interventions from addressing gender-related issues experienced by women, which then impose more constraints on women achieving empowerment and ultimately food security. Revisiting women's rights and access to human, economic, and social resources (e.g., land, information, technology, and education) is essential to amplifying the process of empowering women toward achieving sustainable food security.

Women's Rights and Entitlements

Finally, as noted earlier, the review of previous research on the women's empowerment and food security nexus revealed that researchers must look beyond individual and household levels and consider women's interactions with the community and country levels. This approach

helps researchers better identify the barriers in such nexus when designing solutions. To demonstrate this point, Wyant's (2021) cross-sectional examination of women's empowerment and food security at the household and country levels demonstrated a positive association at the household level. Nevertheless, their multilevel analysis of 42 countries found that higher legal equality (e.g., financial, legal, and land ownership) between men and women at the country level was not directly associated with better food security.

Prior studies have failed to analyze how legal rights constrain or enable women's abilities to achieve empowerment and maintain food security. Among the few studies that did focus on women's legal rights and food security in developing countries, Bhandari and Burroway's (2018) longitudinal analysis on data from 42 LMICs found that improvements in women's property rights and constitutional rights,⁴ independently and jointly, were essential for ensuring food security in LMICs. Their results suggested that current policy interventions and market systems marginalize women and devalue their products, ending in reducing their economic efficiency.

Relatedly, other researchers have emphasized the need for an enabling policy environment (Galiè, 2019; Manjula, 2012; Quagliariello et al., 2015; St. Louis & Oliveira, 2020). Manjula (2012) suggested that through an enabling policy environment, women could gain more visibility and recognition; therefore, their training and received resources could effectively be translated into desired food security outcomes without facing legal and social barriers. At the global scale, Collins (2021) argued that gender inequality in food systems is rooted in various systemic and structural barriers thus emphasizing the need to "re-politicize gender inequality" (p. 5) and to

⁴ According to Bhandari and Burroway, "the index for property rights measures the extent to which women have the right to immovable property (e.g., land or home) ownership and are protected through inheritance laws" and "the index for constitutional rights measures the extent to which women are guaranteed equality in the constitution and whether gender-based anti-discrimination provisions are directly addressed in national constitutions" (2018, p. 433).

move beyond including women into already flawed societal structures, calling instead for a structural change and finding the root causes.

Collins (2021) suggested that feminist global governance frameworks are essential to analyze food policies for effectively addressing issues around sociocultural norms. Similarly, Brown (2019) pointed out that institutionalizing women's rights in global policy can shape national policies related to recognizing women's entitlements and reducing gender inequalities thereby resulting in better food security for impoverished urban women.

Study Limitations

Due to the limited number of studies about women's empowerment and food security in LMICs and highly heterogeneous designs with a variety of food security outcomes, a narrative format was chosen instead of a systematic review and meta-analysis design. The literature review revealed challenges and facilitators present at the nexus of women's empowerment and food security. That said, the review also identified gaps suggesting the need for a systematic review to better elucidate the relationship between women's empowerment and food security and to identify effective pathways to both. Future research should also mindfully select food security and women's empowerment measurement tools and conceptual and definitional frameworks in context-specific ways. Findings further supported the call to enhance study methodologies and integrate gender at all stages of food security programs.

Conclusion

In this paper, the authors provided evidence on the potential barriers and challenges in the association between women's empowerment and food security. The reviewed studies pinpointed a gap in conceptualizing and operationalizing food security and women's empowerment at different stages of agricultural development programs, including design, data collection, data

analysis, and interpretation. The current lack of evidence does not indicate an absence of an underlying association between women's empowerment and food security – the two *are* related thus meriting further research.

Findings supported the recommendation for context-specific and mixed-methods approaches that can effectively address programs aimed at improving food security by strengthening women's empowerment. Approaches embedded in GTAs more likely generate long-term food security outcomes. Employing an intersectionality framework can allow for targeting structural barriers at various layers of individual, household, community, and country thus ensuring that no one is left behind.

As a cautionary note, because GTAs involve more effort, complexity, and time, they might be implemented less frequently than merited and be small in scale. Nonetheless, the final takeaway from this review of the literature is that more sustainable benefits will ensue if gender goals in food security programs are linked to the broader goals of gender equality and women's empowerment.

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Table 2.2 Principal search terms

<p><i>Scopus</i></p> <p>TITLE-ABS-KEY (<i>"food secur*" OR "food insecur*"</i>) AND TITLE-ABS-KEY (<i>"wom*n's right*" OR "wom*n's empower*" OR "wom*n's disempower*" OR "Wom*n's status"</i>) AND (<i>"developing countr*" OR "developing nation*" OR "low-income countr*" OR lic OR "emerg* nation*" OR "third world" OR "middle-income countr*" OR mic OR mlic</i>) AND PUBYEAR >2009</p> <p>Complementary search</p> <p>TITLE-ABS-KEY (<i>food secur*" OR "food insecur*"</i>) AND TITLE-ABS-KEY (<i>"Women's Empowerment in Agriculture Index" OR "weai" OR "pro_weai"</i>) AND PUBYEAR>2009</p>
<p>Global Health</p> <p>("food secur*" or "food insecur*") and ("wom*n's right*" or "wom*n's empower*" or "wom*n's disempower*" or "Wom*n's status") and ("developing countr*" or "developing nation*" or "low-income countr*" or lic or "emerg* nation*" or "third world" or "middle-income countr*" or mic or mlic)).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]</p> <p>limit 1 to yr="2010 -Current"</p>
<p>PubMed</p> <p>("food supply"[MeSH Terms] OR "food storage"[MeSH Terms] OR "food secur*" [Text Word] OR "food insecur*" [Text Word]) AND (((("Women"[MeSH Terms:noexp] OR "Pregnant Women"[MeSH Terms] OR "Female"[MeSH Terms] OR "Mothers"[MeSH Terms] OR "Gender Identity"[MeSH Major Topic]) AND "Empowerment"[MeSH Terms]) OR "women's rights"[MeSH Terms] OR "women's empower*" [Text Word] OR "women's disempower*" [Text Word] OR "Women's status" [Text Word])</p>

Table 2.3 Outline of studies included in the literature review to investigate the association between women's empowerment and food security

Author(s), year, country/ Region	Research approach - Methods	Studied population - Analysis unit for food security outcomes	Food security definition/ conceptualization - measurement tool	Women's empowerment definition/ conceptualization - measurement tool	Direction of results	Key results/findings	Included gender parity index?
Asitik & Abu (2020), Ghana	Quantitative - Secondary analysis	Rural (82.5%) and urban women - Individual	Authors' constructed framework - HHS	Kabeer, 1999 - Three domains: decision-making power over crops and livestock and access to cultivatable land	Positive with all three domains	All three dimensions of women's empowerment had a positive association with household food security.	No
Aziz et al. (2020), Pakistan	Quantitative - Primary data collection	Rural households - Individual	World Food Summit, 1996 - HFIAS	Kabeer, 1999 - Six domains: Legal, ICT, familial rights, decision making, infrastructure, and leadership	Mixed results with different indicators	Among six domains of women's empowerment, four of them (legal rights, ICTs, familial rights, and social support) were negatively associated with food insecurity, while infrastructural facilities and sense of land entitlement were not significantly associated with food insecurity. A 33% of variance in food insecurity was explained with six domains of women's empowerment.	No
Aziz et al. (2021), Pakistan	Quantitative - Primary data collection	Rural female-headed households - Household	World Food Summit, 1996 - HFIAS	Kabeer, 1999 - WEAI → SDE	Mixed results with different domains	Leadership, time allocation, income, resources, and production explained 17.4% of variance in food insecurity. There was a significant negative association between leadership and food insecurity; women's input in production decisions was associated with a 20 percentage point decrease in food insecurity; Resources and food insecurity had a negative association; The right to resources could improve food security by 13.5 percentage point; Increased working hours of women was negatively associated with household food insecurity; and there was a positive relationship between food insecurity and income control.	No
Bain et al. (2020), Uganda	Mixed methods - Primary data collection	Rural households - Household	No - HDDS and FCS	Kabeer, 1999 - WEAI → SDE	Positive with overall score	Dairy cattle ownership for women showed a positive relation to household food security. From the in-depth interviews, women revealed that "the primary benefit of having access and control over dairy cattle was to provide milk for home consumption, especially for their children".	No

Bhandari & Burroway (2018), LMICs in the Global South (42 countries)	Quantitative/ Longitudinal Analysis (Retrospective cohort study) - Secondary analysis	Women within 42 countries - Individual	Four perspectives on food security: - Entitlement approach - Modernization Theory - Dependency Theory - Democracy and conflict Measurement: Depth of Hunger: average caloric amount that the food-deprived population lacks in terms of dietary energy	Discussed different theories and perspectives such as 'Depth of Hunger' Measurement: Women's status (legal rights): a combined index for property rights and constitutional rights Measurement Tool: The 50 Years of Women's Legal Rights historical database	Positive	Over the past 20 years, depth of hunger decreased in the 42 countries as women obtained more legal rights. Women's constitutional protections increased over the past 20 years along with food security in the 42 countries. Improvements to women's constitutional rights, property rights and protections, independence and agency, land equipped for irrigation, dietary energy supply and democracy were all negatively associated with levels of hunger, implying that hunger decreased in areas where women had more rights.	No
Clement et al. (2019), Bangladesh, Nepal, and Tajikistan	Nepal: Mixed method Tajikistan & Bangladesh: Quantitative - Primary data collection	Rural households - <i>Bangladesh:</i> household head; 86.8% male <i>Nepal:</i> household head <i>Tajikistan:</i> Adult females	World Food Summit, 1996 Measurement: A mix of indicators of food access, self-consumption, coping strategies, and undernutrition/ anthropometric indicators	Kabeer, 1999 - Nepal: Abbreviated WEAI Tajikistan & Bangladesh: decision-making variables	Mixed	Bangladesh - Unlike for rice and fish, the share of vegetables retained for consumption was determined by the women's input on agriculture production usage. When women had decision-making power over agriculture, coping by relying on cheaper foods was reduced. Female-headed households were more likely to face food shortage and rely of cheaper foods. Nepal - Women who were empowered regarding credit access and input retained significantly more vegetable and cereal produced for consumption, but a smaller portion of vegetables when women were empowered in the income domain. Wheat productivity in Nepal was positively associated with women's more power on income decisions, but negatively related to women's increased credit access and decisions. Tajikistan - Depending on women's decision-making, a significantly smaller share of maize was kept. The coping strategies depended on wealth and ethnicity.	No

Essilfie et al. (2021), Ghana	Quantitative - Secondary analysis	Nationally representative household survey - Household	World Food Summit, 1996 - FIES	Sen (1999) and others - Three dimensions of relative education, autonomy in decision-making, and domestic violence	<i>Dominance analysis</i> : positive with overall score and its indicators <i>OLM analysis</i> : mixed results with different indicators	Increasing women's empowerment was associated with a reduced chance of being in a worse state of food insecurity. In dominance analysis, the most significant contributors to food security in descending order were autonomy in decision-making, domestic violence, and education. In generalized linear analysis, a household with a woman allowed to make decisions on household resource allocation had a 67 percentage point increase in food security. Domestic violence did not show a significant association with food security.	No
Galiè et al. (2019), Tanzania	Mixed methods - Primary data collection	Rural households - Individual & household	World Food Summit, 1996 Measurement: 1- HFIAS 2- WDDS 3- CDDS 4- ASF	Kabeer, 1999; Sen, 1999 and others - Women's Empowerment in Livestock Index (WELI), including three domains: access to and control over land and livestock, control and use of income, workload and control over own time	Negative in qualitative analysis & Positive in quantitative analysis	Quantitative component: The three selected domains of women's empowerment showed no significant association with food security while assets indicator was significant across all other models. Qualitative component: Qualitative component showed a positive association between food security and domains of empowerment. In the food security focus groups, women shared how their own experiences agree with existing literature that contradicted the results of the first component's quantitative study.	No
Kehinde et al. (2022), Nigeria	Quantitative - Primary data collection	Rural dual adult households - Household	No - HFSSM and HDDS	No - 1- Abbreviated WEAI → 5DE 2- Gender Parity Index (GPI)	Mixed	Gender parity and women's achievement in group membership, income control, and workload were associated with a decrease in food insecurity. Women's achievement in productive decision-making and credit were related to an increase in the severity of food insecurity.	Yes
Murugani & Thamaga-Chitja (2019), South Africa	Quantitative - Primary data collection	Rural male and female farmers - Household	No - HDDS	No - WEAI: 10 indicators & 5DE	Mixed	Women's empowerment through public speaking and input in production decision-making had a positive association with HDDS, but women's increased access to credit was negatively associated with HDDS. For food secure and insecure households, their ability to access food markets played an important role in increasing their food security.	No

Sariyev et al. (2020), Bhutan	Mixed methods - Primary data collection	Rural dual adult households - Household	Conceptual framework on linkages between agriculture and nutrition: highlighting the effects of intra-household inequality – HDDS and FVS	Kabeer, 1999 - 1- Women's participation in decision-making (WPDM) 2- WPDM Index (WPDMI): Constructed through aggregation of seven decision-making variables 3- Gender equality in decision-making index (GEDI)	Positive with all measures of women's empowerment	An increase in WPDMI was associated with an increase in both FVS and HDDS in low levels of WPDMI, while after some threshold level the association was negative; so positive association at low levels and then negative at higher levels of decision-making, indicated that the relationship between women's participation in decision-making and dietary diversity was non-linear. Gender equality in decision-making index was positively associated with food security.	Yes
Sharaunga et al. (2016), South Africa	Quantitative - Primary data collection	Rural female-headed households - Household	Sustainable livelihood framework - HFIAS	Kabeer, 1999; Sen, 1999 and others - Four dimensions: economic, social, agricultural, and civic	Mixed	Female-headed households with higher levels of <i>economic agency</i> , physical capital empowerment, psychological empowerment, and farm financial management skills empowerment tended to be food secure. Women with high levels of <i>economic agency</i> tended to be food secure due to their control over the means of production and their self-motivation to acquire and utilise resource to achieve food security. Women with higher levels of <i>physical capital empowerment</i> tend to be more food secure since physical assets represented capital in its most tangible forms. Women with high levels of <i>farm financial management skills empowerment</i> tended to be more food secure due to the likelihood to invest in profitable farming enterprises. Women with higher levels of <i>psychological resource empowerment</i> are more food secure due to their ability to develop interpersonal skills to achieve household food security.	No
Sraboni et al. (2014), Bangladesh	Quantitative - Primary data collection	Rural dual adult households - Individual & household	No Measurement: 1- Per capita calorie availability 2- HDDS 3- Adult BMI [for men and women]	Kabeer, 1999 - WEAI → 5DE	Mixed	Households with increased women's empowerment were likely to have increased calorie availability and dietary diversity. Women's increased participation in groups was positively associated with household food security. Women's ownership of and rights over assets improved household food security. A decreased gender parity gap was positively related to household food security. Women's group membership and credit was negatively associated with adult male BMI indicated that intrahousehold trade-offs may exist.	Yes

Tsiboe et al. (2018), Ghana	Quantitative - Primary data collection	Households from population-based survey - Household	Focused on Food availability - Measurement: 1) Food poverty, measured by food monetary shortfall 2) Household nutrition, measured from daily carbohydrate, protein and fat intake	Kabeer, 1999 - WEAI → 5DE	Mixed results with different domains and overall score	Lower achievements in income, production, and leadership domains resulted in women having significant negative results for all macro-nutrients intake. The relative monetary shortfall was positively associated with disempowerment in income and leadership and low achievement in production. A low achievement in the time domain was related to an increase in carbohydrate, protein, and fat intake, and a decrease in the relative monetary food shortfall. Better nutritional status was observed when women were disempowered in the time and resources domains.	No
Wei et al. (2021), Bangladesh	Quantitative - Primary data collection	Rural married women between 18-46 years old- Individual	World Food Summit, 1996- HFIAS	Kabeer, 1999; Sen, 1999 and others - Six domains: Legal, ICT, familial rights, decision making, infrastructure, and leadership	Positive with overall score & Mixed results with different indicators	Achieving greater gender equality under familial and legal rights enabled women to negotiate household food utilization and involved them in decision-making, thus lowering food insecurity for women. ICTs and adequate infrastructures enabled rural households to save time and cost and prevented risks related to farming, thus lowering food insecurity while increasing profitability for women and their families. Leadership did not significantly impact food security, being a less potent empowerment domain in the studied setting. Overall, women's empowerment benefited their food security and accounted for 32% of its variance.	No

Abbreviations

5DE: Five dimensions of WEAI, including production, resources, income, leadership, and time; **ASF:** Animal Source Foods; **BMI:** Body Mass Index; **CDDS:** Child Dietary Diversity Score; **FCS:** Food Consumption Score; **FIES:** Food Insecurity Experience Scale; **FVS:** Food Variety Score; **HDDS:** Household Dietary Diversity Score; **HFIAS:** Household Food Insecurity Access Scale; **HFSSM:** Household Food Security Survey Module; **HHS:** Household Hunger Scale; **ICT:** Information & Communication Technology; **WDDS:** Women's Dietary Diversity Score; **WEAI:** Women's Empowerment in Agriculture Index.

Chapter 3: Methods

In this dissertation, secondary data from Uganda were used. In Chapter 4 (Manuscript 1), Gallup World Poll (GWP) data were employed. GWP data provide a representative population sample at the national level. Data for Manuscripts 2 and 3 (Chapters 5 and 6, respectively) came from the baseline survey of the NutriFish project in Uganda, which used the pro-WEAI survey.

Within this reporting context, Chapter 3 (methods) begins with a brief overview of the study context, Uganda and its status vis-à-vis food security, gender, and women's empowerment, in addition to the mitigating impacts of the COVID-19 pandemic. This contextual overview is followed with a description of each dataset used in this dissertation, including population, sampling, study setting, and key measurements. Finally, the conceptual and analytical frameworks applied in this dissertation are described, including an overview of the statistical approach.

Study Context: Uganda

Uganda is in East Africa (see Figure 3.1) with a population of 47 million people in 2021 (World Bank, 2022a). The country gained independence from the United Kingdom (UK) in 1962. Kampala is the largest city and the country's capital. The official language is English, but Luganda is the most widely used language. Uganda has a wide range of ethnic and religious groups with different political views and cultures (UBOS & ICF, 2018).

Uganda has a fast-growing population (3% per year) in addition to having one of the highest rates of refugee crises in the world (United States Agency for International Development [USAID], 2022). Despite the country's economic growth in 2022, a faster recovery than anticipated after the global pandemic, it is still hampered by the country's fast population growth (World Bank, 2022b). Uganda ranks 136th out of 163 countries in progress toward meeting the SDGs (see Figure 3.2) (Sachs et al., 2022). The country's progress toward SDG 1, No Poverty, is

not promising and remains stagnated. Prior to the pandemic, only 29% of Ugandan households had electricity, and only 19% used improved toilet facilities (UBOS & ICF, 2018).

Figure 3.1 Map of Uganda



Source: <https://www.fiamc.org/regional-news/region-1-africa/lessons-from-uganda/>

The COVID-19 Pandemic in Uganda and Its Impact on Food Security

Agriculture is the principal source of income for Ugandans with 84% of the population living in rural areas (USAID, 2022). The COVID-19 pandemic surged in March 2020 in most countries, including Uganda. From March 18 until the end of May 2020, the whole country was under strict lockdown with all places, including markets, schools, and places for worship, closed. In addition, there was a curfew from 7 pm until 6:30 am, as of March 30 (Mahmud & Riley, 2021). In all rural areas, it was reported that the police outside of villages restricted people's movement (Mahmud & Riley, 2021).

In the context of the agricultural season, the lockdown occurred post-planting and pre-harvest for maize, millet, and beans – the main crops in rural areas (Mahmud & Riley, 2021).

This is considered the off-season period in the agriculture seasonal calendar, and most rural households have stable activity (Adjognon et al., 2021). Mahmud & Riley (2021) stated that difficulty in accessing markets in nearby towns led to food shortages in most villages at the beginning of the pandemic. The authors found a significant (60%) drop in household non-farm income in Uganda at large, mainly due to loss of income in rural areas of Western Uganda at that time (Mahmud & Riley, 2021).

Figure 3.2 Sustainable Development Goals (SDGs) Progress in Uganda



Source: Sachs et al., 2022

One of the households' main coping strategies in response to their income loss was a 40% decline in food expenditure for each adult member with a high likelihood of missing at least a meal per day. Worsening diet quality and food insecurity were reported in another study (April 18–27, 2020) that investigated households' experiences since the lockdown in both rural and urban areas (Kansiime et al., 2021). They reported a 44% increase in the proportion of food-insecure respondents with greater than two-thirds of respondents facing income shocks due to the

pandemic economic crisis. Kansiime et al. (2021) also found that low-income households dependent on labour income faced more difficulties and vulnerabilities (than other households) due to income shocks and therefore had poorer food consumption during the pandemic.

The recent UNDP report analyzed the socioeconomic impacts of COVID-19, showing that the poorest Ugandan people in rural and urban areas were most affected by the pandemic's restrictions (UNDP Uganda, 2020). The higher vulnerability of this population was attributed to their role as net buyers with already limited food storage and savings that were exacerbated by income loss and food access restrictions during the pandemic. Kansiime et al. (2021) reported a similar result affirming the worsened food insecurity status of poor consumers dependent on the markets compared to the farmers who produced their food. The lack of access to the markets affected the farmers in a different way. Farmers who relied on the market for selling their crops and other products lost their income and savings during the lockdown, and their purchasing power for other necessities was significantly reduced (Adjognon et al., 2021; Kansiime et al., 2021).

Authors of the SOFI 2022 reported that moderate or severe food insecurity prevalence in Uganda increased by 9% during the pandemic, up from 63.4% in 2014–2016 to 72.5% in 2019–2021 (FAO et al., 2022). This rate of food insecurity was higher than the overall prevalence of food insecurity in the Eastern Africa region; 65.8% in 2019–2021 representing a 7% increase compared to 2014–2016 (FAO et al., 2022). The key determinants of food insecurity in Uganda are rooted in a complex set of underlying conditions at the individual, household, community, and system levels.

To illustrate, at the household and individual level, some of the common determinants are low income and education, lack of land or asset ownership, lack of access to clean water and

hygiene, and lack of skills or access to technology to mitigate or manage risks related to environmental and climate shocks (Feed the Future, 2018; Mfitumukiza et al., 2020; Mukasa et al., 2020; Nabuuma et al., 2021; Semazzi & Kakungulu, 2020). Prolonged drought, declining soil fertility, and reduced land size are key drivers of household food insecurity, mainly affecting crop yields and agricultural productivity (Apanovich & Mazur, 2018; Feed the Future, 2018; Semazzi & Kakungulu, 2020; Twongyirwe et al., 2019).

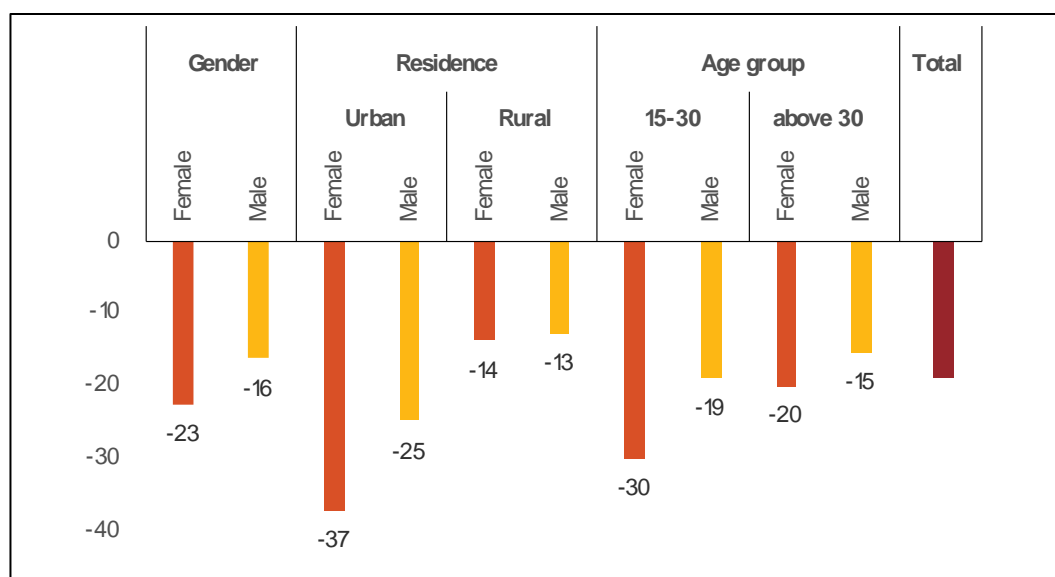
Gender and Women's Empowerment in Uganda

Uganda is one of the African countries where expressing non-binary gender is criminalized, up to a penalty of life imprisonment (Human Dignity Trust, 2022). In both political and sociocultural contexts, LGBTQIA people are subjected to discrimination and violence. Therefore, collecting non-binary gender data in household surveys is a missing piece that does not allow for studying a comprehensive picture of inequities in health research. Accordingly, the gender information available in the datasets used in this dissertation was binary: men and women.

In Uganda, women are more disadvantaged than men in many socioeconomic and particularly cultural areas, which intensifies food security inequities. Over two-thirds (67%) of women and 59% of men (15–49 years) have no education or below secondary level with considerable regional variation (UBOS & ICF, 2018). The gender gap in educational attainments across rural areas is wider than in urban areas with older women (45–49) having lower literacy rates than younger women (15–19) (20% vs 51%, respectively). Virtually half of both men and women are employed in the agricultural sector in Uganda. Among employed women who are not paid for the work they do (21%), one-third of them work in the agriculture sector (UBOS & ICF, 2018).

Although some progress has been made toward achieving SDG 5, by closing gender gaps in rates of labour force participation in 2020, Uganda still needs to work to achieve gender equality (Sachs et al., 2022). Ugandan women continue to face gender inequality in economic empowerment, particularly amidst the COVID-19 pandemic (World Bank, 2021). The increasing gender gap in paid work and business ownership adversely affected women greater than their male counterparts. Moreover, job losses and school closures resulted in longer stays at home, which in turn led to more unpaid care work, increased domestic violence, early marriage for adolescent girls, and a lack of respect to sexual and reproductive health and rights for women and girls. For instance, by June 2020, a higher percentage of women than men (23% vs 16%, respectively) lost their work. Similar patterns emerged after disaggregation by age and residence area (see Figure 3.3) (Wilman et al., 2022).

Figure 3.3 Work stoppages among Ugandan nationals and refugees



Source: Wilman et al., 2022

A nationally representative survey of violence against women in 2020 reported that virtually all (95%) Ugandan women and girls (aged 15–49) had experienced physical or sexual

domestic violence (partner or non-partner) in their lifetime (UBOS, 2021). There was a remarkable surge of gender-based violence (GBV) during the first COVID-19 lockdown in March 2020 with a 24% increase in the occurrence of rape within six months after the first lockdown. Consequently, there was a significant rise (17%) in adolescent pregnancy between April and September 2020 compared with the October 2019 to March 2020 period (Apondi et al., 2021). Many of the causes and consequences of gender inequality in Uganda also existed prior to the pandemic. Ugandan women are among the most vulnerable groups to economic, health, and environmental shocks. They struggle with hindering sociocultural barriers such as early marriage, pregnancy, leaving school, and discriminatory land ownership rights (Apondi et al., 2021; Brown, 2019; Doss et al., 2014; UBOS & ICF, 2018; UNDP, 2022).

For example, land ownership laws and entitlements are poorly defined in Uganda, and women are generally disadvantaged and dependent on their male relatives or husbands to claim their rights. In their Ugandan study, Doss et al. (2014) highlighted that although many households reported joint land ownership of husbands and wives, it was more likely that only the husband was listed on the ownership documents. As previously noted, one of the gender inequality challenges for women during the pandemic was their inability to claim household lands after the death of husband due to COVID-19 (Doss et al., 2020).

In terms of women's empowerment, findings from the WEAI pilot study in Uganda showed that 43.3% of women and 63.0% of men were empowered. Increased workload and lack of women's control over resources (e.g., ownership of assets; purchase, sale, or transfer of assets; and access to and decisions on credit) were the main contributors to their disempowerment (Alkire et al., 2013). The last report of the Uganda Demographic Health Survey (UDHS, 2016) revealed that very few men and women had a bank account (22% and 13%, respectively). A

higher percentage of men (66%) than women (46%) owned a mobile phone (UBOS & ICF, 2018). In terms of women's participation in household decision making, UDHS (2016) reported that 51% of Ugandan women (aged 15–49) participated in three specific household decisions jointly with their husbands or alone: (a) the woman's own health care, (b) major household purchases and (c) visits with the woman's family or relatives (see also UBOS & ICF, 2018).

Bain et al. (2020) conducted a mixed-methods study among Ugandan households involved in the livestock sector and found women's lack of income control, followed by increased workload, as the main contributors to their disempowerment. They pointed out the importance of considering sociocultural norms, namely gender norms, in the design and implementation of programs that aim to improve women's empowerment and challenge gender inequalities. Similarly, Sell and Minot (2018) showed that geographic patterns reflecting cultural and linguistic differences were strongly associated with different levels of Ugandan women's empowerment, suggesting cultural differences should be taken into account in policymaking and programs.

Data Collection

Gallup World Poll Data

For the first objective (Manuscript 1, Chapter 4), the nationally representative GWP data for Uganda (collected in December 2019) was used. A cross-national dataset with individuals as the unit of analysis (>15 years), the GWP is an annual survey conducted in over 150 countries since 2005. Sample sizes of at least 1,000 respondents per country are most common, as in Uganda, where the survey was administered through face-to-face interviews. In the GWP survey, self-reported data on personal experiences, aspirations, and opinions are also collected to analyze essential issues that globally affect people's lives (Gallup Inc., 2020).

The GWP samples are intended to be nationally representative of the resident and non-institutionalized populations in each country. Some of the topics covered by the survey are food and shelter; institutions and infrastructure; law and order; job climate; and financial, social, physical, and self-reported well-being. Most of the questions have dichotomous response options (yes/no), but some questions offer a wider response set (Cafiero et al., 2016).

Samples are probability based, including both rural and urban areas. GWP applies multi-stage random sampling (Cafiero et al., 2016). The first sampling stage involves the identification of sampling units (referred to by GWP as clusters of households) stratified by population size or geographic units. Random route procedures are used to select households in the second sampling stage. In the last stage, an eligible individual is selected in each household. To account for gender norms in some contexts, the gender of the respondent and the interviewer is matched.

Outcome Variable: Food Insecurity Experience Scale (FIES)

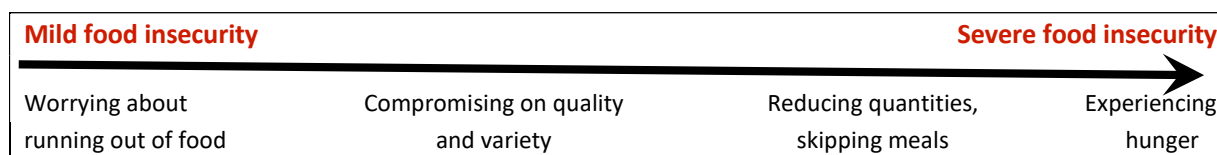
Since 2014, FAO, in collaboration with the Voices of the Hungry Project,⁵ has included the FIES-Survey Module (FIES-SM) in the GWP survey (Cafiero et al., 2016; see also 2.1, Chapter 2 of this dissertation). FIES has been validated globally (Cafiero et al., 2016) and in SSA (Wambogo et al., 2018). Combined with information gathered on other topics included in GWP data, the FIES can help reveal potential determinants and consequences of food insecurity at different levels (Cafiero et al., 2016). This measure of food security is used for monitoring global food security status (SDG indicator 2.1.2.) reported every year in SOFI series.

The FIES is generally categorized into four levels of food security status based on the number of affirmative responses, where the score of zero means “food security,” one to three

⁵ For more information see FAO, Voices of the Hungry website <https://www.fao.org/in-action/voices-of-the-hungry/resources/background/en/>

“mild food insecurity” (MFI), four to six “moderate food insecurity” (MoFI), and seven to eight “severe food insecurity” (SFI) (see Table 2.1, Chapter 2). In the analysis of Manuscript 1 (Chapter 4), these were condensed into two categories: food security and food insecurity. From a conceptual perspective, both FAO’s (2001) definition of food security and the application of its measuring tool were considered. Both are focused on the ‘access’ dimension of food security. Food security (combined FS and MFI) was ultimately conceptualized as the stages in which an individual does not experience a ‘lack of food’ in terms of quantity and compromises only food quality. Food insecurity was conceptualized as a combination of MoFI and SFI, wherein individuals experience a ‘lack of food’ in addition to limitations to the quality of food (see Figure 3.4). Furthermore, using a similar category to SDG indicator 2.1.2 allowed for comparing my findings with FAO estimates in SOFI reports.

Figure 3.4 Food insecurity severity along a continuous scale of severity



Source: FAO, 2017

Covariate Measures

The following covariate measures were included in all models estimated for the first objective (Manuscript 1, Chapter 4): gender, age, region, marital status, number of children (<15 years) and adults (>15 years) in the household, education, income, employment, shelter, social support, the Community Basics Index (CB-index), and Corruption within business. The next paragraph discusses some of the variables used less frequently in the literature.

The *shelter* question captured difficulties in affording shelter in the previous year. *Social support* measured counting on the help of relatives or friends whenever needed. The CB-index

reported an individual's satisfaction with everyday life, including public transportation systems, roads and highways, air quality, water, healthcare, availability of affordable housing, and educational system. *Corruption within businesses* assessed perceptions in a community about the level of corruption in businesses and the extent to which residents perceive corruption as widespread.

Ethical Considerations

Gallup is not affiliated with political or advocacy groups, and all collected information regarding respondents' identities is strictly confidential. Gallup data are collected using scientifically proven methodologies to provide reliable and impartial data that are allowed to be used by individuals, governments, and organizations. Consultation with the research ethics board office at McGill University established that ethical approval for GWP secondary data analysis was not required.

NutriFish Project

Project's Context and Objectives

For the second and third objectives (Manuscripts 2 [Chapter 5] and 3 [Chapter 6] respectively), secondary data from the NutriFish initiative were used. NutriFish is a gender- and nutrition-sensitive agricultural intervention in Ugandan fishing villages. This NutriFish project is a 42-month (2019–2022)⁶ collaboration among five partners: Makerere University, Uganda; the National Agricultural Research Organization (NARO), Uganda; McGill University, Canada; the International Development Research Centre (IDRC), Canada; and the Australian Centre for International Agricultural Research (ACIAR). The last two partners provided project funding

⁶ Due to the COVID-19 pandemic, the project was recently extended for additional six months (Oct 2022 – Mar 2023) to complete disrupted fieldwork activities.

under the Cultivate Africa Future Fund (CultiAF), which is a 10-year partnership between IDRC and ACIAR and aims to improve food security, resilience, and gender equality across Eastern and Southern Africa.

In consultation with the project PI and consultant, and upon reviewing the project's documents, the candidate can affirm that the NutriFish project was conducted in the fish sector and its associated value chains. It addressed nutritional deficiencies among vulnerable groups by adding affordable fish to their food baskets and increasing their diet quality. The overall goal of NutriFish was to increase the availability, accessibility, and consumption of (a) underutilized small fish by upgrading the existing value chain, and (b) processing by-products (e.g., head, frame, and skins) that come from the wasted parts of larger and more expensive fish (like Nile perch) through creating a new value chain. Underutilized small fish are the main fish caught in Lakes Alberts and Victoria.

The motivation for NutriFish was driven by the several factors: (a) the high nutritional value of by-products compared to underutilized small fish (six times richer in micronutrients such as Zinc), (b) better affordability compared to Nile perch and (c) long shelf life when properly processed. Some of the major challenges involved (a) a lack of comprehensive nutrient profiles of the small fish species and by-products; (b) rudimentary post-harvest handling and processing methods that lead to high qualitative and quantitative losses; (c) lack of access to structured markets; (d) gender inequalities, including cultural and gender norms; and (e) negative perceptions and stereotypes that limit access to and consumption of fish and fish-based products.

NutriFish aimed to address these challenges through five broad goals: (a) quantify stocks and nutrient composition of small fishes in four Ugandan lakes (Victoria, Kyoga, Nabugabo, and Albert) to guide the formulation of management strategies; (b) formulate appropriate gender-

inclusive strategies/interventions by identifying and assessing socioeconomic and institutional factors impeding access to and consumption of fish and fish-based products by vulnerable groups; (c) generate information on drivers and magnitude of post-harvest losses of underutilized small fishes and promote cost-effective processing technologies among women, youths, policy makers, and other actors (stakeholders) in the value chain; (d) develop and commercialize fish-based nutritious foods for vulnerable groups; and (e) enhance the capacity of partner institutions and actors along the underutilized small fish value chain.

This doctoral research project fell into the scope of the second objective wherein NutriFish's gender-sensitive interventions were employed. NutriFish deliberately integrated a gender-responsive strategy to ensure that product development, marketing, decision-making, and entrepreneurship strategies included women to enhance their economic capacities as well as their adoption of fish and its by-products within their diets. In doing so, NutriFish targeted (a) enhancing women's roles in fish value chains (e.g., by increasing their involvement in specific nodes of the existing and new value chains, like processing) and (b) expanding opportunities for women to start operating within the new value chain (e.g., marketing of new products). Appendix 3.1 describes the timeline of the NutriFish project and key activities within the scope of the second objective of the NutriFish project, and the role of the candidate in the project.

An assessment of the extent of the empowerment of women, gender dynamics, and power relations was conducted using the pro-WEAI tool in the NutriFish project. The qualitative component of the pro-WEAI data collection was conducted from November 2019 to January 2020. The quantitative part was carried out between January and February 2020. In this dissertation (Manuscripts 2 [Chapter 5] and 3 [Chapter 6]), the quantitative component of pro-WEAI was used. The unpublished initial field report to Makerere University containing the

qualitative findings for the NutriFish project ⁷ guided the development of the research questions, data analysis plan, and interpretation of the candidate's empirical results.

Study Population

Data for the quantitative component of the NutriFish project were collected at six Ugandan fishing villages: three on Lake Victoria (Kiyindi, Kikondo, and Lambu) and three on Lake Albert (Dei, Wanseko, and Kaiso) (see Figure 3.5). Not all fishing villages handle small pelagic fish in Uganda, so for the purpose of the NutriFish project, these fishing villages were purposively selected as the most important sites in terms of the volume of underutilized small fish catch for implementing the project's activities.

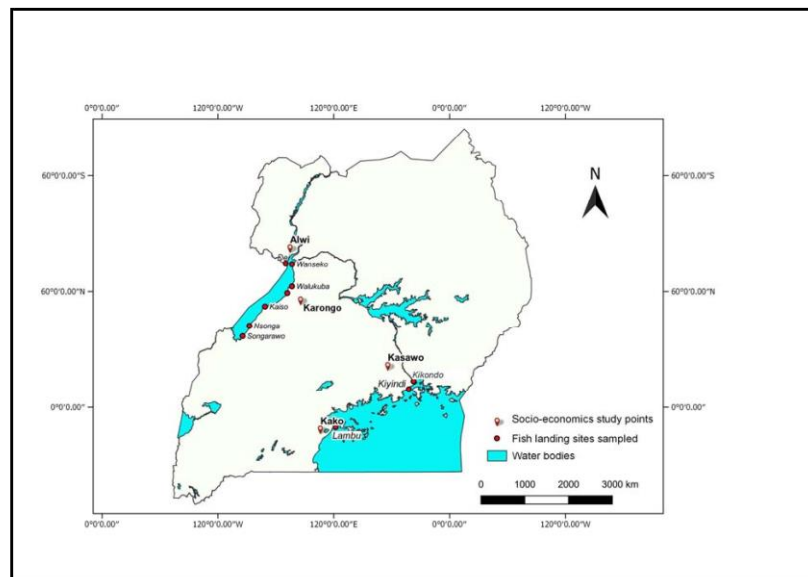
Participants in those villages lived near the shores of Lakes Victoria and Albert, where the main livelihood is fishing-related occupations (e.g., fishing, processing, and marketing). Other groups of people with a variety of non-fishing occupations (e.g., farming, and business) resided in the same villages or, at most, within 50 Km of the lake shores. The fishing and non-fishing groups experience different challenges and opportunities depending on their occupation. Thus, the occupation variable was categorized into fishing and non-fishing groups and was used as a proxy to understand the context-specific differences addressed in Manuscript 2 (Chapter 5).

Participant Selection

Because the fishing communities are transitory by nature, a national census would not provide an accurate picture of the number of households and other demographic parameters;

⁷ Ankunda, J. B., & Nanyonjo, G. (2020). *Women's empowerment among fishing communities: A case of Kiyindi, Kikondo, and Lambu landing sites on Lake Victoria and Kaiso and Dei landing sites on Lake Albert in Uganda*. Field report to NutriFish Project at Makerere University, Uganda.

people are constantly moving in and out of the fishing villages. To accommodate this feature of the study population, in each fishing village, household listing preceded the survey to identify DHHs and FHHs. The main occupation of household adults was also recorded. Target sample sizes represented both fishing and non-fishing groups, thereby ensuring that, in 50% of the selected households, at least one of the adults was involved in the small-scale fisheries value chain. The targeted number of households for each group was then randomly selected from the corresponding list.



Data Collection

The Makerere University in Kampala, Uganda implemented data collection for the NutriFish project. The quantitative household survey included the pro-WEAI questionnaire, main modules, and additional Nutrition and Health modules (respectively, pro-WEAI + H&N). In addition, complementary questions addressed individual food security status, access to reliable sanitation, marriage and fertility agency, and sexual hostility (complete questionnaires are in Appendices 3.2 and 3.3). Except for the additional Nutrition and Health modules of pro-WEAI, both male and female individuals in DHHs responded to the rest of the questions. The HN module surveyed only women who had a child under five years old.

Given the technical complexity related to implementing pro-WEAI data collection in the field, Makerere University hired a consultant to lead the sampling and data collection process and train the enumerators. Electronic data were captured from the survey questionnaire by using the Open Data Kit (ODK) Computer-Aided Personal Interview (CAPI) software platform on Android tablets, uploaded onto a server, downloaded, and transformed into STATA-compatible datasets, further checked for inconsistencies and errors, and prepared for analysis.

Makerere University conducted enumerators' training in November 2019. Eighteen enumerators (nine male and nine female) were involved. They were mostly young professionals in their mid-twenties and early thirties who were fluent in the relevant local languages. Training consisted of tutorials (focusing on questions in the standard pro-WEAI tool) and practical, hands-on sessions involving mock interviews of enumerators with each other. Plenary sessions were held after each practical session to discuss enumerators' experiences and address various challenges. Practical sessions involved using electronic tablets loaded with the pro-WEAI tool on

the ODK CAPI software platform. The gender of respondents and enumerator was matched in the field to avoid sociocultural conflicts.

Pre-testing

Following enumerator training, a pre-testing exercise was conducted at Katosi fishing village on the shores of Lake Victoria, located in Mukono District, from 21st to 22nd November 2019. Eighteen trained enumerators participated in the exercise. Pre-testing involved practicing the procedures and administration of the Pro-WEAI tool in DHHs and FHHs. The procedures included introducing the team to the community and selected households and training them in how to obtain consent from participants, and how to administer the Pro-WEAI questionnaire using electronic tablets. This practice run prepared the enumerators for the actual baseline survey. Following the pre-testing training, an evaluation was carried out during which the enumerators met and shared experiences encountered during the exercise. This provided an opportunity to clarify contentious issues and address any challenges encountered during the field-pre-testing exercise.

Ethics and Consent Procedures

Before commencing the study, ethical clearance for primary data collection was sought and obtained from Makerere University in Uganda, and the Uganda National Council for Science and Technology (UNCST) (Appendix 3.4). Additionally, the candidate obtained ethical approval for secondary data analysis used in this dissertation from McGill University, Canada (Appendix 3.5). All questionnaires were translated into local languages. Participants could choose to complete the survey in the official national language or their preferred local language. Prior to administering the survey, participants were informed about the purpose of the study and how the results would be used. They were provided a short brief on the confidential and anonymous

nature of the survey and reassured that no names or other identifying information would be recorded. Before the verbally informed consent procedure, participants were informed that they had the right to refuse answering any question they did not wish to answer and to terminate the interview or withdraw their consent at any time without penalty. The survey was administered in settings that ensured privacy, and other individuals (adults as well as children over the age of five) were asked to stay away from the survey setting during the data collection procedure.

Key Measures















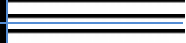






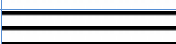
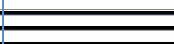
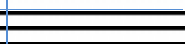
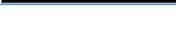
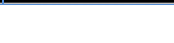
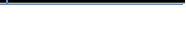
Outcome Variable: Household Food Insecurity Access Scale (HFIAS)


The Household Food Insecurity Access Scale (HFIAS) was used to measure the food security status of the studied populations. The HFIAS questionnaire consists of nine questions to assess the access dimension of food security (see Appendix 3.6) (Coates et al., 2007). The respondents were asked whether each situation happened for themselves or their households. Thus, the responses might not reflect the actual individual food security status, but rather the perception of each respondent from the overall food security status of the household. Consequently, there might be different food security statuses for men and women in the same household. This was taken to mean the individual's perception of household food security and referred to it as *individual food security*.


Although two timeframes were included in the NutriFish's HFIAS questionnaire, only the four-week period was followed up with the frequency questions, which are required to construct the HFIAS score. The candidate therefore used the four-weeks measures of food security status in Manuscripts 2 (Chapter 5) and 3 (Chapter 6). The possible HFIAS score ranges from 0 to 27 and measures a continuous degree of food insecurity (access) in the last four weeks. The score is categorized into four levels of food insecurity: food security, and mild, moderate, and severe


food insecurity (see Table 3.1). The candidate grouped the four categories into *food security* (food secure) and *food insecurity* (mild, moderate, and severe food insecurity) groups.


Table 3.1 Categories of Household Food Insecurity Access Scale (HFIAS)

Question	Frequency		
	Rarely 1	Sometimes 2	Often 3
1a			
2a			
3a			
4a			
5a			
6a			
7a			
8a			
9a			

 - food secure

 - moderately food insecure

 - mildly food insecure

 - severely food insecure

Source: Coates et al., 2007

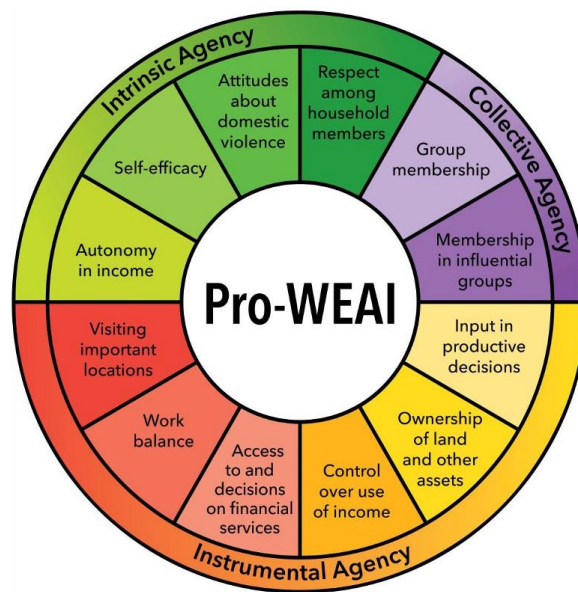
Project-level Women's Empowerment in Agriculture Index (pro-WEAI)

As noted in the previous chapter, pro-WEAI was developed as a tool to evaluate and monitor the impact of agricultural development programs on women's empowerment as an intermediate or final outcome or on nutritional outcomes as the final outcome (Malapit et al., 2019). Depending on the needs of any given project, additional questions can be added to the core questions and the following analysis to construct the index. In the NutriFish questions, additional questions related to the fish sector (see Appendices 3.2 and 3.3).

The pro-WEAI measure consists of three domains of empowerment (3DE) that are mapped into 12 indicators (see Figure 3.6). Each respondent in the pro-WEAI is classified as either

adequate (=1) or inadequate (=0) in a given indicator by comparing their responses to the survey questions with a given threshold (Malapit et al., 2019); thresholds for each indicator are in Appendix 3.7. Each indicator receives an equal proportion (1/12) of the overall weight. Respondents are considered empowered if they score *adequate* in 75% of the indicators.

Figure 3.6 Pro-WEAI empowerment domains and indicators of empowerment



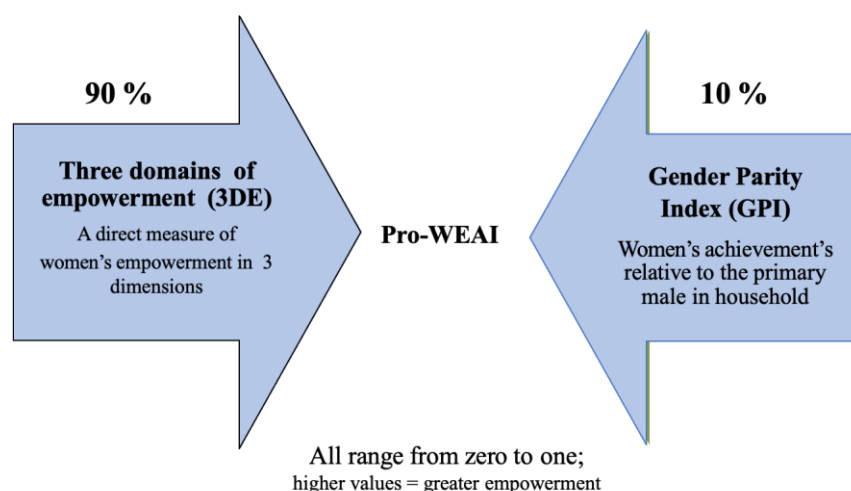
Source: Martinez, 2019

A respondent's empowerment score is simply the weighted average of their adequacy scores in the 12 indicators (all weighted 1/12). If their score is 75% or higher (≥ 0.75), or if they are adequate in nine out of 12 indicators, then they are classified as empowered. Conversely, if their score is below 75%, or if they are inadequate in four or more indicators, then they are classified as disempowered.⁸

⁸ Note that the use of pronouns in this paragraph respects APA's new protocol for gendered identity.

The GPI is another component of pro-WEAI. The GPI score is only calculated for DHHs to estimate the relative empowerment score of men and women in the same household and to compare them. A household achieves gender parity if the woman is empowered or, if she is not empowered, if her inadequacy score is equal to or lower than that of the man in her household (Malapit et al., 2019). As noted earlier, pro-WEAI consists of 3DE and GPI scores $[0.9 (3DE) + 0.1 (GPI)]$ shown in Figure 3.7; see appendices in Malapit et al. (2019) for more information about the computation of the index.

Figure 3.7 Pro-WEAI score



Adapted from (Martinez, 2019)

There are standardized add-ons to pro-WEAI core modules depending on project needs, such as a Nutrition and Health (N&H) module and a livestock module (Martinez, 2019). In the NutriFish project, the N&H module was added to evaluate women's empowerment in the nutrition domain along with measuring their empowerment in agriculture (see Appendix 3.2).

Covariate Measures

For all models estimated for the second and third research objectives (Manuscripts 2 and 3), five covariate measures were included: gender ⁹, age, education, occupation (fishing vs non-fishing), and household size. Age was categorized into three groups: 15-25, 26-45, and older than 45 years old. Education was grouped into low education (no formal education and Primary) and high education (secondary and tertiary). Occupation was classified as a binary variable: Fishing vs non-Fishing. The Fishing category included fishing, fish processing, fish trading, and causal work in fisheries. The Non-Fishing category included farming, housework, business, student, and causal work. The Household Size was the number of all members of the household (children and adults), provided by the female respondent.

Analytical and Conceptual Frameworks

Social Determinants of Health

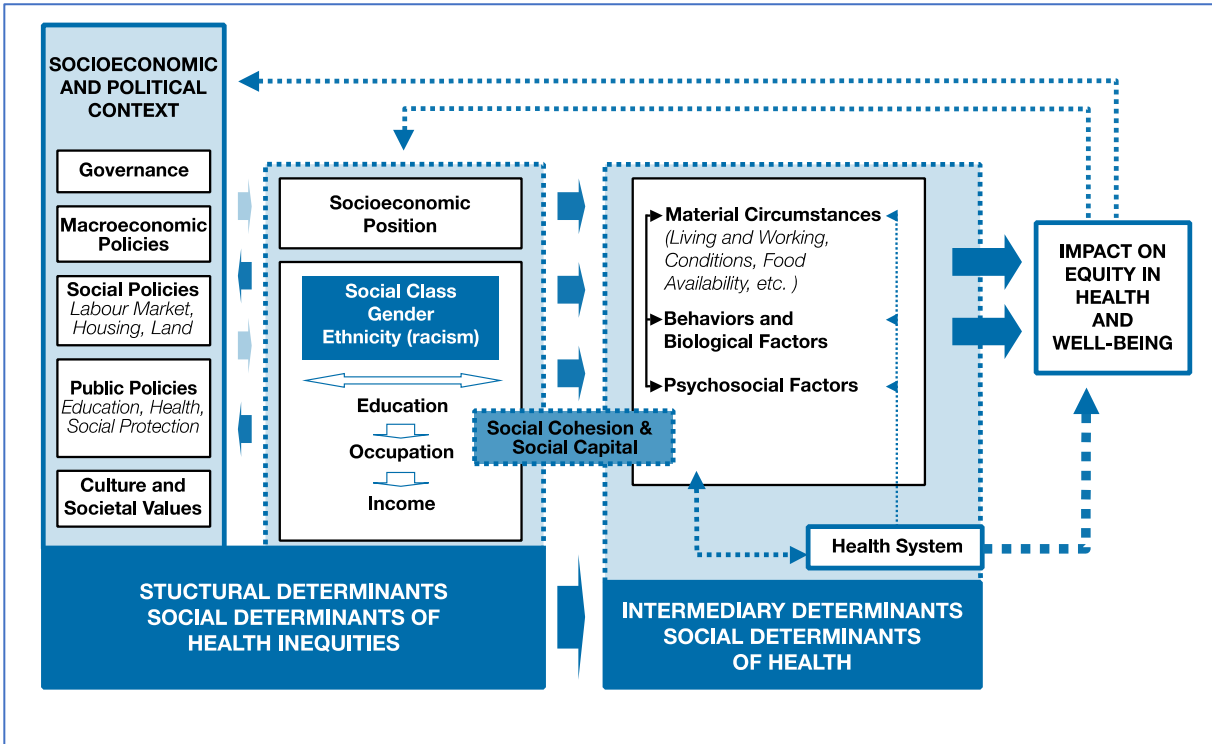
In Manuscript 1 (Chapter 4), the Social Determinants of Health (SDH) conceptual framework developed by WHO was used to select the points of inequity as the model covariates. According to WHO, the SDH are defined as “access to power, money, and resources, and the conditions of daily life in which people are born, grow, live, work, and age” (Solar & Irwin, 2010, p. 76).

⁹ To ensure an accurate understanding of the Ugandan context and that selecting gender over sex was appropriate, the candidate had long hours of debate and discussion with her supervisory committee members, a Canadian colleague who is a member of LGBTQIA communities in Canada, and Dr. Peace Musiimenta, Senior Lecturer in the School of Women and Gender Studies at Makerere University and the Chair of Women of Uganda Network Board. Additionally, at all stages of the study, the NutriFish team based in Uganda was consulted to ensure that local insights were included in the research process; more details on p. 83.

As noted in Chapter 2, where equity was defined, the mechanisms by which inequalities manifest are related to the concept of inequity. The SDH framework aims to elucidate the distinction between the social determinants that affect health and the social processes that structure the unequal distribution of these social determinants between advantaged and disadvantaged groups (Solar & Irwin, 2010). The SDH framework is therefore focused on health inequities and dismantling the social processes that shape these inequities. As shown in Figure 3.8, the SDH framework illustrates the interconnection between social, economic, and political context and a set of socioeconomic positions (e.g., race, gender, education, or income). Together, these structural determinants are referred to as *social determinants of health inequities*. In turn, socioeconomic positions affect *social determinants of health* (intermediary determinants), which are indicators of people's status within social hierarchies that are influenced by or shape health systems.

Hence, the intent of using the SDH framework is to draw policy attention to the *social determinants of health inequities* that work within different mechanisms to generate an inequitable distribution of *social determinants of health* among different groups. In doing so, the framework answers the question of “Where do health inequities come from?” The answer lies in the *social determinants of health inequities*. By demonstrating the interplay between socioeconomic and political context and socioeconomic position, the framework emphasizes the importance of including contextual factors in analyzing the impact of structural determinants on health inequities.

Figure 3.8 The social determinants of health conceptual framework



Source: Solar & Irwin, 2010

In more detail, socioeconomic positions are at the center of the SDH framework, which includes education, income, and occupation as measures of social stratification. Social class, gender, and ethnicity/race are used as the main aspects of social hierarchy. These aspects define social structure in society through the unequal distribution of power, prestige, and resources among groups in society. In the context of this framework, power is conceptualized as a pathway to allow for the expression and inclusion of the collective social power of marginalized and oppressed groups. In tuning to policy action, social participation and empowerment are suggested as key policy directions of the SDH framework: “To ensure that communities have “the last word” – ultimate control over the key decisions that affect their wellbeing” (Solar & Irwin, 2010, p. 58).

Intersectional Gender Analysis

Intersectionality

As described in the SDH framework, making progress on equity requires uncovering and addressing its root causes, in addition to considering how different axes of inequities interact with one another to generate unequal health experiences. Intersectionality can be used as a powerful tool to advance this goal toward health equity (Bauer, 2014). Intersectionality was first introduced in 1989 by Kimberlé Crenshaw within Black feminism theory (Crenshaw, 1989). She applied the intersectionality framework to the intersection between race and gender, arguing demarginalizing of Black women. Intersectionality has been developed as a theoretical framework in public health to describe unequal health experiences resulting from inequitable social processes (Bowleg, 2012; Collins, 1990; Combahee River Collective, 1977; Crenshaw, 1990).

The key focus of intersectionality is on the combined effect of several social positions (e.g., gender, class, and race) in shaping individuals' unequal health experiences rather than their isolated effect independent from other social positions (Bowleg, 2012; Hancock, 2007). For instance, Bowleg's paper (2008) is titled *When Black + Lesbian + Woman ≠ Black Lesbian Woman* and emphasizes the multiplicative and interdependent effect of various social identities and positions instead of their additive effect. Employing the intersectionality framework in health research allows for a multi-dimensional analysis by studying the role of the broader socioeconomic and political context in shaping the social hierarchies that structure unequal socioeconomic positions (Collins, 1990; Crenshaw, 1989).

Although intersectionality has been widely used in qualitative research, it is more recent in quantitative work (Bauer et al., 2021; Phillips et al., 2020). A recent systematic review of

intersectionality publications showed that the first paper to include an intersectionality framework using a quantitative approach was published in 2001 followed by 94% of other papers published since 2010 (Bauer et al., 2021). This time trend indicates the recent incorporation of this framework into quantitative research, which can explain why quantitative methodologies are still under development in the intersectionality literature (Bauer et al., 2021; Phillips et al., 2020).

In terms of disciplines that apply the framework, Bauer et al. (2021) reported that psychology, sociology, medical and life sciences, other social sciences, and gender and sexuality studies were the most common. Incorporating this theoretical framework in food security research has been very limited to date. Its absence highlights a potential missed opportunity. Integrating intersectionality as an analytical lens into food security research is critical, as food insecure people are often disadvantaged in more than one way. For example, a low-income woman living in a rural area faces challenges arising from the interaction among gender, residing area, and income. These factors overlap. Identifying pathways to overcome them requires studying their compounding effects. Project implementers, policymakers, and researchers are thus urged to use an intersectional approach to better understand where and how these factors intersect to generate different experiences of food insecurity – crucial to truly addressing inequities.

Gender Analysis

Equity is interconnected to power relations, and they should be recognized as related to each other (Solar & Irwin, 2010). As described in the SDH framework, gender is an important social position that is influenced by social hierarchies. There is a growing gender gap in experiencing food insecurity with women experiencing higher rates of food insecurity than men

(see Chapter 2). Recognizing women as a disadvantaged group requires a framework that helps researchers, policymakers, and project implementers include gender at all stages of the research (e.g., framing research questions and collecting, analyzing, and interpreting data) (WHO, 2020). A gender analysis framework can fulfill this objective.

Morgan et al. (2016) defined gender analysis as the process of analyzing how gender power relations affect people's lives, create differences in needs and experiences, and how policies, services, and programs can help to address these differences, helps in understanding how to intervene to reduce inequities (p. 1070). Gender power relations comprise (a) access to resources; (b) division of labour and everyday practices; (c) social norms, ideologies, beliefs, and perceptions; and (d) decision-making power (see Table 3.2). Applying gender analysis frameworks help researchers understand how each of these domains affects the phenomenon under investigation.

Intersectional Gender Analysis

Intersectionality emphasizes structural inequality and societal power dynamics. In an intersectional gender analysis approach, gender is included as a key social position that creates different experiences of privilege, vulnerability, marginalization or some combination (WHO, 2020). Analyzing the ways gender and gender power relations intersect with other social hierarchies and positions is referred to as intersectional gender analysis. In this analytical approach, gender is a focal point and not merely a dominant social category of analysis. As with the SDH and intersectionality frameworks, accounting for the context is similarly essential in the intersectional gender analysis approach. Gender power relations are context-specific and evolve over time, therefore including context-specific indicators within this framework is integral (Kalbarczyk et al., 2022). The candidate has no knowledge of studies in food security research

that used this approach to study the association between women's empowerment and food security. There are studies in research from other disciplines that have employed a gender analysis framework in studying different outcomes using quantitative or qualitative approaches.

Table 3.2 Gender as a power relation and driver of inequality

What constitutes gendered power relations	
Access and resources: <i>Who has what?</i>	Access to resources (e.g., education, information, skills, income, employment, services, benefits, time, space, and social capital)
Labor-sharing: <i>Who does what?</i>	Division of labour within and beyond the household and everyday practices
Social norms and beliefs: <i>How are values defined?</i>	Social norms, ideologies, beliefs, and perceptions
Decision-making and autonomy: <i>Who decides?</i>	Rules and decision-making (both formal and informal)
How power is negotiated and changed	
Individual/people	Critical consciousness, acknowledgement or lack thereof, agency/apathy, interests, historical and lived experiences, resistance, and violence
Structural/environment	Legal and policy status, institutionalization within planning and programs, funding, and accountability mechanisms

Source: Morgan et al., 2016

To illustrate, in a qualitative study in Eastern Uganda, Morgan et al. (2017) conducted a gender analysis to identify key gender dynamics affecting maternal health and maternal health care. They reported the ways gender power relations affected the maternal outcome (e.g.,

division of labour, women's workload during and after pregnancy, and lack of men's involvement at health facilities were identified as key issues when seeking maternal health services). Garrison-Desany et al. (2021) used a quantitative approach and a similar framework to investigate the role of gender power relations within Tanzanian households on women's health outcomes. They reported that, in the domain of access to resources, women who had mobile phones were 1.69 times (95% CI: 1.29, 2.22) more likely to use contraception.

The application of gender analysis frameworks is increasing in health research along with the intersectionality framework but independent of each other. Integrating them as a single framework in health research has been overlooked. The WHO (2020) developed a toolkit about *Incorporating intersectional gender analysis into research on infectious diseases of poverty: A toolkit for health researchers*. So far, very limited studies have used this approach. Rotz et al. (2022), a team of Canadian researchers, used an intersectionality lens to critically scrutinize the uptake and implementation of existing sex and gender frameworks in health research. They found that applying intersectionality has been overlooked in sex and gender analysis frameworks. They argued that the lack of an intersectional lens is a considerable gap in understanding the socioeconomic and political context that shapes different discrimination systems such as racism and colonialism. The dearth of research suggests that additional support from research and funding agencies is required to support researchers and institutions in applying intersectionality to their projects. For the first time, the SDH, intersectionality, and gender analysis frameworks were applied in this dissertation as an analytical approach to interpret results.

Statistical Analysis

Following data collection, Gallup weights data to ensure each country's sample is nationally representative. Weighting accounts for the non-equal probability of selection, geographic disproportionality, and respondent demographics (e.g., age, gender, education, and socioeconomic status when reliable targets at the national level are available). It is recommended that all analyses of respondent-level data are carried out while using the respondent-level weighting variable. The candidate thus used the `svyset` command in STATA in Manuscript 1 (Chapter 4) to designate variables that contained information about the GWP survey design, such as the sampling units and weights:

- Sampling stratification accounts for the stratification variable
- Primary sampling unit (PSU) accounts for the sampling units (clusters of households in GWP)
- Respondent-level weighting as described above.

No weighting was required for the pro-WEAI data in Manuscripts 2 and 3. Nevertheless, to account for differences between fishing villages, standard errors at the level of fishing villages were clustered by adding the option of `vce (cluster var [fishing villages])`¹⁰ to the `logit` command in STATA. STATA (version 17.0) was used to conduct all stages of analysis in this dissertation.

¹⁰ `vce(cluster clustvar)` specifies that standard errors allow for intragroup correlation, relaxing the usual requirement that the observations be independent. That is to say, the observations are independent across groups (clusters) but not necessarily within groups. For more detail see StataCorp. (2021). *Stata 17 base reference manual*. Texas Stata Press.

Missing Data

The FIES_SM questionnaire used in Manuscript 1 (Chapter 4) allows recordings of “don’t know” and “refused” responses to any of the FIES items. By FAO’s recommendation, for analytic purposes, these answers were treated as “missing,” and excluded from the analysis. Similarly, only those cases that included data for all variables were used in the primary analysis ($N=951$ respondents).

In Manuscripts 2 and 3, standard and open access pro-WEAI STATA do.files provided by the International Food and Policy Research Institute (IFPRI) team were used and the codes were modified to suit the NutriFish baseline data to construct the pro-WEAI related indicators and scores.¹¹ As recommended by the IFPRI’s researchers, observations with missing information on any of the indicators were removed because with at least one missing indicator, the total score

¹¹ To elaborate, the candidate received pro-WEAI raw data in July 2020. Before proceeding to data analyses, some standard data checks were performed to ensure the data were consistent and error free. In addition, to use do-files (STATA codes) developed by IFPRI, the candidate reconstructed the pro-WEAI data for Index calculations in winter 2021. The process of data cleaning and preparation in the required format, with the assistance of nine undergraduate students, started in March 2021 and took 10 weeks to complete under the candidate’s supervision. The candidate documented lessons learned and best practices and shared them with the NutriFish team (see summary of detailed report in Appendix 3.8). During this process, the candidate worked closely with the IFPRI team that provided technical assistance in implementing and applying the pro-WEAI questionnaire to the NutriFish team. One-on-one troubleshooting meetings via Microsoft Teams were held as needed from 2020 to 2022. To ask questions related to the process of pro-WEAI data management, the candidate contacted the NutriFish consultant via email and the IFPRI team via Slack. Later, before conducting the analysis, the candidate consulted with Nutrifish team members via Zoom meetings and emails about the abstract of each manuscript (Chapters 4, 5, and 6) including the main objectives, analytical plan, and expected outcomes: Dr. Jackson Efitre (PI), Dr. Robinson Odong (co-PI) and Dr. Margaret Masette (field advisor). Each manuscript was shared with them to include their local insights. The candidate connected with Dr. Masette via WhatsApp to consult on analytical steps and result interpretation. For example, after reading manuscript 2, Dr. Masette suggested additional analysis by fishing vs non-fishing groups due to context-specific differences.

cannot be constructed. The observations for FHHs ($n = 23$) were removed for missing information on the indicator of *respect among household members*.

Difference-in-Difference Approach

In all three manuscripts, binary logit regression models were estimated for the food security outcome. Then, the differences in the predicted probabilities of food security, referred to as marginal effects (MEs), were computed.¹² The MEs indicate how changes in the independent variable of interest affect the predicted value of the outcome, in the natural metric of the outcome, holding other independent variables at a specific value. The essence of MEs is that they are predictions and help with a better interpretation of the model on a scale that makes more sense. For further details, see Long and Freese (2014, pp. 270–280). The example below describes MEs:

- *Outcome*: food security (FS) [binary: food insecure=0, food secure=1]
 - *Variable of interest*: gender [binary: man=0, woman=1]
 - *Covariate*: age [continuous: mean = 38] and education (ed) [binary: low=0, high=1]
- * *Pr*: Predicted probability

$$FS = \beta_0 + \beta_1 (\text{gender}) + \beta_2 (\text{age}) + \beta_3 (\text{ed})$$

$$ME (\text{gender}) = Pr^*_2 (\text{food security} \mid \text{woman}) - Pr_1 (\text{food security} \mid \text{man})$$

¹² The `mchange` command in STATA was used to estimate MEs. `mchange` is one the user-written postestimation commands in the collection of `SPost13` commands for regression models which takes advantage of Stata's powerful margins command and factor variable notation. For more information see Long, J. S., & Freese, J. (2014). *Regression models for categorical dependent variables using Stata*. Stata press.

ME (gender) is the change in the predicted probability of food security when the gender variable changes from 0 to 1 and other variables are held at a specific value like average (age at 38 years, and education equals to high level).

Interpretation: Being a woman increases/decreases the predicted probability of food security by (ME)%, holding other variables on average.

To examine intersectionality, interaction terms or stratification was used in all manuscripts. In Manuscript 1 (Chapter 4), to assess the significance of the intersecting of gender with each variable of interest, two-way interaction terms between gender and each variable of interest in separate binary logit models was used. In Manuscript 2 (Chapter 5), a two-way interaction term of men's and women's empowerment status stratified by gender and occupation was used. Stratifying the model with gender or occupation functions the same as a fully interacted model. The reason for selecting a stratified model over a fully interacted model was model parsimonious and having more ease of interpreting the results. Otherwise, a four-way interaction term between men's and women's empowerment status, gender, and occupation would have had to be included in the model, which was a challenging endeavour to interpret the outputs. In Manuscript 3 (Chapter 6), the candidate challenged herself by adding a three-way interaction term between women's empowerment in agriculture, women's agency on her dietary intake, and women's agency on food purchase.

The decision to use the interactions to examine intersectionality came from the possibility of further testing of interactions, which makes it a useful approach for undersetting intersectionality in non-linear models like binary logit regression (Mize, 2019). Some maintain that the statistics on the coefficient of the interaction term are insufficient to decide about the

(in)significance effect of the interaction term in terms of the predicted probabilities. Testing for interaction in binary logit regression requires the technique called the difference-in-difference (diff-in-diff) approach (Mize, 2019).

This approach is now described by expanding on the example above, including an interaction between gender and education. Four Pr (s) are estimated for each level when using an interaction term between two binary variables: (a) high-educated men, (b) high-educated women, (c) low-educated men and (d) low-educated women. In the diff-in-diff approach, first, for each education category, MEs of gender (gender gaps) are estimated and referred to as the first difference (1st diff):

$$ME_1 [\text{Gender Gap}_{\text{high education group}}] = \text{Pr}(\text{food security} \mid \text{women}) - \text{Pr}(\text{food security} \mid \text{men})$$

$$ME_2 [\text{Gender Gap}_{\text{low education group}}] = \text{Pr}(\text{food security} \mid \text{women}) - \text{Pr}(\text{food security} \mid \text{men})$$

Then, the differences in the effects of gender across levels of education are estimated and referred to as the second difference (2nd diff): $ME_1 - ME_2$. The statistics of the second difference indicate the significance of the interaction term in deciding whether the interaction term should be included in the model. This example came from Manuscript 1. Further detail is provided in Manuscripts 2 and 3 with an example of specific variables included in the analysis.

Chapter 4: Manuscript 1. Gender and Food Security Inequities

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Gendered Determinants of Food Security Inequities within an Intersectionality Framework: A Case Study from Uganda

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Abstract

Objective: Prior research in health equity, including food security, has indicated that disadvantaged groups, characterized by gender and access to fewer resources, face more barriers to exercising their rights and are more marginalized than advantaged groups. This study aimed to identify and test the gender differences in experiencing food security inequities within the intersectionality framework in Uganda.

Design: Binary logit models disaggregated by gender were estimated to identify gender differences in food security explained by personal characteristics, human capital and available resources, and socioeconomic and political context. The moderation effect of gender with each variable exhibited a difference between men and women was tested.

Setting: Nationally representative data from Gallup World Poll, Uganda 2019

Participants: Men and women of different socio-economic categories ($N = 951$)

Results: Although most control variables showed a difference in experiencing food security by gender, only marital status and social support showed a significant gender difference. The differences between gender means of the food security score were heterogeneous at the studied social support and marital status levels. Accounting for the significant moderation effect of gender on social support and marital status, the final model showed that residing in the Eastern region of Uganda and lacking shelter decreased food security. More adults in the household, higher education and income, social support, and satisfaction with community infrastructures increased food security.

Conclusion: This was the first attempt to model and test gender differences in experiencing food security within an intersectionality framework. Conventional food security approaches may not suffice to model inequities if gender is conceived as a control variable rather than a foundation to

explain inequities. Gendered-centred analysis helps better identify disadvantaged groups and inform policies to target inequities.

Keywords: food security, food insecurity, inequity, gender, intersectionality, policy, Uganda

Introduction

One of the most studied variables associated with food security inequities is gender and the differences between experiencing food security by men and women referred to as the gender gap. Equity refers to the “equal opportunity to be healthy [here, food secure], for all population groups” (Braveman & Gruskin, 2003, p. 257) through equitable distribution of resources between more- and less-advantaged social groups. Men and women face disproportionate socioeconomic inequities that result in a gender gap when experiencing food security (Broussard, 2019; Gebre et al., 2021). Although there is evidence that gender differences in food security exist in low-, middle-, and high-income countries (Broussard, 2019; Harris et al., 2021; Kassie et al., 2015; Sinclair et al., 2019; Sraboni et al., 2014; Wambogo et al., 2018), most studies on food security and gender have been conducted in low- and middle-income countries (LMICs) in the context of agricultural settings. This is unsurprising given that most LMICs populations live in rural areas, and agricultural activities form their primary income source (Aryal et al., 2019; Gebre et al., 2021; Harris-Fry et al., 2020; Kassie et al., 2015; Lutomia et al., 2019; Sraboni et al., 2014).

Of additional interest is the fact that few studies have assessed the relationship between food security and gender on the national or global scale (Abdi, 2018; Broussard, 2019; Sinclair et al., 2019; Smith et al., 2017; Wambogo et al., 2018). Evidence shows that women are generally more food insecure than men. Broussard (2019) raised two arguments to this effect. One, there was a significant gender gap in mild to moderate food insecurity in most areas around the globe. Two, severe food insecurity was significantly different between men and women only in South-of-Sahara Africa (SSA) and South Asia (2.7% and 1.9% gender gap, respectively). Similarly, the recent report on *The State of Food Insecurity in the World* (SOFI 2022) showed a worldwide growing gender gap in moderate or severe food insecurity from 2019 to 2021

reflecting the disproportionate effect of the COVID-19 pandemic on women (Food and Agriculture Association [FAO] et al., 2022).

Research on food security has consistently revealed that disadvantaged groups (e.g., gender, race, and class) have fewer resources and are therefore more marginalized than advantaged groups (Botreau & Cohen, 2020; Broussard, 2019; Gebre et al., 2021). This situation leads to more food insecurity experiences beyond insufficient food to eat thus constituting a complex phenomenon encompassing sociocultural norms and structural determinants. Although there are multiple definitions of food security, this study adopts the FAO's (2001) definition: "food security exists when all people, at all times, have social, physical, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (p. 49).

Previous studies have indicated that some well-known determinants of food insecurity include residing in rural areas, low education, low income, unemployment, age, and lack of social support (Broussard, 2019; FAO et al., 2022; Sinclair et al., 2019; Smith et al., 2017; Wambogo et al., 2018). Gender differences associated with such determinants could explain 23% to 97% of the gender gap in food insecurity (Broussard, 2019). Most earlier studies, however, reported the observed differences without examining their significance. Examining the significance of gender differences across such determinants of food insecurity is integral for providing evidence on whether they merit empirical and policy attention. Thus, a key question is how gender intersects with other axes of inequity to shape men's and women's food insecurity experiences differently? To effectively direct policies and programs, an empirical analysis should identify and test not only a potential gender gap in outcomes but also model and test the significance of those gender differences for other relevant determinants.

For example, Sinclair et al. (2019) showed that rural men and women were more vulnerable to food insecurity in SSA and the Middle East and North Africa (MENA). In Latin America, in addition to rural residency, living in a small town for both men and women and in the suburb of a large city for only women were positively associated with food insecurity. These results profiled the different food security experiences by gender, residence area, and region. However, Sinclair et al. did not further test the combined effect or the intersection between gender, residence area, and region. For instance, was the probability of experiencing food insecurity significantly different between a rural woman living in SSA and a woman living in a large city in Latin America or a man living in a small town in MENA? Intersecting gender with various vulnerabilities and barriers can exacerbate food insecurity experiences disproportionately between men and women. Considering these differences is lacking in the current food security research, which displays only the inequalities in the food security outcome without testing the significance of such differences (Smith et al., 2017; Wambogo et al., 2018).

When it comes to policy objectives, according to the Social Determinants of Health (SDH) framework, it is crucial to project the distinct difference between addressing determinants of health or health inequities (Solar & Irwin, 2010). The SDH framework illustrates the interactions between socioeconomic and political context and a set of socioeconomic positions, which stratifies the population according to gender, race/ethnicity, income, and other determinants. These socioeconomic stratifiers reflect an individual's position within social hierarchies (social strata). Consequently, an individual experiences different privileges and vulnerabilities to health equity outcomes. With this appreciation, this study was designed to address gendered determinants of food security inequities by (a) describing food security inequities guided by the SDH framework, (b) identifying gender gaps in experiencing food insecurity and (c) examining

the intersections between each determinant of inequity with gender and testing their significance within the intersectionality framework.

Theoretical Framework: Intersectionality

Introduced and developed within Black feminist theory (Collins, 1990; Combahee River Collective, 1977; Crenshaw, 1989, 1990), intersectionality was identified as a theoretical framework in public health to describe unequal experiences of individual health (Bowleg, 2012). The intersectionality framework focuses on the combined effects of several social positions (e.g., gender, class, and race) in generating individuals' unequal health experiences (Bowleg, 2012; Hancock, 2007). It allows for a multi-dimensional analysis of how those personal experiences at various socioeconomic and demographic intersections are constructed by the social-structural context (Collins, 1990; Crenshaw, 1989).

Current intersectionality scholarship highlights how individual identities and social positions are occupied with processes of privilege and oppression in structural and institutional contexts to shape inequalities in health and well-being outcomes (Bauer, 2014). Intersectionality scholarship further emphasizes the non-additivity effects of social positions and considers their joint and combined effects (Bowleg, 2008, 2012; Bowleg & Bauer, 2016; Dubrow, 2008; Hancock, 2007). Although most intersectionality research has been mainly qualitative, there are recent quantitative studies (Bauer et al., 2021; Phillips et al., 2020). To account for intersectionality in the quantitative research methodology, a broad range of methods has been applied (Bauer & Scheim, 2019a) ranging from common techniques, such as logistic regression, to more advanced ones, including multilevel modelling, structural equation modelling (SEM), and decomposition (Bauer et al., 2021; Phillips et al., 2020). Methodological debates for intersectional statistical analysis have been advanced in recent years and are still under

development (Bauer & Scheim, 2019a, 2019b; Evans et al., 2018, 2020; Harnois & Bastos, 2019; Merlo, 2018).

To date, the use of an intersectional approach in the food security literature is very limited. In a recent scoping review, only two papers out of 243 studying equity in agriculture, nutrition, and health (ANH) applied an intersectional approach (Harris et al., 2021). Unfortunately, even such studies did not focus on food security as the primary outcome (Abera et al., 2019; Jha et al., 2009), and no definition or explanation of intersectionality was provided.¹³ In interdisciplinary quantitative research, there are barriers to incorporating intersectionality (Bauer et al., 2021; Phillips et al., 2020). A recent systematic review on intersectionality in quantitative research highlighted three main areas for improvement: a more theoretical approach and in-depth engagement with intersectionality core concepts, sampling and measurement methods, and analytical approaches (Bauer et al., 2021). There seems to be an emergent demand for incorporating intersectionality into food security research, for better consideration of the SDH's equity framework, and to ensure inclusion in that no one is left behind.

Methods

Data Source - This study focused on Uganda and its 2019 nationally representative Gallup World Poll (GWP) data, which is cross-national and uses individuals as the unit of analysis (ages >15 years). The GWP is annually conducted in over 150 countries and utilizes self-reported data on personal experiences, aspirations, and opinions to analyze issues affecting individuals' lives (Gallup Inc., 2020). Data in Uganda were collected face-to-face using a stratified multiple-stage cluster design.

¹³ For more details about intersectionality criteria, see Bauer et al. (2021).

Context - Uganda has one of the highest prevalence of severe food insecurity in SSA (Wambogo et al., 2018). When monitoring the progress of Sustainable Development Goal number 2 (SDG2, Zero Hunger), Uganda seems far from meeting this goal.¹⁴ The report of SOFI 2022 indicated that Uganda's moderate and severe food insecurity had increased from 63% (2014–2016) to 72.5% (2019–2021) (FAO et al., 2022).

Although 70% of Ugandans are involved in subsistence agriculture and predominantly women residing in rural areas, the country is quickly urbanizing (United Nations Development Program [UNDP] Uganda, 2020). It has been projected that by 2060, the urban population will exceed the rural population, mainly through rural-urban migration (World Bank, 2020). The total population will double between 2020–2060 despite the existing challenges in delivering basic needs such as education, electricity, water, and sanitation (Uganda Bureau of Statistics [UBOS] & ICF, 2018; World Bank, 2020). A recent UNDP report analyzing the socioeconomic impact of COVID-19 showed that the pandemic and public health policies intended to limit contagion mostly affected the poorest people in rural and urban areas (UNDP Uganda, 2020). In particular, the informally-employed and refugee women disproportionately experienced food insecurity (UNDP Uganda, 2020), confirming findings that the pandemic and health policies have worsened the situation of already marginalized and vulnerable populations.

In terms of gender equality, Uganda's progress is slow with several glaring gaps, including pervasive and widely accepted early and forced marriages especially for girl children, high rates of intimate partner violence, unequal distribution of unpaid care work, and limited land rights

¹⁴ By 2030, end hunger and ensure access by all people, particularly the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round, <https://www.un.org/sustainabledevelopment/hunger/>

and management for women (Organization for Economic Co-operation and Development (OECD), 2015). The adverse effect of these gender-based barriers on food security has been well-studied in isolation from the other axes of inequities and depicts the complex nexus of food security, gender, and equity in Uganda, specifically in the context of COVID-19.

Gender in Uganda

The World Health Organization (WHO) (2002) defines *gender* as socially constructed characteristics of women, men, girls, and boys including associated norms, behaviours, sociocultural roles, and relationships with each other. The terms gender (roles) and sex (biological) have been used interchangeably in scientific literature in the past, when they are in fact distinct (Krieger, 2003). In both measurement and description throughout the GWP documentation, sex and gender appear to have been conflated, similar to most surveys in the health research (Johnson et al., 2009). In the GWP survey, respondents are asked about their gender with the response options of male or female (sex).

Researchers herein used the term gender under the assumption that gender is socioculturally identified as a binary concept in the Ugandan context due to the hostile public and political environment for lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) people. Expression of non-binary gender identity is dangerous. The LGBTQIA shelters and people have been attacked and some killed (Human Dignity Trust, 2022).

Therefore, in Uganda, gender is extensively linked to the social and political context, which is ‘prescribed’ to males and females. The researchers acknowledge this limitation in using the gender variable of GWP data, as some respondents might not be able to openly reveal their gender identity and must adhere to a binary choice (man or woman). Accounting for these limitations coming from sociocultural barriers in reporting gender and survey shortcomings in

the distinction between sex and gender, the term *gender* was used in the study. This research design decision was based on the ongoing discussion in gender literature, arguing that the health outcome under study can direct researchers to differentiate between sex and gender and clarify the concept when it is conflated in the secondary data (Johnson et al., 2009; Krieger, 2003). This study's primary outcome was food security; sociocultural determinants such as income, education, marital status, and social support were considered contributing factors to achieving equity in experiencing food security. In effect, studying social factors rather than biological factors supported using gender as a social construct instead of sex as a biological construct.

Outcome: Food Security Status

The Food Insecurity Experience Scale (FIES) was used to measure food security. Since 2014, the FIES Survey Module (FIES-SM) has been included in the GWP in the FAO *Voices of the Hungry* project and is used to monitor progress toward SDG 2.1.2 (i.e., prevalence of moderate or severe food insecurity in the population, based on FIES). The FIES-SM is an experience-based approach to directly measure the access dimension of food security through eight questions with binary response options (Yes/No) (see Table 4.1). The FIES questions were tested and validated to be cross-culturally comparable both globally (Cafiero et al., 2016) and in SSA (Wambogo et al., 2018). It is generally categorized into four levels of food insecurity status (Ballard et al., 2013). From a theoretical and conceptual perspective, the study herein focused on the *access* dimension of food security, conceptualizing it as the stages in which an individual does not experience a “lack of food” in terms of quantity but instead experiences compromised food quality. The classification was condensed into two categories: food security and food insecurity (see Table 4.1). A food insecure individual experiences a “lack of food” and

limitations to consumed food quality. A similar measurement approach to SDG 2.1.2 allowed the researchers to compare their findings with FAO estimates (see Cafiero et al., 2018).

Determinants of Food Security Inequities

Guided by the SDH framework and intersectionality theory, points of intersection were categorized into three levels: personal characteristics (known as social identities), human capital and available resources (known as social strata), and socioeconomic and political context (known as structural determinants) (Evans et al., 2018; Harris et al., 2021; Solar & Irwin, 2010). Based on the GWP dataset's available variables, the researchers selected variables to assess each level (see Supplemental Table 4.1).

To elaborate, personal characteristics were measured using gender, age, region, marital status, and household number of children aged <15 and adults aged >15. Social strata were assessed by including education, income, employment, shelter, and social support. Structural determinants were estimated by measuring the Community Basics Index (CB-index) and corruption within the business. By way of explanation relative to these two variables, the CB-index reports individuals' satisfaction with everyday life, including infrastructure, air quality, water, healthcare, affordable housing, and educational system. Few studies in the food security literature have examined the structural determinants of food security within an equity framework (Harris et al., 2021). Explicit consideration of environments has lacked quantitative intersectional analyses to consider the structural mechanisms and processes that shape power and policies (Bauer, 2014). Corruption can also adversely affect food security at individual and household levels (Helal et al., 2016; Olabiyi, 2022; Uchendu & Abolarin, 2015); reducing corruption promotes governance and is a strategy to mitigate food insecurity (Olabiyi, 2022).

Analytical Strategy

Accounting for the complex survey design,¹⁵ the analysis herein was carried out in three steps: 1) run disaggregated analysis by gender; 2) apply difference-in-difference (diff-in-diff) approach to (a) test the intersection of gender with variables exhibiting a gender difference in step one and (b) test the statistical significance of such differences; and 3) compare models before and after including significant interactions with gender. Each step is now elaborated.

In the first step, binary logit models were estimated for the total sample, men and women. In doing so, the difference in the predicted probabilities (Pr) was computed,¹⁶ referred to as marginal effect (MEs). MEs are the change in Pr of food security for a change in one specific independent variable, holding other independent variables at specific values (Long & Freese, 2014). For example, for the binary variable of gender, the Pr of food security is computed at two levels, men (= 0) and women (=1), generating two Pr (s) for food security outcome, holding other variables at a specific value such as average marginal effect (AME)¹⁷ in the analysis. MEs are the differences between the Pr of food security for men and women:

$$ME(\text{gender}) = \text{Pr}(\text{food security} \mid \text{women}) - \text{Pr}(\text{food security} \mid \text{men})$$

In the second step, variables were selected that showed a difference between men and women (gender differences) in terms of significance and direction of MEs. To test the

¹⁵ Gallup weighs data to ensure each country's sample is nationally representative. In the presented analytic approach, the data were `svyset` and respondent-level weighting variables were included.

¹⁶ `mchange` command in STATA was used.

¹⁷ Average Marginal Effects (AME) represent an effect on average across the sample, which is the average (mean) of the marginal effects calculated for each observation in the sample; for further details, see Mize (2019).

significance of gender differences, the researchers tested the interaction effect of each selected variable with gender, using the diff-in-diff approach. In doing so, separated binary logit models were estimated for each interaction between gender and the selected variables, controlling for other variables.

While intersectionality literature has acknowledged the “measurement difficulty of capturing the intersections” in quantitative research (Bauer, 2014, p. 12), Hinze et al. (2012) argued that creative use of existent statistical techniques, such as using interaction terms or stratification in logistic regressions, can capture the intersections (Hinze et al., 2012). In the context of an intersectionality framework, interaction terms have been used as a common method by examining the multiplicative effect beyond the sum of the main effects (Bauer et al., 2021). Methodological literature across different disciplines has shown that the coefficient for the interaction term, in terms of predictions as described earlier, is not a proper way to interpret and test an interaction effect. Nevertheless, only the statistics for the coefficient on the interaction term are often used to conclude whether an interaction effect is significant or not (Mize, 2019).

Therefore, the researchers applied the diff-in-diff approach to test the significance of the interaction effects in terms of the predictions (Mize, 2019). Four Pr (s) were estimated for each level when using an interaction term between two binary variables. For example, for testing the interaction between gender (men/women) and education (low/high), four levels were generated: (a) high-educated men, (b) high-educated women, (c) low-educated men and (d) low-educated women. In the diff-in-diff approach, first, for each education category, MEs of gender (gender gaps) were estimated, referred to as first difference (1st diff):

$$ME_1 [\text{Gender Gap}_{\text{high education group}}] = \text{Pr}(\text{food security} | \text{women}) - \text{Pr}(\text{food security} | \text{men})$$

$$ME_2 [\text{Gender Gap}_{\text{low education group}}] = \text{Pr}(\text{food security} | \text{women}) - \text{Pr}(\text{food security} | \text{men})$$

Then, the differences in effects of gender across levels of education were estimated, referred to as the second difference (2nd diff): $ME_1 - ME_2$.

In the last step, significant interactions were included in the final model to account for the intersection of gender with the variables that showed an interactive effect. Odds ratios were computed from the initial model estimated in the first step (main effects model before including interactions) and the final logit model that included interactions. Data were analyzed using STATA (version 17.0).

Ethical Considerations

This study used secondary data provided by Gallup Worldwide Research, a division of Gallup, Inc., as part of the 2019 Gallup World Poll®, for a larger study toward the first author's Ph.D. dissertation. Gallup is not affiliated with political or advocacy groups, and all collected information regarding respondents' identities is strictly confidential. Gallup data were collected using scientifically proven methodologies to provide reliable and impartial data and are allowed to be used by individuals, governments, and organizations.

Results

Among the studied population, 52% were women ($N = 951$) (Table 4.2). Compared to women, a higher proportion of men were employed and had higher education and income above average. A higher proportion of men, however, responded affirmatively to almost all FIES items.

Table 4.3 presents the difference in the predicted probabilities of food security for each variable, disaggregated by gender. In the total population, being a woman tended to increase the probability of food security ($\Delta = 0.05$; $p < 0.1$). Although being unmarried did not significantly change the predicted probability of food security in the total sample, when disaggregated by gender, a different pattern emerged. Marital status was associated with food security differentially; the association was positive for men and negative for women ($\Delta_{\text{men}} = 0.09$; $p < 0.1$ vs $\Delta_{\text{women}} = -0.09$; $p < 0.05$). On average, one additional child was related to a 0.02 increase in the predicted probability of food security ($p < 0.05$). After disaggregation by gender, a similar pattern remained significant only for men.

The predicted probability of food security for high-educated compared to low-educated men was 0.10 higher ($p < 0.05$). While in the total sample, education showed a 0.07 increase in food security ($\Delta = 0.07$; $p < 0.05$). Although, on average, a one unit increase in income was significantly associated with an increase in food security for men and women, this increase was twice for men ($\Delta_{\text{men}} = 0.06$; $p < 0.01$ and $\Delta_{\text{women}} = 0.03$; $p < 0.05$). A lack of housing in the previous 12 months was related to a significant decrease in food security in all models (all $p < 0.01$). Similarly, men and women with a family or a relative's help had respectively 0.10 and 0.24 higher food security compared to those without social support ($p < 0.05$ and $p < 0.01$, respectively). Satisfaction with basic community infrastructures was associated with improved food security with almost similar probability ($\Delta_{\text{men}} = 0.15$ and $\Delta_{\text{women}} = 0.14$; $p < 0.05$).

For the next analysis stage, variables that exhibited a gender difference in direction or significance were selected: age, region, marital status, household members under and over 15 years, education, income, employment, social support, and corruption within the business.

Table 4.4 and Figures 4.1 and 4.2 present the results of testing whether (a) these differences (gender gaps) were statistically significant and (b) gender significantly intersected with each of these variables using the test of interaction effect (diff-in-diff). For marital status, the results showed a significant gender gap between married men and women with married women having a significantly higher probability of food security (0.32) than married men (0.19; $\Delta = 0.13$; $p < 0.01$).

The second difference showed that the size of the gender gap differed significantly between married and single status (Second difference = - 0.14; $p = 0.03$); the effect of gender significantly differed between married and single status (Figure 4.1- B). Results indicated that the probability of food security for single women (0.24) tended to be less than married women (0.32) ($p = 0.06$). There was no significant difference between married and single status for men.

The predicted probability of food security for the four combinations of gender and social support status showed a significant gender gap in food security between men and women with social support ($\Delta = 0.07$; $p < 0.05$). The difference of 0.12 increase in the probability of food security for socially supported men and women was statistically significant ($p < 0.05$). Another pattern that merits attention is the marginally significant gender gap across low-education level ($\Delta = 0.09$; $p = 0.057$). Testing the effect of education between men and women showed no significance, although the first difference of men's group was significant ($\Delta_{\text{men}} = 0.1$; $p = 0.02$ vs $\Delta_{\text{women}} = 0.03$; $p = 0.45$; Second Difference = - 0.07; $p = 0.27$). Other variables, such as business corruption, age, region, and employment did not exert a significant difference within any group (see Figures 4.1- D and 4.2- A–C).

To test for significant group differences between men and women at different income levels, information about the significance of the group difference (men vs. women) was directly

incorporated into Figure 4.2-D. That is, the gender gap was significant with women having significantly higher food security with income between zero and six compared to men (all contrasts $p < 0.05$). There were no gender differences in food security when income was between six and 11 (all contrasts $p = ns$). The second difference showed that the size of the gender gap marginally differed across income levels ($-0.04, p = 0.07$). Testing the effect of income between men and women – high-income men vs low-income men and high-income women vs low-income women – indicated that for men, the income effect was marginally greater than for women ($p < 0.1$).

Table 4.5 presents the odds ratios from binary logit models before and after, including the significant interaction terms. Most variables' effects remained similar after having interactions of gender with marital status and social support. One important difference manifested for the gender variable, which showed a different direction between the main effects and final models. In the final model, women had lower odds of food security than men by a factor of 0.89 (95% CI: 0.27, 2.97; $p = 0.85$), while in the main effects model, women had higher odds of food security (OR: 1.39; 95% CI: 0.96, 2.02; $p = 0.08$), controlling for other factors.

Overall, the final model showed that residing in the Eastern region of Uganda and having no shelter decreased the odds of food security. On the contrary, having an additional household member under 15 years, higher education, higher income, more social support, and satisfaction with the community infrastructures enhanced the odds of being food secure status after accounting for gender variability.

Discussion

The primary objective was to determine the sources of gendered food security inequities in Uganda and measure their relative significance using nationally representative data. By

challenging the conventional analytical approaches, findings revealed different layers of gender differences. Most previous studies focused on describing unequal food security outcomes by gender. This study's results by further diff-in-diff analysis displayed that the size of a gender gap differed significantly between different levels of social support and marital status, consistent with previous studies.

For example, having someone to count on in times of need was associated with a decrease in food insecurity at a globe scale, across different economic development rankings (Smith et al., 2017). Another study showed that gender differences in social support significantly contributed to 7–20% of the gender gap in food insecurity worldwide, excluding SSA. The positive impact of social support on food security was at the household level (Broussard, 2019). Schmeer et al. (2015) reported that increasing maternal social support was associated with 0.16 lower odds of household food insecurity. Tanzanian women with higher social support encountered lower seasonal food insecurity with stronger associations for wealthier communities (Hadley et al., 2007). The findings of qualitative studies have confirmed the protective effect of social support, especially for women, showing that higher social ties and networks were associated with lower food insecurity (Lemke et al., 2003).

The results of this study also demonstrated that the effect of gender was significant between levels of marital status. The overall impact of marital status on food security has been well studied. In a comparative global analysis, Broussard (2019) showed mixed effects for gender differences in marital status across regions, exhibiting a significant contribution of gender differences in marital status to explain gender differences in severe food insecurity in SSA. In another study in SSA, Wambogo et al. (2018) found no significant association between marital status and severe food insecurity. Only older married adults (>50 years) had lower

severe food insecurity than their single counterparts (Wambogo et al., 2018). Similar to our results, a cross-country analysis of FIES in 134 counties showed that being single (never or previously married) was positively associated with food insecurity (Smith et al., 2017).

In most earlier studies, results were not disaggregated by gender; therefore, the researchers cannot draw conclusions about the final association of marital status with food insecurity. Results did highlight the importance of generating gender-specific results and testing them before drawing conclusions. In this study, due to small marginal distributions, the analysis combined the two categories of never- and previously-married into one category of 'single.' The unobserved differences between these two categories could affect the overall outcome. To elaborate, Kassie et al. (2015) showed that female-headed households run by a single, widowed, divorced, or separated woman were more disadvantaged than male-headed households in many areas, and women were more likely to be food insecure than men.

It is not surprising that single women had about 0.08 lower food security than married women in the sample frame of this study. Another potential explanation for the lower food security status of single women, particularly in Uganda, includes social and gender barriers that other groups of single women face, such as unmarried adolescent mothers, and older widowers (Brown, 2019). Over and above these socioeconomic and demographic disadvantages, structural and institutional context (e.g., ethnicity, living in poor urban areas, political marginalization, refugee status) can add more complexity to food insecurity experiences of disadvantaged groups such as single women (Brown, 2019; Kwiringira et al., 2014).

Although results in the final model did not identify causal relationships, they provided thought-provoking information about gender and food security consistent with previous studies. This central finding emphasized the importance of accounting for gender as a meaningful source

of variation in studying food security and any health outcome. In a recent commentary titled *Stop ‘controlling’ for sex and gender in global health research*, Shapiro et al. (2021) argued that framing sex/gender in quantitative analysis models as a controlling or confounding variable is a “considerable danger” resulting in “incorrect findings” that are “detrimental to equitably improving global health,” (p. 2) as confirmed in this study.

In most previous studies, the main effect of education was strongly associated with higher food security. More layers can be found when the combined effect of other variables is included. In Uganda, 67% of women and 59% of men (15–49 years) had low education with considerable regional variation (UBOS & ICF, 2018). From the intersectionality perspective herein, gender, age, region, living in urban areas, and income were found to be contributors to low education in Uganda. Other scholars have proposed that only having higher education for women does not translate into a better job, income, or food security because women face more socioeconomic inequalities, including cultural stereotypes and continued exclusion from active participation in social life (see Bhandari & Burroway, 2018; Tanankem et al., 2017). Similar context complexity exists for income inequalities in Uganda. Women have less access to credit, economic resources, and wage-earning opportunities compared to men (UBOS & ICF, 2018). This may explain the doubled increase in the probability of food security in men found in our study. Other strong determinants of food security were shelter and the CB-index. The strong association of these less-studied variables, regardless of gender differences, highlights the importance of incorporating intermediary and structural determinants when studying health equity.

The lack of a significant gender gap in this study across different levels of other well-studied determinants of food security (e.g., age, regions, and employment) did not mean that these personal identities and social positions failed to account for gender gaps. Instead, these

results supported the call for more in-depth analysis by examining various intersections, not only by gender but also with other social positions.

In the over-emphasis on well-known determinants of food security, the fundamental role of women's legal rights in closing gender gaps has been overlooked (Bhandari & Burroway, 2018; Burroway, 2015). In Uganda, the struggle to institutionalize women's rights has been in a "stop-start" process for years and is ongoing (Brown, 2019; Burgess & Campbell, 2016). Food insecurity goes beyond food availability and includes food access as well. Some determinants used in this research design have been well-studied; yet the role of gender differences and how entitlement failures of women affect food access have been less investigated (Bhandari & Burroway, 2018). This suggests that policy programs should target structural determinants of food security inequities rooted in a lack of rights and governance for marginalized groups, including women.

Study Limitations

Firstly, the selection of variables for the analytical model was limited by the variables in the GWP data. For instance, the lack of information about intrahousehold gender dynamics, patriarchal belief systems, or gender-specific policies and institutional practices did not allow for studying social processes further, as suggested within the intersectionality framework. Secondly, only two-level interactions were performed, which might be limited in satisfying feminist criteria for intersectional analysis because (a) the focus of the study was gender; therefore, the exploratory approach included only the intersections between gender and other variables that exhibited gender inequality.

To continue, (b) there were concerns about model parsimony and difficulties in interpreting high order interactions when moving beyond two-way interactions. One solution

employed to embrace the complexity of intersectionality was to consider both between and within interaction for each intersection by testing both sides. Testing the intersection of gender with various variables allowed for a heuristic approach in that different independent variables could be introduced and assessed in the model. The authors acknowledge that, on both technical and interpretive grounds, two-way interaction effects have limited capacity to bring the context and complexity of intersectionality into the analysis. Further work should be extended to other suggested approaches that are more compatible with feminist understandings of intersectionality, such as multilevel regression analysis.

Thirdly, the authors applied a descriptive intersectionality approach and did not assess the structural mechanisms of social power to explain why these inequities happen and elaborate on the mechanisms further. Advancing knowledge about inequities in food security within the intersectionality framework must go beyond describing unequal food security outcomes, and more analytical work is required to identify root causes.

Conclusion

Results of this study contributed to the current knowledge base on the nexus of food (in)security, gender, and equity. First, FIES was used as an experience-based individual measure of food security; accordingly, the “gender gap” was quantified as the difference between gender means of the FIES. Second, the analysis went beyond identifying merely gender differences in experiencing food security. The authors know of no study in this area that applied a diff-in-diff approach to model gender differences between and within the underlying factors, guided by the intersectionality framework. Third, food security determinants were modelled at different levels of equity recommended by the SDH framework, which provided new insights into less-studied determinants of food insecurity.

Illnesses, and deaths due to COVID-19, and policies that reduced contagion, negatively affected food security in all nations including Uganda (Boero et al., 2021). Various studies have documented the adverse effect of gender discrimination against women during the pandemic as one of the main contributors to higher food insecurity among women (Béné et al., 2021; International Food Policy Research Institute [IFPRI], 2021; United Nations [UN], Uganda, 2020). The results from the study herein can be used to support comprehensive policies integrating equity-based strategies to tackle food insecurity, considering the extra burden owing to the COVID-19 pandemic.

In turning to policy action on food security inequities, three broad approaches might be considered pursuant to study results: (a) identify disadvantaged groups through an intersectionality lens and consider joint effects of marginalization rather than independent effects; (b) include context-specific strategies, specifically by benefiting from mixed-methods approaches; and (c) focus on advancing women's rights in the context of food security by targeting inequalities in socioeconomic, political, and cultural context. To tackle food security inequities, policymakers should not limit themselves to socioeconomic and demographic determinants but specifically include the social processes and power that shape a system of oppression and privilege that has resulted in an inequitable distribution of the determinants of food security (Collins, 2021).

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Contribution of Authors

FB designed the project conception, developed the overall research plan, analyzed the data, and wrote the first draft of the manuscript; PM assisted with integrating local context in interpreting the results and conceptualizing the analytical approach; HMQ guided the overall research plan, including the project conception, and the analytic design and approach; FB had primary responsibility for the final content. All authors read the manuscript, interpreted the results, provided critical intellectual content, and read and approved the final manuscript.

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Table 4.1 Food Insecurity Experiences Scale (FIES) questions

Binary outcome	FIES categories	Short Reference	During the last 12 MONTHS, was there a time when because of a lack of money or other resources? (Yes/No/ Do not know/ Refused to answer)
Food security	Food secure	FS	No affirmative responses
	Mild FI	WORRIED	1) You were worried you would run out of food?
		HEALTHY	2) You were unable to eat healthy and nutritious food?
Food insecurity	Moderate FI	FEWFOODS	3) You ate only a few kinds of foods?
		SKIPPED	4) You had to skip a meal?
		ATELESS	5) You ate less than you thought you should?
	Severe FI	RANOUT	6) Your household ran out of food?
		HUNGRY	7) You were hungry but did not eat?
		WHLDAY	8) You went without eating for a whole day?

Table 4.2 Sample characteristics overall and by gender ¹

Characteristics	Overall ² (n= 951)	Men (n= 454)	Women (n= 497)
Independent variable			
<i>Personal characteristics</i>			
Age (in years), %			
15-25	45.3	45.1	45.5
26-45	37.6	37.6	37.5
>45	17.1	17.3	16.9
Region, %			
Central	27.6	25.6	29.6
Eastern	27.3	30.6	24.3
Northern	17.7	19.9	15.7
Western	27.4	23.9	30.5
Marital status, %			
Married	43.9	44.0	43.7
Single ³	56.1	56.0	56.3
Household size <15 years	2.5 (0.1)	2.3 (0.1)	2.6 (0.1)
Household size >15 years	2.8 (0.1)	2.9 (0.1)	2.8 (0.1)
<i>Human capital and resources</i>			
Education, %			
Low education	45.2	40.5*	49.5
High education	54.8	59.5	50.5
Income ⁴	5.8 (0.1)	6.0 (0.1)*	5.7 (0.1)
Employment, %			
Employed	54.1	63.6***	45.3
Underemployed	19.8	17.7	21.8
Out of workforce	26.1	18.7	32.9
Shelter, %			
No	53.5	55.4	51.8
Yes	46.5	44.6	48.2
Social support, %			
No	19.8	20.2	19.4
Yes	80.2	79.8	80.6
<i>Structural determinants</i>			
CB-index ⁵ , %			
Dissatisfied	64.5	67.2	62.0
Satisfied	35.5	32.8	38.0
Corruption within business, %			
No	20.9	20.0	21.8
Yes	79.1	80.0	78.2

Outcome variable: Food security items ⁶			
WORRIED, %	71.3	72.0	70.6
HEALTHY, %	73.5	73.0	74.1
FEWFOODS, %	79.1	80.0	78.3
SKIPPED, %	65.7	68.4	63.2
ATELESS, %	70.7	70.7	70.6
RANOUT, %	63.3	66.4	60.5
HUNGRY, %	62.5	67.2 *	58.2
WHLDAY, %	44.0	46.8	41.4

¹ Values are means (SDs) or percentages (weighted).

² Chi-square and adjusted Wald tests were used to evaluate the distributions between groups.

³ Never married, divorced, separated, widowed.

⁴ Per capita annual log income in international dollars estimated by dividing the annual household income by the total number of individuals living in the household. Income ranged from \$0 to ~\$45K dollars with a mean of \$964. To normalize the income distribution, we transformed it into log income, and we refer to this variable as income.

⁵ Community Basic Index measuring the seven items of public transportation systems, roads and highways, quality of air, water, and healthcare, availability of affordable housing, and educational system.

⁶ Only affirmative responses (%) were reported.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$; two- tailed tests.

Table 4.3 Predicted probabilities of food security overall and by gender ¹

Variables	Overall	Men	Women
Gender			
Women vs Men	0.05 * (0.03)	-	-
Age			
26-45 vs 15-25	- 0.04 (0.03)	0.01 (0.04)	- 0.08 * (0.04)
>45 vs 15-25	0.03 (0.05)	0.13 (0.09)	-0.01 (0.07)
>45 vs 26-45	0.07 (0.05)	0.13 (0.08)	0.07 (0.07)
Region			
Eastern vs Central	- 0.10 ** (0.05)	- 0.08 (0.06)	- 0.13 ** (0.06)
Northern vs Central	- 0.03 (0.04)	- 0.03 (0.07)	- 0.06 (0.05)
Western vs Central	- 0.01 (0.05)	- 0.01 (0.07)	- 0.01 (0.05)
Northern vs Eastern	0.07 (0.05)	0.05 (0.06)	0.08 (0.06)
Western vs Eastern	0.09 * (0.05)	0.07 (0.06)	0.12 ** (0.06)
Western vs Northern	0.02 (0.05)	0.02 (0.07)	0.05 (0.05)
Marital status			
Single vs Married	- 0.02 (0.03)	0.09 * (0.05)	- 0.09 ** (0.04)
Household size <15 years ²	0.02 ** (0.01)	0.03 ** (0.01)	0.01 (0.01)
Household size >15 years ²	- 0.001 (0.01)	-0.01 (0.01)	0.01 (0.01)
Education			
Secondary or higher vs <Secondary	0.07 ** (0.03)	0.10 ** (0.04)	0.04 (0.05)
Income ²	0.04 *** (0.01)	0.06 *** (0.02)	0.03 ** (0.01)
Employment			
Underemployed vs Employed	- 0.07 * (0.04)	- 0.03 (0.06)	- 0.09 ** (0.05)
Out of workforce vs Employed	0.01 (0.04)	- 0.01 (0.05)	0.03 (0.06)
Out of workforce vs Underemployed	0.08 * (0.05)	0.02 (0.07)	0.12 ** (0.06)
Shelter			
Yes vs No	- 0.16 *** (0.03)	- 0.18 *** (0.04)	- 0.14 *** (0.05)
Social support			
Yes vs No	0.18 *** (0.03)	0.10 ** (0.05)	0.24 *** (0.04)
CB-index			
Satisfied vs Dissatisfied	0.15 *** (0.03)	0.15 ** (0.05)	0.14 ** (0.05)
Corruption within business			
Yes vs No	- 0.02 (0.04)	0.01 (0.05)	- 0.05 (0.06)

¹ Marginal effects (MEs) were computed at Average Marginal Effects (AME) with standard errors in parentheses.

² For continuous variables, a one-unit discrete change was reported.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; two- tailed tests.

Table 4.4 Probability of food security by gender and variables of interest with test of interaction effect

	Pr (FS) ¹ Women	Pr (FS) Men	Gender gap ² (1 st difference)	Contrasts ³ (2 nd difference)
Binary X Binary interactions				
Education				
Secondary or higher	0.29 (0.03)	0.27 (0.03)	0.29 – 0.27 = 0.02 (0.04)	0.02 – 0.09 = - 0.07 (0.06)
<Secondary	0.26 (0.04)	0.17 (0.04)	0.26– 0.17 = 0.09 * (0.05)	
Marital status				
Single	0.24 (0.03)	0.25 (0.03)	0.24 – 0.25 = - 0.01 (0.04)	-0.01 – 0.13 = - 0.14 ** (0.06)
Married	0.32 (0.04)	0.19 (0.03)	0.32 – 0.19 = 0.13 *** (0.05)	
Social support				
Have social support	0.31 (0.03)	0.24 (0.03)	0.31 – 0.24 = 0.07 ** (0.03)	0.07 – (-0.05) = 0.12 ** (0.05)
No social support	0.08 (0.03)	0.13 (0.04)	0.08 – 0.13 = - 0.05 (0.05)	
Corruption within business				
No corruption	0.31 (0.05)	0.21 (0.05)	0.31 – 0.21 = 0.1 (0.06)	0.1 - 0.04 = - 0.06 (0.07)
With corruption	0.27 (0.03)	0.23 (0.03)	0.27 – 0.23 = 0.04 (0.03)	
Multi-category X Binary interactions				
Age				
15-25	0.29 (0.03)	0.23 (0.03)	0.29 – 0.23 = 0.06 (0.04)	None ⁴
26-45	0.24 (0.04)	0.20 (0.03)	0.24 – 0.20 = 0.05 (0.05)	None
>45	0.31 (0.06)	0.26 (0.07)	0.31 – 0.26 = 0.05 (0.09)	None
Region				
Central	0.32 (0.04)	0.25 (0.04)	0.32 – 0.25 = 0.07 (0.05)	None
Eastern	0.19 (0.05)	0.18 (0.04)	0.19 – 0.18 = 0.01 (0.05)	None
Northern	0.28 (0.04)	0.23 (0.05)	0.28 – 0.23 = 0.06 (0.07)	None
Western	0.31 (0.04)	0.24 (0.05)	0.31 – 0.24 = 0.07 (0.05)	None
Employment				
Employed	0.29 (0.03)	0.23 (0.03)	0.29 – 0.23 = 0.06 (0.04)	None
Underemployed	0.19 (0.04)	0.20 (0.06)	0.19 – 0.20 = -0.01 (0.06)	None
Out of workforce	0.31 (0.04)	0.23 (0.05)	0.30 – 0.23 = 0.08 (0.06)	None

¹ Marginal effects (MEs) were computed at Average Marginal Effects (AME) with standard errors in parentheses.

² Statistics for gender gap is the difference in the effect of interest variable between men and women.

³ The second differences column reports whether gender gaps are significantly different across levels of interest variable. For multi-category variables, the "contrasts" column reports which gender gaps are significantly different across levels of interest variable (second differences).

⁴ 'None' indicates that none of the paired second differences were significant.

Note: Because of rounding, the differences do not always equal the discrete change coefficient in women minus the discrete change coefficient in men, similar for the 2nd differences.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; two-tailed tests

Table 4.5 Odds ratios from logit model for being food secure, comparing two models; before and after including interactions

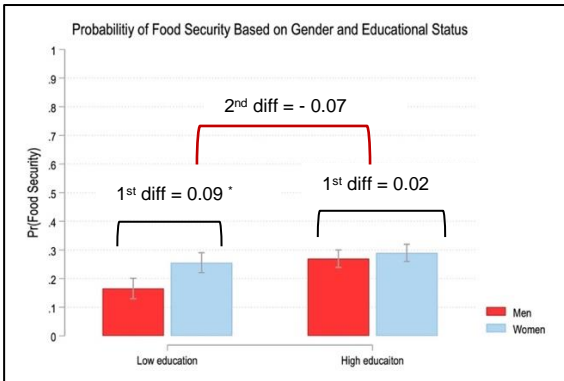
Variables	Main Effects Model OR (95% CI)	Model with interactions OR (95% CI)
Personal characteristics [Social identities]		
Gender (ref. Men)		
Woman	1.39 (0.96, 2.02) *	0.89 (0.27, 2.97)
Age (ref. 15-25)		
26-45	0.76 (0.51, 1.13)	0.77 (0.52, 1.14)
>45	1.17 (0.65, 2.08)	1.39 (0.75, 2.56)
Region (ref. Central)		
Eastern	0.52 (0.26, 1.03) *	0.51 (0.25, 1.01) *
Northern	0.85 (0.51, 1.41)	0.84 (0.50, 1.40)
Western	0.96 (0.55, 1.69)	0.95 (0.54, 1.67)
Marital status (ref. Married)		
Single	0.88 (0.60, 1.27)	1.50 (0.82, 2.74)
Household size <15 years	1.13 (1.01, 1.25) **	1.15 (1.03, 1.27) **
Household size >15 years	0.99 (0.88, 1.12)	0.99 (0.88, 1.12)
Human capital and available resources [Social strata]		
Education (ref. Secondary or higher)		
<Secondary	1.56 (1.02, 2.39) **	1.58 (1.03, 2.42) **
Income	1.26 (1.13, 1.42) ***	1.28 (1.14, 1.44) ***
Employment (ref. Employed)		
Underemployed	0.63 (0.37, 1.08) *	0.63 (0.37, 1.10)
Out of workforce	1.08 (0.67, 1.75)	1.13 (0.70, 1.80)
Shelter (= Yes)	0.360 (0.24, 0.54) ***	0.36 (0.24, 0.54) ***
Social support (= Yes)	3.99 (2.02, 7.88) ***	2.37 (1.08, 5.20) **
Socioeconomic and political context [Structural determinants]		
CB-index (= Satisfied)	2.46 (1.65, 3.67) ***	2.39 (1.58, 3.62) ***
Corruption within business (= Yes)	0.90 (0.53, 1.52)	0.86 (0.51, 1.46)

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; two-tailed tests.

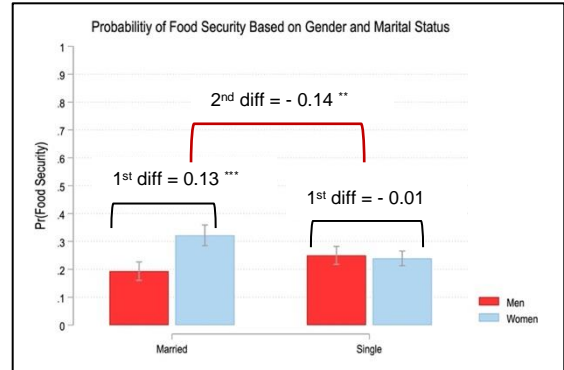
Figure 4.1 Predicated probability of food security: Two-way interaction

*Two-way interaction between gender and A) education, B) marital status, C) social support, and D) corruption within the business (Binary X Binary interactions). Marginal effects (MEs) were computed at Average Marginal Effects (AME). $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; two-tailed tests.*

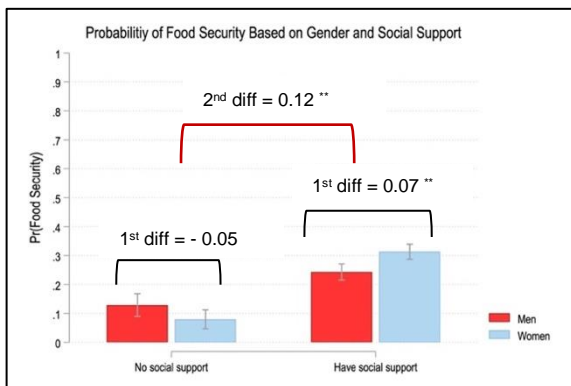
A



B



C



D

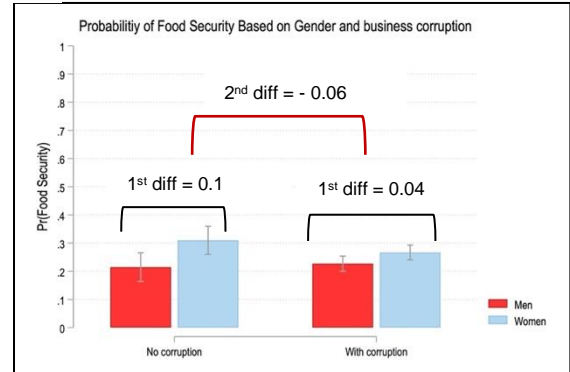


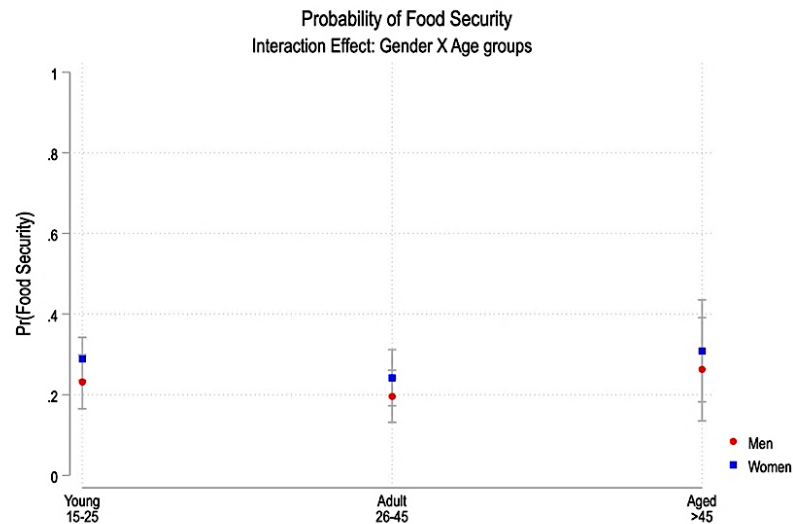
Figure 4.2 Predicated probability of food security: multi-category and continuous interactions

Multi-category X Binary interactions between gender and A) age, B) region and C) employment status.

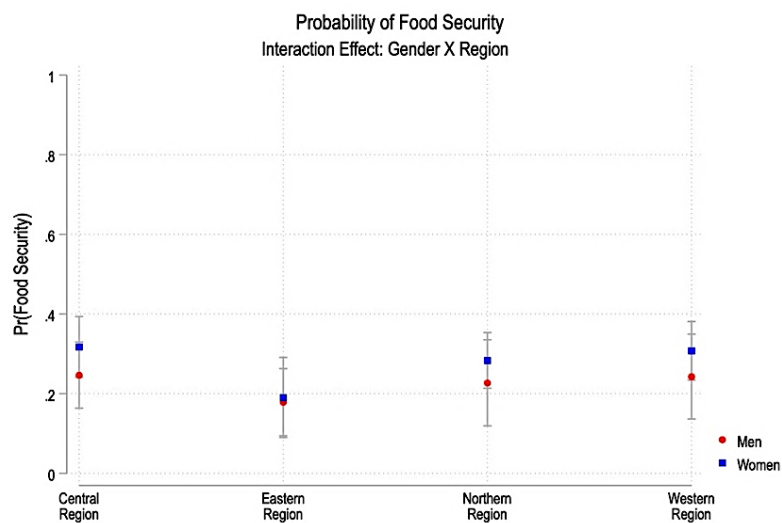
Continuous X Binary interactions between gender and D) income, E) Household size <15 years, and F) Household size >15 years

Note: Marginal effects (MEs) were computed at Average Marginal Effects (AME). There were no significant first and second differences for A-C variables. $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; two-tailed tests.

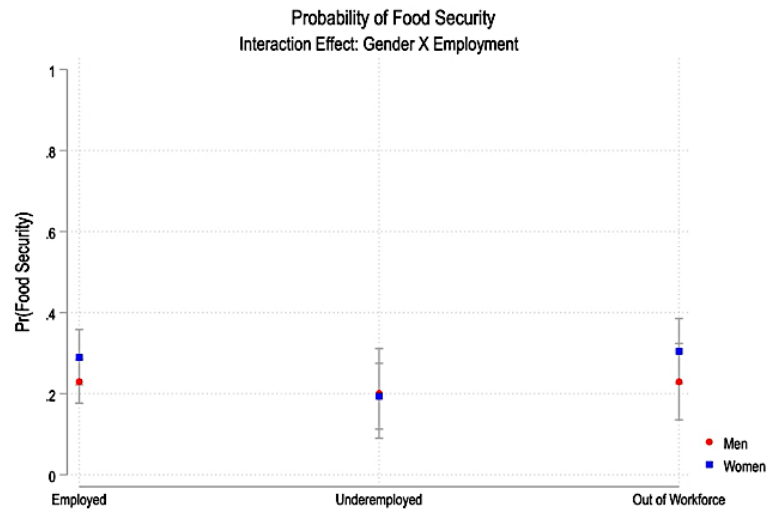
A



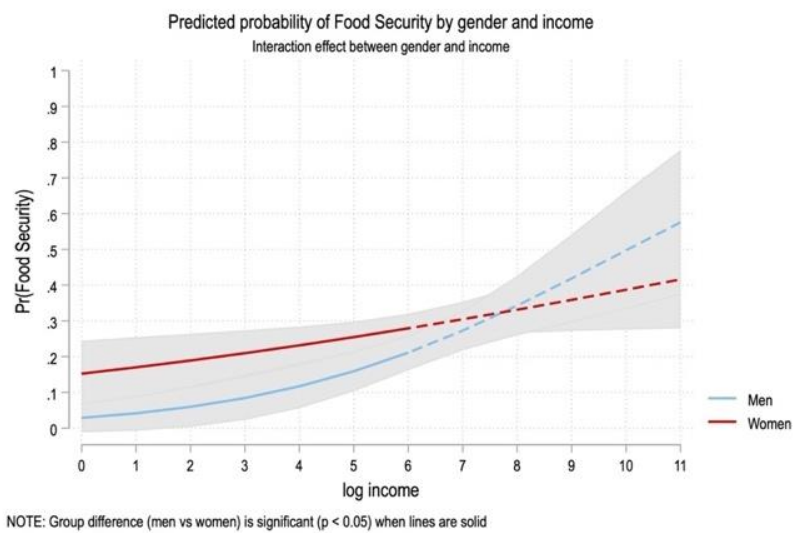
B



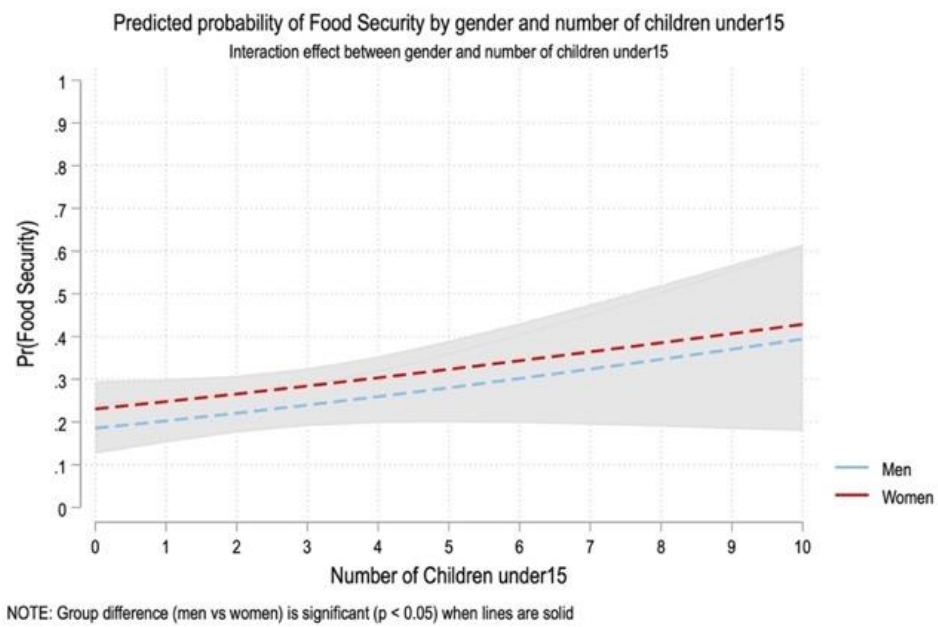
C



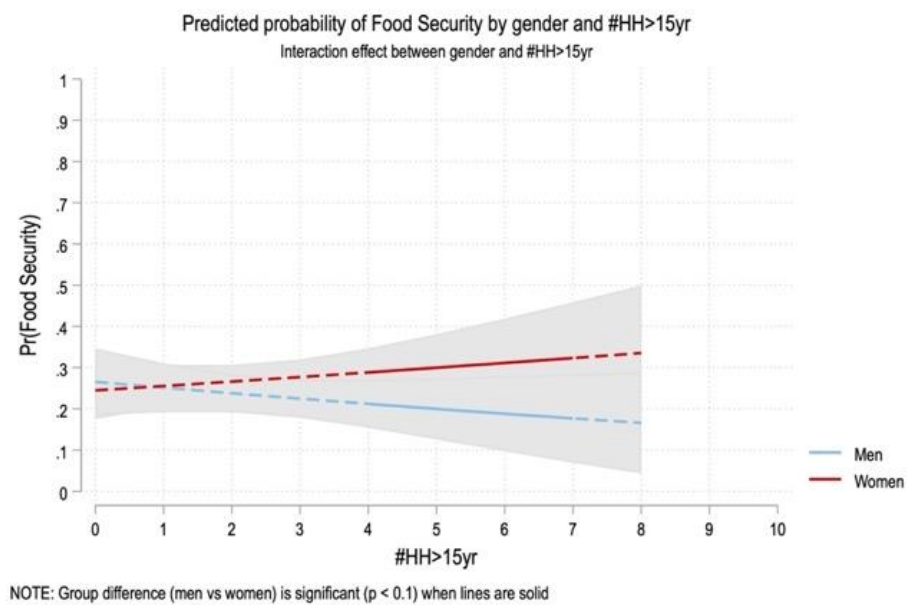
D



E



F



Supplemental Table 4.1 Variable descriptions

Variable label	Question	Response categories
Dependent variable		
Food security	See Table 4.1	0 = Food security (food security, mild food insecurity) 1 = Food insecurity (moderate and severe food insecurity)
Independent variable		
<i>Personal characteristics</i>		
Gender	Gender?	0 = Men; 1 = Women
Age	Please tell me your age.	0 = 15-25; 1 = 26-45; 2 = older than 45
Region	Respondent lives in:	1 = Central; 2 = Eastern; 3 = Northern; 4 = Western
Marital status	What is your current marital status?	0 = married; 1 = single
Household size <15 years	How many children under 15 years of age are now living in your household?	# Residents <15yr in HH
Household size >15 years	How many people older than 15 years of age are now living in your household?	# Residents 15+ in HH
<i>Human capital and available resources</i>		
Education	What is your highest completed level of education?	0 = <secondary; 1 = secondary or higher
Income	What is your monthly household income in local currency?	# logged income in International Dollar
Employment	What is your employment status?	0 = employed; 1 = underemployed; 2 = out of workforce
Shelter	Have there been times in the past 12 months when you did not have enough money to provide adequate housing for you and your family?	0 = No; 1 = Yes

Social support	If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?	0 = No; 1 = Yes
<i>Structural determinants</i>		
Community basics index (CB-index)	In the city or area where you live, are you satisfied or dissatisfied with the public transportation systems, roads and highways, quality of air, quality of water, availability of good affordable housing, educational system or the schools, availability of quality healthcare?	0 = Dissatisfied; 1 = Satisfied (See text for details about score construction)
Corruption within the business	Is corruption widespread within businesses located in (country), or not?	0 = No; 1 = Yes

Bridging Statement 1

In Chapter 4 (Manuscript 1), food insecurity in Uganda was examined at the macro level using secondary data collected by the Gallup World Poll in 2019. Gender differences in experiencing food security were estimated at three equity levels: structures/context, socioeconomic positions, and personal identities. Results showed the importance of structural variables for both women and men; however, different layers of gender differences at socioeconomic positions and personal levels were reported. Manuscript 1 provided evidence of the importance of including an intersectional lens in studying gender as a focal point in generating unequal experiences of food insecurity.

Using the results reported in Manuscript 1 (Chapter 4), the focus of Chapter 5 (Manuscript 2) shifted towards the micro-level in examining gender as a source of power relations at the individual and household levels in generating different experiences of food insecurity between men and women. Data collected in fishing villages in Uganda were included in this secondary analysis taking advantage of the larger gender- and nutrition-sensitive agriculture NutriFish project that focused on gender and food security issues within the fish value chain. The original data were collected using a cross-sectional household survey called pro-WEAI, a widely used questionnaire in agricultural development studies. It measures the empowerment status of primary male and female decision-makers in the same household. In Chapter 5, the food security and the empowerment status of men and women were estimated in two different contexts fishing and non-fishing groups. In addition, the role of gender-sensitive indicators in facilitating and hindering the food security status of men and women using an intersectional gender analysis framework was identified and discussed.

Chapter 5: Manuscript 2. Gender Power Relations and Food Security

To be submitted to the journal of Global Food Security

**Intrahousehold Empowerment Patterns, Gender Power Relations, and Food Security:
A Case Study from Small-Scale Fisheries in Uganda**

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Abstract

Objective: Most studies of women's empowerment have excluded as a covariate the empowerment status of their male counterparts in the household and the potential interactions between them. Gender power relations that are constituted and negotiated within households can contribute to gender dynamics associated with the food security status of men and women separately or jointly. This study aimed to (a) quantify the moderating effect of the empowerment status of men in households in the association from the empowerment of women to the individual food security of men and women, and (b) elucidate the effect of gender power in households on the food security status of women and men.

Design: A secondary data analysis was conducted using baseline survey data from the NutriFish initiative, an ongoing gender- and nutrition-sensitive agricultural intervention in Uganda in which the authors were involved. An intersectional gender analysis approach was used on the project-level Women's Empowerment in Agriculture Index (Pro-WEAI) data. Empowerment indicators were grouped into five domains to measure gender power relations. Binary logit models were computed, including interactions between the empowerment of women and men, controlling for the individual- and household-level characteristics and stratified by gender and occupation (fishing vs non-fishing) to account for the context differences.

Setting: Six fishing villages on the Lakes Victoria and Albert in Uganda

Participants: Primary male and female decision makers in $N=381$ households with both a male and female adult ($N=762$ individuals)

Results: Empowering women in non-fishing groups increased the food security of women and men, whether men were disempowered or not. Women in fishing groups had the highest improvement in their food security status when their partner was already empowered, whereas

the food security status of men was not affected to a statistically significant degree. Among various domains of gender dynamics, the norms and beliefs indicators showed the most significant associations with the food security status of the studied groups, except for non-fishing men.

Conclusions: Context-specific gender interventions and analyses can detect gaps between the food security of women and men. Considering a comprehensive picture of which indicators matter for men or women should guide interventions and policies.

Keywords: Gender analysis, food security, women's empowerment, small-scale fisheries, intrahousehold empowerment, Uganda

Introduction

All over the world, food insecurity experienced by women is not equal to food insecurity experienced by men (Broussard, 2019; Food and Agriculture Organization [FAO] et al., 2022; Sinclair et al., 2019). In the poorest regions, including South-of-Sahara Africa (SSA), women are two percentage point more likely than men to be severely food insecure (Broussard, 2019). The World Health Organization (WHO) defines gender as “socially-constructed roles, behaviours, expressions, and identities,” recognized under the gender binary as ‘man’ and ‘woman’ (WHO, 2020a). Sex, on the other hand, refers to biological characteristics at birth, categorized as ‘male’ or ‘female’ or ‘intersex’ (Morgan et al., 2016; WHO, 2002).

The current knowledge about food security and gender is largely based on empirical studies that investigated the relationship between the empowerment of women and their own food security (Asitik & Abu, 2020; Aziz et al., 2020; Bhandari & Burroway, 2018; Sraboni et al., 2014; Wei et al., 2021) or their households (Asitik & Abu, 2020; Aziz et al., 2021; Bain et al., 2020; Clement et al., 2019; Essilfie et al., 2021; Galiè et al., 2019; Murugani & Thamaga-Chitja, 2019; Sariyev et al., 2020; Sharaunga et al., 2016; Tsiboe et al., 2018; Zereyesus, 2017). Although empirical evidence of the positive association between women’s empowerment and food security is growing, it is still inconclusive (Asitik & Abu, 2020; Aziz et al., 2020; Aziz et al., 2021; Bain et al., 2020; Clement et al., 2019; Essilfie et al., 2021; Galiè et al., 2019; Sariyev et al., 2020; Tsiboe et al., 2018; Wei et al., 2021).

For example, Murugani and Thamaga-Chitja (2019) found that increasing the input of women in decision making, increasing their access to credit, and speaking in public were associated with an increase in household dietary diversity as a proxy of measuring household food security status in South Africa. Sraboni et al. (2014) reported that per capita calorie

availability was greater for empowered women compared to disempowered women in Bangladesh. They also showed that there was a positive relationship between the equal decision-making rights of women with household livelihoods and their dietary quality. Kehinde et al. (2022) found that the achievement of women in productive decision-making and credit was associated with an increase in the severity of food insecurity.

Food security exists “when all people, at all times, have social, physical, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2001, p. 49). Food security and the empowerment of women are nuanced phenomena, and the contributing factors are context-specific, specifically from the perspective of gender power relations (Akter et al., 2017; Galiè et al., 2019). For example, in their mixed-method study in Uganda, Bain et al. (2020) showed that the empowerment of women, which resulted from cattle ownership, was positively associated with household food security. Cattle ownership by women challenged social norms associated with household and agricultural gender inequality and, overall, enhanced the empowerment of women, gender equity, and household food security.

In another mixed-method study in the livestock sector in Tanzania, however, Galiè et al. (2019) did not find a significant association between three domains of empowerment (assets, income, and time use) and food security in the quantitative component of the study. That said, the qualitative component, which used focus group discussions (FDGs), showed that the empowerment of women was an effective strategy for bettering their food security status. The contrast between the quantitative results and qualitative findings was attributed to the absence of considering sociocultural determinants of empowerment in the quantitative measurements, namely gender norms, and power relations (Galiè et al., 2019).

Most studies that focused on the effect of the empowerment of women have overlooked the empowerment status of their male counterparts in the household (Asitik & Abu, 2020; Aziz et al., 2020; Aziz et al., 2021; Bain et al., 2020; Clement et al., 2019; Essilfie et al., 2021; Galiè et al., 2019; Tsiboe et al., 2018; Wei et al., 2021) and the potential interactions between them, which was referred herein as “intrahousehold empowerment patterns” following Malapit et al.’s (2019) protocol. The probability of food security, either at the individual or household level, might change depending on the empowerment status of women and men in households (Gebre et al., 2021; Zingwe et al., 2021).

To explain, in their mixed method study in Ethiopia, Gebre et al. (2021) found significant differences in the probability of food security among three categories of households: male, female, and joint decision-making farm households. In their Malawian study, Zingwe et al. (2021) showed that dual-adult households (DHHs), which include both a male and female adult, had better household food security status than female-adult-only households (FHHs). Additionally, they reported that, among DHHs, those with a dominant female voice (bargaining power) were more likely to be food secure compared to a male-dominant voice.

Some studies have investigated intrahousehold empowerment patterns by measuring household gender parity (Diirro et al., 2018; FAO, 2011; Kehinde et al., 2021; World Bank, 2014). For example, the food security of Bangladeshi households was associated with gender parity (i.e., the difference between empowerment levels of men and women) (Sraboni et al., 2014). Similar findings were reported in a matrilineal context in Bhutan, where gender equality in decision-making was related to an increase in household food security (Sariyev et al., 2020). They suggested that an imbalance in gender equality in either direction adversely affected food security. Their view was recently supported by Quisumbing et al. (2021a) who analyzed the

differences between empowerment outcomes of the primary male and female decision maker in the household, defined as intrahousehold inequality. Their study highlighted the importance of considering the sociocultural context in the implementation of interventions that aim to empower women.

Gebre et al. (2021), Morgan et al. (2016, 2017), and Ragasa et al. (2019), among others, identified gender power relations as a significant barrier to food security. Some of the barriers Gebre et al. (2021) and others identified include unequal access to economic, human, and social resources in addition to related gender norms and beliefs that affect roles, behaviours, and decision-making power between and among men and women. Hence, understanding how gender power relations are constituted and negotiated within the household can help to capture the complex gender dynamics associated with the food security status of men and women separately or jointly.

Indeed, some scholars have suggested that analyzing only the overall empowerment status of women may not suffice to unpack the positive effects it has on food security (Essilfie et al., 2021; Quisumbing, et al., 2021b; Tsiboe et al., 2018; Wei et al., 2021). Quisumbing et al. (2021b) noted that there can be tradeoffs between the dimensions of empowerment, underlining that empowering women in one dimension might result in their disempowerment in another dimension. More in-depth analysis of gender power relations within households can model the dimensions of the empowerment of women and men that affect food security outcomes.

To illustrate, Ragasa et al. 2019 examined the determinants of food security in Malawi concerning gendered household types: dual-headed, sole male adults, and sole female adults. They found that the provision of empowerment opportunities to women through training sessions was unsuccessful because training increased the time poverty of the study participants, and

women had limited power to apply the lessons to benefit their households. The authors concluded that joint access to information was a more effective strategy to enhance food security than only increasing women's access. Considering the relative positions of power occupied by genders in households could elucidate the contribution of men and women to the household food security (Morgan et al., 2016; Ragasa et al., 2019).

Given the limited knowledge in accounting for gender power relations in studying the relationship between women's empowerment and food security in prior research, the project-level Women's Empowerment in Agriculture Index (pro-WEAI) was used herein to conduct a gender analysis of the baseline survey data from the NutriFish project in Uganda (a gender- and nutrition-sensitive agricultural intervention in Ugandan fishing villages). Study objectives included (a) assessing how the predicted probability of food security differed in each intrahousehold empowerment pattern disaggregated by gender (men and women in each household) and occupation as a proxy for context (fishing and non-fishing) and (b) understanding whether the various domains of gender dynamics were associated with women and men's food security status. Associated hypotheses were explained in the methods section.

Empowerment: Concepts and Measurements

In this study, empowerment was measured using pro-WEAI, which others adapted from the widely used WEAI to measure the empowerment of women and men in the agricultural development interventions (Malapit et al., 2019). Pro-WEAI was built on Kabeer's (1999) definition, wherein empowerment was conceptualized as three interrelated dimensions: resources (pre-conditions), agency (process), and achievements (outcomes).

Regarding agency (process), Kabeer (1999) proposed it is "the ability to define one's goals and act upon them" (p. 438). Agency can take various forms that are not decision-making

measurements. The pro-WEAI identifies different forms of agency based on three domains of empowerment (3DE): intrinsic agency (power within), instrumental agency (power to), and collective agency (power with). The aggregated pro-WEAI index consists of two sub-indices: 3DE, and the Gender Parity Index (GPI). The 3DE measures the degree to which respondents are empowered, mapped into 12 indicators. The GPI is only calculated for DHHs by measuring the relative empowerment score of men and women in the same household and then comparing them (Malapit et al., 2019).

Analytical Framework: Intersectional Gender Analysis

The pro-WEAI score is decomposable, allowing researchers to disaggregate the 3DE achievements by indicators to recognize particular areas of empowerment contributing the most to food security. Building on Morgan et al.'s (2016) conceptual gender framework, the research team grouped disaggregated indicators of the 3DE into four domains: decision making, household labour sharing, resource access, and norms and beliefs (see Table 5.1).

An intersectional gender analysis framework was applied to direct the analysis and interpret the results. According to Morgan et al. (2016), gender analysis is the process of analyzing gender as a power relation and driver of inequality resulting in different experiences and needs. Adding an intersectionality lens to the gender analysis framework uses gender as a critical social stratifier, and an entry point into a deeper intersectional analysis in relation to other social stratifiers such as class, race, education, and ethnicity (Bottorff et al., 2011; Hankivsky, 2012; WHO, 2020b). To elaborate, intersectionality has received more recent attention in quantitative research and is a critical theoretical framework that focuses on describing unequal health experiences (Bauer et al., 2021; Bowleg, 2012). The intersectionality approach helps researchers describe and analyze how the experiences of those at an intersection of different

sociodemographic identities or positions are shaped by social power in structural and interpersonal contexts (Collins, 1990; Crenshaw, 1989). It emphasizes that those experiences may not be accurately described by studying each social identity or position separately, and their combined effect should be investigated (Bowleg, 2008; Hancock, 2007; McCall, 2005).

Methods

Context and Data

Uganda is one of the fastest growing African countries with a fast-growing population (3% per year). Uganda also faces the challenge of having one of the largest refugee crises in Africa (United States Agency of International Development [USAID], 2021; World Food Programme [WFP], 2022). The country produces enough food to feed the whole population; yet food insecurity is a major public health concern (WFP, 2022). Recent statistics report an increase in the prevalence of food insecurity with 72.5% of the Ugandan population suffering from moderate to severe food insecurity (FAO et al., 2022). Moreover, Uganda is ranked 166 among 191 countries on the Gender Inequality Index (United Nations Development Programme [UNDP], 2022).

Fisheries in Uganda are a major food source and play an essential role in the Ugandans' livelihoods and economies. In the last decade, small-scale fisheries have received increased attention in food security initiatives and policies owing to their significance in the African food basket (Chan et al., 2019; FAO, 2020; March & Failler, 2022). The study herein employed a secondary data analysis and presented results from the NutriFish initiative. The overall goal of NutriFish was to increase the availability, accessibility, and consumption of underutilized small fish by (a) upgrading the existing value chain and (b) processing by-products that come from the wasted parts of larger and more expensive fish like Nile perch thus creating a new value chain.

NutriFish further aimed to (a) increase the number of women actively involved in fisheries' value chains (e.g., by increasing their involvement in nodes of value chains, such as processing, and (b) expand women's opportunities to operate in newly created value chains (e.g., marketing of new products).

Makerere University in Uganda collected the data for this study using a nonparametric sampling protocol. Data were collected between January and February 2020 at six fishing villages on the shores of Lakes Victoria and Albert. Not all fish landing sites handle underutilized small fish in Uganda, so for the purpose of the NutriFish project, these fishing villages were purposively selected as the most important sites in terms of the volume of underutilized small fish catch for implementing the project's activities.

The main livelihood of the participants in selected fishing villages is fishing-related occupations (e.g., fishing, processing, and marketing). Other groups of people with a variety of non-fishing occupations (e.g., farming, and business) resided in the same villages or, at most, within 50 Km of the lake shores. In each fishing village, household listing preceded the survey to identify DHHs and FHHs. The main occupation of household adults was also recorded. Target sample sizes represented both fishing and non-fishing groups, thereby ensuring that, in 50% of the selected households, at least one of the adults was involved in the small-scale fisheries value chain. The targeted number of households for each group was then randomly selected from the corresponding list.

Akin to Alkire et al.'s (2013) research design, the research team aimed for a total of $N=350$ households (700 individuals), including at least 60 DHHs and five FHHs from each of the six selected fishing villages. A total of $n=391$ DHHs and $n=23$ FHHs participated in the study ($N=414$ households) mapped into five districts: Buliisa, Hoima, Pakwach, Buikwe, and Masaka.

Analytical Approach

The Household Food Insecurity Access Scale (HFIAS) was the primary outcome measure and was completed separately by men and women in each household. HFIAS consists of nine questions to assess the access dimension of food security (Coates et al., 2007). The respondents were asked whether each situation happened for themselves or their households. Thus, the responses might not merely reflect the actual individual food security status nonetheless, the perception of each respondent from the overall food security status of the household. Consequently, there might be different food security statuses for men and women in the same household, which were considered as the individual perception of household food security and are referred to it as individual food security throughout this manuscript.

Built on the overarching goal of NutriFish and guided by the intersectional gender analysis framework, the researchers employed a comparative analytical approach among men and women disaggregated by their occupation¹⁸. To elaborate, fishing and non-fishing groups experience different challenges and opportunities depending on their occupation. Thus, the occupation variable was categorized into fishing and non-fishing groups and was used as a proxy to understand the context-specific differences addressed in this study. This approach allowed the researchers to consider the diversity and complexity of gender norms and values in each context that affected the challenges and privileges of each group. The analysis was conducted in three steps. First, a descriptive analysis of the studied population was conducted to provide an overall picture of the food security and empowerment status of the respondents. This information was used to develop the analysis plan for the first research objective.

¹⁸ A binary variable was generated for occupation (Fishing vs non-Fishing); Fishing category included fishing, fish processing, fish trading, and causal work in fisheries. Non-fishing category was composed of wage employer, farmer, business, student, household work, and causal work.

Second, built on the planned interventions to empower women in the NutriFish project and on the descriptive results drawn from the first step, two main conditions were identified. (a) When only a male adult was empowered (M-EMP), successful interventions to empower women could lead to ‘both empowered’ status (2-EMP). (b) When both male and female adults were disempowered (0-EMP), women’s empowerment could result into ‘only woman is empowered’ status (W-EMP). It was hypothesized that depending on the empowerment status of men in the household, the relationship between women’s empowerment and food security could differ in each combination of intrahousehold patterns of empowerment (M-EMP, 0-EMP, W-EMP, and 2-EMP). To evaluate changes in the relationship between each intrahousehold empowerment pattern and food security, marginal effects (MEs) (Long & Freese, 2014) were computed from binary logit models that included interactions between men’s and women’s empowerment, stratified by gender and occupation (fishing vs non-fishing). MEs show how much the food security outcome changes for a change in one focal independent variable, holding other control variables at specific values. For example, MEs for a binary independent variable like women’s empowerment display the differences in the predicted probability (Pr) of food security with a change between empowered (=1) and disempowered (= 0) status, holding other control variables at specific values such as AME.¹⁹ In this example, one Pr_1 is computed for empowered status and another Pr_0 for disempowered status. The difference between these two predicted probabilities ($Pr_1 - Pr_0$) is referred to as MEs (for further details, see Long and Freese, 2014).

Four Pr (s) are computed instead of two when the independent variable is an interaction term. For example, as described in the previous paragraph, by interacting two binary variables of

¹⁹ Average Marginal Effects (AME) represent an effect on average across the sample, which is the average (mean) of the marginal effects calculated for each observation in the sample; for further details, see Mize, 2019.

men's empowerment (0 and 1) and women's empowerment (0 and 1), four statuses were created: 2-EMP (1 and 1), M-EMP (1 and 0), W-EMP (0 and 1), and 0-EMP (0 and 0). The significance of interaction terms was tested through a difference-in-difference approach (diff-in-diff) (Mize, 2019) to determine whether a moderating effect existed across different intrahousehold empowerment patterns. The intent was to test the differences in Pr of food security (MEs) between the two conditions, referred to as the first differences (1st diff):

$$1) \text{ Pr (food security | 2-EMP) - Pr (food security | M-EMP) = ME}_1$$

$$2) \text{ Pr (food security | W-EMP) - Pr (food security | 0-EMP) = ME}_2$$

The researchers tested whether the effect of each empowerment pattern varied across the two conditions referred to as the second difference (2nd diff: $\text{ME}_1 - \text{ME}_2$). They applied this approach to each gender category in three groups: total sample, fishing, and non-fishing.

For the second research objective, guided by the gender analysis framework, to examine the association between the pro-WEAI indicators and food security, the researchers calculated separate binary logit regressions on each of the four power relation domains shown in Table 5.1. A model of the association between GPI and food security was also estimated. The analysis aimed to identify the empowerment indicators in each power relation domain associated with men's and women's food security outcomes. In all models of objectives one and two, the researchers controlled for the individual- (age and education) and household-level (household size) characteristics, stratified by gender and occupation, and clustering standard errors at the level of fishing villages. Whereas the authors acknowledge that gender is not binary, data for this study were collected considering the dominant sociocultural norms in Uganda. In this context, gender is typically recognized as the biological sex and a binary characteristic identified as

woman or man and their contextual relationships.²⁰ Stata (version 17) was used to conduct the analysis.²¹

Ethical considerations

Before commencing the study, ethical clearance was sought and obtained from Makerere University in Uganda and the Uganda National Council for Science and Technology (UUCST) for primary data collection by the NutriFish team. Additionally, ethical approval for secondary data analysis was obtained from McGill University, Canada.

Results

After removing subjects where observations were missing, the final sample frame comprised $N=381$ DHHs; $N=762$ individuals. Tables 5.2 and 5.3 and Figure 5.1 present the results of the descriptive analysis in step one of analytical strategy. Table 5.2 summarizes the prevalence of food security and food insecurity between and among different groups of men and women against different demographic variables. As shown, 37.3% of women and 26.5% of men were food secure. In the total population, 26.2% of women were empowered, compared to 54% of men. For household-level variables, the prevalence of food security significantly differed only in the Kikondo village or the district of Buikwe when comparing women and men. There were significant differences between food secure and food insecure women (columns) among all villages and districts; the same trend existed for men, providing insights into context differences (by occupation) in experiencing food insecurity.

²⁰ In the NutriFish project, data were collected from the primary male and female decision makers within the household unit, self-identified predominantly as husband and wife. Therefore, the term gender is mainly attributed to as “gender expression” (or “gender roles”) but not “gender identity.”

²¹ Standard Stata do-files were used to calculate the pro-WEAI score available on the International Food Policy and Research Institute (IFPRI)’s website and modified as needed to suit the NutriFish baseline data.

Figure 5.1-A compares the 3DE score and contributors to disempowerment between and among men and women. The average of the 3DE score was below the empowerment adequacy for women in all groups with the non-fishing group having the lowest score (3DE = 0.55). The 3DE score of men met the adequacy score. The contribution of each indicator to disempowerment (1-3DE) is illustrated in Figure 5.1-B. Work imbalance was among the top three contributors in all groups with a lack of respect among household members as another major contributor for women compared to not being a member in influential groups for men.

Table 5.3 compares the adequacy scores of couples and empowerment status in each household. As presented, in most households, the adequacy score of men was greater than their female counterparts in all groups. In terms of intrahousehold empowerment patterns, similarly, more households comprised two categories of ‘only man is empowered’ or ‘neither empowered’ in all groups. The percentages of households achieving gender parity in all groups were almost similar and around 40% with the highest average empowerment gap among the non-fishing group.

Table 5.4 and Figure 5.2 illustrate the differences in the probability of food security at the intersection of intrahousehold empowerment patterns, gender, and occupation. In the total population, the test of the first differences for women showed that moving from 0-EMP to W-EMP status was associated with an increase in the probability of food security by 0.17 (Pr = 0.29 vs Pr = 0.46, $p < 0.01$). Likewise, 2-EMP status compared to M-EMP was related to 0.18 improve in food security (Pr = 0.54 vs Pr = 0.36, $p < 0.05$). The test of the second difference for women showed no significant difference between the two conditions. This result implied that women’s empowerment in either condition was significantly associated with an increase in food security for women despite men’s empowerment. For men, food security was significantly

related to an improvement in food security when their female partner was empowered (W-EMP) ($\text{Pr} = 0.20$ vs $\text{Pr} = 0.30$, $p < 0.01$). M-EMP and 2-EMP statuses were not associated with the food security status of men ($\text{Pr} = 0.30$ vs $\text{Pr} = 0.29$, $p = \text{ns}$). The test of the second difference did not exhibit a significant difference between the two different conditions (2nd difference = - 0.11). This result showed that women's empowerment was associated with an increase in men's food security when only the woman was empowered despite the man's disempowerment status.

Among the fishing group, the 2-EMP pattern was related to an improvement in the food security status of women, which was significantly different from the M-EMP pattern (1st difference = 0.24; $p < 0.01$). The second condition did not significantly change women's food security (first difference = 0.03, $p = \text{ns}$). The test of the second difference showed that in condition one, women's food security significantly differed from condition two by 0.21 ($p < 0.01$). On the contrary, women's empowerment was not significantly associated with men's food security, whether men were empowered or not.

In contrast to women in the fishing group, their counterparts in the non-fishing group had the highest probability of food security by 0.33 when only themselves (women) were empowered (W-EMP) ($\text{Pr} = 0.60$ vs $\text{Pr} = 0.28$, $p < 0.01$). In the case of non-fishing men, their food security improved in the W-EMP pattern compared to 0-EMP (1st difference = 0.23, $p < 0.05$). The other condition did not change their food security (1st difference = - 0.01, $p = \text{ns}$; 2nd difference = - 0.24, $p = \text{ns}$).

Table 5.5 contains the results of the analysis for objective two. In the total population of women, attitudes about not justifying domestic violence, having respect among household members, and control over the use of income were associated with an increase in the probability of food security (all $p < 0.01$), and lack of gender parity was related to a 0.08 decrease in food

security ($p < 0.05$). Among men in total population, attitudes about not justifying domestic violence, and having respect among household members, in addition to having self-efficacy and group membership, were associated with a better food security status (all $p < 0.01$). Membership in influential groups was related to a 0.16 decrease in food security ($p < 0.01$).

In the fishing group, having respect among household members, and group membership were associated with a 0.24 ($p < 0.01$) and 0.25 ($p < 0.05$) increase in women's food security status, respectively. Lack of household gender parity was related to a 0.15 lower probability of women's food security ($p < 0.01$). Their male counterparts' food security was associated with having self-efficacy (0.13), group membership (0.17) (both $p < 0.01$), attitudes about not justifying domestic violence (0.12), and having respect among household members (0.10) (both $p < 0.05$). Being a member of an influential group was related to a 0.18 decrease in men's food security ($p < 0.01$). In the non-fishing group, attitudes about not justifying domestic violence (0.10), having respect among household members (0.17), and ownership of land and other assets (0.16) were associated with an improvement in women's food security ($p < 0.01$). For men, only higher input in productive decisions was related to a 0.17 contribution to their food security status ($p < 0.01$).

Discussion

The researchers applied a comparative approach to data on pro-WEAI from six fishing villages in Uganda. Using the aggregated empowerment score, a diff-in-diff approach was employed to unpack the associations between intrahousehold empowerment patterns and food security by gender and occupation. In doing so, insights were provided into the role of couples' empowerment status on each other's food security.

As expected, there were substantial differences between men and women, varying by context. Considering the significantly high rates of food insecurity reported among Ugandan men compared to women, it will be necessary to (a) find effective solutions for enhancing the food security status of disadvantaged groups of men and (b) examine the role of empowering their female counterparts in their food security status. Most studies focusing on women's empowerment and food security generally overlooked the data on the men's side (Aziz et al., 2021; Bain et al., 2020; Galiè et al., 2019; Murugani & Thamaga-Chitja, 2019; Tsiboe et al., 2018). Even in the presence of gender-disaggregated data such as WEAI surveys, these studies reported women's empowerment role in desired outcomes targeting households or women.

Results herein showed the importance of generating gender-sensitive analysis to underline the differences between men and women in the same household, where they have a similar situation but experience different challenges and advantages or might simply have different perceptions that lead to different answers to the same questions, such as food security. Additionally, results showed that even for women, it is crucial to pay more attention to the pattern of empowerment in their household and the role of their partner's empowerment in their food security status in different contexts. Varying results by context were also reported in a cross-country analysis of aggregated women's empowerment and gender equality in Asia and Africa (Quisumbing et al., 2021a). Accounting for the context-specific heterogeneity in empowerment and unequal gender relations is crucial to capturing the cross-cultural variations in gender power relations and related constraints and opportunities (Akter et al., 2017; Mason & Smith, 2003).

Considering gender and fisheries, the scholarly literature points to the significance of women's roles in African fisheries. Despite their fundamental role in fishing activities for

survival and livelihood, women suffer from various obstacles, such as unrecognized contributions, being excluded from fisher organizations, and receiving little training (e.g., marketing opportunities) (Kaminski et al., 2020; Lentisco & Lee, 2015; Ragsdale et al., 2022; Smith, 2022). Empowering women and their inclusion in the decision-making process at all nodes of the fishing value chain is integral to developing sustainable food security strategies in Uganda. Hence, gender-sensitive data and methodologies, such as data collected through the pro-WEAI questionnaire, can help identify gendered barriers in small-scale fisheries.

The second objective of the study was motivated by the need to identify which dimensions of empowerment were related to individual food security experiences. Previous studies have suggested that in analyzing the subdomain of empowerment, scholars should not rely only on top contributors to disempowerment (Carlson et al., 2015; Quisumbing et al., 2021b; Santoso et al., 2019). Given the complex and context-specific nature of empowerment, it is imperative to lay it out as much as possible to discover the tiers of gender inequality resulting from uneven power relations. Mapping out the 12 indicators of empowerment guided by an established gender framework presented more significant associations, confirming the ongoing discussion in the literature about the existence of trade-offs among different dimensions of empowerment (Quisumbing et al., 2021b; Tsiboe et al., 2018). Emerging a more subtle pattern of associations in each model, however, raised more questions than answers.

To elaborate, the associations between the indicators in the social norms and beliefs category (model 3) and food security were more apparent compared to other groups. These results were consistent with the qualitative component of the NutriFish project as reported in the

unpublished initial field report to Makerere University.²² The field researchers collected data through focus groups and key informant interviews. Findings revealed high conflicts between couples. For example, focus groups showed that most men preferred marrying disempowered women for fear of being disrespected and controlled by an empowered woman. Women were similarly reluctant to marry highly empowered men owing to their rights being undermined and not being respected. The field report affirmed that lack of trust and balance in intrahousehold power relations can result in increased domestic violence, which indicated a negative association with better food security among fishing men and non-fishing women.

These results call for interventions to develop behaviour change communications at the household level. Gendered-focused interventions can foster a supportive household environment and more balanced intrahousehold power relationships (Ridolfi et al., 2019). Previous studies have demonstrated the success of Gender Transformative Approaches (GTAs) in identifying potential opportunities for change starting from the household (e.g., Galiè & Kantor, 2016). GTAs acknowledge that gender is a socially constructed concept, and that men and women behave based on predefined roles and expectations (Njuki et al., 2016; Risman, 2004).

Results also suggested that the first step to balancing the unequal power relations in the household and reducing the empowerment gap might be targeting the root causes of disempowerment and, consequently, food insecurity. Transforming the perceptions of men and women towards their roles and capabilities, how they should interact with each other, and what is

²² Ankunda, J. B., & Nanyonjo, G. (2020). *Women's empowerment among fishing communities: A case of Kiyindi, Kikondo, and Lambu landing sites on Lake Victoria and Kaiso and Dei landing sites on Lake Albert in Uganda*. Field report to NutriFish Project at Makerere University.

appropriate in their everyday life can greatly affect the creation of equitable gendered power relations in the household and, therefore, community (Galiè & Kantor, 2016).

Concerning other domains, no improvement was shown in men's food security status despite their empowerment status in the fishing group. Still, they showed the greatest number of significant associations between empowerment indicators and food security. This result may once more confirm the importance of individual gender-sensitive analysis, as it was affirmed that women's empowerment did not contribute to men's food security status, but investing in men's empowerment through different indicators, namely self-efficacy, group membership, and work balance, has the potential to enhance their food security. Fishing women's food security also benefited from men's empowerment besides having household gender parity. Taken together, these results confirmed the importance of intrahousehold gender dynamics in empowering both men and women resulting in better food security in the fishing group.

On the other side, not finding fewer robust relationships among men and women in non-fishing group compared to their fishing counterparts could be attributed to more heterogeneity in this group, consisting of various occupations, including farming, business, and housework. Results also showed that non-fishing women were the only group that exhibited a positive relationship between land and asset ownership and food security. This fact may relate to their involvement in land-based activities, such as small-scale farming, and to the importance of women's asset ownership in achieving food security (Doss et al., 2014a; 2014b).

Although work imbalance was one of the top contributors to disempowerment in all groups, it was not necessarily correlated with better food security, except among fishing men which tended to be significant. One possible explanation is that some socioeconomic characteristics were not captured during data collection (e.g., income, district of origin, and

ethnicity). This research design decision could have limited capturing the moderating impact of other determinants in the subsequent analysis and interpretation phases, influencing not only work imbalance but also other indicators.

Study Limitations

The generalizability of the results is subject to certain limitations. First, further research will allow for the application of our context-specific results to other populations, owing to the context-specific nature of gender and food systems. Second, assessing gender power relations, using either quantitative or qualitative methodologies, involves various challenges, such as social desirability of the respondents, and recall or other internal biases (Garrison-Desany et al., 2021; Shuib et al., 2013). As a result, there were likely to be nuances and other aspects of gender dynamics that were not captured in the available dataset, which could limit some of the interpretations of the results.

Third, the analysis was limited to available data on DHHs. Different studies have shown the higher vulnerability of FHHs and their various challenges related to gender and sociocultural norms. Thus, studying FHHs' specific hardships in the nexus of gender, empowerment, and food security could provide more insights into the complexity of gender power relations in the studied context. Finally, this study was based on secondary and cross-sectional survey data, which may not capture the unobserved dynamics of food security and empowerment. Considerably more empirical work is needed to assess the causal relationships in this pathway.

Conclusion

The results provided several contributions to the current literature. First, the researchers conducted a gender analysis within an intersectionality framework to highlight the context-specific complexity of gender relations using pro-WEAI data. In so doing, the gendered and

context-specific determinants of food insecurity were addressed prompting tailored recommendations for the studied population. Importantly, results confirmed findings from previous research about the importance of context-specific and multi-domain approach, namely sociocultural determinants, to accurately measure gender dynamics and empowerment phenomena (Akter et al., 2017; Galiè et al., 2019; Morgan et al., 2017; O'Hara & Clement, 2018; Seymour & Peterman, 2018).

Second, the analytical approach accounted for the moderating effect of men's and women's empowerment on their food security status and tested the differences between patterns of intrahousehold empowerment. Third, in addition to analyzing the aggregated empowerment score, the researchers investigated the disaggregated score to underline the differences between and among men and women. Previous studies have pointed out the prominence of assessing aggregated and disaggregated empowerment status in directing the interventions and policies in a way that does not cause unintended consequences and worsen existing gender inequalities (Carlson et al., 2015; Quisumbing, et al., 2021b; Sariyev et al., 2020; Tsiboe et al., 2018).

Fourth, there has been little quantitative analysis of gender power relations on food security of men and women, particularly within the intersectionality framework. This was the first study using this approach in analyzing food security. The interpretation of the inaugural results was informed by the qualitative component of the NutriFish project.

Finally, the individual level's relationship between empowerment and food security was assessed. In analyzing the association between women's empowerment and food security, little attention has been focused on women's food security status. Although HFIAS was designed to measure food insecurity at the household level, the NutriFish project focused on respondents' individual experiences rather than asking about those of the entire household. Measuring

individual-level food insecurity provided imperative insights on intrahousehold differences in experiencing food insecurity. Moreover, Natamba et al. (2015) demonstrated strong reliability, internal validity, and contextual fidelity of food insecurity measures using the individual-level food insecurity access scale (FIAS) in Uganda.

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Authors contributions

FB designed the study conception and developed the overall research plan, analyzed data, wrote the manuscript, and had primary responsibility for the final content; JE and RO adapted the pro-WEAI questionnaire to NutriFish's objectives, supervised data collection, and provided data for this study; HMQ provided guidance on the overall research plan including the project conception, the analytic design and approach; all authors read and approved the final manuscript.

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Table 5.1 Grouping pro-WEAI indicators guided by gender analysis framework

What constitutes gendered power relations		3DE indicators
Access and resources: Who has what?	Access to resources (education, information, skills, income, employment, services, benefits, time, space, social capital etc.)	<ul style="list-style-type: none"> • Ownership of land and other assets • Group membership • Membership in influential groups • Self-efficacy
Labor-sharing: Who does what?	Division of labour within and beyond the household and everyday practices	<ul style="list-style-type: none"> • Work balance
Social norms and beliefs: How are values defined?	Social norms, ideologies, beliefs, and perceptions	<ul style="list-style-type: none"> • Visiting important locations • Respect among household members • Attitudes about intimate partner violence against women
Decision-making and autonomy: Who decides?	Rules and decision-making (both formal and informal)	<ul style="list-style-type: none"> • Input in productive decisions • Control over use of income • Access to and decisions on financial services • Autonomy in income

Source: Morgan et al., 2016

Table 5.2 Prevalence of food security between and among men and women against different demographic variables (intersectional gender-disaggregated analysis)

Characteristics	Women (n=381)			Men (n=381)		
	Total	FS	FI	Total	FS	FI
Number of observations, n (%)	381 (50)	142 (37.3) ***	239 (62.7)	381 (50)	101 (26.5) ***	280 (73.5)
<i>Individual level</i> ¹						
Empowerment status (% empowered)	100 (26.2) ***	51 (51) ***	49 (49)	206 (54)	61 (29.6)	145 (70.4)
Age (in years), %						
15-25	103 (27) ***	46 (44.7)	57 (55.3)	32 (8.4)	8 (25)	24 (75)
26-45	225 (59)	76 (33.8)	149 (66.2)	250 (65.6)	68 (27)	182 (73)
>45	53 (14)	20 (37.8)	33 (62.2)	99 (26)	25 (25)	74 (75)
Education (% high education) ²	101 (26.5) ***	54 (53.5) ***	47 (46.5)	139 (36.5)	46 (33) **	93 (67)
Occupation (% Fishing) ³	201 (52.8) ***	70 (34.8)	131 (65.2)	261 (68.5)	63 (24.1)	198 (75.9)
<i>Household level</i> ⁴						
Household size, mean (SD)	6.1 (0.1)	5.3 (0.2) ***	6.7 (0.2)		5.5 (0.3) **	6.4 (0.2)
District, %						
Buikwe	117 (30.7)	60 (51.3) ***	57 (48.7)		41 (35) ***	76 (65)
Masaka	58 (15.2)	27 (46.5)	31 (53.5)		15 (25.9)	43 (74.1)
Bulisa	71 (18.6)	10 (14.1)	61 (85.9)		9 (12.7)	62 (87.3)
Hoima	70 (18.4)	28 (40)	42 (60)		23 (32.9)	47 (67.1)
Pakwach	65 (17.1)	17 (26.2)	48 (73.8)		13 (20)	52 (80)
Fishing villages, %						
Kikondo	74 (19.4)	33 (44.6) ***	41 (55.4)		17 (23) ***	57 (77)
Lambu	58 (15.2)	27 (46.5)	31 (53.5)		15 (26)	43 (74)
Kiyindi	43 (11.3)	27 (62.8)	16 (37.2)		24 (55.8)	19 (44.2)
Wanseko	71 (18.6)	10 (14.1)	61 (85.9)		9 (12.7)	62 (87.3)
Kaiso Tonya	70 (18.4)	28 (40)	42 (60)		23 (32.9)	47 (67.1)
Dei	65 (17.1)	17 (26)	48 (74)		13 (20)	52 (80)

FS: Food Security; FI: Food Insecurity: A food secure individual experiences none of the food insecurity conditions, or just experiences worry, but rarely in preceding four weeks; otherwise, the person is food insecure.

Values are means (SDs) or frequencies (%). Chi-square and Independent Student t tests were used to evaluate the distributions between and among men and women. ** $p < 0.05$; *** $p < 0.01$

¹ For individual variables, between differences were indicated in the total column and among differences in the FS column.

² Low education: No formal education and Primary; High education: Secondary and Tertiary.

³ Binary variable: Fishing vs non- Fishing; Fishing category includes fishing, fish processing, fish trading, and causal work in fisheries.

⁴ Total values at the household level are the same for men and women and were reported in the women's column.

Table 5.3 Intrahousehold patterns of empowerment by occupation (%)

Intrahousehold empowerment patterns	Total (n = 762)	Fishing (n = 462)	Non-Fishing (n = 300)
Man adequacy score > Woman adequacy score ¹	65.5	63	68
Woman adequacy score > Man adequacy score	21.5	22	21
Woman adequacy score = Man adequacy score	13	15	11
Only man is empowered ²	39	39	39
Only woman is empowered	11.5	12.5	10.5
Both man and woman are empowered	15	14.5	15
Neither man nor woman are empowered	34.5	34	35.5
Households achieved gender parity ³	40	42	41
Average empowerment gap ⁴	0.37	0.32	0.42

¹ An individual receives adequacy on a given indicator if that indicator meets a certain threshold (3DE score ranging from 0 to 12). The first three rows compare the number of adequate indicators between men and women within the household.

² Empowered if is adequate in 9 out of the 12 indicators (3DE $\geq 75\%$). The 3DE score ranges from 0 to 1, where higher values reflect greater empowerment.

³ A household achieves gender parity if either the woman is empowered, or her score is greater than or equal to the empowerment (3DE) score of the male decision-maker in her household. GPI score ranges from 0 to 1, where higher values reflect greater gender parity.

⁴ The extent of the disparity between women's and men's inadequacy scores in households that lack gender parity is captured through an empowerment gap.

Table 5.4 Probability of food security by intrahousehold empowerment patterns with test of interaction effect (difference-in-difference) among fishing and non-fishing groups

	Total			Fishing			Non-Fishing		
	Pr (FS) ¹	1 st diff ²	2 nd diff ³	Pr (FS)	1 st diff	2 nd diff	Pr (FS)	1 st diff	2 nd diff
Panel A: Women									
Condition 1: M-EMP → 2-EMP									
Both empowered (2-EMP)	0.54 (0.1)	0.18 ** (0.08)		0.53 (0.1)	0.24 *** (0.09)		0.51 (0.1)	0.07 (0.1)	
Only man is empowered (M-EMP)	0.36 (0.06)			0.30 (0.06)			0.44 (0.06)		
Condition 2: 0-EMP → W-EMP									
Only woman is empowered (W-EMP)	0.46 (0.06)	0.17 *** (0.04)	0.001 (0.08)	0.33 (0.09)	0.03 (0.1)	0.21 *** (0.08)	0.60 (0.09)	0.33 *** (0.08)	- 0.26 (0.17)
Both disempowered (0-EMP)	0.29 (0.06)			0.31 (0.1)			0.28 (0.08)		
Panel B: Men									
Condition 1: M-EMP → 2-EMP									
Both empowered (2-EMP)	0.29 (0.1)	- 0.005 (0.1)		0.29 (0.1)	0.01 (0.09)		0.32 (0.1)	- 0.01 (0.1)	
Only man is empowered (M-EMP)	0.30 (0.06)			0.28 (0.07)			0.33 (0.07)		
Condition 2: 0-EMP → W-EMP									
Only woman is empowered (W-EMP)	0.30 (0.06)	0.10 *** (0.04)	- 0.11 (0.12)	0.22 (0.04)	0.04 (0.07)	- 0.02 (0.1)	0.47 (0.1)	0.23 ** (0.1)	- 0.24 (0.2)
Both disempowered (0-EMP)	0.20 (0.04)			0.19 (0.04)			0.24 (0.08)		

All models were estimated using binary logit regression adjusted for age, education, occupation (only total estimations), and household size.

¹ Pr (FS): Predicated probability of food security. Marginal effects reported and robust standard errors in parentheses were clustered by fishing villages. ** $p < 0.05$; *** $p < 0.01$.

² Statistics for first difference (1st diff) is the difference in the effect for each specific condition.

³ The second differences (2nd diff) column reports whether the effect of each empowerment pattern varies across the two conditions.

Note: Because of rounding, the differences do not always equal the discrete change coefficient in one pattern minus the discrete change coefficient in another pattern, similar for the 2nd differences.

Table 5.5 Adjusted individual gender models in fishing and non-fishing groups

Variables	Total		Fishing		Non-Fishing	
	Women	Men	Women	Men	Women	Men
Model 1: Access to resources						
Ownership of land and other assets	0.02 (0.07)	- 0.02 (0.11)	- 0.13 (0.11)	- 0.07 (0.15)	0.16 (0.06) ***	0.16 (0.14)
Self-efficacy	0.08 (0.05)	0.14 (0.02) ***	0.11 (0.06)	0.13 (0.04) ***	0.01 (0.04)	0.13 (0.11)
Group membership	0.10 (0.08)	0.13 (0.04) ***	0.25 (0.11) **	0.17 (0.05) ***	- 0.09 (0.23)	- 0.02 (0.13)
Membership in influential groups	- 0.05 (0.08)	- 0.16 (0.06) ***	- 0.18 (0.12)	- 0.18 (0.07) ***	0.10 (0.19)	- 0.09 (0.09)
Model 2: Labor-sharing						
Work balance	0.03 (0.04)	0.01 (0.06)	0.03 (0.04)	0.08 (0.04) *	0.04 (0.08)	- 0.11 (0.16)
Model 3: Social norms and beliefs						
Attitudes about domestic violence	0.12 (0.02) ***	0.14 (0.05) ***	0.10 (0.06)	0.12 (0.06) **	0.10 (0.03) ***	0.18 (0.12)
Respect among household members	0.20 (0.04) ***	0.13 (0.02) ***	0.24 (0.07) ***	0.10 (0.05) **	0.17 (0.06) ***	0.18 (0.11)
Visiting important locations	- 0.02 (0.06)	0.03 (0.05)	- 0.06 (0.08)	0.06 (0.06)	0.01 (0.06)	- 0.01 (0.09)
Model 4: Decision-making and autonomy						
Control over use of income	0.10 (0.04) ***	- 0.02 (0.05)	0.14 (0.09)	- 0.02 (0.08)	0.05 (0.09)	- 0.02 (0.06)
Autonomy in income	- 0.03 (0.05)	0.03 (0.06)	- 0.01 (0.07)	0.07 (0.05)	- 0.08 (0.09)	- 0.02 (0.09)

Input in productive decision	0.03 (0.06)	0.02 (0.05)	- 0.02 (0.11)	- 0.09 (0.08)	0.09 (0.06)	0.17 (0.05) ***
Access to and decisions on credit	0.01 (0.07)	0.01 (0.03)	- 0.02 (0.10)	0.004 (0.03)	0.04 (0.06)	0.00 (0.09)
Model 5: Household gender parity						
Lack of gender parity	- 0.08 (0.04) **	0.02 (0.04)	- 0.15 (0.05) ***	0.04 (0.04)	0.01 (0.04)	0.02 (0.11)

All models were estimated using binary logit regression adjusted for age, education, occupation (only total estimations), age, and household size. Marginal effects reported, and robust standard errors in parentheses were clustered by fishing villages.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Figure 5.1 A) Empowerment score (3DE) between and among men and women, B) Contributors to disempowerment (1-3DE) by occupation ¹

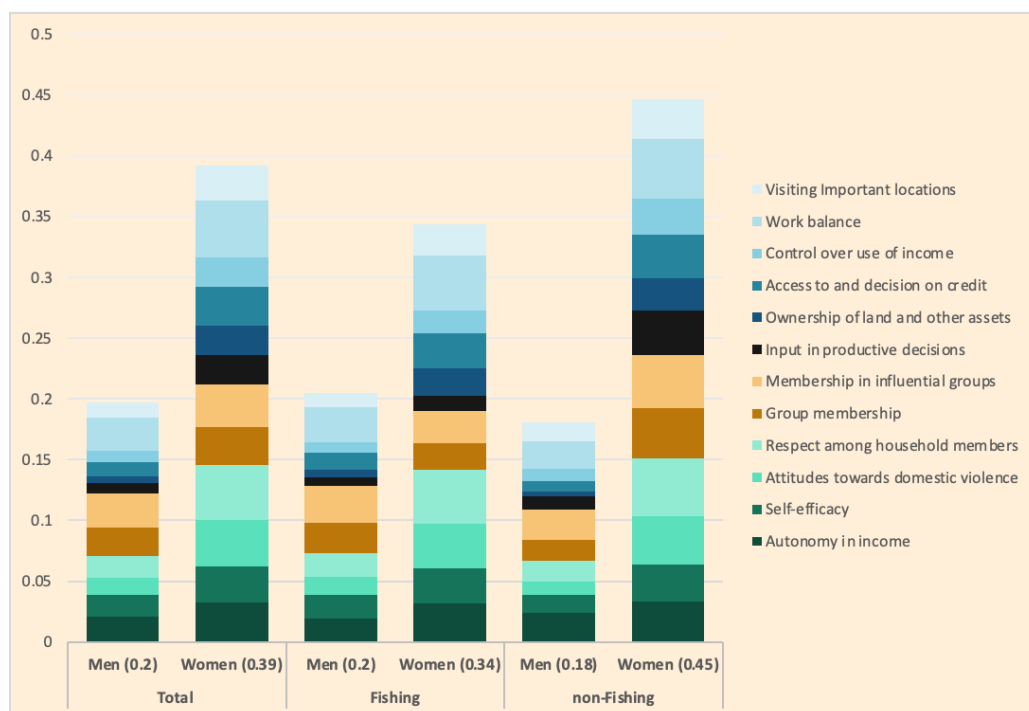
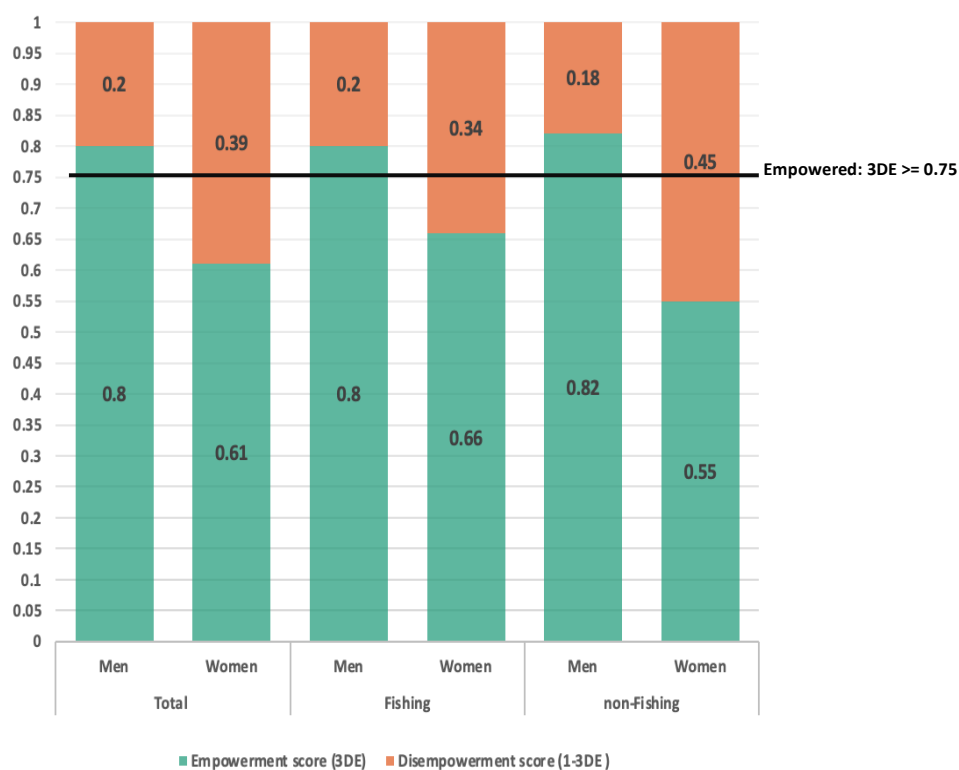
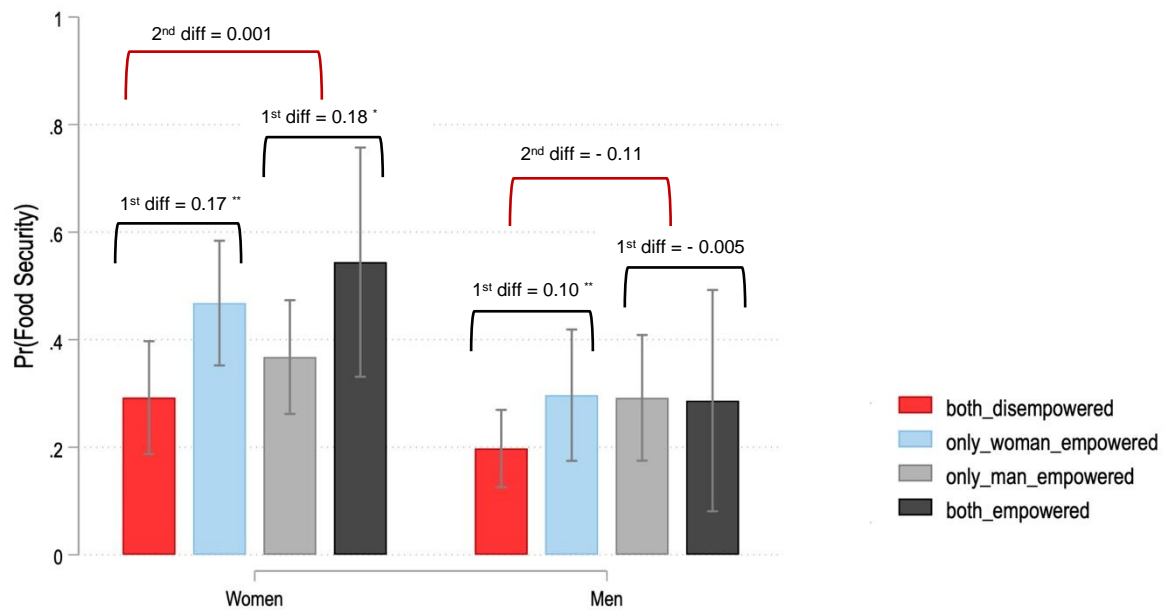
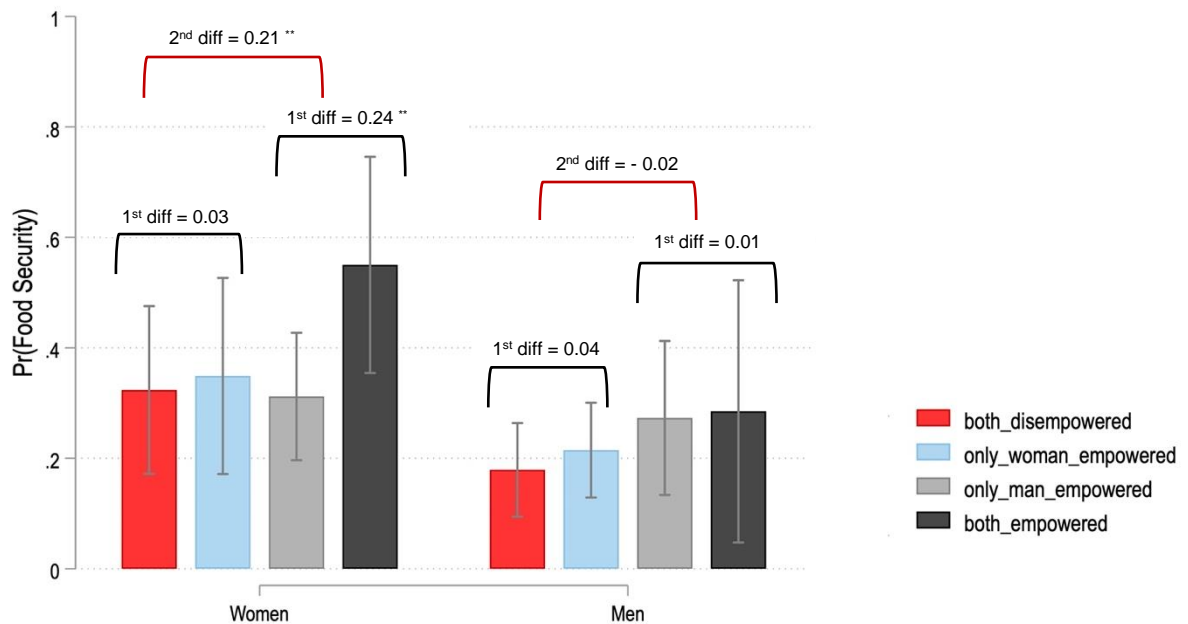


Figure 5.2 Probability of food security by gender and intrahousehold patterns of empowerment in a) Total population, b) Fishing group, and c) non-Fishing group¹

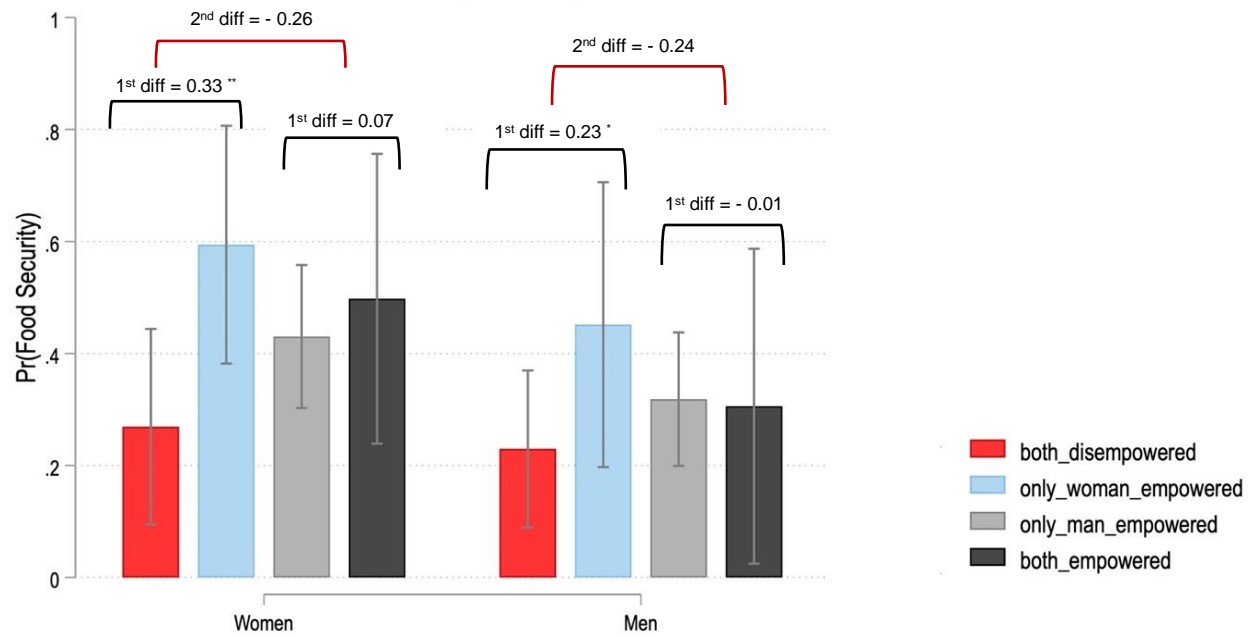
a) Total population



b) Fishing group



c) non-Fishing group



¹ Marginal effects reported (see Table 5.4). * $p < 0.05$; ** $p < 0.01$.

Bridging Statement 2

In Chapter 5, the candidate examined how the interaction between the empowerment of couples in the household can change the predicted probabilities of food security in different contexts. It was highlighted that studying the intersection of men's and women's empowerment in the household is critical to inform the project implementers and policymakers in the projects like NutriFish to target the most vulnerable groups. In addition, the candidate illustrated how analyzing the disaggregated empowerment score through different domains of intrahousehold gender power relations is important in understanding the nuances in the association between women's empowerment and food security, which is often overlooked in current research.

Moreover, context-specific models comparing fishing and non-fishing groups were estimated using aggregated and disaggregated empowerment measures. Discovering considerable differences between the two groups emphasized the importance of context-specific models in analyzing empowerment and food security over standardized "one-size-fits-all" alternatives.

In Chapter 6 (Manuscript 3), the candidate assessed the role of nutrition-sensitive indicators in the association from women's empowerment in agriculture to food security in a way that explored more nuances in such a nexus. The linkages between women's empowerment in agriculture and women's agency in nutrition was also examined. Further, the moderating effect of women's agency in nutrition in the association between women's empowerment in agriculture and food security was tested. Chapter 6 also contains a discussion of the limitations of the current measurement tools of women's empowerment in nutrition.

Chapter 6: Manuscript 3. Women's Agency in Nutrition and Food Security

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Women's Agency in Nutrition in the Association between Women's Empowerment in Agriculture and Food Security: A Case Study from Uganda

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Abstract

Objective: To date, the literature is silent on whether or not women's participation in nutrition-focused decisions, referred to as "women's agency in nutrition", affects the relationship between women's empowerment in agriculture (WEA) and their food security. This study aimed to (a) model the relationship between WEA and (i) women's agency in nutrition, and (ii) their food security status; and (b) quantify the moderating effect of women's agency in nutrition in the association from WEA to the food security of women.

Design: The Project-level Women's Empowerment in Agriculture Index (pro-WEAI) was used to measure WEA and four measures of women's agency in nutrition, including women's agency on their diet (regular, during pregnancy, and when breastfeeding) and food purchase. Differential associations of WEA with food security were estimated to test the three-way interactions between WEA, women's agency on their regular diet and on food purchase. Marginal effects were estimated using binary logit regressions models.

Setting: Six fishing villages on the Lakes Victoria and Albert in Uganda.

Participants: Primary Ugandan female decision makers in households with both a male adult and a female adult (380 individuals)

Results: WEA was associated with a 0.18 increase in the predicted probability of food security ($p < 0.01$). The participation of women in food purchase decisions strengthened the association from WEA to food security by 0.33 higher compared to the condition with the absence of a food purchase agency ($p < 0.05$).

Conclusions: The results suggested that food purchase agency can strengthen the positive association between WEA and food security. Promoting women's food purchase agency

preceding other interventions can be an effective strategy for improving food security in future nutrition-sensitive programs.

Keywords: Food security, women's empowerment, agency in nutrition, food purchase agency, Uganda

Introduction

Recent studies have suggested that to identify and address barriers to the food security of women, a complementary set of indicators is needed to capture the empowerment status of women explicitly in the domain of nutrition (Narayanan et al., 2019, 2022). Narayanan et al. (2019) defined empowerment in nutrition as “the process by which individuals acquire the capacity to be well fed and healthy, in a context where this capacity was previously denied to them” (p. 2). One of the key dimensions of empowerment is ‘agency’ which is the ability to define goals and act upon them (Kabeer, 1999, p. 438). Kabeer (1999) operationalized agency as quantified decision-making that can be indicated by cognitive actions of reflection and analysis such as deceiving or manipulating, bargaining, and subverting (Kabeer, 1999). In the current study, women’s agency in nutrition was referred to the participation of women in the decisions about their dietary intake and food purchases in the household.

Narayanan et al. (2019) adapted the definition of empowerment by Kabeer (1999) and conceptualized the empowerment of women in nutrition as the expansion of the capacity through processes that support the voice of women around their nutritional status (Narayanan et al., 2022). Supportive processes include promoting access to and control over sufficient and nutritious food, increasing knowledge related to nutrition, participating in the decisions related to individual health and nutrition, and having the support of the family, community, and other institutions to maintain healthy practices (Narayanan et al., 2022).

Empowerment in nutrition indicates individual ability to be empowered and the broader structural and contextual freedom from constraints such as power relations in food and gender systems. Several researchers have attempted to quantify women’s empowerment in nutrition; yet these indices are not widely or rigorously applied (Hannan et al., 2020; Malapit et al., 2014;

Olney et al., 2016). The recent Women's Empowerment in Nutrition Index (WENI) served to introduce an approach aimed at quantifying empowerment in nutrition (Narayanan et al., 2019, 2022). The explicit focus of WENI researchers is on the quantification of nutrition-focused empowerment, which was shown to be a statistically significant and meaningful predictor of Body Mass Index (BMI), anemia, and women's minimum dietary diversity (Gupta et al., 2022; Lentz et al., 2021; Narayanan et al., 2019; Saha & Narayanan, 2022).

Methods for the quantification of women's empowerment in nutrition are relatively new, and scholars in many disciplines have researched the quantification of women's empowerment. Ewerling et al. (2017) operationalized empowerment in terms of economic empowerment, Alkire et al. (2013) and Malapit et al. (2019) quantified empowerment in agriculture, Colverson et al. (2020) and Galiè et al. (2019) introduced measurements tools for empowerment in livestock, and Malapit et al. (2020) did so for empowerment in agricultural value chains. Among them, women's empowerment in agriculture (WEA) has received more attention as an effective strategy to enhance food security within nutrition-sensitive agriculture interventions in the context of Low- and Middle-Income Countries (LMICs) (Di Prima et al., 2022; Ruel et al., 2013, 2018). Evidence of a positive association between WEA and food security is however inconclusive (Asitik & Abu, 2020; Aziz et al., 2020; Bhandari & Burroway, 2018; Sraboni et al., 2014; Wei et al., 2021).

To elaborate, in studying the association between the indicators of empowerment and food security, findings often indicate trade-offs (Aziz et al., 2020; Wei et al., 2021), that is, empowerment does not necessarily affect food security, or other nutrition outcomes, positively for women (Cornwall, 2016; Essilfie et al., 2021; Quisumbing et al., 2021; Tsiboe et al., 2018). This outcome is likely because existing indices do not account for nutrition-sensitive indicators

in operationalizing empowerment, and their focus is mainly on economic enablers and productive resources while targeting a nutrition or food security outcome. In effect, as the results of prior research suggested, empowering women in agriculture did not necessarily empower them in nutrition-focused decisions at individual or household levels (Narayanan et al., 2019; Quisumbing et al., 2021; United Nations Women, 2018).

The study herein argued that empowering women in both agriculture *and* nutrition might complement each other by addressing respective shortcomings, while strengthening one another. It was hypothesized that empowering women in nutrition could moderate the association from WEA to their food security. To that end, this study aimed to (a) examine the relationship between aggregated and disaggregated measures of WEA and (i) women's empowerment in nutrition, and (ii) the food security status of women; and (b) quantify the moderating effect of women's empowerment in nutrition in the association from WEA to their food security. The interest was to expand the analysis to assess whether women's empowerment in nutrition could explain the relationship between WEA and their food security, an approach currently absent in the literature.

Measuring Women's Empowerment

In this study, the project-level Women's Empowerment in Agriculture Index (pro-WEAI) was used to measure WEA (Malapit et al., 2019). The pro-WEAI survey aims to measure empowerment in agriculture development programs in rural contexts. This tool is mainly operationalized by the agency dimension of empowerment, as Kabeer (1999) defined (p. 437). Empowerment, the ability to make strategic life choices, can be exercised through three interrelated dimensions: resources (pre-conditions), agency (process), and achievement

(outcome) (Kabeer, 1999). In agricultural development studies, the agency dimension of empowerment has been less studied compared to other dimensions (Malapit et al., 2019).

To measure women's empowerment in nutrition, pro-WEAI includes a Health and Nutrition (H&N) module as an add-on, but it has not yet been widely used (Hannan et al., 2020). This module is focused on women's agency in the health and nutrition. In this study, only questions related to women's agency in nutrition were used, which were operationalized empowerment as decision-making through four sections: (a) women's regular diet (what to prepare and what to eat); (b) women's diet during pregnancy and/or breastfeeding (intake of dairy products, eggs, and meat, poultry, or fish); (c) children's diet (same as b); and (d) women's agency related to purchasing food and supplements for themselves, their households, and children (see Table 6.1).

Method

Country Context and Data

Uganda's Demographic and Health Survey (UDHS) in 2016 showed that among women of reproductive age, 32% suffered from anemia, 9% were underweight, and 24% were overweight or obese (Uganda Bureau of Statistics [UBOS] & ICF, 2018). These data suggested a high risk of micronutrient deficiencies for Ugandan women.

Limited data on the quantity and quality of food consumed by Ugandan households suggests a poor-quality diet with one-third of households having low dietary diversity (four or fewer food groups per day) (World Food Program [WFP], 2019). The main source of household food intake is energy-providing staple foods such as cassava, rice, and white maize, which do not provide the required micronutrient intake, especially for vulnerable groups such as women and adolescent girls. The main barriers to consuming a diverse and balanced diet among Ugandan

households are lack of food availability and economic access to sufficient and nutritious food, indicating high rates of food insecurity (WFP, 2019).

The recent report on the State of Food Security and Nutrition in the World (SOFI 2022) showed a 9% increase in the prevalence of moderate or severe food insecurity from 2014-2016 (63.4%) to 2019-2021 (72.5%). This increase was mainly affected by the adverse effects of the COVID-19 pandemic and increased food prices resulting in lower affordability of a healthy diet (Food and Agriculture Association [FAO] et al., 2022).

To improve the quality of diet among low-resource households, the NutriFish project was implemented in Uganda to promote the availability, accessibility, and consumption of underutilized small fish. Incorporating culturally preferred small fish into low diverse diets can address nutritional issues among vulnerable groups like women (Ahern et al., 2021). Built on the overarching goal of NutriFish, which aimed to foster sustainable food security and better livelihood of vulnerable groups, including women, the project focused on promoting nutrition- and gender-sensitive fisheries through three intervention components: (a) group-based training for men and women, (b) nutrition behaviour change and (c) gender sensitization.

The study herein involved a secondary data analysis using cross-sectional data from the larger NutriFish project. The project collected survey data from January to February 2020, covering $n=381$ dual-adult households (DHHs), which included both a male and a female adult, and $n=23$ female-adult-only households (FHHs) in six fishing villages on the shores of Lakes Victoria and Albert in Uganda, mapped into five districts. The pro-WEAI score for FHHs was not constructed due to missing responses for some of the indicators. Instead, the authors of this paper conducted their analysis with data from primary female decision-makers in DHHs.

Analytical Approach

The authors adapted the methodology employed by Malapit et al. (2015) and Quisumbing et al. (2021) to conduct the analysis using aggregated and disaggregated WEA scores, which were our key independent variables. The individual empowerment status of men and women in pro-WEAI is an aggregated measure of three domains of agency (3DE): intrinsic, instrumental, and collective agencies mapped into 12 indicators (Malapit et al., 2019) (see Table 6.1). Each indicator has a threshold to meet the adequacy in pro-WEAI (Malapit et al., 2019). An individual is categorized empowered if she or he is adequate in nine out of 12 indicators ($3DE \geq 0.75$), ranging from 0 to 1. Both aggregated and disaggregated measures were used in this study.

Aggregated Score: Two measures of the aggregated WEA were calculated. The first one relied only on the women's empowerment scores (WEA). The second one, which was household gender parity (HGP), compared the empowerment score of men and women within the same household. The HGP score measures gender parity in the household; a household achieves gender parity when the woman is empowered ($3DE \geq 0.75$) or her 3DE score is equal or greater than her male counterparts in the household (Malapit et al., 2019). These two measures were included in the analysis as the aggregated measures of empowerment. See Table 6.1 for the empowerment and food security measures and explanatory variables used in the analysis and how they were operationalized.

Disaggregated Score: To assess the association between the 3DE indicators and the outcomes, 12 separate binary logit models were estimated for each of the 3DE indicators to avoid collinearity among the indicators followed by Quisumbing et al. (2021).

Outcome Variables: The first outcome measure was women's agency in nutrition in four independent categories: women's agency on their diet (regular, during pregnancy, and when

breastfeeding), and food purchase. It was hypothesized that WEA was associated with these measures of women's agency in nutrition, estimated by four binary logit regression models. The same procedure was repeated for HGP.

The second outcome measure was the Household Food Insecurity Access Scale (HFIAS). HFIAS measures the food security status of women at the individual level using nine questions to assess the access dimension of food security (Coates et al., 2007). It was hypothesized that women's agency in nutrition can moderate the association from WEA to food security. Two measures of women's agency on their diet and food purchase were included in this model because the data were available for the total sample size ($n = 380$) and not for the measures of women's agency on pregnancy and breastfeeding diets ($n = 152$). The researchers additionally tested whether WEA, women's agency on their regular diet, and women's agency on food purchase have interactive effects beyond their independent additive effects on the food security status of women. In so doing, tests of three-way interactions were carried out by running a binary logit model estimating the difference in the predicted probabilities (Pr) of food security, referred to as marginal effects (MEs).

MEs measure how much the outcome changes (a) for a change in one focal independent variable while (b) holding other control variables constant. For example, there are two Pr (s) of food security for a dichotomous variable like WEA: Pr_1 is when WEA is set at empowered ($=1$), and Pr_0 is when WEA is set at disempowered ($=0$), holding other control variables at a specific value such as Average Marginal Effect (AME)²³ in the analysis. The difference between Pr (s) is referred to as MEs ($Pr_1 - Pr_0$). Whereas the independent variable is a three-way interaction term

²³ Average Marginal Effects (AME) represent an effect on average across the sample which is the average (mean) of the marginal effects calculated for each observation in the sample; for further details, see Mize (2019).

between three dichotomous variables, there are eight Pr (s). The following text contains an elaboration of the steps of testing the three-way interaction effect referred to herein as the difference in difference in difference approach (diff-in-diff-in-diff) (Mize, 2019).

Step 1) MEs were estimated to compare two conditions of whether women are empowered in agriculture or not at four levels having or not having agency on general diet and food purchase, as follows:

- 1) No agency: Food Purchase agency = 0, Regular diet agency = 0
- 2) Only purchase agency: Food Purchase agency = 1, Regular diet agency = 0
- 3) Only regular diet agency: Food Purchase agency = 0, Regular diet agency = 1
- 4) Both agency: Food Purchase agency = 1, Regular diet agency = 1

At each level, MEs were computed, referred to as the first differences (1st diff):

$$\text{Pr (food security | WEA = 1)} - \text{Pr (food security | WEA = 0)} = \text{ME}_{i(1-4)}$$

Step 2) Second differences (2nd diff) were estimated: a test of the equality of MEs, comparing two conditions of whether women have agency on their regular diet or not:

$$2^{\text{nd}} \text{ diff}_1 = \text{ME}_1 - \text{ME}_2$$

$$2^{\text{nd}} \text{ diff}_2 = \text{ME}_3 - \text{ME}_4$$

Step 3) Third differences (3rd diff) were estimated to test the equality of the second differences, comparing two conditions of whether women have agency on food purchase or not.

$$3^{\text{rd}} \text{ diff} = 2^{\text{nd}} \text{ diff}_1 - 2^{\text{nd}} \text{ diff}_2$$

All models were estimated using binary logit regression and controlled for the following variables in all models: age, education, occupation, and household size, clustering standard errors

at the level of fishing villages. Women's agency on food purchase was included in all models except model four (food purchase model). Stata (version 17) was used to conduct the analysis.²⁴

Ethical Considerations

Before commencing the study, ethical clearance was sought and obtained from Makerere University in Uganda and Uganda National Council for Science and Technology for primary data collection by the NutriFish team. Additionally, ethical approval for secondary data analysis was obtained from McGill University, Canada.

Results

Sample Characteristics

After removing the missing responses, the final sample size was $N=380$ individuals. Overall, 37% of women were food secure, and 26% were empowered in agriculture ($n = 380$) (see Table 6.2). Almost 81% were able to decide on what food to prepare and what food to eat (agency on their regular diet) ($n = 380$). Among the total sample, $n=152$ (40%) of women had been pregnant or given birth within the previous two years with 76% and 80% reporting agency on their diet during pregnancy and while breastfeeding, respectively. The rate of women's agency on food purchase was amongst the lowest WAN rates, $n=380$ (69%). Only 26% of mothers were highly educated (secondary, tertiary, or higher level) with the majority <45 years old. More than half of them worked in the fisheries sector. Among the 12 indicators of 3DE, women had the lowest adequacy for intrinsic agency in addition to work balance, access to and decisions on credit, and membership in influential groups.

²⁴ Standard Stata do-files were employed to calculate the pro-WEAI score available on the International Food Policy and Research Institute's (IFPRI) website and modified as needed to suit the NutriFish baseline data.

Women's Empowerment in Agriculture and Their Agency in Nutrition

The aggregated WEA score tended to be associated with a 0.07 and 0.06 increase in women's diet agency and pregnancy diet agency ($p < 0.1$) (see Table 6.3). Having agency on food purchase was positively associated with women's agency on their regular (0.18, $p < 0.01$), pregnancy (0.26, $p < 0.05$), and breastfeeding (0.32, $p < 0.01$) diets (Models 1- 3, Table 6.3). On contrary, the absence of gender parity in the household was associated with a 0.12 decrease in women's agency on their regular diet ($p < 0.05$) and tended to be associated with a 0.05 increase on women's agency on their pregnancy diet ($p < 0.1$) (see Table 6.4). Similar to the results shown in Table 6.3, the higher participation of women in decisions related to food purchase was associated with an increase in the predicted probability of having an agency on the regular (0.18, $p < 0.01$), pregnancy (0.26, $p < 0.05$), and breastfeeding (0.33, $p < 0.01$) diets (Models 1- 3, Table 6.4). The results from model 4 in both Tables 6.3 and 6.4 showed a positive association between higher education (0.12, $p < 0.01$) and adult age (26-45 years) (0.10, $p < 0.05$) and women's voice in food purchase decisions.

Figure 6.1 presents marginal effects using the 12 indicators of women's empowerment. In all models, work balance was negatively associated with the measures of women's agency in nutrition, except their agency on food purchase. Having control over the use of income and respect among household members were respectively associated with a 0.15 ($p < 0.01$) and 0.14 ($p < 0.05$) increase in the participation of women in decision-making about their regular diet. Visiting important places (i.e., hospital, health center, community meetings/gatherings, and market) more frequently was negatively related with breastfeeding agency (- 0.15, $p < 0.01$), while group membership improved it (0.05, $p < 0.05$). Income control (0.08, $p < 0.05$) and asset ownership (0.25, $p < 0.01$) were positively associated with food purchase agency, while negative

attitudes toward gender violence was associated with a 0.14 decrease in food purchase agency ($p < 0.05$). Detailed results are in Supplemental Table 6.1.

Women's Empowerment in Agriculture and Food Security

Empowering women in agriculture was strongly associated with a 0.18 increase in their food security (see Table 6.5 and Figure 6.2). Household gender parity and women's agency on their regular diet and food purchase appeared to have no association with food security. In both models, education showed opposite associations with food security. In model 1, higher education was associated with a 0.06 decrease in food security ($p < 0.01$), while in model 2, it was associated with a 0.15 increase in food security ($p < 0.01$). The smaller household size was strongly associated with a better food security status in both models (-0.03 , $p < 0.01$). Having control over income, respect among household members, and negative attitudes toward gender violence improved the food security status of women by 11 ($p < 0.05$), 21 ($p < 0.01$), and 13 ($p < 0.01$) percentage point, respectively. Detailed results are in Supplemental Table 6.2.

Interactions Between WEA and Agency on Regular Diet and Food Purchase

The predicted probabilities of food security were higher when women were empowered in agriculture compared to when they were not (see Table 6.6 and Figure 6.3). The highest probability for the condition occurred when women were empowered in agriculture *and* had agency on food purchase but not on their general diet ($\text{Pr} = 0.88$) compared to their disempowerment status in WEA ($\text{Pr} = 0.28$), which showed a 61% significant difference ($p < 0.01$). This result meant that when WEA was paired with agency on food purchase, there was a higher probability of being food secure compared to the condition when women were not empowered in agriculture despite having agency on food purchase.

Similarly, women had significantly a higher probability of food security when they were empowered in agriculture and had agency on their general diet and food purchase compared to when they were disempowered in agriculture (first difference = 0.17, $p < 0.05$). Testing the difference between these two conditions in terms of second differences showed a 0.44 increase in the predicted probability of food security. This result implied that the first difference in the predicted probability of food security for women with an agency on their regular diet was 0.17, compared to a significantly higher predicted probability of about 0.61 for women with no agency on their diet (second difference = - 0.44, $p < 0.01$). In other words, there was an insignificant moderation role of women's agency on their regular diet in the relationship between WEA and their food security.

The moderation role of women's agency on food purchase was tested through a third difference to compare the two second differences, with or without a food purchase agency. The participation of women in food purchase decision-making strongly moderated the association between WEA and food security by 0.33 compared to the condition with the absence of a food purchase agency (third difference = - 0.33, $p < 0.05$). These results confirmed that while WEA was positively associated with food security, the food purchase agency could change the strength of this relationship regardless of the status of the women's agency on their regular diet.

Discussion

Results indicated a lack of association between aggregated WEA score and the measures of women's agency in nutrition, except marginal significant associations with improvement in women's agency on their diet and pregnancy diet. A similar pattern appeared for lack of household gender parity with women's agency on pregnancy diet. Nevertheless, gender disparity in household was negatively related to women's agency on their diet. When the empowerment

indicators were analyzed, trade-offs emerged. Not all WEA indicators were associated with women's agency in nutrition outcomes. Previous studies similarly reported that WEA indicators were not always associated with better nutrition outcomes (Quisumbing et al., 2021; Sraboni et al., 2014). Results herein showed the same pattern in relation to the women's agency in nutrition outcomes rather than the nutrition outcomes. For instance, the increased workload of women (>10 hours per day) was associated with an increase in their participation in all nutrition-related decision making. Previous empowerment studies reported similar results between longer work hours of women and better nutrition outcomes for themselves and their children (Malapit et al., 2015; Quisumbing et al., 2021; Santoso et al., 2019).

In addition to emerging trade-offs, it became apparent that the WEA indicators that were significant for women's agency in nutrition in one category did not always overlap with other categories. This result suggested that different indicators of WEA may be important for different measures of women's agency in nutrition at each life stage. For example, while having income control was positively associated with a women's agency on both regular diet and food purchase, it was not significantly related to breastfeeding, and pregnancy agencies. On the other hand, group membership was positively associated with only breastfeeding agency, whereas having mobility by visiting important places was negatively associated with this category of agency in nutrition. These results supported a call for careful designing of gender- and nutrition-sensitive programs and policies to promote the most important aspects of WEA as immediate goals. In doing so, implementers and policymakers should be aware of the differences that women experience at each critical life stage (especially motherhood), in addition to trade-offs between WEA indicators.

Results showed positive associations between women's agency on purchasing food and other measures of women's agency in nutrition. Current evidence related to women's decision-making regarding household purchases is mostly available through analysis of Demographic and Health Survey (DHS) questions in various settings, focusing on women's participation in large and daily household purchases. These studies have shown that women having a voice in household purchase decisions (alone or jointly) is associated with better nutritional status for themselves and/or their children (Amugsi et al., 2016; Bhagowalia et al., 2010; Hindin, 2006; Saaka, 2020; Tebekaw, 2011). In addition to the two aforementioned questions, this study's food purchase indicator also focused on nutrition-sensitive decisions by including questions about the purchase of eggs, milk and milk products, meat, poultry, or fish (recognized nutritious food sources for mothers recommended by a health worker); medications; vitamins and supplements for mothers and children; and special food for children.

There is a dearth of knowledge on the association between women's food purchase agency and outcomes such as women's empowerment either in agriculture or nutrition and food security. Results showed that education, age, income control, and land/asset ownership were predictors of having food purchase agency. Likewise, previous studies have overwhelmingly highlighted that age and education are strong determinants of women's greater agency in household purchasing decisions (Acharya et al., 2010; Chandradasa et al., 2021; Riaz & Pervaiz, 2018; Tebekaw, 2011). Education in particular may be associated with improvement in a woman's level of self-efficacy, which could affect her ability to participate in the decision-making processes related to her food intake as well as her children's. Similar to our results, previous studies, i.e., Bain et al. (2020) Haley & Marsh (2021), and Mishra & Sam (2016), have discussed the important role of enabling economic resources such as income control and land/asset ownership in promoting

women's empowerment in various domains has been discussed in the literature. Results herein and from previous studies affirmed the importance of economically empowering women as a focal point in the pathway to nutritionally empowering them. Placing women's food purchase agency prior to other forms of agency in nutrition as an intermediate step may facilitate this process.

In the second section of the analysis of the food security model, suggestive evidence was found regarding the association of WEA with women's food security status, but household gender parity was not significantly related to food security. This result aligned with existing evidence in the literature that the relationship between WEA and food security is inconclusive and becomes very limited when it examines household gender parity as a gender-sensitive predictor of food security. To illustrate, Quisumbing et al. (2021) recently reported mixed associations between these two measures of empowerment and various nutrition outcomes. They reported that decreasing intrahousehold inequality was associated with reduced child stunting and improved women's BMI, but it did not contribute to either women's or household dietary diversity. Similar to the results of this study, a subtle pattern of trade-offs was displayed in assessing the relationship between WEA indicators and food security.

Results also indicated that women's agency on their regular diet and their food purchase were not significant predictors of their food security. That said, results from testing the moderating effect of these two forms of nutrition agency in the association from WEA to food security showed that food purchase could strengthen the positive association between WEA and food security. These results suggested that food purchase agency can strengthen the positive relationship of WEA with food security. Hence, this should be considered an effective strategy in

future nutrition-sensitive agriculture interventions, so women can reach their full potential in improving their own food security status and that of their households.

On the contrary, women's agency on their regular diet alone did not show a significant moderating effect. In the present study, food security was a measure of food access rather than food utilization. Measuring the access dimension of food security might explain the positive moderator role of food purchase agency compared to women's agency on their regular diet. By way of discussion, by definition, food purchase agency may better measure the food access dimension and more likely to be correlated with this measure of food security, while the measure of women's agency on their diet could be closer to the utilization dimension of food security. Furthermore, the measure of women's agency on their regular diet might not be a sufficiently comprehensive and rigorous measure of women's agency in nutrition, as it only asks about women's input in decisions about which foods to eat and prepare. Incorporating the other dimensions of nutritional empowerment in such analyses could shed more light on the role of such indicators in the pathway from WEA to food security.

Narayanan et al. (2019) argued that focusing on the agency dimension of empowerment is insufficient to quantify the complexity of nutritional empowerment. Other important factors, such as knowledge and broader institutional resources, should be considered, as they are included in WENI. The measures of women's agency in nutrition in the optional H&N module of pro-WEAI are missing these two important aspects. This is unfortunate because broader context such as sociocultural norms, i.e., taboos around eating some types of nutritious food like fish are significant barriers to the optimal dietary intake of women. Despite these shortcomings, H&N module covers important nutrition- focused questions that are not included in WENI.

For example, the optional H&N module asks about a detailed list of foods to purchase, which is missing in WENI. Results revealed that this indicator had a significant role in understanding the association between WEA and food security. Moreover, the pro-WEAI questions differentiate between different life stages and conditions to better understand which dimensions and domains matter most at each stage and for whom. Nonetheless, validity testing is still needed to ensure that the questions can be well understood and interpreted in different cultures and settings as intended (Hannan et al., 2020).

Aside from debates on which tool can better measure nutritional empowerment, there are challenges at the implementation and analysis stages that make it difficult to implement, analyze, and interpret (Alsop & Heinsohn, 2012). These challenges may explain the shortcomings of current measures, which focus on capturing limited proxy indicators depending on the goals of the project and on considering both generic approaches and parsimonious of quantifying empowerment in nutrition (Narayanan et al., 2019; Saha & Narayanan, 2022).

Study Limitations

First, pro-WEAI's optional H&N module targeted women only and did not include responses from male counterparts. This limitation did not allow for further gender-sensitive analysis to capture intrahousehold disparities. This is particularly important in low-resource communities such as the context of this study, where both men and women were economically, and therefore nutritionally, maybe not equally, deprived. Second, available data did not provide information about sociocultural norms around food consumption of women and their decision-making capacity in the household, such as imposed dietary restrictions namely during pregnancy and breastfeeding, the type and portion of distributed food, or the order of eating within a household.

Third, more socioeconomic information about the household background (e.g., wealth) could shed more light on the important role of food affordability and availability. The structural and institutional context outside of households, such as community and government services, can significantly affect women's empowerment in nutrition (Narayanan et al., 2022). For example, market access can change women's food purchase agency despite having a voice within the household. If they do not have access to the market, other barriers such as lack of affordable transportation or hindering social norms for travelling to the market, can impede their active participation in household food purchase decisions. These variables should be included in future research. Finally, the measures of women's agency in nutrition and their food security status used in this study were confined to representing aspects for which secondary data were available. The context-specific results limit their generalizability to other populations.

Conclusion

Results from this study have several important implications for future practice. Primarily, the study uncovered and identified obstacles to women's agency in nutrition in different life stages and conditions as a subset of women's empowerment in nutrition. Also, results provided additional evidence on the importance of assessing all 12 indicators instead of focusing on top contributors to women's disempowerment in agriculture. Furthermore, results suggested that awareness of existing trade-offs between WEA indicators by policymakers and program implementers can provide a context-specific and comprehensive picture of the gaps in nutrition-sensitive agriculture interventions in the studied population.

Results affirmed that the aggregated WEA score was not associated with the measures of women's agency in nutrition, but food purchase agency was strongly associated with the other measures of women's agency in nutrition. That said, several other WEA indicators were

positively associated with food purchase agency. Taken together, these results prompted the following research question in need of further investigation: “Does women’s food purchase agency mediate the relationship between the WEA and any of the outcomes related to women’s agency in nutrition?” More research is needed to better understand the role of food purchase agency in this pathway.

Conclusively, the present study provided additional evidence with respect to the importance of looking beyond the current measurements of empowerment in agriculture (e.g., pro-WEAI) to uncover and identify the determinants of food insecurity. Although empowering women in agriculture is essential on its end, and is progressing in nutrition-sensitive agriculture programs, the evidence about its promising association with food security and nutrition outcomes is still mixed. As noted earlier, one reason could be the lack of including complementary and rigorous nutritional empowerment indicators that are more sensitive to nutrition outcomes (Narayanan et al., 2019). Given the shortcomings of current measurement tools of empowerment in nutrition, including WENI and the pro-WEAI optional nutrition module, an approach to measuring this phenomenon is needed that includes all crucial indicators, such as direct decision-making questions related to food practices and intake, or access to technology and the internet as well as education and healthcare.

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Authors Contributions

FB designed the study conception and developed the overall research plan, analyzed the data, wrote the manuscript, and had primary responsibility for the final content; JE and RO adapted the pro-WEAI questionnaire to NutriFish's objectives, supervised data collection, and provided data for this study; HMQ provided guidance on the overall research plan including the project conception, the analytic design and approach; all authors read and approved the final manuscript.

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Table 6.1 Definitions of empowerment, outcome, and explanatory variables

Indicator	Definition of Indicator
Women's Empowerment in Agriculture (WEA) score and its indicators	
Empowerment score	Calculated using Project-level Women's Empowerment in Agriculture Index (Pro-WEAI) composed of 12 indicators mapped into three domains of empowerment (3DE), as three categories of agency, including instrumental, intrinsic, and collective. Empowered (=1) if adequate 9 out of 12 indicators, otherwise, disempowered (=0).
3DE indicators	<p>Adequate if meeting a pre-defined threshold (=1), otherwise inadequate (=0). See Table 2 in Malapit et al. (2019) for more details about adequacy.</p> <p><i>Intrinsic Agency:</i> autonomy in income, self-efficacy, attitudes towards domestic violence, and respect among household members</p> <p><i>Instrumental Agency:</i> input in productive decisions, ownership of land and other assets, access to and decision on credit, control over use of income, work balance, and visiting important locations</p> <p><i>Collective Agency:</i> group membership and membership in influential groups</p>
Household Gender Parity (HGP)	A household achieves gender parity (=0) if either the woman is empowered, or her score is greater than or equal to the empowerment score of the male decision-maker in the household.
Women's Agency in Nutrition	
Women's agency on her own diet (regular diet)	Input into decisions about what foods to prepare and what foods to eat. A woman has agency on her own diet (=1) if she is sole decision maker or contributes to a medium or high extent when decision is made jointly for both decisions. The questions about regular diet were asked from all female participants in the study ($n = 380$).
Women's agency on her own diet during pregnancy (pregnancy diet)	Input into decisions whether a woman can eat a) eggs; b) milk and milk products; and c) meat, poultry, or fish during her current or most recent pregnancy. A woman has agency on her own diet during pregnancy (=1) if she is sole decision maker or contributes to a medium or high extent when decision is made jointly for at least two items. The questions about pregnancy diet were asked from female participants who have been pregnant or gave birth

	within the previous two years (including currently pregnant women) ($n = 152$).
Women's agency on her own diet during breastfeeding (breastfeeding diet)	Input into decisions whether a woman can eat a) eggs; b) milk and milk products; and c) meat, poultry, or fish when her youngest child was being breastfed. A woman has agency on her own diet during breastfeeding (=1) if she is sole decision maker or contributes to a medium or high extent when decision is made jointly for at least two items. The questions about breastfeeding diet were asked from female participants who have been pregnant or gave birth within the previous two years (including currently pregnant women) ($n = 152$).
Women's agency on food purchase	Input into decisions about purchasing food items, medications, and supplements for herself or her household ($n = 7$); A woman has agency on food purchase (=1) if she is sole decision maker or contributes to a medium or high extent when decision is made jointly for four or more decisions. The questions about food purchase were asked from all female participants in the study ($n = 380$).
Food security	
Food security	Measured by Household Food Insecurity Access Scale (HFIAS) at individual level. Food secure (=1) if experiences none of the food insecurity conditions or just experiences worry, but rarely in the previous four weeks; otherwise, the person is food insecure (=0).
Socio demographic variables	
Age	Three categories: 15-25, 26-45, and >45 years old.
Education	High education at secondary and tertiary or higher level (=1); Low education with no formal education or at primary level (=0).
Household size	Number of household members
Occupation	Fisheries versus non-Fisheries; Fisheries (=1) includes fishing, fish processing, fish trading, and casual work in fisheries.

Table 6.2 Study sample characteristics

Variables	% (n = 380)
Food secure	37.11
Women's Empowerment in Agriculture status and its indicators	
Empowered	26.32
<i>Intrinsic Agency</i>	
Autonomy in income	57.37
Self-efficacy	56.58
Attitudes towards domestic violence	45.00
Respect among household members	33.16
<i>Instrumental Agency</i>	
Input in productive decisions	69.47
Ownership of land and other assets	69.74
Access to and decision on credit	56.05
Control over use of income	70.53
Work balance	30.00
Visiting Important locations	60.79
<i>Collective Agency</i>	
Group membership	60.79
Membership in influential groups	56.58
Women's Agency in Nutrition	
Regular diet	80.79
Pregnancy diet	76.32 (n = 152)
Breastfeeding diet	80.26 (n = 152)
Food purchase	68.68
Socio demographic variables	
Age (y)	
15-25	57.11
26-45	58.95
>45	13.95
Education (high educated)	26.32
Household size (#)	6.2 (3.2) ¹
Occupation (Fisheries)	52.89

¹ Mean (SD)

Table 6.3 Aggregated women's empowerment in agriculture and women's agency on her diet (regular, pregnancy, and breastfeeding) and on food purchase

Variables	Model 1: Regular diet ($n = 380$)		Model 2: Pregnancy diet ($n = 152$)		Model 3: Breastfeeding diet ($n = 152$)		Model 4: Food purchase ($n = 380$)	
	Pr ¹	SE	Pr	SE	Pr	SE	Pr	SE
Women's empowerment	0.07 *	0.04	0.06 *	0.03	-0.03	0.05	-0.01	0.05
Food purchase agency	0.18 ***	0.05	0.26 **	0.12	0.32 ***	0.04		
Age (y): 26-45 vs 15-25	0.03	0.07	0.06	0.10	0.08	0.08	0.10 **	0.04
Age (y): >45 vs 15-25	0.06	0.04	-0.11	0.21	-0.08	0.06	0.09	0.09
Age (y): >45 vs 26-45	0.03	0.09	-0.17	0.24	-0.16	0.11	-0.01	0.07
Education	0.07 *	0.04	0.01	0.12	-0.02	0.05	0.12 ***	0.03
Household size	-0.01	0.01	-0.01	0.02	-0.01	0.01	0.00	0.01
Occupation	0.00	0.02	-0.02	0.02	-0.04	0.05	0.05	0.07

¹ Predicated probability, marginal effects reported. Robust standard errors in parentheses were clustered by fishing villages.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 6.4 Household gender parity status and women's agency on her own diet (regular, pregnancy, and breastfeeding) and on food purchase

Variables	Model 1: Regular diet ($n = 380$)		Model 2: Pregnancy diet ($n = 152$)		Model 3: Breastfeeding diet ($n = 152$)		Model 4: Food purchase ($n = 380$)	
	Pr ¹	SE	Pr	SE	Pr	SE	Pr	SE
Household Gender Parity status	- 0.12 **	0.05	0.05 *	0.03	0.08	0.05	0.00	0.05
Food purchase agency	0.18 ***	0.05	0.26 **	0.12	0.33 ***	0.04		
Age (y): 26-45 vs 15-25	0.02	0.06	0.07	0.11	0.09	0.09	0.10 **	0.05
Age (y): >45 vs 15-25	0.04	0.03	-0.14	0.22	-0.06	0.05	0.08	0.09
Age (y): >45 vs 26-45	0.02	0.09	-0.21	0.25	-0.15	0.11	-0.02	0.07
Education ¹⁰	0.07 *	0.04	-0.21	0.25	-0.02	0.05	0.12 ***	0.03
Household size	-0.01	0.01	-0.01	0.02	-0.01	0.01	0.00	0.01
Occupation ¹¹	0.00	0.03	-0.01	0.02	-0.03	0.05	0.05	0.07

¹ Predicated probability, marginal effects reported. Robust standard errors in parentheses were clustered by fishing villages.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 6.5 Aggregated women's empowerment in agriculture score, household gender parity, and women's food security

Variables	Food security ($n = 380$)			
	Model 1		Model 2	
	Pr ¹	SE	Pr	SE
Women's empowerment in agriculture	0.18 ***	0.05		
Household Gender Parity status			-0.07	0.05
Regular diet agency	-0.01	0.05	0.02	0.05
Food purchase agency	0.03	0.07	0.04	0.07
Age (y): 26-45 vs 15-25	-0.06	0.07	-0.05	0.08
Age (y): >45 vs 15-25	0.08	0.11	0.09	0.11
Age (y): >45 vs 26-45	0.14 *	0.08	0.14 *	0.08
Education	-0.06 ***	0.07	0.15 ***	0.04
Household size	-0.03 ***	0.01	-0.03 ***	0.01
Occupation	-0.03	0.01	0.00	0.06

¹ Predicated probability, marginal effects reported. Robust standard errors in parentheses were clustered by fishing villages. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 6.6 Probability of women's food security by women's empowerment in agriculture status with test of three-way interaction effect (difference-in-difference)

	Empowered (=1)		Disempowered (=0)		1st Diff ²		2nd Diff ³		3rd Diff ⁴	
	Pr ¹	SE	Pr	SE	Pr	SE	Pr	SE	Pr	SE
Regular diet agency = 0 Food Purchase agency = 0	0.39	0.15	0.24	0.10	0.14	0.17				
Regular diet agency = 1 Food Purchase agency = 0	0.40	0.10	0.36	0.07	0.04	0.06	- 0.11	0.22	- 0.33 **	0.13
Regular diet agency = 0 Food Purchase agency = 1	0.88	0.13	0.28	0.05	0.61 ***	0.12	- 0.44 ***	0.15		
Regular diet agency = 1 Food Purchase agency = 1	0.50	0.08	0.34	0.05	0.17 **	0.08				

Models were estimated using binary logit regression adjusted for age, education, occupation, and household size.

¹ Pr (FS): Predicated probability of food security. Marginal effects (MEs) reported and robust standard errors in parentheses were clustered by fishing villages. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

² Statistics for first difference (1st diff) is the difference in the effect for each specific condition across women's empowerment in agriculture status.

³ The second differences (2nd diff) column reports whether the effect of agency on regular diet varies across each of the two conditions.

⁴ The third difference (3rd diff) column reports whether the effect of purchase agency varies across the two conditions.

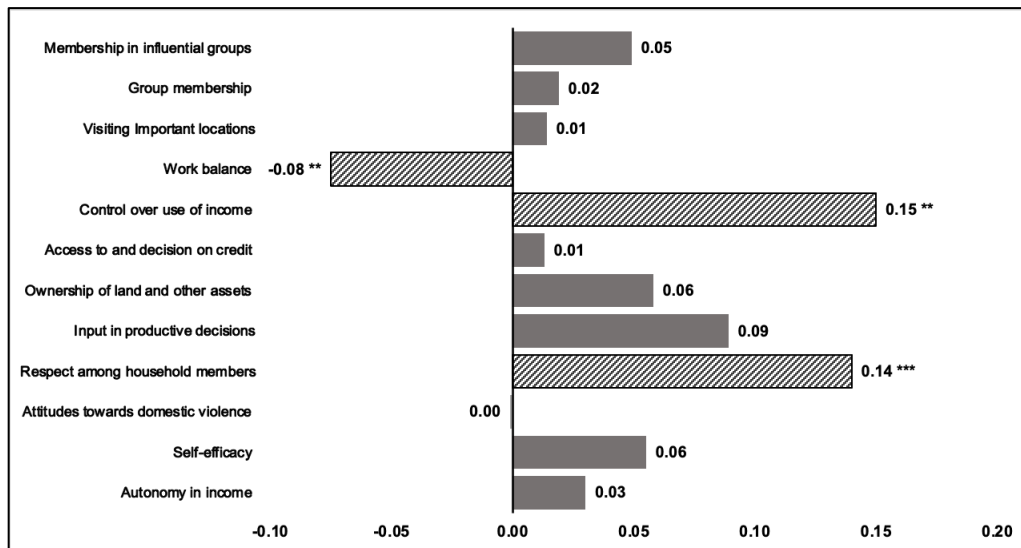
Note: Because of rounding, the differences do not always equal the MEs in one pattern minus the MEs in another pattern, similar to the 2nd differences.

Figure 6.1 Women's empowerment in agriculture indicators and women's agency on 1) her regular diet, 2) pregnancy diet, 3) breastfeeding diet, and 4) food purchase.

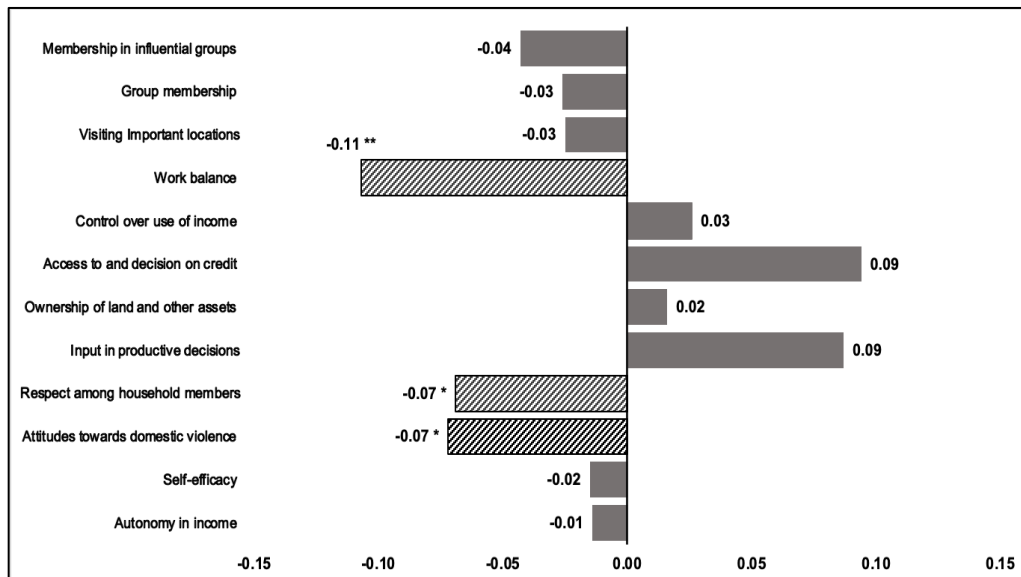
Marginal effects reported; patterned colours depict statistically significant coefficients

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

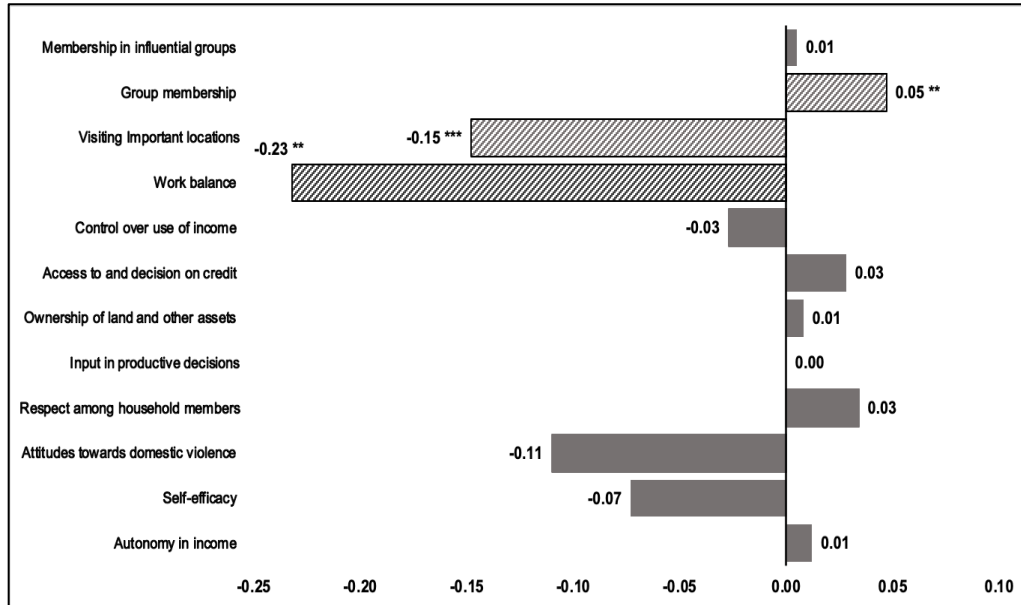
1) Women's agency on her regular diet



2) Women's agency on her pregnancy diet



3) Women's agency on her breastfeeding diet



4) Women's agency on food purchase (excluding children's food)

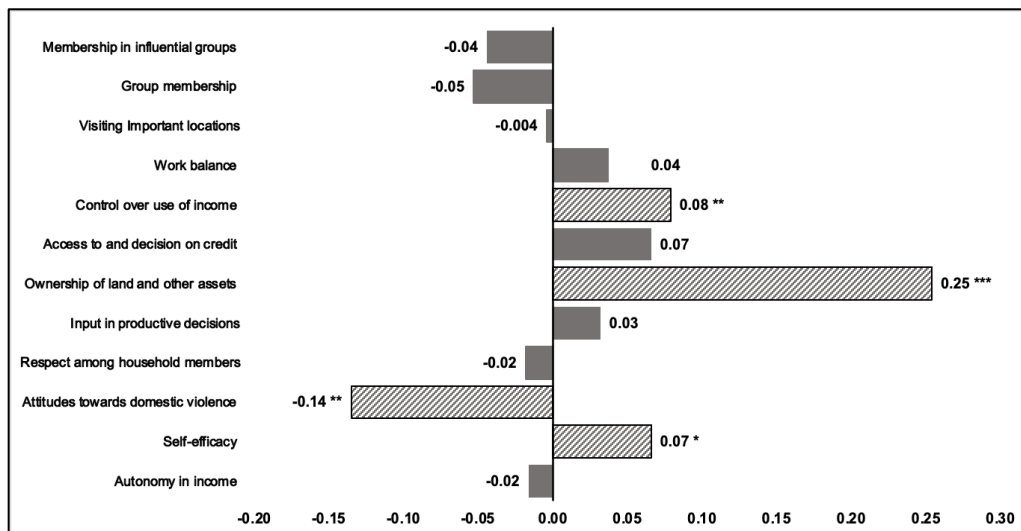


Figure 6.2 Pro-WEAI indicators and women's food security

*Marginal effects reported; patterned colors depict statistically significant coefficients; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

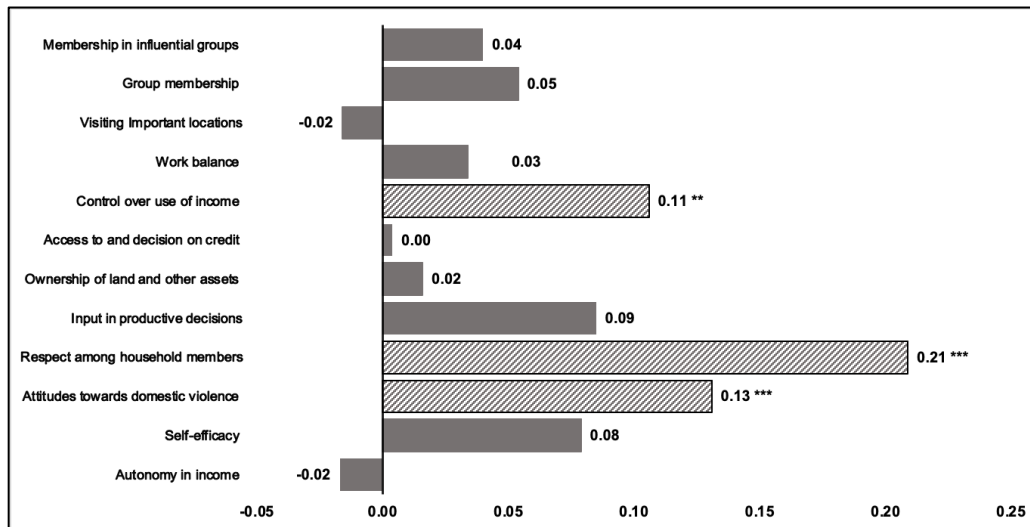
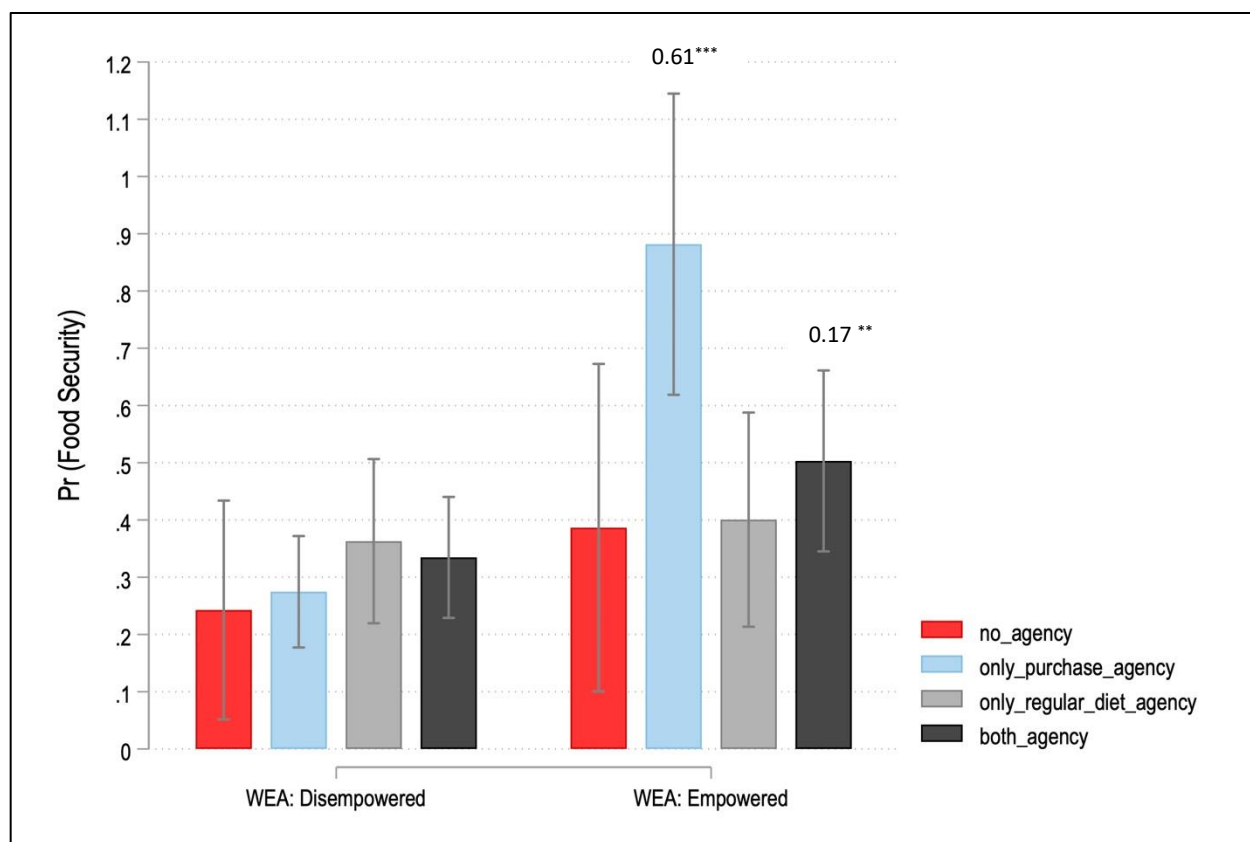


Figure 6.3 Probability of food security by women’s empowerment in agriculture (WEA) status including three-way interaction between WEA, regular diet agency, and food purchase agency



WEA: Women’s Empowerment in Agriculture

no_agency: Women have no agency on their regular diet agency and food purchase.

only_purchase_agency: Women have agency only on food purchase.

only_regualr_diet_agency: Women have agency only on their regular diet.

both_agency: Women have agency on both their regular diet agency and food purchase.

Note: Only the significant first differences are displayed. The first differences between similar colors are shown in the ‘WEA: Empowered’ category. Statistics for first difference is the difference in the effect for each specific conditions across WEA status. See the results of the second and third differences in Table 6.6; ** $p < 0.05$, *** $p < 0.01$.

Supplemental Table 6.1 Pro-WEAI indicators and women's agency on 1) her regular diet, 2) pregnancy diet, 3) breastfeeding diet, and 4) food purchase.

Marginal effects reported.

1) Women's agency on her regular diet

Empowerment indicators	Change	Std Err	P-value
Autonomy in income	0.03	0.04	0.473
Self-efficacy	0.06	0.05	0.287
Attitudes towards domestic violence	0.00	0.06	0.989
Respect among household members	0.14	0.02	< 0.001
Input in productive decisions	0.09	0.07	0.195
Ownership of land and other assets	0.06	0.05	0.255
Access to and decision on credit	0.01	0.03	0.612
Control over use of income	0.15	0.06	0.012
Work balance	-0.08	0.03	0.024
Visiting Important locations	0.01	0.03	0.683
Group membership	0.02	0.04	0.644
Membership in influential groups	0.05	0.05	0.295

In all models, purchase power was strongly significant ($p < 0.01$), education effect was mixed. Older age than 45 yrs compared to 15-25 (younger age) was significant in almost all models except income control, feeling input into productive decisions.

2) Women's agency on pregnancy diet

Empowerment indicators	Change	Std Err	P-value
Autonomy in income	-0.01	0.08	0.857
Self-efficacy	-0.02	0.07	0.815
Attitudes towards domestic violence	-0.07	0.04	0.095
Respect among household members	-0.07	0.04	0.066
Input in productive decisions	0.09	0.07	0.205
Ownership of land and other assets	0.02	0.03	0.616
Access to and decision on credit	0.09	0.07	0.178
Control over use of income	0.03	0.08	0.733
Work balance	-0.11	0.05	0.035
Visiting Important locations	-0.03	0.05	0.644
Group membership	-0.03	0.04	0.536
Membership in influential groups	-0.04	0.03	0.122

In all models, purchase power and education are strongly significant ($p < 0.01$). There were no other significant correlators.

3) Women's agency on breastfeeding diet

Empowerment indicators	Change	Std Err	P-value
Autonomy in income	0.01	0.06	0.85
Self-efficacy	-0.07	0.05	0.131
Attitudes towards domestic violence	-0.11	0.12	0.348
Respect among household members	0.03	0.06	0.591
Input in productive decisions	0.00	0.10	0.997
Ownership of land and other assets	0.01	0.08	0.927
Access to and decision on credit	0.03	0.05	0.554
Control over use of income	-0.03	0.05	0.62
Work balance	-0.23	0.12	0.047
Visiting Important locations	-0.15	0.02	<0.001
Group membership	0.05	0.02	0.026
Membership in influential groups	0.01	0.03	0.841

In all models, purchase power was significant ($p < 0.05$), except never violence model ($p < 0.1$). There were no other significant correlators.

4) Women's agency on food purchase

Empowerment indicators	Change	Std Err	P-value
Autonomy in income	-0.02	0.04	0.703
Self-efficacy	0.07	0.04	0.08
Attitudes towards domestic violence	-0.14	0.06	0.021
Respect among household members	-0.02	0.06	0.766
Input in productive decisions	0.03	0.04	0.473
Ownership of land and other assets	0.25	0.04	<0.001
Access to and decision on credit	0.07	0.06	0.237
Control over use of income	0.08	0.03	0.011
Work balance	0.04	0.05	0.408
Visiting Important locations	-0.004	0.055	0.949
Group membership	-0.05	0.03	0.102
Membership in influential groups	-0.04	0.04	0.281

In all models, education was strongly significant ($p < 0.01$), and adult age (26-45 vs 15-25) was significant ($p < 0.05$) except for asset ownership model. There were no other significant correlators.

Supplemental Table 6.2 Pro-WEAI indicators and women's food security

Empowerment indicators	Change	Std Err	P-value
Autonomy in income	-0.02	0.04	0.703
Self-efficacy	0.08	0.06	0.18
Attitudes towards domestic violence	0.13	0.02	<0.001
Respect among household members	0.21	0.04	<0.001
Input in productive decisions	0.09	0.06	0.131
Ownership of land and other assets	0.02	0.06	0.798
Access to and decision on credit	0.00	0.08	0.961
Control over use of income	0.11	0.04	0.014
Work balance	0.03	0.04	0.382
Visiting Important locations	-0.02	0.06	0.775
Group membership	0.05	0.05	0.253
Membership in influential groups	0.04	0.05	0.424

In all models, education was positively and household size negatively significant ($p < 0.01$), and older age (>45 vs 26-45) was significant ($p < 0.1$). There were no other significant correlators.

Chapter 7: General Discussion and Conclusion

Summary of Results

The overarching objective of this dissertation was to contribute new knowledge, approaches, and insights to the current knowledge base about the association between women's empowerment and food security by applying an intersectional gender analysis approach and considering context-specific characteristics, using Uganda as a case study. Collective results underscored the importance of gender-sensitive and context-specific approaches in assessing the relationship between women's empowerment and food security. Using an intersectionality lens, the candidate adopted a different analytic approach to critically highlight the importance of including gender-sensitive indicators and their interactions with other socioeconomic positions and structural factors.

Results indicated that not all indicators and domains of women's empowerment in agriculture and nutrition, such as work balance, control over the use of income, and agency on a regular diet, were consistently and positively associated with food security outcomes. Results further suggested that, after carefully assessing the sociocultural context of the target population, some domains and indicators of women's empowerment in both realms of agriculture and nutrition, like social norms and beliefs domain and agency on food purchase, should be prioritized over the other domains and indicators.

Regarding the three studies embedded within the dissertation, Chapter 4 investigated the determinants of gendered food security inequities in a nationally representative sample in Uganda. The analysis estimated the magnitude and significance of changes in the predicted probabilities of food security at the intersections between gender and various structural, socioeconomic positions, and personal characteristics. Results underscored the critical role gender plays as a source of variation rather than a control variable in investigating the

determinants of food security inequities. Employing an intersectionality approach in an exploratory way shed light on the potential of new analytical approaches in identifying gendered determinants of food security inequities.

In Chapter 5, the relationship between aggregated and disaggregated domains of women's empowerment and food security outcomes was assessed. It was found that, depending on the empowerment status of men in the household, the magnitude and significance of the association between the aggregated score of women's empowerment and the food security status of men and women changed. The analysis of the associations between different domains of empowerment and food security, using a gender analysis framework, revealed different patterns between and among men and women in fishing and non-fishing groups. Although results were mixed, most associations favoured improved food security outcomes in the domain of social norms and beliefs.

In Chapter 6, the authors examined the relationship between aggregated and disaggregated measures of women's empowerment in agriculture and (a) women's agency in nutrition, and (b) their food security status. Results showed a lack of association between aggregated measures of women's empowerment in agriculture and various indicators of women's agency in nutrition. The authors drew on the hypothesis of a complementary association between women's empowerment in agriculture and women's agency in nutrition to improve the food security status of women from the broader literature. They thus estimated and tested the moderating effect of women's agency in nutrition in association from the empowerment of women in agriculture to the food security of women. Taking into account the moderating effect of women's agency on food purchase yielded strong associations between women's empowerment in agriculture and their food security status. Results also revealed mixed associations between disaggregated

measures of women's empowerment in agriculture and the four indicators of women's agency in nutrition, suggesting trade-offs between empowerment indicators.

Further Reflection and Discussion Points

COVID-19: Gender Gap in Mobile Phone Ownership and Connectivity

Although not within the scope of the original research question, the role of global pandemics in women's empowerment and food security became glaringly obvious with the advent of COVID-19 in March 2020. This unexpected contextual development prompted this not-so-tangential discussion of the role of Information Technology and Communications (ICTs) in the phenomenon under study.

The two datasets used in this doctoral dissertation were collected shortly before the pandemic. The GWP data were collected in December 2019, and NutriFish's pro-WEAI data were collected from January to February 2020. The qualitative component of pro-WEAI was conducted from November 2019 to January 2020. Therefore, results herein depicted the situation *prior* to the adverse effects of the global health pandemic on the food systems and gender inequalities. A systematic review of the impact of COVID-19 on diet quality, nutrition, and food security in LMICs found that all eleven studies that assessed the status of food security since the outbreak of COVID-19 reported increased levels of food insecurity during the pandemic (Picchioni et al., 2021).

One of these studies was conducted in Uganda and showed that the food security status of the studied household worsened from 43% pre-pandemic to 87% in April 2020, just *one month* after the COVID-19 outbreak in March (Kansiime et al., 2021). Picchioni et al. (2021) further indicated that female-headed households, poorer families, young adults, and workers in the informal sector faced higher rates of food insecurity in the studied countries, including Uganda.

Likewise, Carducci et al. (2021) discussed the greater impacts of the pandemic on women, individuals with low socioeconomic status, informal workers, and young adults who relied on daily wages. The results of these studies confirmed the importance of applying intersectional gender analysis and SDH frameworks in identifying the most vulnerable groups and addressing barriers to their bettering food security status. This approach is required to assess the potential short, medium, and long-term impacts of COVID-19 on poverty, food security, and public health nutrition.

A significant and rapid change that happened during the pandemic was the heavy reliance on technology for connectivity (i.e., mobile phones and internet access). Access to and knowledge of technology thus became more critical than ever – in some cases a matter of life and death. With the increased availability of smartphones, mobile devices are playing an essential role in access to the internet, referred to as *mobile internet*. In LIMCs, mobile phones were the primary way of accessing the internet among men and women during the pandemic.

But despite a remarkable growth in access to the Internet in LIMCs during the pandemic, a gender gap remains in mobile ownership and internet access (GSMA, 2022). In their report of the *Mobile Gender Gap in 2021*, GSMA (2022) stated that women were 7% and 18% less likely than men to own a mobile phone and smartphone, respectively, with affordability as the main barrier. Likewise, women were 16% less likely than men to use mobile internet across LIMCs in 2021. The main mobile internet usage barriers were low literacy and digital skills and low affordability (GSMA, 2022). Low literacy, low income, residing in rural areas, and disability decreased the probability of women's access to mobile phones and the internet. The gender gap persisted at the same levels of education, income, literacy, and employment, priming acceptance of the mitigating role of discrimination and social norms (Butler & Shanahan, 2020).

Thomas and Prakash (2020) found that access to mobile phones and the internet helped women in South India stay connected with other groups of women in their neighbourhood and community especially through WhatsApp groups during the COVID-19 crisis. Mobile internet helped women feel more connected, safe, and autonomous by giving them access to important information to better manage their daily lives and the challenges brought about by the pandemic. Access to internet helped women report domestic violence when they felt unsafe at home (Agarwal, 2021). The candidate proposes that addressing and reducing the gender gap in mobile phone ownership and access to the internet is critical for achieving SDGs and should be included in measuring tools for women's empowerment and food security.

To elaborate further, in the pro-WEAI questionnaire, owning a cell phone is included in the indicator of ownership of land along with other assets such as fishing and fish processing equipment, large and small livestock, mechanized and non-mechanized farm equipment, and means of transportation. In total, 25 other assets are measured in addition to land ownership. All these items are aggregated as one single indicator in the 3DE score. As shown in Manuscripts 2 and 3, aggregated empowerment score is insufficient to uncover the barriers in the pathway from women's empowerment to food security. Considering the emerging mobile phone gender gap during the pandemic, the candidate further argues that, in addition to studying the disaggregated score through 12 indicators of 3DE, depending on the context, some specific indicators should also be disaggregated. For instance, in the context of the COVID-19 pandemic, to identify pandemic-related barriers, more attention must be given to specific questions (like cellphone ownership, cellphone connection, and internet access) to understand the role of mobile phone gender gaps in the empowerment of women and food security outcomes. Even now, the empowerment measurement tools (e.g., different versions of WEAI) have not adapted their

questions to the context of the COVID-19 pandemic to consider its emerging challenges and needs.

Some studies before COVID-19 included ICTs measures as one of the indicators of women's empowerment (Aziz et al., 2020; Sharaunga et al., 2016; Wei et al., 2021). As an example, Wei et al. (2021) measured ICTs by two indicators: access to mobile phone use and access to radio or television use. They found that women's food insecurity decreased by 22% when they had access to ICTs – ICTs access improved food security. Similarly, Baumüller (2018) highlighted that access to mobile phones could increase small-scale farmers' access to market news and financial services, even further eliminating some barriers, such as removing intermediaries in the market and increasing profitability. As discussed, amidst COVID-19, there is a need to include new questions to measure the agency of men and women related to ICTs, such as affordability, access to mobile phones and the internet, and whether they have the required literacy, knowledge, and skills to use mobile phones and the internet. Addressing the mobile gender gap is crucial in future studies of women's empowerment and food security.

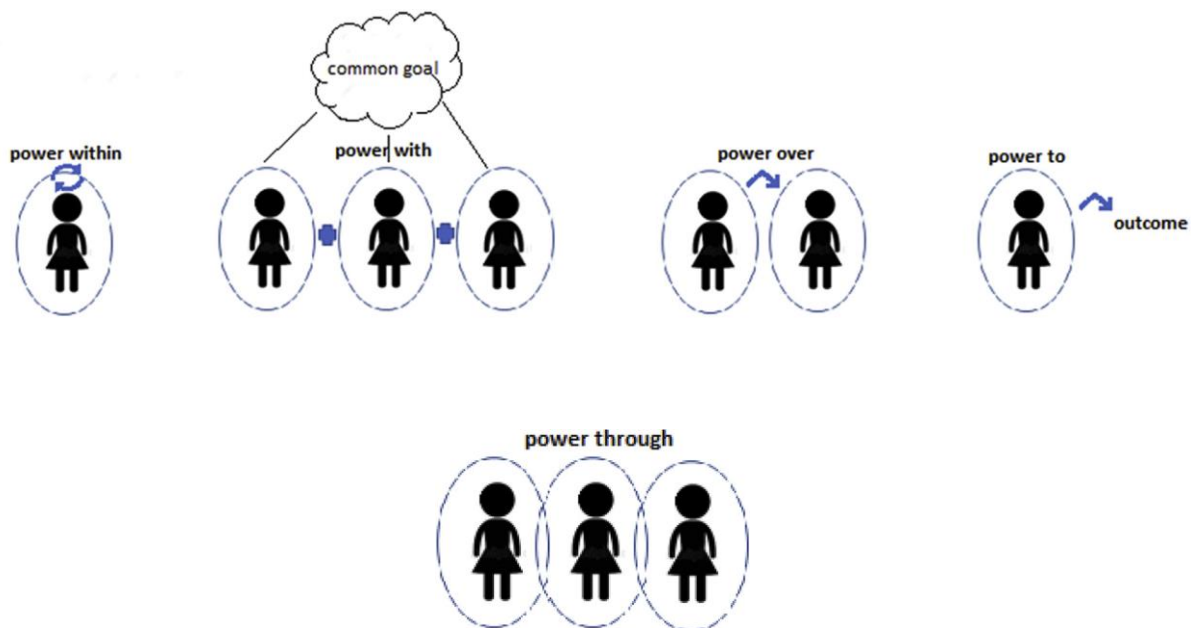
Power Through: The Role of Social Norms

According to the authors of the SDH framework, changes in power relationships should appear at both macro and micro levels. Without considering the changes at the macro level structural relations among social constituencies, the micro-level transformations at the individual, household, and community levels are insufficient and cannot be sustainable. Structural changes without considering incentives at the micro-level are ineffective. It is important to consider that changes at both levels are mediated through economic, social, and political institutions. The results in Manuscript 2 (Chapter 5) showed the importance of social

norms and beliefs domain among the other power relation domains in achieving food security among men and women.

In turning to the importance of sociocultural context in the process of empowering women, Galiè and Farnworth (2019) suggested a new concept of power in addition to the four definitions of power (Figure 7.1). They conceptualized *power through* to capture the mediator role of the community and other significant people associated with an individual in the process of empowerment. They maintained that this aspect of empowerment stems from how an individual values the judgment of the community and behaves in a locally valid way. *Power through* underscores that social norms have an essential role in the extent of an individual's ability to exercise agency, which is beyond personal control.

Figure 7.1 Four Existing Definitions of Power and ‘Power Through’



Source: Galiè & Farnworth, 2019

The candidate therefore suggests that empowerment interventions should consider the mediating role of social norms and the empowerment status of the significant relatives. Results in Manuscript 2 (Chapter 5) showed how the empowerment status of men moderated the association from the empowerment of women to food security. One possible explanation for the mixed results among and between men and women in fishing and non-fishing groups could be attributed to the mediating role of the social norms as proposed by Galiè and Farnworth (2019).

Heise and Manji (2016) defined social norms as socially constructed concepts that are collectively approved behaviours and beliefs in one's reference network. These informal rules are about "what others do (what is typical) and what is expected of what others do within the group (what is appropriate)" (p. 1). Gender norms are embedded in social norms and define appropriate actions and social expectations for men, women, girls and boys in society. A recent guide on formulating gendered social norms indicators in the context of food security and nutrition proposed that conducting a social norms assessment is imperative before starting a project (FAO, IFAD, & WFP, 2022).

Such informative research prior to the intervention could help researchers identify critical social norms in society, precisely the ones that might affect the outcomes of their project. A synthesis of 11 agricultural development projects that applied pro-WEAI found mixed results with nearly no impact in most projects on the empowerment status of women (Quisumbing et al., 2022). In terms of the disaggregated 3DE into the indicators of each agency group, results indicated more significant impacts on the indicators of instrumental and collective agencies. Few significant impacts were found on the indicators of intrinsic agency (i.e., respect among household members, attitudes about domestic violence) except for the projects that accounted for gender norms (Quisumbing et al., 2022).

Previous studies have also shown positive results in addressing discriminatory social norms on food security and nutrition outcomes (Njuki et al., 2016; Núñez et al., 2015; Rhiannon & Van Eerdewijk, 2021) and empowering women (Cole et al., 2020). Hence, achieving long-lasting changes in food security status through agricultural development projects requires addressing discriminatory social norms as a precondition based on which an individual is intentionally able to act to improve their empowerment status or not (FAO, IFAD, & WFP, 2022; Galiè & Farnworth, 2019).

Intersectional Gender Analysis and the Way Forward

Discriminatory gender norms, as a subset of the broader sociocultural context, interact with other structural barriers to generate unequal gender power relations thus slowing down progress toward poverty reduction and food security (Njuki et al., 2022). This dissertation has affirmed that intersectionality as an approach to exploring simultaneous interactions between socioeconomic positions and structural levels is a powerful tool to advance the gender equality agenda in food security programs (see also McDougall et al., 2022; Springer et al., 2012). By applying this approach through innovative methods, researchers can attempt to investigate power and equity and unpack further nuances in the complex context of health inequities (Springer et al., 2012).

That said, there are challenges in bringing the theory into research (Bauer, 2014). The quantitative analytical approaches in modelling intersectionality continue to be discussed and debated, and there is no census on what works best (Bauer & Scheim, 2019a, 2019b; Evans et al., 2020; Evans et al., 2018; Harnois & Bastos, 2019; Merlo, 2018). Important methods are, however, emerging that have advanced the intersectionality approach in quantitative research.

As an example, some studies (Evans et al., 2018; Merlo, 2003) have elaborated on the advantages of a multilevel approach in modelling large numbers of interactions and intersectional identities. The most common approach is a Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) (Evans, 2019; Merlo, 2003, 2018), which involves nesting the respondents within social strata or physical contexts like neighbourhoods. This approach allows for examining the heterogeneity within and between social strata or contexts and resolves some of the common challenges in conventional intersectional models, like lack of parsimony in analyzing multiple interactions and the challenging endeavour of interpreting the results (Evans et al., 2020).

To continue, multilevel models such as MAIHDA provide a valuable tool for estimating multiple interactions simultaneously and modelling inequalities across different contexts (Evans et al., 2020). Although Merlo (2018) argued that MAIHDA is a robust approach and can be a ‘gold standard’ for studying health inequities, he emphasized that “the translation of intersectionality theory into (social) epidemiology and the intersectional quantitative methodology (especially for generalized linear models) are still under development” (p. 79). Researchers continue to apply innovative and exploratory approaches depending on the objectives of their study and statistical skills, such as this doctoral research, to model intersectionality.

In short, turning to the importance of broader context in studying the association between women’s empowerment and food security, intersectionality-informed mixed-methods studies (qualitative and quantitative design) have the potential to address the underlying causes of inequality. These approaches are known as GTAs, which, in recent years, have received attention as a supportive tool for social change (Hillenbrand et al., 2022; Njuki et al., 2022). Integrating

GTAs into women's empowerment and food security research can address the multilevel power relations and inequalities, emphasizing that gender is not an isolated variable in development research studies but takes meaning in combination with other axes of inequity (Hillenbrand et al., 2022; Shields, 2008).

Study Limitations

Several considerable challenges and limitations were encountered in the data analysis process conducted as part of this doctoral research project. Most remarkably, due to using data from two sources, there were different measures of food security outcomes and the availability of some variables in one dataset that were not collected in the other dataset. In GWP, food security was measured using the FIES questionnaire, which is a well-known measure of the individual experience-based food security status. In the NutriFish project, HFIAS was used to measure the food security status of men and women while the unit of analysis was both at individual and household levels (the question of *you or any household member ...?*).

It was therefore impossible to distinguish between the individual or household level of food security. Although different answers from most male and female respondents in the same household indicated the individual experiences of food insecurity, there could be other explanations. First, the perceptions of men and women about their food insecurity experiences at both individual and household levels were different. Although they lived in the same household, they could readily perceive the severity of the status differently.

Second, another possible explanation is the lack of information in pro-WEAI data about the family composition of male respondents. In the Ugandan fishing villages, most men might not have an only one wife/household (i.e., polygamous households). Men may not spend the whole year with the same household included in the questionnaire; therefore, their food

insecurity experience could be more likely their individual experience rather than their household status. Third, studies have shown that women generally provide a more accurate picture of food insecurity status in the household than men.

By not accounting for these important differences in the data collection process, the candidate was unable to draw reliable conclusions about the actual unit of food security status among participants in the NutriFish project. Nonetheless, the abovementioned justifications provided more possibility of individual status rather than household level, which was referred to as individual perceptions on the food security status of the respondents or their household. As discussed in Chapter 2, using different measures of food security limits comparability between different studies and creates validity challenges.

Another limitation of the research design was the women's agency in nutrition measures in the NutriFish project, using the pro-WEAI H&N module, which was not validated in Uganda and specifically in the study populations. The candidate has no knowledge of studies that have used this add-on module of pro-WEAI to date or widely validated this tool in another context (see Heckert et al., 2018). There was only one study conducted in Bangladesh that used cognitive interviewing to assess the comprehensiveness of the questions and identify potential misunderstandings (Hannan et al., 2020). They reported that, although most of the questions were generally well understood, some questions did not reflect the participants' real experiences or were misunderstood. As an example, some key terms like 'special foods for children' or 'milk/milk products' were misinterpreted. The lack of external and local validation of this scale is particularly important to note when interpreting the results of Manuscript 3 (Chapter 6).

Future Research and Policy Directions

The candidate was directly involved with the entire duration of the NutriFish project (2019–2022 with a recent extension to March 2023), which formed the foundations for this dissertation. With hindsight, she can attest that the entire enterprise would have been more compelling if the original research design had been intentionally mixed method, specifically a sequential rather than a convergent design (Creswell, 2018). A sequential design would likely have been able to identify bottlenecks related to gender norms and broader sociocultural norms in the studied communities. In this way, the planned activities could target more vulnerable groups and address the underlying challenges related to social norms. Not having conducted a rigorous mixed-methods study that provided a complete picture of the existing context was a missed opportunity.

Several novel results emerged from this doctoral research project providing important contributions to the literature, as outlined in the summary of results earlier in this chapter and through Chapters 4-6. At the same time, the analysis revealed several areas that would benefit from further research:

1. As proposed in the SOFI 2021, one of the six strategies to transform food systems and tackle food insecurity is accounting for structural inequalities and inclusive interventions. The SOFI 2021 report moreover emphasized “reducing gender inequalities in food security and nutrition and supporting women’s economic activities in food value chains” as one of the key policy areas and goals for tackling structural inequalities and ensuring interventions are “pro-poor and inclusive” (FAO et al., 2021, p. 105). This means that addressing the social determinants of health inequities requires political actions that engage both the agency of disadvantaged groups and the responsibility of the institutions.

Intersectionality is recognized as a valuable tool for analyzing the complexity of social inequities and differences; therefore, it should be brought to the fore in food security research.

2. Research on the nexus of women's empowerment and food security needs more in-depth gender-analysis approaches. Identifying and addressing structural gender inequalities will provide insights for equitable recovery from the adverse impacts of inherently challenging health events like global pandemics.
3. Sociocultural-informed studies should take precedence in agricultural development interventions.
4. Future research must take advantage of mixed methods designs to unpack the context-specific nuances of women's empowerment and gender norms. As well, the sociocultural barriers in the relationship between women's empowerment and food security are better addressed in GTAs. Both of these approaches have the potential to generate more sustainable impacts.
5. The empirical research underpinning this dissertation should be expanded to capture the causal associations between women's empowerment (in agriculture and nutrition) and food security.

Conclusion

The results of this doctoral research project highlighted the importance of multi-pronged approaches to food security research (e.g., theories, conceptual frameworks, and methods). Much work remains but results further suggested that long-lasting impacts require context-specific approaches targeting both macro- and micro-level determinants of gender inequities in experiencing food insecurity that is impacted by women's empowerment.

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Appendices

Appendix 3.1 The timeline of the NutriFish project and key activities

Appendix 3.2 Project Level Women's Empowerment in Agriculture Index (pro-WEAI) survey in NutriFish project

Appendix 3.3 Health and Nutrition module and complementary questionnaire in NutriFish project

Appendix 3.4 NutriFish ethics approval

Appendix 3.5 McGill ethics approval

Appendix 3.6 Household Food Insecurity Access Scale (HFIAS) in the NutriFish household survey

Appendix 3.7 Pro-WEAI indicators and definitions of adequacy

Appendix 3.8 Pro-WEAI data management report for the NutriFish Project

Appendix 3.1 The timeline of the NutriFish project and key activities

Activity	Description	Year (Y)
Comprehensive NutriFish baseline survey	The Project-level Women's Empowerment in Agriculture Index (Pro-WEAI), main and additional modules	Y1 (March 2019 - 2020)
Policy analysis and stakeholder mapping conducted	1) analyzed policies, regulations, and strategies governing the exploitation and marketing of fish and fish products to identify gaps 2) conducted stakeholder mapping and identify value chain nodes along the underutilized small fish and fish-based products with a gender analysis	Y1 (March 2019 - 2020)
NutriFish Communication Strategy	Developed a Social and Behavior Change Communication (SBCC) strategy and a training manual	Y2 (March 2020 - 2021)
Develop and commercialize fish-based nutritious foods for vulnerable groups	Developed and characterized fish-based complementary foods for nutritionally vulnerable women of reproductive age and children aged less than five years	Y2 (March 2020 - 2021)
Improve awareness and changed behaviour (positive attitudes) about the value of fish in meeting nutritional demands for children and pregnant and lactating women	a) conducted radio awareness campaign with 29 short and concise 'spot messages' from September 2021 to March 2022 on four FM radios in local languages b) developed an underutilized small fish cookbook (www.nutrifish.mak.ac.ug) and used it to conduct food preparation demonstration sessions attended by community members c) trained 68 (42 males and 26 females) stakeholders along the value chain as 'Champions' in the different fishing villages, focusing on gender and women empowerment, hygiene and sanitation, appropriate harvesting, handling, processing, value addition, and marketing. The Champions have gone on to share knowledge acquired with a total of 650 (405 women; 245 men) in their respective communities.	Y3+ (March 2021 – Aug 2022)
Social and behavioural change	1) piloted the solar tent dryer as women-friendly drudgery reducing processing	Y3+ (March 2021 – Aug 2022)

interventions using gender transformative approaches	technology to help reduce time and labor burdens of women; 2) conducted gender transformative tools including; theater for development (drama, role plays), sensitization of communities on role sharing (engaging men on household chores), facilitated group discussion sessions and use of role models in respective communities; and 3) strengthening existing groups through conducting training on group dynamics, entrepreneurship and financial literacy) ² .	
Comprehensive NutriFish endline survey	The Project-level Women's Empowerment in Agriculture Index (Pro-WEAI) for small pelagic fisheries of Uganda	Aug 2022 – March 2023

¹ The baseline results informed the development of the Gender Transformative Approaches (GTAs) for addressing underlying behaviours, practices, social norms and power relations in order to achieve gender equality and women empowerment.

² Since transformation is a gradual process, the project is engaging the trained “Champions” and capacitating them to facilitate local groups (platforms) through bimonthly meetings. To-date results (observed and reported) from the GTAs activities demonstrate a positive transformation of attitudes and behaviors at household and community levels including:

- Access to financial resources such as loans has increased among women, obtained through savings groups that they are now using to purchase and own assets hence improving incomes and livelihoods. This is gradually changing gender norms and stereotypes that consider boat ownership and fishing as a male domain
- Women have started to own their own boats and earn more money from the fish trade. This has been reported at Ntoroko fishing village on Lake Albert where one of the Champions earns 20,000-40,000 Ugandan shillings (US\$ 6-12) per day from her various fish-trading activities.
- More men allowing their spouses to get engaged in activities along the value chain activities of small fishes
- Men's beginning to change their attitudes towards domestic chores such as cooking and participating in cooking (labour sharing), hence reducing the work burden for their spouses.
- Men have increased allocation for food as a result of participating in the cooking demonstration and getting to understand the cost per each recipe.
- Changing attitudes towards the consumption of underutilized fish among the communities due to realizing that the underutilized fish are rich in nutrients. This is because of awareness created by the project team and the Champions after attending the training.

- Improved fish quality and increased income for the women fish processors. This has been reported in Kiyindi fishing village, where the use of the solar tent dryer has doubled the sale price of mukene (local name for underutilized fish) from U\$1 to US\$2 per kilogram. However, the issue of limited capacity of the solar tents was raised in Kiyindi and in Dei fishing villages as the quantities of fish landed far exceed the amounts that can be dried in the tents.

Note: The results of this dissertation (chapters 5 and 6) contributed to the highlighted activities of the NutriFish project pertinent to the baseline report of the empowerment and food security status of men and women and contributors to their empowerment. Additionally, the results of these two chapters informed NutriFish's GTAs activities concerning gender power relations in the household and women's agency in nutrition.

Appendix 3.2 Project Level Women's Empowerment in Agriculture Index (pro-WEAI) survey
in NutriFish project

PROJECT-LEVEL WOMEN'S EMPOWERMENT IN AGRICULTURE INDEX
PILOT VERSION
MAY 2019

These survey modules are a DRAFT version of the project-level Women's Empowerment in Agriculture Index (pro-WEAI). Optional questions and modules are designated in purple text. The survey questions, format, and required portions are subject to change as the pro-WEAI continues to develop. Updated survey modules may be available from the pro-WEAI team.

Pro-WEAI is a survey-based index for measuring empowerment, agency, and inclusion of women in the agriculture sector. It is being developed jointly by the International Food Policy Research Institute (IFPRI), the Oxford Policy and Human Development Initiative (OPHI), and thirteen partner projects in the portfolio of the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2). The tool helps agricultural development projects assess women's empowerment in a project setting, diagnose areas of women's disempowerment, design strategies to address deficiencies, and monitor project outcomes. Pro-WEAI is an adaptation of the Women's Empowerment in Agriculture Index (WEAI), originally developed in 2012 by IFPRI, the United States Agency for International Development (USAID), and OPHI.

For more information about pro-WEAI, please visit weai.ifpri.info or email Hazel Malapit at h.malapit@cgiar.org.

**** The purple text indicates changes in the questionnaire tailored to the NutriFish project.**

A. IDENTIFICATION	
A1	Name of interviewer (<i>Dzina la ofunsa</i>)
A2	Date of interview (<i>Tsikulofunsa</i>)
A3	Starting Time (<i>Nthawiyoyamba</i>)
A4	Name of District (<i>Boma</i>)
A5	Sub-county/Traditional Authority (<i>Mfumuyaikuluyaderalino</i>)
A6	Village (<i>Mudziuno</i>)
A7	Fish landing site (<i>Dzina la dokolino</i>)
A8.	GPS Location (Record GPS)

B. HOUSEHOLD ROSTER

Member ID	B1. List the names of all individuals you live with in the household (<i>Pelekanimayina a abaleomwemumakhalana wolimodzi</i>)	B2. Sex (<i>Mwamunakapena mkazi</i>) 1=Male, 2=Female	B3. Age (<i>Zakazake</i>)	B4. Who is this person to you? (<i>Chibalechakendichot anindiinuyo</i>)	B5. What is your highest level of education? (<i>Kodisukulumunalekeze rapati?</i>) [1]No formal Education [2]Primary [3]Secondary [4]Tertiary [Cert., Dip. Degree 1, 2]	B6. What is his/her main employment in the last four months? (<i>Ntchitoyawoyayikulu yomwe amagwilamiyez iinayiyapitayindichani?</i>)
01						
02						
03						
04						
Up to 15 members						

Codes B4			Codes B5			Codes B6	
1	Respondent	(<i>Oyankhamafunso</i>)	1	None	(<i>Sindinapitekokusukulu</i>)	1	Wage employee (<i>Ntchitoyolembedwa</i>)
2	Spouse	(<i>Mzangawapabanj a</i>)	2	std1-std5	(<i>Pakati pa kalasi 1 mpaka 5</i>)	2	Farmer (<i>Mulimi</i>)
3	Child	(<i>Mwana</i>)	3	Std6-Std8	(<i>Pakati pa kalasi 6 mpaka 8</i>)	3	Business (<i>KuchitaMalonda</i>)
4	Parent	(<i>Kholo</i>)	4	Form	(<i>Folomu 1/2</i>)	4	Student (<i>Maphunziro</i>)

5	Sibling	(Mchimwene/Mche mwali)	5	1/2 Form	(Folomu 3/4)	5	Household work	(Ntchitozapakhomo)
6	Other (Specify)	(Ena (Tchulani))	6	3/4 Tertiary	(Maphunziro a ukachenjede)	6	Casual work (Fisheries)	(Ganyuzokhudzana ndinsomba)
						7	Casual work (Other)	(Ganyu (ntchitozina)
						8	Fishing	(Usodzi)
						9	Fish processing	(Kuwamba/Kuwum ikansomba)
						10	Fish trading	(Kuhulandikugulits ansomba)
						11	Other (specify)	(Zina (Tchulani))

MODULE G. WOMEN'S EMPOWERMENT IN AGRICULTURE INDEX–Pilot Pro-WEAI Version

Note to survey designers: The information in module G1 can be captured in different ways; however, there must be a way to: (a) identify the proper individual within the household to be asked the survey, (b) link this individual from the module to the household roster, (c) code the outcome of the interview, especially if the individual is not available, to distinguish this from missing data, and (d) record who else in the household was present during the interview. This instrument must be adapted for country context including adding relevant examples and translations into local languages when appropriate.

Note to enumerators: This questionnaire should be administered separately to the primary and secondary respondents identified in the household roster of the household level questionnaire. You should complete this coversheet for each individual identified in the “selection section” even if the individual is not available to be interviewed for reporting purposes. For some surveys (such as those focusing on nutrition outcomes), the female respondent may be the beneficiary woman or mother or primary caregiver of the index child (also the respondent for the pro-WEAI nutrition module). Please make sure that she is also the person interviewed for this questionnaire and that the male respondent is her spouse/partner (if applicable).

Please double-check to ensure:

- You have completed the roster section of the household questionnaire to identify the correct primary and/or secondary respondent(s);
- You have noted the household ID and individual ID correctly for the person you are about to interview;
- You have gained informed consent from the individual in the household questionnaire;
- You have sought to interview the individual in private or where other members of the household cannot overhear or contribute answers.
- Do not attempt to make responses between the primary and secondary respondents the same—it is okay for them to be different.

MODULE G1. INDIVIDUAL IDENTIFICATION

G1.01. HOUSEHOLD IDENTIFICATION:		<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>	G1.04 TYPE OF HOUSEHOLD	MALE AND FEMALE ADULT.....1 FEMALE ADULT ONLY.....2
G1.02. NAME OF RESPONDENT CURRENTLY BEING INTERVIEWED (ID CODE FROM ROSTER IN SECTION B HOUSEHOLD ROSTER):		<div> <div></div> <div></div> </div>	G1.05. OUTCOME OF INTERVIEW: CIRCLE <u>ONE</u>	COMPLETED.....1 HOUSEHOLD MEMBER TOO ILL TO RESPOND/COGNITIVELY IMPAIRED.....2 RESPONDENT NOT AT HOME/TEMPORARILY UNAVAILABLE.....3 RESPONDENT NOT AT HOME/EXTENDED ABSENCE.....4 REFUSED.....5 COULD NOT LOCATE.....6
SURNAME, OTHER NAME: _____				
G1.03. SEX OF RESPONDENT:		MALE.....1 FEMALE.....2	G1.06. ABILITY TO BE INTERVIEWED ALONE: CIRCLE <u>ONE</u>	ALONE.....1 WITH ADULT FEMALES PRESENT.....2 WITH ADULT MALES PRESENT.....3 WITH ADULTS OF BOTH SEX PRESENT.....4 WITH CHILDREN PRESENT.....5 WITH ADULTS OF BOTH SEX AND CHILDREN PRESENT.....6

HOUSEHOLD IDENTIFICATION (IN DATA FILE, EACH SUB-MODULE (G2-G8) MUST BE LINKED WITH A HH AND RESPONDENT ID)

HOUSEHOLD ID						
RESPONDENT ID						

MODULE G2: ROLE IN HOUSEHOLD DECISION-MAKING AROUND PRODUCTION AND INCOME

Now I'd like to ask you some questions about your participation in certain types of work activities and on making decisions on various aspects of household life.		Did you [NAME] participate in [ACTIVITY] in the past 12 months (that is, during the last [one/two] cropping seasons), from [PRESENT MONTH] last year to [PRESENT MONTH] this year?	When decisions are made regarding [ACTIVITY], who is it that normally takes the decision? ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS <u>MEMBERID (SELF)</u> ONLY → <i>G2.05</i> OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE ...98 → <i>NEXT ACTIVITY</i>			How much input did you have in making decisions about [ACTIVITY]? USE CODE G2↓	To what extent do you feel you can participate in decisions regarding [ACTIVITY] if you want(ed) to? CIRCLE <u>ONE</u>	To what extent are you able to access information that you feel is important for making informed decisions regarding [ACTIVITY]? CIRCLE <u>ONE</u>	How much input did you have in decisions about how much of the outputs of [ACTIVITY] to keep for consumption at home rather than selling? USE CODE G2↓	How much input did you have in decisions about how to use income generated from [ACTIVITY]? USE CODE G2↓
ACTIVITY		G2.01	G2.02			G2.03	G2.04	G2.05	G2.06	G2.07
			ID #1	ID #2	ID #3					
A	Staple grain farming and processing of the harvest: grains that are grown primarily for food consumption (rice, maize, wheat, millet)	YES.....1 NO.....2 → <i>ACTIVITY B</i>					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
B	Horticultural (gardens) or high value crop farming and processing of the harvest	YES.....1 NO.....2 → <i>ACTIVITY C</i>					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
C	Large livestock raising (cattle, buffaloes) and processing of milk and/or meat	YES.....1 NO.....2 → <i>ACTIVITY D</i>					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
D	Small livestock raising (sheep, goats, pigs) and processing of milk and/or meat	YES.....1 NO.....2 → <i>ACTIVITY E</i>					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
E	Poultry and other small animals raising (chickens, ducks, turkeys) and processing of eggs and/or meat	YES.....1 NO.....2 → <i>ACTIVITY F</i>					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		

CODE G2

LITTLE TO NO INPUT IN DECISIONS	1
INPUT INTO SOME DECISIONS	2
INPUT INTO MOST OR ALL DECISIONS	3
NO DECISION MADE.....	98

	Did you [NAME] participate in [ACTIVITY] in the past 12 months (that is, during the last [one/two] fishing seasons), from [PRESENT MONTH] last year to [PRESENT MONTH] this year?	When decisions are made regarding [ACTIVITY], who is it that normally takes the decision? ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS MEMBER ID (SELF) ONLY → G2.05 OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98 → NEXT ACTIVITY			How much input did you have in making decisions about [ACTIVITY]? USE CODE G2↓	To what extent do you feel you can participate in decisions regarding [ACTIVITY] if you want(ed) to? CIRCLE ONE	To what extent are you able to access information that you feel is important for making informed decisions regarding [ACTIVITY]? CIRCLE ONE	How much input did you have in decisions about how much of the outputs of [ACTIVITY] to keep for consumption at home rather than selling? USE CODE G2↓	How much input did you have in decisions about how to use income generated from [ACTIVITY]? USE CODE G2↓
ACTIVITY	G2.01	G2.02			G2.03	G2.04	G2.05	G2.06	G2.07
		ID #1	ID #2	ID #3					
F Fisheries Value chain									
F1. Fishing	YES.....1 NO.....2 → ACTIVITY F2					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
F2. Fish processing	YES.....1 NO.....2 → ACTIVITY F3					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
F3. Fish trading	YES.....1 NO.....2 → ACTIVITY G					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
G Non-farm economic activities (running a small business, self-employment, buy-and-sell)	YES.....1 NO.....2 → ACTIVITY H					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
H Wage and salary employment (work that is paid for in cash or in-kind, including both agriculture and other wage work)	YES.....1 NO.....2 → ACTIVITY I					NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		

I	Large, occasional household purchases (bicycles, land, transport vehicles)						NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		
J	Routine household purchases (food for daily consumption or other household needs)						NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4	NOT AT ALL.....1 SMALL EXTENT.....2 MEDIUM EXTENT.....3 TO A HIGH EXTENT...4		

CODE G2	
LITTLE TO NO INPUT IN DECISIONS	1
INPUT INTO SOME DECISIONS	2
INPUT INTO MOST OR ALL DECISIONS	3
NO DECISION MADE.....	98

HOUSEHOLD ID					
RESPONDENT ID					

MODULE G3(A): ACCESS TO PRODUCTIVE CAPITAL

Now I'd like to ask you specifically about your household's land.

QUESTION		RESPONSE		
G3.01. Does anyone in your household currently own or cultivate land?		YES.....1 NO.....2 → <i>G3.06, ITEM A</i>		
G3.02. Who generally makes decisions about what to plant on this land? <div> ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98 </div>		ID #1	ID #2	ID #3
G3.03. Do you [NAME] solely or jointly cultivate any land? CIRCLE <u>ONE</u>		YES, SOLELY1 YES, JOINTLY2 YES, SOLELY AND JOINTLY3 NO4		
G3.04. Who generally makes decisions about what to plant on the land that you yourself cultivate? <div> ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98 </div>		ID #1	ID #2	ID #3
G3.05. Do you own any of the land owned or cultivated by your household? CIRCLE <u>ONE</u>		YES, SOLELY1 YES, JOINTLY2 YES, SOLELY AND JOINTLY3 NO4		

Now I'd like to ask you about a number of items that could be used to generate income.		Does anyone in your household currently have any [ITEM]?	Do you [NAME] own any [ITEM]? CIRCLE ONE
ITEM		G3.06	G3.07
A	Large livestock (cattle,donkeys)	YES.....1 NO.....2 → <i>ITEM B</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
B	Small livestock (sheep, goats, pigs, rabbits)	YES.....1 NO.....2 → <i>ITEM C</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
C	Poultry and other small animals (chickens, ducks, turkeys, pigeons, quails, guinea fowls)	YES.....1 NO.....2 → <i>ITEM D</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
Fishing and fishing processing equipment			
D	D1. Boat (Boti)	YES.....1 NO.....2 → <i>ITEM D2</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
	D2. Boat Engine	YES.....1 NO.....2 → <i>ITEM D3</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
	D3. Canoe	YES.....1 NO.....2 → <i>ITEM D4</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
	D4. Gill net	YES.....1 NO.....2 → <i>ITEM D5</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
	D5 Mukene/Muziri/Ragooge net	YES.....1 NO.....2 → <i>ITEM D6</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
	D6.Drying racks	YES.....1 NO.....2 → <i>ITEM D7</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3

Now I'd like to ask you about a number of items that could be used to generate income.		Does anyone in your household currently have any [ITEM]?	Do you [NAME] own any [ITEM]? CIRCLE ONE
ITEM		G3.06	G3.07
			NO 4
D7 Light source (traditional)		YES.....1 NO.....2 → <i>ITEM D8</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D8 Light source (solar lamp)		YES.....1 NO.....2 → <i>ITEM D9</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D9 Solar-tent dryer		YES.....1 NO.....2 → <i>ITEM D10</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D10. Smoking kiln (traditional)		YES.....1 NO.....2 → <i>ITEM D11</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D11. Smoking kiln (improved)		YES.....1 NO.....2 → <i>ITEM D12</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D12. Salting vats		YES.....1 NO.....2 → <i>ITEM D13</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
D13. Hammer mill		YES.....1 NO.....2 → <i>ITEM E</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
E Non-mechanized farm equipment (hand tools, animal-drawn plough)		YES.....1 NO.....2 → <i>ITEM F</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
F Mechanized farm equipment (tractor-plough, power tiller, treadle pump)		YES.....1 NO.....2 → <i>ITEM G</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4

Now I'd like to ask you about a number of items that could be used to generate income.		Does anyone in your household currently have any [ITEM]?	Do you [NAME] own any [ITEM]?
			CIRCLE ONE
ITEM		G3.06	G3.07
G	Non-farm business equipment (solar panels used for recharging, sewing machine, brewing equipment, fryers)	YES.....1 NO.....2 → <i>ITEM H</i>	YES, SOLELY 1 YES, JOINTLY 2 YES, SOLELY AND JOINTLY 3 NO 4
H	House or building	YES.....1 NO.....2 → <i>ITEM I</i>	YES, SOLELY 1 YES, JOINTLY 2 YES, SOLELY AND JOINTLY 3 NO 4
I	Large consumer durables (refrigerator, TV, sofa)	YES.....1 NO.....2 → <i>ITEM J</i>	YES, SOLELY 1 YES, JOINTLY 2 YES, SOLELY AND JOINTLY 3 NO 4

		Does anyone in your household currently own any [ITEM]?	Do you [NAME] own any [ITEM]? CIRCLE ONE
ITEM		G3.06	G3.07
J	Small consumer durables (radio, cookware)	YES.....1 NO.....2 → <i>ITEM K</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
K	Cell phone	YES.....1 NO.....2 → <i>ITEM L</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
L	Other land not used for agricultural purposes (pieces/plots, residential or commercial land)	YES.....1 NO.....2 → <i>ITEM M</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4
M	Means of transportation (bicycle, motorcycle, car, oxcart, transport boats)	YES.....1 NO.....2 → <i>MODULE G3(B)</i>	YES, SOLELY 1 YES, JOINTLY..... 2 YES, SOLELY AND JOINTLY 3 NO 4

MODULE G3(B): ACCESS TO FINANCIAL SERVICES

Next I'd like to ask about your household's experience with borrowing money or other items (in-kind) in the past 12 months.	Would you or anyone in your household be able to take a loan or borrow cash/in-kind from [SOURCE] if you wanted to?	Has anyone in your household taken any loans or borrowed cash/in-kind from [SOURCE] in the past 12 months? CIRCLE ONE	Who made the decision to borrow from [SOURCE] most of the time? ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98	Who makes the decision about what to do with the money or item borrowed from [SOURCE] most of the time? ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98	Who is responsible for repaying the money or item borrowed from [SOURCE]? ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98						
LENDING SOURCES	G3.08	G3.09	G3.10			G3.11			G3.12		
			ID#1	ID#2	ID#3	ID#1	ID#2	ID#3	ID#1	ID#2	ID#3
A Non-governmental organization (NGO)	YES.....1 NO.....2 → SOURCE B MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → SOURCE B DON'T KNOW97									
B Formal lender (bank/financial institution)	YES.....1 NO.....2 → SOURCE C MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → SOURCE DON'T KNOW97									
C Informal lender (e.g. katapila)	YES.....1 NO.....2 → SOURCE D MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → SOURCE DON'T KNOW97									
D Friends or relatives	YES.....1 NO.....2 → SOURCE E MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → SOURCE DON'T KNOW97									
E Group based micro-finance or lending including VSLAs /SACCOs	YES.....1 NO.....2 → SOURCE F MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → SOURCE F DON'T KNOW97									
F Informal credit/savings groups (e.g., merry-go-rounds /chipereganyo, etc.)	YES.....1 NO.....2 → G3.13 MAYBE.....3	YES, CASH.....1 YES, IN-KIND2 YES, CASH AND IN-KIND3 NO4 → G3.13 DON'T KNOW97									

G3.13	An account can be used to save money, to make or receive payments, or to receive wages or financial help. Do you, either by yourself or together with someone else, currently have an account at any of the following places: a bank or other formal institution (e.g., post office)?	YES.....1 NO.....2 Don't know97
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G4.03. In the last 24 hours did you work (at home or outside of the home including chores or other domestic activities) less than usual, about the same as usual, or more than usual?	FOR FEMALES ONLY: DOES RESPONDENT HAVE A CHILD UNDER 5 YEARS OLD?	G4.04. If you wanted to do something (livelihood-related, training-related, self-care) and could not take your child with you, is there someone who could care for your child in your absence?	G4.05. Who could care for your child in your absence?	ID #1	ID #2	ID #3
LESS THAN USUAL.....1 ABOUT THE SAME AS USUAL.....2 MORE THAN USUAL.....3 IF RESPONDENT IS <u>MALE</u> → MODULE G5	YES.....1 → G4.04 NO.....2 → MODULE G5	YES.....1 → G4.05 NO.....2 → MODULE G5	ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER.....94 NO DECISION MADE98			

HOUSEHOLD ID					
RESPONDENT ID					

MODULE G5: GROUP MEMBERSHIP

Now I'm going to ask you about groups in the community. These can be either formal or informal and customary groups.		Is there a [GROUP] in your community?	Is this group composed of all male or female or mixed-sex members?	Are you an active member of this [GROUP]?	To what extent do you feel like you can influence decisions in this [GROUP]?	To what extent does this [GROUP] influence life in the community beyond the group activities?
GROUP CATEGORIES		G5.01	G5.02	G5.03	G5.04	G5.05
A	Agricultural / livestock/ fisheries producer's group (including marketing groups)	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP B	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP B	YES1 NO2 → GROUP B	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP B	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP B
B	Water users' associations	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP C	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP C	YES1 NO2 → GROUP C	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP C	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP C
C	Community forestry groups / Natural resource management groups	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP D	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP D	YES1 NO2 → GROUP D	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP D	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP D
D	Credit or microfinance group (including SACCOs/merry-go-rounds/ VSLAs)	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP E	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP E	YES1 NO2 → GROUP E	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP E	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP E
E	Mutual help or insurance group (including burial societies)	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP F	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP F	YES1 NO2 → GROUP F	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP F	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP F
F	Trade and business association group	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP G	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP G	YES1 NO2 → GROUP G	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP G	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP G
G	Civic group (improving community) or charitable group (helping others)	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP H	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP H	YES1 NO2 → GROUP H	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP H	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP H
H	Religious group	YES1 <input type="checkbox"/> NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/> GROUP I	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 GROUP I	YES1 NO2 → GROUP I	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP I	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4 GROUP I

I	Beach management committee (BMC)	YES1 <input type="checkbox"/> GROUP K NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/>	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97	YES1 NO2 → GROUP I	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4
K	Women Fish processor Groups	YES1 <input type="checkbox"/> GROUP J NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/>	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97	YES1 NO2 → GROUP J	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4
J	Other (specify)	YES1 <input type="checkbox"/> MODULE G6 NO2 <input type="checkbox"/> DON'T KNOW97 <input type="checkbox"/>	ALL MALE1 ALL FEMALE2 MIXED SEX3 DON'T KNOW97 <input type="checkbox"/>	YES1 NO2 → MODULE G6	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4	NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT3 HIGH EXTENT4

HOUSEHOLD ID					
RESPONDENT ID					

MODULE G6. PHYSICAL MOBILITY

QUESTION	RESPONSE
	FOR G6.01 - G6.06: USE CODE G6↓
G6.01 How often do you visit an urban center?	
G6.02 How often do you go to the market/leisure center /shops?	
G6.03 How often do you go to visit family or relatives?	
G6.04 How often do you go to visit a friend / neighbor's house?	
G6.05 How often do you go to the hospital / clinic / doctor (seek health service)?	
G6.06 How often do you go to a public village gathering / community meeting / training for NGO or programs?	

CODE G6	
EVERYDAY	1
EVERY WEEK AT LEAST ONCE.....	2
EVERY 2 WEEKS AT LEAST ONCE	3
EVERY MONTH AT LEAST ONCE	4
LESS THAN ONCE A MONTH.....	5
NEVER / <i>Not Applicable</i>	6

REMAINDER OF MODULE (G6.09-G6.012) SHOULD ONLY BE **ASKED IF RESPONDENT IS FEMALE**

Now I'd like to ask you some questions about different places you might visit.		Who usually decides whether you can go to [PLACE]?			Does your husband/partner or other household member object to you going <u>alone</u> to [PLACE]?	Under what circumstances would this person <u>NOT</u> object to your going to [PLACE] alone?	Do these objections prevent you from going <u>alone</u> to [PLACE]?
		ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS MEMBER ID (SELF) ONLY → NEXT PLACE OTHER CODES: NON-HH MEMBER.....94 No Decision Made98				CIRCLE <u>ALL</u> APPLICABLE	
PLACE		G6.09			G6.10	G6.11	G6.12
		ID #1	ID #2	ID #3			
A	Urban center				YES.....1 NO.....2 → PLACE B	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW APPROPRIATE AND ACCEPTABLE DRESSING.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → PLACE B	YES.....1 NO.....2
B	Market / leisure centre/ shops				YES.....1 NO.....2 → PLACE C	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW PURDAH / DRESS ACCEPTABLY.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → PLACE C	YES.....1 NO.....2
C	Visit family or relatives				YES.....1 NO.....2 → PLACE D	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW PURDAH / DRESS ACCEPTABLY.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → PLACE D	YES.....1 NO.....2
D	Visit a friend / neighbor's house				YES.....1 NO.....2 → PLACE E	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW PURDAH / DRESS ACCEPTABLY.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → PLACE E	YES.....1 NO.....2
E	Hospital / clinic / doctor (seek health service)				YES.....1 NO.....2 → PLACE F	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW PURDAH / DRESS ACCEPTABLY.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → PLACE F	YES.....1 NO.....2

		Who usually decides whether you can go to [PLACE]? ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS MEMBER ID (SELF) ONLY → NEXT PLACE OTHER CODES: NON-HH MEMBER.....94 NOT APPLICABLE.....98			Does your husband/partner or other household member object to you going <u>alone</u> to [PLACE]?	Under what circumstances would this person <u>NOT</u> object to your going to [PLACE] alone? CIRCLE <u>ALL</u> APPLICABLE	Do these objections prevent you from going <u>alone</u> to [PLACE]?
PLACE		G6.09			G6.10	G6.11	G6.12
		ID #1	ID #2	ID #3			
F	Public village gathering or community meeting				YES.....1 NO.....2 → <i>Module G7</i>	IF I HAVE COMPANY (RELATIVES, CHILDREN).....1 IF I CAN ARRANGE MY OWN EXPENSES (FOR TRANSPORT).....2 IF I FOLLOW PURDAH / DRESS ACCEPTABLY.....3 OTHER (SPECIFY).....4 UNDER NO CIRCUMSTANCES WOULD I BE ALLOWED TO GO.....5 → <i>Module G7</i>	YES.....1 NO.....2

MODULE G7: INTRAHOUSEHOLD RELATIONSHIPS

23

MODULE G8(A): AUTONOMY IN DECISION-MAKING

Are you like
this person?

CIRCLE ONE

CIRCLE ONE

CIRCLE ONE

STORY

G8.01

	G8.02
--	--------------

G8.03

A1

"[PERSON'S NAME] cannot fish, process and trade in bigger fish species such as Nile perch, tilapia and catfish Chambo, Kampango, bombe for consumption and sale in market. Small fish species (mukene, ragooge and muziri usipa, ndunduma, kambuzi) are the only fish species that he/she can do here."

YES...1
NO.....2 → **G8.03**

COMPLETELY THE SAME...1→A2
SOMEWHAT THE SAME.....2→A2

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT.....2

A2

"[PERSON'S NAME] is a fish processor and only processes small fish species (mukene, ragooqe and muziri usipa, ndunduma, kambuzi) because her spouse, or another person or group in her community tells her she must process these fish species. She does what they tell her to do."

YES...1
NO.....2 → *G8.03*

COMPLETELY THE SAME...1→A3
SOMEWHAT THE SAME.....2→A3

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT.....2

A3

"[PERSON'S NAME] trades/sells the small fish species for household income that her family or community expect. She wants them to approve of her as a good lady."

YES...1
NO.....2 → *G8.03*

COMPLETELY THE SAME...1→A4
SOMEWHAT THE SAME.....2→A4

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT.....2

A4

"[PERSON'S NAME] chooses the fish species that she personally wants to fish, process, and/or trade in market and thinks are best for herself and her family. She values the fish species. If she changed her mind, she could act differently."

YES...1
NO.....2 → *G8.03*

COMPLETELY THE SAME....1→B1
SOMEWHAT THE SAME.....2→B1

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT.....2

B1

"[PERSON'S NAME] cannot grow other types of crops here for consumption and sale in markets. Change to location specific situation in Uganda Beans, sweat potato and maize are the only crops that grow here."

YES...1
NO.....2 → *G8.03*

COMPLETELY THE SAME....1→**B2**
SOMEWHAT THE SAME.....2→**B2**

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT.....2

B2

"[PERSON'S NAME] is a farmer and grows maize, beans and sweat potato because her spouse, or another person or group in her community tell her she must grow these crops. She does what they tell her to do."

YES...1
NO 2 → *G8.03*

COMPLETELY THE SAME...1→B3
SOMEWHAT THE SAME 2→B3

COMPLETELY DIFFERENT....1
SOMEWHAT DIFFERENT 2

	B3	<i>"[PERSON'S NAME] grows the crops for agricultural production that her family or community expect. She wants them to approve of her as a good farmer."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ B4 SOMEWHAT THE SAME.....2→ B4	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	B4	<i>"[PERSON'S NAME] chooses the crops that she personally wants to grow for consumption and sale in the market and thinks are best for herself and her family. She values growing these types. If she changed her mind, she could act differently."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ C1 SOMEWHAT THE SAME.....2→ C1	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2

Taking fish to the market (or not)	C1	<i>"There is no alternative to how much or how little of fish species [PERSON'S NAME] can process and take to the market. She is taking the only possible amount."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ C2 SOMEWHAT THE SAME.....2→ C2	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	C2	<i>"[PERSON'S NAME] takes fish to the market because her spouse, or another person or group in her community tell her she must sell them there. She does what they tell her to do."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ C3 SOMEWHAT THE SAME.....2→ C3	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	C3	<i>"[PERSON'S NAME] takes fish to the market that her family or community expect. She wants them to approve of her."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ C4 SOMEWHAT THE SAME.....2→ C4	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	C4	<i>"[PERSON'S NAME] chooses to take fish to market that she personally wants to sell there, and thinks is best for herself and her family. She values this approach to sales. If she changed her mind, she could act differently."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ D1 SOMEWHAT THE SAME.....2→ D1	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
How to use income generated from agricultural and non-agricultural activities	D1	<i>"There is no alternative to how [PERSON'S NAME] uses her income. How she uses her income is determined by necessity."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ D2 SOMEWHAT THE SAME.....2→ D2	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	D2	<i>"[PERSON'S NAME] uses her income how her spouse, or another person or group in her community tell her she must use it there. She does what they tell her to do."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ D3 SOMEWHAT THE SAME.....2→ D3	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	D3	<i>"[PERSON'S NAME] uses her income in the way that her family or community expect. She wants them to approve of her."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ D4 SOMEWHAT THE SAME.....2→ D4	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2
	D4	<i>"[PERSON'S NAME] chooses to use her income how she personally wants to, and thinks is best for herself and her family. She values using her income in this way. If she changed her mind, she could act differently."</i>	YES...1 NO.....2 → G8.03	COMPLETELY THE SAME....1→ G8.04 SOMEWHAT THE SAME.....2→ G8.04	COMPLETELY DIFFERENT....1 SOMEWHAT DIFFERENT.....2

MODULE G8(B): NEW GENERAL SELF-EFFICACY SCALE

Now I'm going to ask you some questions about different feelings you might have. Please listen to each of the following statements. Think about how each statement relates to your life, and then tell me how much you agree or disagree with the statement on a scale of 1 to 5, where 1 means you "strongly disagree" and 5 means you "strongly agree." (Note: Randomize order of statements)

STATEMENTS		G8.04
A	I will be able to achieve most of the goals that I have set for myself.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
B	When facing difficult tasks, I am certain that I will accomplish them.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
C	In general, I think that I can obtain outcomes that are important to me.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
D	I believe I can succeed at most any endeavor to which I set my mind	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
E	I will be able to successfully overcome many challenges.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
F	I am confident that I can perform effectively on many different tasks.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
G	Compared to other people, I can do most tasks very well.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5
H	Even when things are tough, I can perform quite well.	STRONGLY DISAGREE1 DISAGREE2 NEITHER AGREE NOR DISAGREE3 AGREE4 STRONGLY AGREE5

MODULE G8(C): LIFE SATISFACTION

The following questions ask how satisfied you feel with your life as a whole, on a scale from 1 to 5, where 1 means you feel “very dissatisfied” and 5 means you feel “very satisfied.”

	STATEMENTS	G8.05
A	Overall, how satisfied are you with life as a whole these days?	VERY DISSATISFIED1 DISSATISFIED2 NEITHER SATISFIED NOR DISSATISFIED3 SATISFIED4 VERY SATISFIED5
B	Overall, how satisfied with your life were you 5 years ago?	VERY DISSATISFIED1 DISSATISFIED2 NEITHER SATISFIED NOR DISSATISFIED3 SATISFIED4 VERY SATISFIED5
C	As your best guess, overall how satisfied with your life do you expect to feel 5 years from today?	VERY DISSATISFIED1 DISSATISFIED2 NEITHER SATISFIED NOR DISSATISFIED3 SATISFIED4 VERY SATISFIED5

HOUSEHOLD ID					
RESPONDENT ID					

MODULE G9. Attitudes about Domestic Violence

Now I would like to ask about your opinion on the following issues. Please keep in mind that I am not asking about your personal experience or whether the following scenarios have happened to you. I would only like to know whether you think the following issues are acceptable.		In your opinion, is a husband justified in hitting or beating his wife in the following situations?	
SITUATION		G9.01	
A	If she goes out without telling him?	YES.....	1
		NO.....	2
		DON'T KNOW.....	97
B	If she neglects the children?	YES.....	1
		NO.....	2
		DON'T KNOW.....	97
C	If she argues with him?	YES.....	1
		NO.....	2
		DON'T KNOW.....	97
D	If she refuses to have sex with him?	YES.....	1
		NO.....	2
		DON'T KNOW.....	97
E	If she burns the food?	YES.....	1
		NO.....	2
		DON'T KNOW.....	97

END OF QUESTIONNAIRE. FILL OUT COVER PAGE OUTCOME G1.05.

Appendix 3.3 Health and Nutrition module and complementary questionnaire in NutriFish project

PROJECT-LEVEL WOMEN'S EMPOWERMENT IN AGRICULTURE INDEX
NUTRITION AND HEALTH MODULE
PILOT VERSION
MAY 2019

These survey modules are a DRAFT version of the nutrition and health module of the project-level Women's Empowerment in Agriculture Index (pro-WEAI). Optional questions are designated in purple text. The survey questions, format, and required portions are subject to change as the pro-WEAI continues to develop. Updated survey modules may be available from the pro-WEAI team.

Pro-WEAI is a survey-based index for measuring empowerment, agency, and inclusion of women in the agriculture sector. It is being developed jointly by the International Food Policy Research Institute (IFPRI), the Oxford Policy and Human Development Initiative (OPHI), and thirteen partner projects in the portfolio of the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2). The tool helps agricultural development projects assess women's empowerment in a project setting, diagnose areas of women's disempowerment, design strategies to address deficiencies, and monitor project outcomes. Pro-WEAI is an adaptation of the Women's Empowerment in Agriculture Index (WEAI), originally developed in 2012 by IFPRI, the United States Agency for International Development (USAID), and OPHI.

The pro-WEAI nutrition and health module helps agricultural development projects with nutrition-related objectives to understand how they empower women in the area of nutrition and health. The module measures women's agency in relation to nutrition and health decisions and outcomes. It is targeted at mothers with young children (under age 2).

For more information about pro-WEAI, please visit weai.ifpri.info or email Hazel Malapit at h.malapit@cgiar.org.

MODULE X. NUTRITION AND HEALTH

2

[Note for survey adaptation: The timeframe highlighted for GX.04 should be altered to reflect the program implementation period, such that women are only being asked this question if they were pregnant after the start of program implementation. Ideally, this same timeframe should be used at all surveys.]									
G	Whether you consulted a doctor or went to a clinic during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
H	How much you worked during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
I	How much you could rest during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
J	Whether you could eat eggs during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
K	Whether you could consume milk or milk products during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
L	Whether you could eat meat, poultry or fish during your current or most recent pregnancy?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
M	How much you worked when your youngest child was being breastfed?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4 NOT APPLICABLE..98	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
N	How much you could rest when your youngest child was being breastfed?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4 NOT APPLICABLE..98	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
O	Whether you could eat eggs when your youngest child was being breastfed?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4 NOT APPLICABLE..98	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
P	Whether you could consume milk or milk products when your youngest child was being breastfed?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4 NOT APPLICABLE..98	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			
Q	Whether you could eat meat, poultry or fish when your youngest child was being breastfed?				NOT AT ALL1 SMALL EXTENT2 MEDIUM EXTENT.....3 TO A HIGH EXTENT .4 NOT APPLICABLE..98	NOT AT ALL1 SOMEWHAT2 VERY CONFIDENT..3			

The next set of questions asks about making decisions about your YOUNGEST child.		When decisions are made about [ACTIVITY], who normally takes the decision? ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS MEMBER ID (SELF) ONLY → GX.08 OTHER CODES: NON-HH MEMBER 94 NO DECISION MADE 98 → Next activity			To what extent do you participate in decisions regarding [ACTIVITY]? CIRCLE ONE		How confident do you feel to make decisions about [ACTIVITY]? CIRCLE ONE		When decisions are made regarding [ACTIVITY], who would you prefer made the decision? ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER 94 NO DECISION MADE 98	
CHILD HEALTH AND NUTRITION		GX.06			GX.07	GX.08	GX.09			
		ID #1	ID #2	ID #3			ID #1	ID #2	ID #3	
A	Whether your child is taken to a clinic or a doctor is consulted when he/she is sick?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
B	Whether your child gets vaccinations?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
C	Whether your child visits the health clinic to see if he/she is growing well?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
D	How to feed your child when he/she is sick?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
E	Who will care for your child when you need to go outside the home for an extended period of time?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
F	Sending your child to school?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				
G	(If child is ≥6 months of age:) Whether or not your child is offered eggs to eat?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3				

H	(If child is ≥ 6 months of age:) Whether or not your child is offered milk or milk products, other than breastmilk?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT .. 3			
I	(If child is ≥ 6 months of age:) Whether or not your child if offered meat, poultry or fish?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT .. 3			
GX.10 Do you have a child less than 2 years of age*?							YES 1 → next item NO 2 → GX.11		
J	Whether to breastfeed your child?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3			
K	When to stop breastfeeding your child?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3			
L	When to start giving foods and liquids (other than breastmilk) to your child?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT 3			
M	(If child is ≥ 6 months of age:) Whether or not your child is fed foods prepared or bought especially for children that adult household members do not eat or drink, such as fortified cereals or baby foods?				NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4	NOT AT ALL 1 SOMEWHAT 2 VERY CONFIDENT .. 3			

Purchase products The next set of questions asks about making decisions and your ability to obtain the types of food, medicine and other items that you want for you and your child.		When decisions are made whether or not to purchase [PRODUCT], who generally makes the decision? ENTER UP TO THREE (3) MEMBER IDs OTHER CODES: NON-HH MEMBER 94 NO DECISION MADE 98			You may acquire an item that you need in a variety of ways, such as purchasing or cultivating it or having someone purchase or cultivate it for you. When you need [PRODUCT], can you usually acquire it?
		GX.11			GX.12
		ID #1	ID #2	ID #3	
A	Small amounts of food, for example smaller than 5 kg				YES 1 NO 2 NOT APPLICABLE 98
B	Larger amounts of food, for example larger than 5 kg				YES 1 NO 2 NOT APPLICABLE 98
C	Eggs				YES 1 NO 2 NOT APPLICABLE 98
D	Milk or milk products				YES 1 NO 2 NOT APPLICABLE 98
E	Meat, poultry or fish (including organ meats)				YES 1 NO 2 NOT APPLICABLE 98
F	Special foods for children (i.e., foods prepared or bought especially for children that adult household members do not eat or drink, such as fortified cereals or baby foods-that programs or health workers tell you should be consumed				YES 1 NO 2 NOT APPLICABLE 98
G	Any nutritious foods that a program or health worker told you to eat or drink				YES 1 NO 2 NOT APPLICABLE 98
H	Medication, vitamins or supplements for children				YES 1 NO 2 NOT APPLICABLE 98
I	Medication, vitamins or supplements for yourself				YES 1 NO 2 NOT APPLICABLE 98
J	Clothing for children				YES 1 NO 2 NOT APPLICABLE 98
K	Clothing for yourself				YES 1 NO 2 NOT APPLICABLE 98
L	Toiletries, such as soap and toothpaste				YES 1 NO 2

					NOT APPLICABLE98
--	--	--	--	--	------------------------

MODULE G10: Household Food Insecurity Access Scale (HFIAS)

		During the last 12 months was there a time when [Situation]?	During the past 4 weeks was there a time when [Situation]?	How often did this [Situation] happen in the past 4 weeks?
	Situation	G10.01	G10.02	G10.03
A	you worry that your household would not have enough food?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
B	you were or any household members not able to eat the kinds of foods you preferred because of a lack of resources?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
C	you or any household member eat just a few kinds of food day after day because of a lack of resources?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
D	you or any household member eat food that you did not want to eat instead of other foods because of a lack of resources?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
E	you or any household member eat a smaller meal than you felt you needed because there was not enough food?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
F	you or any household member eat fewer meals in a day because there was not enough food?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
G	there was ever no food at all in your household because there were no resources?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
H	you or any household member go to sleep at night hungry because there was not enough food?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3
I	you or any household member go a whole day without eating anything because there was not enough food?	YES.....1 NO.....2→Next situation	YES.....1 NO.....2→Next situation	Rarely (1-2 times)1 Sometimes (3-10 times).....2 Often (> 10 times)3

MODULE G12(A): ACCESS TO RELIABLE SANITATION

Next, I am going to ask you some questions about access to sanitation facilities.

Question		Response
G12.01	Where do you spend most of your working time?	AGRICULTURAL PLOT.....1
		FISHERY/FISHPOND.....2
		HIVE.....3
		ORCHARD.....4
		HOUSEHOLD PLOT.....5
		HOME (E.G., HOME PROCESSING).....6
		MARKETPLACE.....7
		PROCESSING CENTER.....8
		SHOP.....9
		OFFICE.....10
		OTHER (SPECIFY).....97
G12.02	At or near your place of work, is there a place where you think it is safe and clean for you to urinate?	YES.....1
		NO.....2
		DON'T KNOW.....97
		NA.....98
G12.03	At or near your place of work, is there a place where you think it is safe and clean for you to defecate?	YES.....1
		NO.....2
		DON'T KNOW.....97
		NA.....98
G12.04	At or near your place of work, is there a place for you to wash your hands?	YES.....1
		NO.....2
		DON'T KNOW.....97
		NA.....98

MODULE G13: MARRIAGE AND FERTILITY AGENCY

Now I'd like to ask you some questions on making decisions about having children.	When decisions are made about [ACTIVITY], who normally takes the decision? ENTER UP TO THREE (3) MEMBER IDs IF RESPONSE IS MEMBER ID (SELF) ONLY → NEXT STATEMENT OTHER CODES: NON-HH AND NON-FAMILY MEMBER 39 NON-HH AND FAMILY MEMBER (SPECIFY RELATIONSHIP TO RESPONDENT) 49 GOD/RELIGION ETC 59 → NEXT STATEMENT NOT SEXUALLY ACTIVE/ABSTINENT 69 → NEXT STATEMENT CAN NO LONGER HAVE CHILDREN 79 → NEXT STATEMENT NEVER USED A CONTRACEPTIVE METHOD 89 → NEXT STATEMENT NOT APPLICABLE 98 → NEXT STATEMENT			To what extent do you participate in decisions regarding [ACTIVITY]? CIRCLE <u>ONE</u>
STATEMENT	G13.02			
	G13.01			
	ID #1	ID #2	ID #3	
A The number of children you should have?			NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4 REFUSED TO ANSWER 98	
B Whether to try to have a/another child?			NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4 REFUSED TO ANSWER 98	
C Whether or not you/your partner use a strategy to delay pregnancy (such as birth control pills, condoms, hormonal shot, or sterilization)?			NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4 REFUSED TO ANSWER 98	
D What method you/your partner use to avoid or delay pregnancy?			NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4 REFUSED TO ANSWER 98	
E When you have sex with your spouse/partner?			NOT AT ALL 1 SMALL EXTENT 2 MEDIUM EXTENT 3 TO A HIGH EXTENT 4 REFUSED TO ANSWER 98	

MODULE G14: SEXUAL HOSTILITY

Next, I will ask you some questions about any maltreatment you may experience while earning your livelihood.

Earlier you said that you spend most of your working time at **[PLACE]**.

		When you are at [PLACE], how often do people [OCCURRENCE]?	In general, for [men/women] of your age who live in your community, when they are at their place of work, how often do you think that they have experiences where others [OCCURRENCE]?
	OCCURRENCE	G14.01	G14.02
A	Treat you “differently” because of your sex (for example, mistreated, slighted, or ignored you)?	Always.....1 Often2 Sometimes3 Never.....4 Refused To Answer.....98	Always.....1 Often.....2 Sometimes3 Never.....4 Refused To Answer.....98
B	Tell you sexual stories or jokes or make sexual comments?	Always.....1 Often2 Sometimes3 Never.....4 Refused To Answer.....98	Always.....1 Often.....2 Sometimes3 Never.....4 Refused To Answer.....98
C	Make remarks that people of your sex are not suited for the kind of work you do?	Always.....1 Often2 Sometimes3 Never.....4 Refused To Answer.....98	Always.....1 Often.....2 Sometimes3 Never.....4 Refused To Answer.....98
D	Spread rumors about your sexuality, sex life, etc.?	Always.....1 Often2 Sometimes3 Never.....4 Refused To Answer.....98	Always.....1 Often.....2 Sometimes3 Never.....4 Refused To Answer.....98
E	Make unwanted attempts to establish a romantic or sexual relationship with you despite your efforts to discourage it?	Always.....1 Often2 Sometimes3 Never.....4 Refused To Answer.....98	Always.....1 Often.....2 Sometimes3 Never.....4 Refused To Answer.....98

		When you are at [PLACE], how often do people [OCCURRENCE]?	In general, for [men/women] of your age who live in your community, when they are at their place of work, how often do you think that they have experiences where others [OCCURRENCE]?
	OCCURRENCE	G14.01	G14.02
F	Touch you in a sexual way without your permission?	Always1 Often2 Sometimes3 Never4 Refused To Answer98	Always1 Often2 Sometimes3 Never4 Refused To Answer98
G	Make you feel like you are being bribed to engage in sexual behavior?	Always1 Often2 Sometimes3 Never4 Refused To Answer98	Always1 Often2 Sometimes3 Never4 Refused To Answer98
H	Sexually proposition you, for example invited you to engage in sexual intercourse with them?	Always1 Often2 Sometimes3 Never4 Refused To Answer98	Always1 Often2 Sometimes3 Never4 Refused To Answer98
I	Make you afraid you will be treated poorly, for example threatened you, did not give you work, or ignored you if you didn't cooperate sexually?	Always1 Often2 Sometimes3 Never4 Refused To Answer98	Always1 Often2 Sometimes3 Never4 Refused To Answer98

Appendix 3.4 NutriFish ethics approval

MAKERERE

P.O. Box 7062,
Kampala, Uganda
Cables: MAKUNIKA



UNIVERSITY

Tel: 256-41-545040/0712 207926
Fax: 256-41-530185
E-mail: makssrec@gmail.com

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES
SCHOOL OF SOCIAL SCIENCES
RESEARCH ETHICS COMMITTEE

Your Ref:

Our Ref: MAKSS REC 03.19.265/AM

13th January 2020

Dr. Jackson Efitre
Principal Investigator (MAKSS REC 03.19.265)
Department of Zoology, Entomology and Fisheries Sciences
P O Box 7062, Kampala
Tel: +256 773 413144
Email: jefitre@cns.mak.ac.ug/jefitre@gmail.com

Initial – Amendment Review

Re: Approval of Protocol titled: “HARNESSING DIETARY NUTRIENTS OF UNDER –UTILISED FISH AND FISH PROCESSING BY-PRODUCTS TO REDUCE MICRONUTRIENTS DEFICIENCIES AMONG VULNERABLE GROUPS IN UGANDA – NUTRIFISH”

This is to inform you that, the Makerere University School of Social Sciences Research Ethics Committee (MAKSS REC) reviewed your request for amendment to the above referenced protocol. The changes approved include:

1. The changes in the economic tool
2. Proweai survey tool (new tool)
3. Household Interview Questionnaire (Consumer of small pelagic fishes – new tool)
4. Household interview questionnaire (Non-consumer of small pelagic fishes – new tool)
5. Participatory video group discussion questionnaire (new Tools)

The approval period of your study ends on **5th March 2020**. please endeavour to submit a progress report at least two months before it ends to renew approval for your study. Any additional modifications in the research protocol, study site, personnel, funding sources or consent form during this time period must be reviewed and approved by the MAKSS REC.

In case they are made, summarise the proposed change and the rationale for it in a letter to the Makerere University School of Social Sciences Research and Ethics Committee. In addition, submit three (3) copies of an updated version of your original protocol application, showing all proposed changes in bold or “track changes” and the other without bold or track changes.

Yours sincerely,


Dr. Stella Neema
Chairperson

Makerere University School of Social Sciences Research and Ethics Committee



c.c.: The Executive Secretary, Uganda National Council for Science and Technology



Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: A 600

28th January 2020

Dr. Jackson Efitre
Principal Investigator
Makerere University
Kampala

Dear Dr. Efitre,

**RE: HARNESSING DIETARY NUTRIENTS OF UNDER – UTILIZED
FISH AND FISH PROCESSING BY – PRODUCTS TO REDUCE
MICRONUTRIENT DEFICIENCIES AMONG VULNERABLE
GROUPS IN UGANDA – NUTRIFISH**

This is to acknowledge receipt of your letter dated **20th January 2020** in which you notified Uganda National Council for Science and Technology (UNCST) about the approved annual renewal for the above study by Joint Clinic Research Centre, Research Ethics Committee. The UNCST has no objection to the notification.

Yours sincerely,

Isaac Makhuwa
for: Executive Secretary

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

MAKERERE

P.O Box 7062 Kampala Uganda

URL: <http://www.cns.mak.ac.ug>**UNIVERSITY**

Phone: +256 414 531902

e-mail: jefitre@cns.mak.ac.ug

Fax: +256 414 531061

**COLLEGE OF NATURAL SCIENCES
DEPARTMENT OF ZOOLOGY, ENTOMOLOGY
AND FISHERIES SCIENCES**

**INFORMED CONSENT FORM: PROJECT LEVEL WOMEN EMPOWERMENT IN AGRICULTURE INDEX
ProWEAI)**

**Title: Harnessing dietary nutrients of under-utilized fish and fish processing by-products to reduce
micronutrient deficiencies among vulnerable groups in Uganda - NutriFish**

Dr. Efitre Jackson (PI)

**Department of Zoology, Entomology and Fisheries Sciences, College of Natural Sciences, Makerere
University, P.O. BOX 7062, Kampala, Uganda.**

Phone: (+256) 773413144

Email: jefitre@cns.mak.ac.ug; jefitre@gmail.com

December 2019



INFORMED CONSENT FORM: PROJECT LEVEL WOMEN EMPOWERMENT IN AGRICULTURE INDEX ProWEAI)

Name: Dr. Efitre Jackson

Phone No.: (+256) 773413144

E-mail Address: jefitre@cns.mak.ac.ug;jefitre@gmail.com

Name of person obtaining consent:.....

Study Title: Harnessing dietary nutrients of under-utilized fish and fish processing by-products to reduce micronutrient deficiencies among vulnerable groups in Uganda – NutriFish.

Introduction

This study on “Harnessing Dietary Nutrients of under-utilised fish and fish based products to combat micro-nutrient deficiency among vulnerable groups in Uganda” is intended to increase availability, accessibility, nutritional quality and consumption of under-utilized small fishes and processing by-products and consequently reduce micronutrient deficiencies among vulnerable groups. It is funded by the **International Development Research Centre (IDRC), Canada**.

Back ground information

Micronutrient deficiencies are widespread in Uganda, particularly among vulnerable groups (women of reproductive age (15-49 years) and children <5 years), in rural and urban poor communities. Due to their high nutritional density and nutrient bioavailability, fish and nutrient-rich fish-based foods can contribute to reducing micronutrient deficiencies. However, fish has become less available to Ugandans due to declining stocks of large fishes (>20 cm length) coupled with high exports. Consequently, locals depend on fish by-products presenting a health and safety risk due to poor handling and rudimentary processing, impeding harnessing of all the nutrients. There is a need to improve the handling and develop nutritious, low-cost, appealing and safe fish-based products to increase availability and accessibility to vulnerable groups. The NutriFish project is intended to come up with strategies to overcome socio-economic, cultural and institutional factors impeding access to and consumption of under-utilized small fishes and fish-based products by vulnerable groups in Uganda. It will: 1) assess socio-economic and institutional factors impeding access to and utilization of under-utilized fishes and fish-based products to guide formulation of gender-inclusive strategies to enhance accessibility and consumption; 2) develop fish-based complementary foods for vulnerable groups using under-utilized small fishes and processing by-products; 3) develop marketing models for efficient distribution of fish-based products.

What the participant would be asked to do

Thank you for the opportunity to speak with you. We are a research team from Makerere University working in collaboration with the National Fisheries Resource Research Institute (NaFIRRI). We are conducting a survey to learn about fisheries, agriculture, food security and wellbeing of households in this area.



You have been selected to participate in an interview which includes questions on topics such as your family background, dwelling characteristics, asset ownership and income earning activities. The survey includes sections which will be asked to a primary adult male and female in your household if applicable. These questions in total will take approximately 1.5 hours to complete and your participation is entirely voluntary.

If you agree to participate, you can choose to stop at any time or to skip any questions you do not want to answer. Your answers will be completely confidential; we will not share information that identifies you with anyone. We will not store your name with the rest of the information you provide, so it will not be possible to link your responses to you.

We will also interview other households in your community and in other parts of the country. After we collect all the information we will use the data to make a study about how various programs can be most helpful to the people in this area.

Do you have any questions about the study or what I have said? If in the future you have any questions regarding the study and the interview, or concerns or complaints we welcome you to contact Dr. Efitre Jackson, by telephone on 0773413144. In addition, you can contact the Makerere University School of Social Sciences (MAKSS REC) at 0704667150. We will leave one copy of this form for you so that you will have record of this contact information and about the study.

Please ask the participants (male and female) if they consent to the participation in the study (check one box):

Participant 1:

YES ☐

NO ☐

Participant 2: YES ☐ NO ☐

I _____, the enumerator responsible for the interview taking place on _____, 20____ certify that I have read the above statement to the participant and they have consented to the interview. I pledge to conduct this interview as indicated on instructions and inform my supervisor of any problems encountered during the interview process.

Risks and benefits of being in the study

- There are no risks associated with our study.
- The potential benefit from consumption of complementary fish based food products among children under the age of 5; pregnant and lactating mothers include improved nutrition, reduced micro-nutrient deficiencies, better health;
- The benefits which may accrue to society in general as a result of the planned work include improved nutrition and health among vulnerable groups, especially in poor peri-urban and rural communities and improved livelihoods.



Confidentiality

The privacy/confidentiality of the participant/respondent will be protected and maintained during the entire data collection, analyses and publication processes. Confidentiality of data will be maintained by use of codes rather than actual names or other personal data. The information provided will not be disclosed to any third parties.

Voluntariness

Participation in this interview is voluntary. The participant/respondent is under no obligation to respond to the questions if he/she feels they interfere with their personal beliefs and confidentiality.

Compensation /Reimbursement

Monetary payment will be made to respondents to compensate for the time spent during filling in questionnaires at the cost of the research project. An amount of 10,000 UGX (Ten thousand Uganda Shs. only) will be paid to each respondent filling in questionnaires during surveys.

Refreshment:

Refreshment will be provided during the time of the interview at the cost of the research project.

Feedback/Dissemination

The project will develop and disseminate behavioural change messages on the benefits of consuming fish and fish-based products from under-utilized small fishes and processing by-products through radio talk shows, community meetings, sms, posters, TV programs and social media.

Ethical Clearance

Key stakeholders along the under-utilized small fish value chain such as fishers, processors, traders, government ministries and agencies, consumer organizations, will be mobilized to input into the standard development process. Uganda National Bureau of Standards (UNBS) will take the lead while NutriFish will provide the scientific basis to inform the standard specifications. By so doing, NutriFish will uphold the do-no-harm principle to ensure that the fish-based products are safe for human consumption. All research activities will be guided by: a) The Uganda National Science Technology and Innovation Policy 2009 (<https://uncst.go.ug/download/national-sti-policy-2009>); and b) Guidelines for Accreditation of Research Ethics Committees (RECs), <https://uncst.go.ug/download/guidelines-for-accreditation-of-recs-in-uganda/>, developed and overseen by the Uganda National Council for Science and Technology (2016). NutriFish will ensure research ethics standards involving humans are complied with and protect participants' privacy and dignity.

Contacts and Questions

The researcher(s) conducting this study are mentioned below. You may ask any questions you have now. If you have any questions later, you may contact them at:

Principal Investigator (P.I)	Dr. Jackson Efitre
Institution & Dept.	Department of Zoology, Entomology and Fisheries Sciences, College of Natural Sciences,

Makerere University		
Postal address		
P.O. BOX 7062, Kampala, Uganda		
E-mail address		
jefitre@cns.mak.ac.ug; jefitre@gmail.com		
Telephone No.		
+256773413144		
Co-investigators Names/Supervisors	Institution/Department	Phone contact
Anthony Taabu-Munyaho	National Fisheries Resources Research Institute (NaFIRRI), P.O Box 343 Jinja	(+256)772518324
Dorothy Nakimbugwe	NUTREAL (U) Limited, Makerere University School of Food Technology, Nutrition and Bio-engineering (Food Science) Food Parlor, P. O. Box 3132 Kampala-Uganda	(+256) 704 246089/+256 7082246089
Lauren Chapman	Department of Biology, McGill University, Montreal, Canada; and Honorary Lecturer, Makerere University, Kampala, Uganda	(514) 398-6431
Ruth Nsibirano	School of Women and Gender Studies, Makerere University	(+256) 772936190/0704636037
Gertrude Muwanga	Department of Policy & Development Economics, College of Business and Management Sciences, Makerere University, Kampala, Uganda.	(+256)7745643423; 751070180
Esther Babirekere	Mulago Hospital/ Makerere College of Health Sciences P.O Box 23491, Kampala, Uganda.	(+256) 772 611167

If you would like to talk to someone other than the researcher(s) about; (1) concerns regarding this study, (2) research participant rights, (3) research-related injuries, or (4) other human subjects' issues, please contact:

The Chair
Makerere School of Social Sciences
Research Ethics Committee
Telephone: +256- 772 457576
E-mail: sheisim@yahoo.com

And,

The Executive Secretary
The Uganda National Council of Science and Technology,
Kimera Road. Ntinda P. O. Box 6884 Kampala, Uganda
Telephone: (256) 414 705500
Fax: +256-414-234579
Email: info@uncst.go.ug



Statement of consent

I have read the above information or had the above information read to me. I have received answers to the questions I have asked. I consent to participate in this research. I am at least years of age.

Name of participant:

Signature or thumbprint/mark of participant: Date:

Name of Person obtaining Consent:

Signature of person obtaining consent: Date:

Witness of person in case person is Illiterate:

Name of Witness:

Signature or thumbprint/mark of witness: Date:



Appendix 3.5 McGill ethics approval



Research Ethics Board Office
James Administration Bldg.
845 Sherbrooke Street West. Rm 325
Montreal, QC H3A 0G4

Tel: (514) 398-6831
Fax: (514) 398-4644
Website: www.mcgill.ca/research/research/compliance/human/

Research Ethics Board 4
Certificate of Ethical Acceptability of Research Involving Humans

REB File #: 21-04-041

Project Title: Women's empowerment in relation to food security among Ugandan fishers: Using intersectional gender analysis

Principal Investigator: Farzaneh Barak

Department: Human Nutrition, School of

Status: Ph.D. Student

Supervisor: Professor Hugo Melgar-Quinonez

Co-researchers: Prof. Claudia Mitchell/ James McGill Professor/ McGill University
Dr. Margaret Masette/ Associate professor/ Makerere University, Kampala, Uganda

Funding: International Development Research Centre (IDRC) and the Australian Center for International Agricultural Research (ACIAR) under the Cultivate Africa's Future Fund (CultiAF).-PI Dr. Jackson Efitre,, Makerere University,

Approval Period: April 26, 2021 to April 25, 2022

The REB 4 reviewed and approved this project by delegated review in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.

Deanna Collin
Senior Research Ethics Administrator

-
- * Approval is granted only for the research and purposes described.
 - * Modifications to the approved research must be reviewed and approved by the REB before they can be implemented.
 - * A Request for Renewal form must be submitted before the above expiry date. Research cannot be conducted without a current ethics approval. Submit 2-3 weeks ahead of the expiry date.
 - * When a project has been completed or terminated, a Study Closure form must be submitted.
 - * Unanticipated issues that may increase the risk level to participants or that may have other ethical implications must be promptly reported to the REB. Serious adverse events experienced by a participant in conjunction with the research must be reported to the REB without delay.
 - * The REB must be promptly notified of any new information that may affect the welfare or consent of participants.
 - * The REB must be notified of any suspension or cancellation imposed by a funding agency or regulatory body that is related to this study.

* The REB must be notified of any findings that may have ethical implications or may affect the decision of the REB.

Appendix 3.6 Household Food Insecurity Access Scale (HFIAS) in the NutriFish household survey

Situation		During the last 12 months was there a time when [Situation]?	During the past 4 weeks was there a time when [Situation]?	How often did this [Situation] happen in the past 4 weeks?
1a	you worry that your household would not have enough food?	YES 1 NO.....2→ Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
2a	you were or any household members not able to eat the kinds of foods you preferred because of a lack of resources?	YES 1 NO.....2 → Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
3a	you or any household member eat just a few kinds of food day after day because of a lack of resources?	YES 1 NO.....2 → Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
4a	you or any household member eat food that you did not want to eat instead of other foods because of a lack of resources?	YES 1 NO.....2 → Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
5a	you or any household member eat a smaller meal than you felt you needed because there was not enough food?	YES 1 NO.....2 → Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
6a	you or any household member eat fewer meals in a day because there was not enough food?	YES 1 NO.....2 → Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
7a	there was ever no food at all in your household because there were no resources?	YES 1 NO.....2→ Next situation	YES1 NO.....2→ Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)

Situation		During the last 12 months was there a time when [Situation]?	During the past 4 weeks was there a time when [Situation]?	How often did this [Situation] happen in the past 4 weeks?
8a	you or any household member go to sleep at night hungry because there was not enough food?	YES 1 NO 2 → Next situation	YES 1 NO 2 → Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)
9a	you or any household member go a whole day without eating anything because there was not enough food?	YES 1 NO 2 → Next situation	YES 1 NO 2 → Next situation	Rarely (1-2 times) Sometimes (3-10 times) Often (> 10 times)

Appendix 3.7 Pro-WEAI indicators and definitions of adequacy

Indicator	Definition of adequacy
Input in productive decisions [Module G2]	Meets at least ONE of the following conditions for ALL of the agricultural activities they participate in <i>1) Makes related decision solely,</i> <i>2) Makes the decision jointly and has at least some input into the decisions</i> <i>3) Feels could make decision if wanted to (to at least a MEDIUM extent)</i>
Ownership of land and other assets [Module G3(A)]	Owns, either solely or jointly, at least ONE of the following: <i>1) At least THREE small assets (poultry, nonmechanized equipment, or small consumer durables)</i> <i>2) At least TWO large assets</i> <i>3) Land</i>
Access to and decisions on financial services [Module G3 (B)]	Meets at least ONE of the following conditions: <i>1) Belongs to a household that used a source of credit in the past year AND participated in at least ONE sole or joint decision about it</i> <i>2) Belongs to a household that did not use credit in the past year but could have if wanted to from at least ONE source</i> <i>3) Has access, solely or jointly, to a financial account</i>
Control over use of income [Module G2 (G2.06 & G2.07)]	Has input in decisions related to how to use BOTH income and output from ALL of the agricultural activities they participate in AND has input in decisions related to income from ALL non-agricultural activities they participate in, unless no decision was made
Work balance [Module G4]	Works less than 10.5 hours per day: <i>Workload = time spent in primary activity + (1/2) time spent in childcare as a secondary activity</i>
Visiting important locations [Module G6]	Meets at least ONE of the following conditions: <i>1) Visits at least TWO locations at least ONCE PER WEEK of [city, market, family/relative], or</i> <i>2) Visits least ONE location at least ONCE PER MONTH of [health facility, public meeting]</i>
Group membership [Module G5]	Active member of at least ONE group
Membership in influential groups [Module G5]	Active member of at least ONE group that can influence the community to at least a MEDIUM extent
Respect among household members [Module G7]	Meets ALL of the following conditions related to another household member: <i>1) Respondent respects relation (MOST of the time) AND</i> <i>2) Relation respects respondent (MOST of the time) AND</i> <i>3) Respondent trusts relation (MOST of the time) AND</i> <i>4) Respondent is comfortable disagreeing with relation (MOST of the time)</i>

Autonomy in income [Module G8(A)]	<p>Uses the relative autonomy index approach (“based on self-motivation theory and is a measure of internal and external motivations that determine a person’s decisions”)</p> <p>More motivated by own values than by coercion or fear of others’ disapproval: Relative Autonomy Index score\geq1</p> <p>RAI score is calculated by summing responses to the three vignettes (yes=1; no=0), using the following weighting scheme: -2 for vignette 2 (external motivation), -1 for vignette 3 (introjected motivation), and +3 for vignette 4 (autonomous motivation)</p>
Self-efficacy [Module G8]	"Agree" or greater on average with self-efficacy questions: New General Self-Efficacy Scale score \geq 32
Attitudes about intimate partner violence against women [Module G9]	<p>Believes husband is NOT justified in hitting or beating his wife in all 5 scenarios:</p> <ol style="list-style-type: none"> 1) <i>She goes out without telling him</i> 2) <i>She neglects the children</i> 3) <i>She argues with him</i> 4) <i>She refuses to have sex with him</i> 5) <i>She burns the food</i>

Source: Malapit et al., 2019

Appendix 3.8 Pro-WEAI data management report for the NutriFish Project

Summary by Farzaneh Barak - July 2021

The McGill University team has proposed two manuscripts about food security and women's empowerment in the NutriFish project (Prof. Melgar-Quinonez and PhD candidate, Farzaneh Barak). The main data source for these manuscripts was pro-WEAI data collected in Jan./Feb. 2020. The primary analyses planned to use pro-WEAI scores and constructed indicators as explanatory variables. The McGill team received pro-WEAI raw data in July 2020.

Before proceeding to the primary analyses, some standard data checks were performed to ensure the data were consistent and error free. In addition, to use do-files (STATA codes) developed by IFPRI to construct the Index, data had to be in the required structure instructed by IFPRI. The first round of standard checks included the following steps:

- Verified the structure of data and checked for duplicate observations
- Checked that reported values were within an acceptable range
 - o Response codes should have corresponded with the survey
 - o Checked for extreme and implausible values.

The following errors were identified in the first round of data checking:

1. The dataset contained some households with more than 1-2 observations per household (1 female and 0-1 male).
2. No Member ID had been assigned. As instructed by IFPRI, household ID and member ID should uniquely identify the observations.
3. The household roster had been collected at the individual level when it should have been collected at the household level. As a result, two sets of household rosters had

been provided by primary male and female respondents in the household with discrepancies in most observations.

The first issue was resolved as much as possible during the fall of 2020 in contact with the project consultant. To resolve the other issues, the McGill team decided to reconstruct the data in winter 2021 in the required format to use IFPRI's do-files for the Index calculations. The first step entailed assigning unique member IDs and then reconstructing the data in correspondence with the questionnaire. A prototype consisting of 10 households was conducted to estimate the required time for reconstructing the entire dataset ($N=419$ households, $N=805$ individuals). The time needed was estimated at 727 hours, which was not doable for one person (i.e., PhD candidate, Farzaneh Barak).

Therefore, a team of nine of Prof. Melgar-Quinonez's undergraduate students was formed. They started collaborating on this project in March 2021. A workplan and timeline were distributed for ten weeks. Each student worked on an assigned part of the anonymized data under the Candidate's supervision (on average, 7-10 hours/week). The Candidate also conducted group and one-on-one training sessions (approximately 35 hours) to help students with data cleaning and to gain familiarity with the dataset and pro-WEAI questionnaire. During this process, all responses were checked one by one for skip patterns. Also, the distribution of missing responses was checked and recorded for later follow up. Any emerging inconsistencies were documented to minimize any loss of observations for the Index calculations.

The IFPRI team was consulted all decisions about occurring errors, and these decisions were documented accordingly. In close collaboration with the IFPRI team, some errors were identified in the questionnaire and do-files, which were appreciated by the IFPRI team and have subsequently been applied in the updated versions of the questionnaire and do-files (details were

described in the longer report of pro-WEAI data cleaning process shared with the NutriFish team). In addition to documenting data collection errors, a codebook and do-file developed by IFPRI were modified according to the adopted NutriFish's pro-WEAI questionnaire.

The project data cleaning was completed in early June 2021. Next, the Index was constructed, and the candidate consulted with IFPRI to ensure accuracy of corresponding tables and graphs. The main achievement of the data cleaning process based on generated results was that the loss of observations was minimized in the initial NutriFish pro-WEAI report ($n=381$, 385 , and 387 vs. $n=302$, 281 , and 302 households, women, and men respectively). Female-headed households were dropped from the dataset as recommended by IFPRI due to data entry errors in Module G7 ($N=23$) (details are provided in another report).