Traditional Food, Dietary Diversity and Nutritional Status of the Aguaruna in the Peruvian Amazon

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Your file Votre référence
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This thesis is dedicated to the memory of my grandfather Jack Staley

...an amazing man who tread softly on this earth
and warmed the hearts of all those in his path

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Indigenous Peoples have an intimate connection to the earth, which nourishes bodies and feeds spirituality. It has been the vision of Dr. Harriet Kuhnlein to promote and protect Indigenous Peoples' Traditional Food Systems and recognize the richness in traditional lifestyle. I would like to sincerely thank my supervisor Dr. Harriet Kuhnlein for introducing me to the realm of traditional food and for trusting me with this project. Her continuous support and guidance were essential in my understanding and growth as a researcher. I would also like to thank my committee members Dr. Timothy Johns and Dr. Olivier Receveur for their support and insight throughout my studies.

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Abstract

Aguaruna Indigenous People live along the Rio Cenepa in the Peruvian Amazon. This thesis describes the Aguaruna traditional food system (TFS) and defines its nutritional importance. Nutritional status of women and young children were assessed using anthropometry. Dietary intakes and dietary diversity were recorded using repeat 24 hour recalls. Subsequently, the relative nutrient contributions of local foods were analyzed. A market survey was conducted to compare the nutrient value and relative cost of seasonal local foods with imported products. Anthropometry suggested a healthy population, although the Agauruna had short stature. They purchased <1% of their food, and group dietary assessments estimated adequate intakes of energy, protein, fat, iron, zinc, vitamin C and vitamin A. Higher traditional food diversity was associated with greater macronutrient, vitamin and mineral intakes (Spearman's rho = 0.29 to r = 0.60). The Aguaruna TFS provides excellent nutrition and should be promoted and protected.

Résumé

Le peuple indigène, Aguaruna, habite le long du Rio Cenepa dans l'Amazone péruvien. Cette étude décrit le mode d'alimentation traditionnel des Aguaruna et son importance au niveau nutritionnelle. L'état nutritif des femmes et jeunes enfants ont été évalués en utilisant des mesures anthropométriques. Nous avons compilé des donnés sur la consommation et la diversité diététique avec des rappels de 24 heures. L'analyse subséquente des rappels a déterminé des contributions relatives aux nutriments des différentes nourritures régionales. Une analyse du marché a été conduite pour comparer la valeur nutritive et prix des produits locaux contre celles importés. Les mesures anthropométriques ont montré une population en bonne santé, malgré leur courte taille. Les Agauruna achète <1% de leur nourriture et l'analyse diététique a démontré une consommation adéquate d'énergie, de protéine, de gras, de fer, de zinc, et des vitamines A et C. La diversification diététique apporte une meilleure consommation des macronutriments, des vitamines et des minéraux. (Corrélation Spearman, rhô=0.29 à 0.60). Le mode d'alimentation traditionnel des Aguaruna procure une excellente valeur nutritive et pour cela, il devrait être protéger.

Contribution of Authors

Marion Roche, Master of Science candidate, worked with Dr. Harriet V. Kuhnlein, the thesis supervisor, who was the overall Principal Investigator of the Global Health Project. The candidate worked with Dr. Harriet V. Kuhnlein in the development of research questions and design of the adaptation of research methods for the specific Aguaruna study presented in this thesis.

Dr. Harriet V. Kuhnlein, Hilary Creed-Kanshiro, and Irma Tuestra were essential in the formation of community research agreements and community focus group sessions, prior to dietary data collection. Subsequently, the candidate along with three nutritionists from the IIN collected all data. Hilary Creed-Kanashiro gave insight into the cleaning and review of dietary recalls. Data entry was done in collaboration with a technician at the IIN. The candidate conducted all analyses and prepared the initial draft for the manuscript. Guidance and insight in interpretation and academic content was provided by Dr. Harriet V. Kuhnlein.

Table of Contents

List of Figures

List of Tables

1.0 Introduction

In this thesis the Aguaruna traditional food system (TFS) is described and assessed. This study is part of a 12 community Global Health Project, based with the Centre for Indigenous Peoples Nutrition and Environment (CINE) at McGill University, which aims to document TFSs of Indigenous People in various regions of the world, with the intention of incorporating this traditional knowledge into health promotion. This thesis contains: a literature review of topics directly related to the Aguaruna TFS, dietary assessment, nutritional status and dietary diversity; a manuscript for publication; and conclusions of the study and appendices adding information on study methodologies and the food system. Indigenous Peoples have generally enjoyed healthful diets, which meet nutrient needs, unless external factors limit ability to produce food. Dietary change has been attributed to decreased land access, shifts in lifestyle resulting in decreased time for traditional food acquisition, environmental causes and introduction of market foods (FAO/WHO, 2002).

A world wide nutrition transition is occurring as more and more people are adopting a "Western diet" characterized by consuming more animal foods, eating a diet with greater overall energy content, more fat, and decreased fiber (Popkin, 2001a). The nutrition transition is the result of modernization and globalization. Increased global accessibility to cheap vegetable oil, imported industrialized foods, animal fats, sedentary lifestyle, and mass media all play a role (Maire *et al.*, 2002). This shift in dietary habits, along with decreases in physical activity, lead to the "epidemiological transition": an increased prevalence of obesity and chronic non-communicable diseases especially diabetes mellitus type II, coronary heart disease, cancer and hypertension (Popkin, 2001b). For Indigenous Peoples who have traditionally consumed local foods the incorporation of low nutrient-dense market foods can lead to a significant decrease in diet quality if traditional local foods are replaced (Kuhnlein *et al.*, 2004). In addition to supporting health, TFSs hold great cultural value for Indigenous Peoples (Kuhnlein *et al.*, 2002).

To be able to promote and protect the TFSs of Indigenous Peoples, the local resources must be understood. There is need to document this biodiversity and understand its relationship to the health of communities (Johns and Sthapit, 2004). The Aguaruna live in the remote hills of the northwestern Amazon of Peru subsisting on a cassava based diet, complemented by hunting, gathering and fishing. In 1977, Berlin and Markell examined the household consumption patterns and nutritional status of the Aguaruna in an anthropological study. The specific dietary intakes of Aguaruna women and children not been reported previously.

Women and children in developing countries are generally at higher risk for nutrient inadequacies (FAO/WHO, 2002). Assessing the diet of a population involves collecting data on group dietary intakes, calculating nutrient levels of consumption and comparing these values with reference intakes (IOM, 2000a). Dietary diversity has also been an indication of nutrient adequacy in developing countries (Mirmiran *et al.*, 2004, Hatloy *et al.* 1998). Nutritional status, as measured by anthropometry, can be an indicator of individual status or used to estimate population prevalence of acute or chronic undernutrition, as well as overnutrition (WHO, 1995).

Defining the Aguaruna traditional food system, nutritional status and dietary diversity will foster an understanding of the local resources and the relationship to health within communities. The results of this study will be shared with the Organización de Desarrollo de Comunidades Fronterizas del Cenepa/ Organization of the Frontier Communities of Cenepa (ODECOFROC) community women's group. In the dissemination of results ODECOFROC will work with women from over 40 communities in the Cenepa area through capacity building activities in order to give these women the skills to be local nutrition educators, as part of local initiatives to promote local foods to improve health.

2.0 Literature Review

The literature herein being reviewed will be limited to that which directly contributes to an understanding of the nutritional status and TFS of the Aguaruna of the Peruvian Amazon, including insight into appropriate qualitative and quantitative methodologies for defining the TFS working with Indigenous Peoples in their communities.

2.1 Indigenous People

For the purpose of this document Indigenous Peoples will be defined as those meeting the following four criteria: 1) residence within or attachment to geographically distinct traditional habitat, ancestral territories, and natural resources in these habitats and territories; 2) maintenance of cultural, social, economic and political institutions separate from dominant societies and cultures; 3) descent from population groups present in a given area and 4) self identification as being a member of a distinct indigenous cultural group (Sims and Kuhnlein, 2003).

2.2 Traditional Food Systems

A TFS of Indigenous Peoples is defined as being comprised of all acceptable foods provided by the natural resources of a particular cultural group (Kuhnlein and Receveur, 1996). Inherent in this term are the socio-cultural values, preparation methods, acquisition techniques, use and nutritional impact associated with each food (Kuhnlein and Receveur, 1996). Rich protein sources such as insects, reptiles and small mammals are very nutritious foods consumed by Indigenous groups in various parts of the world, while both the cultivated and wild dark leafy greens pertaining to many TFSs are very high in carotene, ascorbic acid, iron, and calcium (FAO, 1997). Almost all traditional dietary patterns can sufficiently attain, and in many cases exceed, the nutrient requirements of a population group. When socio-economic factors affect agricultural production and limit capacity to purchase food or food choice is restricted by cultural practices, traditional nutritional patterns may be hindered (FAO/WHO, 2002). Importance should be given to defining traditional food systems and understanding the relationships between human health and biodiversity (Johns and Sthapit, 2004). In contrast to traditional food (TF), market food (MF) will be defined as those items which are imported to the community and sold in the community or purchased outside the community and brought back. Donated food (DF) refers to foods which are supplied to the communities from government or non-governmental organizations.

2.3 The Nutrition Transition

A world wide nutrition transition is occurring as more and more people are consuming a "Western diet" consisting of excessive energy intake, marked by higher consumption of animal foods, greater than 30% of calories coming from fat and a decrease in amount of cereal and fiber in the diet (Popkin, 2001a). This shift in diet alone or coupled with decreased activity level is accompanied by an "epidemiological transition" characterized by increased prevalence of obesity and chronic non-communicable diseases especially diabetes mellitus type II, coronary heart disease, cancer and hypertension (Popkin, 2001b). Infectious diseases continue to lead as causes of morbidity and mortality in the developing world, however there is dramatic rise in the incidence and prevalence of obesity and chronic non-communicable diseases (Maire *et al.*, 2002). In developing nations the nutrition transition has been linked to poverty and urbanization (Popkin, 2001a). In Latin America, overall obesity is increasing most evident in countries emerging from poverty (Albala *et al.*, 2001). This is explained by an energy imbalance resulting from decreased activity and increased consumption of high fat and high carbohydrate energy dense foods, which is observed in lowest income groups with improved means for purchasing (Uauy, *et al.* 2001). The nutrition transition is a consequence of modernization and globalization, often thought to be triggered by increased global accessibility to cheap vegetable oil and perpetuated by increased availability of locally produced and imported industrialized foods, animal fats, sedentary lifestyle, and mass media (Maire *et al.*, 2002). Industrialized nations are forced to absorb the constantly rising costs of research, treatment and secondary health care resulting from the increasing rates of chronic non-communicable diseases. These costs are beyond the financial capacities of the developing countries (Popkin, 2002). These fragile economies are further strained by the double burden of infectious diseases and under-nutrition and over-nutrition which is leading to obesity, diabetes and cardiovascular diseases (Monteiro *et al.*, 2004). Indigenous Peoples are being affected by the nutrition transition in both industrialized and developing countries (Albala et al, 2001, Maire *et al.*, 2002, Popkin, 2002). Before the turn of the 20th century most Indigenous Peoples were eating 100% TF, so dietary change can often be measured by percent MF being consumed (Kuhnlein *et al.*, 2004). A study looking at a total of 44 Yukon First Nations, Dene/Metis, and Inuit communities in the Canadian Arctic found that not only were there less fat, carbohydrate and sugar consumed on days where the diet included traditional foods, there was also higher levels of dietary protein, and many vitamins, minerals and micronutrients including vitamin A, vitamin D, iron and zinc (Kuhnlein *et al.*, 2004). Acculturation or loss of culture among Indigenous Peoples puts these groups at risk of non-communicable chronic diseases, while preservation of food culture and lifestyle can be protective. According to national anthropometry data, Bolivia is in a transitional state, yet for Indigenous Peoples maintenance of the Quechua language as well as residing in a rural community, have both been protective factors against overweight and obesity (Perez-Cueto and Kolsteren, 2004).

Not only is traditional food nutritionally beneficial to Indigenous Peoples, but access to these resources is also a Human Right (Kuhnlein et al, 2002). The Declaration of Atitlán, Guatemala of Indigenous Peoples' Consultation on the Right to Food recognizes that the right to food by Indigenous Peoples is not only a means of food security as the declaration states "*in no case may a people be deprived of its own means of subsistence*", but also an important aspect of social structure, language, culture, spirituality and identity. Kuhnlein *et al* (2002) suggest that "*to deny the right to food is to deny the collective indigenous existence.*"

2.4 Food System Assessment

To assess the food system of a group of people it is essential to evaluate the nutrient potential of a population, in comparison with actual dietary intake as well as the health consequences of the current diet. With Indigenous Peoples it is also essential to define the biodiversity of local resources to understand the full potential and consequences of loss of this source of dietary variety.

2.5 Nutrient Intake Assessment of Groups

Nutrient adequacy often refers to consuming amounts equal to or above recommended intakes (Ruel, 2003). In the FAO/WHO expert consultation it is mentioned that before Food Based Dietary Guidelines (FBDGs) can be implemented, the first step must be to compare dietary intake of a population to the reference standards (FAO/WHO, 2002). Methods for collecting dietary intake data of individuals within the group of study include 24-hour recalls, food frequency questionnaires, weighed food records and one day records (IOM, 2000a). The exception is the method of doubly-labeled water which is used only for total energy intake estimations. There is no "gold standard" for validating each of these methodologies. There are several challenges to obtaining dietary intake and each method has its inherent strengths and limitations. Bias can result in all methodologies from a systematic over/under-estimation of intake in individuals or groups often to differing extents depending on the culture. Another source of bias can result from inaccurate food composition databases (Beaton, 1994). Within subject variation can be minimized by repeat 24 hour recalls on non-consecutive days in order to improve estimates of usual intake (Nelson *et al.*, 1989), while still maintaining between subject variation which is sometimes lost with food frequency questionnaires or diet histories (Beaton, 1994). Consideration must be given to seasonality, especially in developing countries (Ferro-Luzzi *et al.*, 1987). Beaton (1994) emphasized that it is not possible to estimate dietary intake free of error; however, value must still be given to dietary intake data, and efforts made to recognize and minimize sources of error.

In order to approximate nutritional adequacy of a population it is essential to obtain accurate dietary intake as well as biological indicators such as biochemical markers, clinical analysis and anthropometry (IOM, 2000a). Current dietary assessment and planning in Peru are based on the United States National Academy of Sciences Dietary Reference Intakes (DRIs), which are comprised of four values for each nutrient. It is appropriate to use the DRIs to assess the dietary adequacy of healthy groups when the designated references are established. The DRIs are not intended for use in assessing individual nutritional intake due to the difficulties in defining individual requirements and usual intakes (IOM, 2000a). Consideration must be given to the variance in individual nutrient requirements as well as intakes within a population. Using the DRIs the adequacy of group intake can be assessed using either the probability approach or the Estimated Average Requirement (EAR) cut-point method (IOM, 2000a) Both methods require EAR values, which have been established for magnesium, phosphorus, selenium thiamin, riboflavin, niacin, vitamin B_6, folate, iron, zinc, vitamin B_{12}, vitamin A, vitamin C, and vitamin E. The EAR can be defined as "the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group." It is also possible to compare the mean intake of a group to the Adequate Intake (AI), as defined as "a recommended average daily nutrient intake level based on observed experimentally determined approximations or estimates of nutrient intake by a group (or groups) or apparently healthy people that are assumed to be adequate" (IOM, 2000a). An AI is available for calcium, fluoride, biotin, choline, vitamin D and pantothenic acid. The assumption of low prevalence of inadequacy of the above nutrients can be made when the mean intake for a group of apparently healthy individuals is greater than the AI. When the mean group intake is below the AI for a nutrient it is not appropriate to use these values to infer the extent of population inadequacy of a nutrient (IOM, 2000a).

2.6 Dietary Diversity

Dietary diversity is often promoted in guidelines for healthy diets (WHO/FAO, 1996). It can simply be defined as the number of foods or food groups within an individual or group's diet. This measure of variety is usually calculated by a simple count of foods or food groups consumed over a given reference period (Ruel, 2003). Studies have used reference periods ranging from 1 to 15 days (Drewnowski *et al.*, 1997). Some methods weight different food groups and account for portion size and assign a higher weighting to certain foods groups to follow the concept of the "dietary score" by Guthrie and Scheer (1981) and later modified by Kant *et al* (1991 and 1993). A review of research in dietary diversity in developing countries suggested that in these settings a simple food count or food groups count is the preferred methodology (Krebs-Smith *et al.*, 1987, Löwik *et al.* 1999, Taren and Chen, 1993, Arimond and Ruel 2002, Tarini *et al.*, 1999, Onyango *et al.*, 1998, and Ferguson *et al.*, 1993). It would be appropriate to measure dietary diversity in settings where there are meals shared from bowls, and therefore greater challenges to quantifying dietary intake (Hatloy *et al.*, 1998).

In developing countries dietary quality has often been synonymous with nutrient adequacy (Mirmiran *et al.*, 2004, Hatloy *et al.* 1998). Recent studies aimed at validating dietary diversity against nutrient adequacy in developing countries have shown a positive relationship also documented in industrialized nations (Mirmiran *et al.*, 2004, Hatloy *et al.* 1998, Torheim *et al.*, 2004). Research in Korea showed a strong relationship between a dietary variety score (number of food items), dietary diversity score (food groups) and Korean Recommended Daily Allowance (Kye *et al.*, 2004). Dietary diversity using both a number of foods (food variety score [FVS]) as well a count of food groups (dietary diversity score [DDS]), was validated against nutrient adequacy in Mali. In this setting regression analysis suggested that food groups were a slightly better indicator of nutrient adequacy than an individual food count (Hatloy *et al.*, 1998).

It is difficult to attribute child growth to single nutrient intakes in the diet, however there is evidence of a positive relationship between child growth and dietary diversity in many countries (Onyango, 2003). Analysis of the Ethiopia Demographic and Health Survey (DHS) showed a positive correlation between food-group diversity and height-for-age z-scores in young children using both a 24-hour recall and a 7 day recall (Arimond and Ruel, 2002). Hatloy *et al* (2000) found a strong relationship between growth and dietary diversity in Mali.

2.7 Nutritional Status Assessment

Anthropometric measurements assess body size and composition, and can reflect normal nutritional status, inadequate or excess food intake, insufficient exercise, and disease (WHO, 1995). These measurements can serve as a risk indicator for present malnutrition and may also be a predictor of potential increased future risk for increased disease or mortality (WHO, 1995). "Wasting" is a term to define weight-for-height z-scores < -2, or <80% of the NCHS standards among children. A prevalence of greater than 10% wasting on a population level indicates "alert", while greater than 15% to 20% of the population with anthropometry suggesting wasting being "serious" (WHO, 1986). "Severe wasting" is indicated by a z-score of less than -3. Acute malnutrition is classified by weight-for-height z-scores and/or edema. A height-for-age z-score, as measured in children of less than -2, would be termed "stunting", while -3 is the cut off for “severe stunting”. Prevalence of stunting can be an indication of chronic malnutrition. (WHO, 1986).

The Body Mass Index (BMI) as determined by weight/height^2 (kg/m^2) is an indicator of nutritional status in adults. A BMI less than 18.5 kg/m^2 is indicative of mild chronic undernutrition, while a BMI less than 16.0 kg/m^2 is alarm for severe chronic undernutrition. Overnutrition is set at a BMI of 25.0 kg/m^2, while obesity is defined at a BMI above 30.0 kg/m^2 (WHO, 1986). However, these cutoffs and measures should not be used independently from standardization for body shape (Collins *et al.*, 2000). One such consideration is the Norgan correction and Cormic Index to obtain the Cormic – adjusted BMI to account for a different proportion in length of trunk relative to the standard reference population (Collins *et al.*, 2000).

The Mid Upper Arm Circumference (MUAC) can be measured to assess potential energy deficiency in adults as well as children. It is sometimes appropriate to combine the BMI and MUAC in nutritional assessment (James *et al.*, 1994). MUAC-for-height and MUAC-for-age z-scores for use in children have been defined by WHO (de Onis *et al.*, 1997).

Food distribution can also be a measure for food security in terms of total food energy distributed to the population without differentiation by age or gender. This measure ignores mal-distribution of food, yet accounts for local climate, body weights of the population, allowances for regain of weight lost due to malnutrition and demographics (WHO, 1986).

2.8 Amazonia

Amazon forest, which spans 7.8 million km^2 and extends into nine South American countries, is home to many Indigenous Peoples (Dorea, 2003). The Peruvian Amazon covers 770,000 km^2 (Kalliola and Puhakka, 1994). According to the Peruvian National Census from 1993, it is estimated that 60,000 inhabitants are members of Indigenous groups in the Amazon region. With a population just over 38 500, Aguaruna are the largest of the 64 Indigenous groups living in the Peruvian Amazon (Brownrigg, 1996). The extreme variance in biodiversity and ecosystems within this zone is mirrored by a vast range of subsistence practices among Indigenous Amazonians. The western peripheral has the highest rainfall receiving between 2500 and 3500 mm annually with no month lower than 100mm. The season of lower rainfall is referred to as the dry season. This is high in comparison with central Brazil which typically receives between 1000-2000 mm/ year and has a dry season of 3-4 months (Prance, 1978). For these reasons a general overview of the Amazonian foods and diets is beyond the scope of this thesis.

2.9 Nutrition Status in the Amazon

There are few reports of nutritional status among Amazonian people. Anthropometric data for weight-for-height from the Curripaco and Yanomani of southern Venezuela, the Alto Xingu region of Brazil, and both the Yanomani, and Tukano of Columbia Amazon, suggest that most children were within normal range of the 80% standard of the Harvard growth standards and the 50^{th} percentile of the NCHS (National Center for Health Statistics,1977) growth curves (Dufour, 1992). An exception to this was documented in the western peripheral Amazon in both the Shipibo and the Aguaruna peoples, where high prevalence of thinness was reported (Behrens, 1984 and Berlin and Markell, 1977). Berlin and Markell (1977) found that 35% of the Aguaruna children ages 1 through 5 and 12% of school aged children and adolescents weighed less than 80% of the standard.

Height-for-age data are less available from past studies due to difficulties in defining the ages and birthdates of children (Dufour, 1992). Stunting is reported as 50% of the Shipibo children being under 90% of the standard, while 16 % of Mekranoti and 26% of San Carlos fell below this level (Dufour, 1992). Shipibo children under the age of 3 years were short in reference to the NCHS values, while length was shown to be increasingly lower than the standards with age (Hodges and Dufour, 1991). Tukanoan, Trio, Wajana and San Carlos children are reported to be very short, while the exception is the Xingu who had mean heights on or above the 50th percentile of the Harvard growth curves (Dufour, 1992).

A recent study of the Naporuna Indigenous People of the Amazon region of Ecuador with 189 mothers and their 347 children reported the prevalence of chronic malnutrition was 22.8%, severe chronic malnutrition was 7.5% and prevalence of underweight was 26.4%, with 9.8% falling below the cutoff for acute malnutrition and 4.9% severely underweight (Buitron *et al.*, 2004). A similar study in Amazonia in Ecuador found moderate chronic undernutrition was present in 28.8% and serious chronic undernutrition in 9.3%. Moderate acute undernutrition was reported in 8.4% of the population and severe acute undernutrition in 3.4% of the population (Quizhpe *et al.*, 2003).

Individual cases of defined marasmus or kwashiorkor malnutrition in the Amazon have been quite few: 0 cases in 60 Siona Secoya (Benefice and Barral, 1991); 3 out of 184 in a study with the Kayapo (Ayres and Salzano, 1972); 14 out of 293 Waorani (Larrick *et al.*, 1979) and 1 out of 112 Aguaruna (Berlin and Markell, 1977).

Adults indigenous to the Amazon region on average are shorter than the 10th percentile of the NCHS standard, with the exception of the Xikrin and Kayapo groups of Brazil (Dufour, 1992). The average weight for height of adults calculated as a BMI ranged between 22.2 and 25.0 kg/m^2 for numerous groups evaluated from Amazonia, indicating normal nutritional status (Dufour, 1992). The Aguaruna were the exception as many of the individuals were estimated to have a BMI of less than 18.5 kg/m^2 (Berlin and Markell, 1977). A study assessing the nutritional status of three different Indigenous groups from Brazil suggested that within the Amazon the differences from height were mostly due to differences in leg length rather than trunk length, as determined by sitting height (Santos and Coimbra Junior, 1991).

Determining nutritional status by means of looking at clinical signs and symptoms for undernutrition, as well as specific nutrient deficiencies, in the Amazon has proven difficult due to confounding causes imposed by the tropical environment. Aguaruna, Yanomami, and San Carlos children's hair was frequently described as lacking luster, sparse and dyspigmented, which can be interpreted as a sign of undernutrition in correspondence with the anthropometry; however, effects of sun and environment on their hair could not be ruled out. Hematomegaly (liver enlargement), a symptom of undernutrition was found in the Kayapo and Xavante children; however, likely a result of malaria infections (Dufour, 1992). Although, high prevalence of pale conjunctiva has suggested anemia in Tukanoan children and Aguaruna, biochemical analysis in the Aguaruna suggested healthy iron status (Berlin and Markell, 1977). Signs of vitamin C deficiency documented as bleeding gums were common among the Aguaruna and the Piapocos (Dufour, 1992). More recently, a study was undertaken to investigate the prevalence of anemia in schoolchildren in the Ecuadorian Amazon. In these school children the prevalence of anemia was found to be 16.6% with 75.5% of these cases termed as iron-deficiency anemia. It was concluded that anemia is not a serious public health concern for this population (Quizhpe *et al.*, 2003).

Virtually all of the Chivacoa Indigenous People of Venezuela were found to have parasites, however there was no relationship between number of species of parasites in an individual and nutritional status (Holmes and Clark, 1992). Among Ecuadorian school children parasitism was reported at 82.0% with *Entamoeba coli* and *Ascaris lumbricoides* most prevalent. In this study there were no relationships between parasitic infections and anemia. (Quizhpe *et al.*, 2003).

With modernization, other health problems are introduced into Amazonia including increased rates of overweight and obesity associated with acculturation (Holmes and Clark, 1992) and exposure to methyl-mercury through fish consumption as a result of industry such as gold mining (Dolbec *et al.*, 2001). Cash cropping was shown to have negative impacts on the Amazon diet with increased dependence on MF compounded by decreased activity levels (Zorini and Lombardi, 2002). Within the Peruvian Amazon it has been shown that men were in better health living in communities with greater adherence to traditional lifestyle than the Indigenous communities in permanent contact with the "outside" (Dricot-D'Ans, and Dricot, 1979). The traditional lifestyle of the Amazon was found protective against risks of developing hypertension, hypercholesterolemia and diabetes type II (Pavan *et al.*, 1999).

2.10 The Aguaruna

In this section the author includes several personal observations and communication along with the literature review, most of which dates from the 1970's and the 1980's.

Community Organization

The Aguaruna traditionally lived in dispersed hamlets of up to 6 households without any political affiliation except in times of war (Berlin and Markell, 1977). Centralization of households occurred when the Jesuit missionaries built schools in the area as part of a government funded project in the 1950's (Uriarte, 1976). Within the political organization of Aguaruna communities the leader is referred to as "apu" (quechua word for chief). In each community also has a vice apu, secretary, elected "vocals" and often a school council (Ramos Calderón, 1999).

Economy

The Aguaruna subsistence lifestyle is based upon shifting cultivation, gathering of wild plants, fishing and hunting. Positions which generate an income in the community are generally restricted to health promoters, school teachers, and government functionaries, with salaries of 320-500 soles/month (Ramos Calderón, 1999). There are also one or two vendors in each community with limited merchandise, including canned tuna, cooking oil and aluminum pots. Salaries are also received by individuals employed in government initiatives. Women's artisan groups make ceramics and jelly to be exported to larger centers for a small income (Personal communication with female elder from Wawaim). Within communities there is also occasional selling of wild game meats, shell fish, and some crops, such as peanuts.

The Aguaruna TFS

Aguaruna subsistence is comprised of a combination of agriculture, hunting, fishing and gathering. The majority of the Aguaruna TFS is obtained from agriculture in the cultivated land known as *chacra (*Ag. *ája*).

Agriculture

As seen throughout the Peruvian Amazon, shifting cultivation techniques are practiced. Land at higher altitude with good natural drainage is preferred. The process begins with the cooperation of a group of men in a general clearing of the land using machetes, which is then followed by cutting large trees, with the exception of some valued palms (Brown, 1984). After a few weeks of drying, the *chacra* is ready to be burned, the last step before cultivation can begin. The preparation of the chacra is avoided in the rainy months of January to April. The chacra is poly-cultivated, however, predominated by cassava. The "sweet" cassava (máma, *Manihot esculenta*) is the most important food in the Aguaruna TFS, and is harvested and consumed in large quantities daily. Berlin and Markell (1977) reported over 200 varieties of cassava in the Cenepa region. As many as 80 species are products of the *chacra* including tubers such as sweetpotato (*Ipomea batatas*), taro (*Colocasia esculenta*), sachapapa (*Dioscorea trifida),* papa china (*Xanthosoma sp.*) and chíki (*Maranta ruiziana*), bananas, plantains, papaya, peanuts and palms (Berlin and Berlin, 1978). The *chacra* is used almost exclusively for household consumption (Brown, 1984). Each *chacra* is cultivated for approximately 3 years, before returning to a forested area (Brown, 1984 and Personal communication with elder from Mamayaque).

Hunting

The Aguaruna are known to be very adept hunters. A male's reputation and self-esteem partly stem from his ability to obtain meat for his family (Brown, 1984). "*El monte*" is the term given to wild areas of jungle where the hunt occurs. Prime game animals for the Aguaruna include peccary, coati, paca, agouti, monkey, deer, tapir and many birds (Ross, 1978). The poison dart blowpipe is the traditional tool used for hunting birds and small mammals, however the 16 caliber rifle was introduced to the region in the 1970's and is now commonly used (Ross 1976 and Personal observation). Many families raise dogs for hunting ground dwellers such as armadillo and white-lipped peccary, which are found by the canine and killed with a machete. More frequently men hunt alone rather than in groups, with the exception being when a pack of coati are discovered; however, the incidence of this is becoming rarer (Personal communication with elder from Nuevo Tutino). Twice a year a group of men may leave a community to hunt animals that are scarce (Brown, 1984).

Fishing

There are five fishing techniques used by the Aguaruna: fish stunning with natural poisons; constructing small traps; netting and trapping; fishing pole and hook as well as spear fishing. Greatest value is given to fish stunning using the plants *barabasco* (timú, *Lonchocarpus sp.*) or *huaca* (basú, *Clibadium sp.*). This process involves the construction of barricades out of cane or bamboo, which are placed in the river. The collected *huaca* or *barabasco* is prepared by removing the leaves and grinding the plant.

It is then wrapped in banana leaves and transported to the stream or river where large quantities are submerged in a basket (Siverts, 1972). Men, women and children all wait down stream to catch the fish which will be forced to swim near the surface of the water due to lack of oxygen and will also swim into the barricades with the flow of the river (Brown, 1984). This means of fishing can also be done in a pond; however, this can have dire consequences on the fish population in a closed environment. For success of the fishing expedition it is important to have low flow in the river, making this technique virtually limited to the months with less rain: July to September in the Cenepa area (Guallart, 1976).

Gathering

El monte contains a wide variety of unique micronutrient dense food sources, including fruits, vegetables, mushrooms, insects, crustaceans, amphibians, reptiles and one culturally important bird called the *táyu* (*Steatornis caripensis*). Key fruits in the TFS include Mauritian palm fruit (áchu, *Mauritia peruviana*), ungurabi (Kunkúk, *Jessenia weberbauri*), guaba (wámpa, *Inga sp.*), *yarina, kunchai, macambo* and *llanchama* (Berlin and Berlin, 1978). Dark green leaves are another important product of *el monte*, which collectively share the term *éep* with the most common being *Anthurium sp.* (Brown, 1984). The palm heart can also be obtained as a vegetable, while one of the most treasured and preferred Aguaruna foods emerges from the fallen palm. A beetle lays its eggs in the rotting palm trunk and the delicious *suri* or palm larvae (Ag. *dukúsh*) are harvested when they reach about 7cm in length weighing, 10-15 grams each. Riverine creatures including snails, crabs, shrimp, frogs and turtles are collected in lesser amounts along the streams. Although not a huge caloric contribution to the diet, these foods from *el monte* provide vitamins and nutrients which may not enter into the diet otherwise. Some of the collected fruits and palms have been brought to the *chacras* for cultivation in recent years (Personal communication with male elder from Mamayaque and male elder from Nuevo Tutino).

Food Preparation Methods

The Aguaruna TFS involves mostly very simple food preparation methods. Most tubers are cleaned and then boiled or occasionally roasted on embers. It is also common to boil some fruits and vegetables, although many are also eaten raw. Wild meats are usually boiled, with the entire animal being placed in the pot. The meat is often served in one piece with fur and claws still intact along with the water in which it was boiled, called "soup". The term "*patarashka*" is given to a preparation involving wrapping the food item with banana leaves and then roasting it in the fire. *Patarashka* can include *suri*, small fish, snails, macambo seeds or animal organs in combination with green leaves, palm heart and mushrooms or any item alone. Plantains and bananas are boiled or roasted by placing the peeled fruit directly on the coals. Small birds, animals and macambo seeds are roasted on sticks. A fire is made by having three large logs (approx 20-30cm diameter) placed in a spindle-like fashion, which are progressively pushed towards the center as the wood burns. This setup is referred to as the stove. A pot can be balanced directly on the logs. *Suri* and frogs are often eaten raw (Ramos Calderón, 1999 and Personal Observation).

The exception to these basic food preparations is the culturally important and nationally renowned *masato* (Ag. *Nijamánch*). This lightly fermented pre-masticated beverage is made from the dietary staple, cassava. After being cleaned, the skin and fibrous core is removed in order to boil the cassava. After boiling, the cassava is then mashed into a paste using a large wooden stick (Ag. *shushún*). Women alone or in a group will place a portion of the mash into her mouth and chew the hot cassava allowing her salivary amylase to combine with the starches in the cassava. She will then spit the masticated cassava into a pot, repeating this process until all of the cassava is finished. This is left for 24 hours to ferment, at which point water is added and the drink is passed through a calabash colander before being served. For fiestas and community events the masato is left to ferment for at least 4 days to increase alcoholic potency (Personal communication with elders from 6 lower Cenepa communities).

Gender Roles in the Aguaruna TFS

Aguaruna subsistence is based upon gender specific division of domestic labour creating a mutual dependence of men and women for the survival of a household. This interdependency contributes to the solidarity of the household in Aguaruna society (Brown, 1984). The task of clearing the *chacra* using shifting cultivation is the responsibility of the man, while the sowing, cultivation and harvesting of crops is done by the women (with the exception of introduced crops). Hunting and spear fishing fall strictly in the male domain, while fish stunning using *barbasco* is performed cooperatively by men and women. Both genders gather wild plants from *el monte*. Food preparation is done by women, while the wood for the fire is collected only by men. Women have the role of infant and child care including feeding. Distribution of food among household members is related to labor tasks and is therefore not equal. The hunter has the option of whether or not to share wild meat with neighbours; however, he is expected to share with immediate family members. The division of this meat is such that the greatest portion goes to the adult male, less to women, and the children receive the least (Brown, 1984). The women determine which food items are brought back from the *chacra*, however certain foods are consumed by women and their children while working in the *charcra*. Plants harvested from the *chacra* are brought to the house, prepared and offered equally to all (Personal Observation).

Introduced Foods in the Lower Cenepa Communities

Raising domestic animals now contributes to Aguaruna food security. Most popular is raising chickens, turkeys and sometimes ducks. Eggs are also an important introduction to the diet with the sale of this product also providing some income. Pigs are moderately common and guinea pigs, imported from the Andean sierra, have had an overall insignificant contribution to the diet (Brown, 1984). Some varieties of palm were brought to the area as well as rice and corn, although the latter two are not heavily cultivated in the Cenepa area (Brown, 1984). Another impact on the food system of the Aguaruna is the PRONAA, the Peruvian National Food Aid Program (Grosh, 1994). This large scale food aid program targeting children, adolescents and women began food distribution, primarily in coordination with education institutions. At the time of this study PRONAA was functioning in the Amazonas district of Peru.

Sharing and Internal Trade in the Cenepa Food System

The exchange of food among Aguaruna does occur occasionally in the Cenepa area, and has been broken down into two conceptual models: 1) sharing of raw food and 2) offering of prepared food or drink (Brown, 1984). Exchange of crude plant products from the *chacra* is rare, as each domestic unit has staples of cassava, plantains and bananas consistently throughout the seasons. Common shared foods would be suri, palm fruits, fruits from *el monte* and fish. *Masato* is considered a social staple and is served whenever an adult visits another household. When there was sufficient wild meat, a hunter would share this protein source with other households (Ross, 1978).

Challenges to the Traditional Food System

A common theme to the nutritional concerns mentioned by lower Cenepa community members in a socio-health diagnosis was the scarcity of resources (INS, 2000). With the delicate subsistence relationship to the environment, food supply could be easily unbalanced with increases in population density (Brown, 1984). Johnson (1974) related the challenges in maintaining traditional food in the Alto Mayo Aguaruna to the formation of larger communities and greater distance between households and both the *chacra* and *el monte*. Aguaruna formerly lived in dispersed hamlets with 3-5 related households using the surrounding land for agriculture and just beyond this boundary was the entry point for hunting. When the farming land was no longer fertile, the Aguaruna would relocate (Brown, 1984). Schools were introduced to the region by Jesuit missionaries sponsored by the Peruvian government in the 1950's, and permanent communities emerged so children could arrive at school without being bitten by venomous snakes along routes from their homes. With this change in settlement patterns more households shift-cultivated the same immediate surrounding land which quickly became depleted and forced many to travel further by boat or foot to get to a *chacra* as well as to gather wood for fire. Greater travel was required to Virgin *monte* making protein sources of game and birds harder to obtain for reasons of over hunting, as there was insufficient density of animals in proportion to the increased size of communities (Brown, 1984). Johnson (1974) found that over a span of 4 years the time required for hunting animals had increased 5 fold in Alto Mayo communities. Recent studies reported average frequency of yearly wild meat consumption to be once every 15 days in the Cenepa region (INS, 2000). For economic reasons many of the Aguaruna of Alto Mayo communities began rice mono-cultivation with the support of government. The Aguaruna living along the lower Cenepa have not experienced the impact of an extreme agricultural shift towards mono-cultivation which exacerbates the scarcity of traditional resources (Brown, 1984). It has been calculated that a *chacra* of 0.25 hectares could sustain a family of 10 along the Cenepa River for at least one year (Berlin and Berlin, 1978), whereas in 1978 the rice cultivation ranged from 1-10 hectors of *chacra* per family. This use of land led to a marked decrease in overall potential dietary diversity (Brown, 1984). Other specific challenges to maintaining the diversity of the traditional diet included: limited area for gathering wild mushrooms, insects and fruits due to permanent housing; destruction of maize, squash, and peanuts caused by insect and rodents invasions (first noticed in 1998); high incidence of disease in small raised animals such as chickens, ducks, turkeys and guinea pigs and lack of technical governmental support in managing such outbreaks; lack of fish in the river and the instability of the new monthly PRONAA governmental food supplies of rice, sugar, tuna and oil (INS, 2000).

Aguaruna Perception of Health

In 2000 a health diagnostic survey was conducted by an anthropologist from the Peruvian Ministry of Health, on 7 selected Cenepa communities, including Mamayaque, Nuevo Kanam, Tutino and Wamem. Key informant interviews, representative community work groups, and open assemblies were used in order to deepen the understanding current social and health priorities. Key informants included bilingual teachers, women, community leaders, health workers or promoters, midwives and local plant experts (INS, 2000).

In discussing the Aguaruna perceptions of local illness the concept of "brujeria" or witchcraft was mentioned as the major cause of illness, which would be associated with accidental injuries and wounds, however the next condition of concern was parasites, considered to be of foreign origin (INS, 2000). Reported social problems affecting health of females in the lower Cenepa communities included suicide among young women, abandonment and neglect of women, and domestic violence (INS, 2000). The communities view men as being healthier, stronger, and better clothed than women and children (INS, 2000).

2.11 Rationale

Traditional diets generally meet population needs, unless limited or altered by outside influences. The cultural importance of foods to Indigenous Peoples must be recognized as part of the human right to subsistence. This study with the Aguaruna of Peru, is part of a 12 community Global Health Project which aims to document the traditional food systems for various Indigenous Peoples, with the intention of incorporating this local traditional knowledge into community health promotion.

The women's group of the lower Cenepa river organization ODECOFROC, expressed interest in collaborating with the IIN (Instituto de Investigación Nutricional/ Institute for Nutritional Research) in Lima Peru, and subsequently CINE and McGill University, to describe and understand the nutritional importance of the local diet and its health benefits. Recently, the communities in the lower Cenepa region expressed concern for their present and future food security as external influences could have consequences for land use, subsistence practices, dietary diversity, cultural prestige of food and overall nutritional quality of the food supply. To the best of our knowledge the most recent nutritional assessment of the Cenepa area was that of Berlin and Markell (1977), an extensive study which concluded dietary adequacy and general good health among the Aguaruna. The overall study design included collaboration with community members through focus groups, key informant interviews and innovative qualitative methodologies, in addition to the quantitative dietary intake measurements and anthropometry in order to establish the cultural and nutritional value of the traditional food system. Given the remoteness of the Cenepa Aguaruna, traditional lifestyle prevails; yet as outside pressures increase there is urgency to understand the Aguaruna traditional food system and its role in sustaining the culture, health and spirit of these communities.

This thesis includes exploration of the Aguaruna women's and children's anthropometry, dietary intake and dietary diversity, as well as descriptive aspects of the TFS, including an overview of the frequency of various food preparation methods and a market survey comparing prices of traditional and imported food.

2.12 Study Objectives

- To define the Aguaruna Traditional Food System of the lower Rio Cenepa region in collaboration with community members.

- To assess the dietary intake of Aguaruna women and young children (ages 3 to 6 years) in the study season (April-May)

- To define the nutritional status of Aguaruna women and young children by means of anthropometry

- To establish relationships between traditional food diversity and nutrient intake of women and children

- To perform a market survey comparing the nutritional value of purchasable local foods and imported market foods

3.0 Manuscript

Traditional Food, Dietary Diversity and Nutritional Status of the Aguaruna in the Peruvian Amazon

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3.1 Abstract

Introduction: Traditional food systems (TFSs) generally support healthy diets. Aguaruna Indigenous People live along the Rio Cenepa in the remote Peruvian Amazon and consume a cassava-based diet, complemented by shifting agriculture, fishing, hunting and gathering. Herein we have described and assessed the Aguaruna TFS.

Methods: Using anthropometric measurements, we established the nutritional status of women and young children. Dietary intakes and dietary diversity were recorded with repeat 24 hour recalls. Subsequently, we analyzed the nutrient contributions of local foods. A market survey was conducted to compare the nutrient value per price of seasonal local foods with imported products.

Results: Anthropometry indicated a healthy population, although Aguaruna had short stature. Group dietary data suggested adequate intakes of energy, protein, fat, iron, zinc, vitamin C and vitamin A. Higher traditional food diversity was associated with greater nutrient, vitamin and mineral intakes (Spearman's rho = 0.29 to 0.60). Aguaruna purchased <1% of their diet and preferred local foods, which offered better nutrient value per unit price.

Discussion: In this remote setting, traditional subsistence lifestyle supports good health. The study found that overall women and children had adequate diets, and greater traditional food diversity resulted in improved nutrient intakes. This study demonstrates that the Aguaruna TFS warrants promotion and protection.

3.2 Introduction

In the absence of external influences, subsistence lifestyle and traditional food systems have generally supported healthful diets for Indigenous Peoples (FAO/WHO, 2002). A TFS of Indigenous People is defined as being comprised of all acceptable foods provided by the natural resources of a particular cultural group (Kuhnlein and Receveur, 1996).

A world wide nutrition transition is occurring as more and more people are adopting a "Western diet" characterized by consuming more animal foods, eating a diet greater overall energy content, more fat, and decreased fiber (Popkin, 2001a). For Indigenous Peoples who have traditionally consumed local foods the incorporation of low nutrient-dense market food (MF) can lead to a significant decrease in diet quality, if local traditional food (TF) is replaced (Kuhnlein *et al.*, 2004). In addition to supporting health, traditional food systems hold great cultural value for Indigenous Peoples (Kuhnlein et al, 2002).

To promote and protect the TFS of Indigenous Peoples, the local resources must be understood. There is need to document this biodiversity and understand its relationship to the health of communities (Johns and Sthapit, 2004).

The Aguaruna live in the remote hills of the northwestern Amazon of Peru subsiding on a cassava-based diet, complemented by hunting, gathering and fishing. In 1977, Berlin and Markell examined the household consumption patterns and nutritional status of the Aguaruna in an anthropological study; however, specific intakes of women and children have not been reported.

By assessing dietary adequacy, dietary diversity, market food options and nutritional status of the remote Aguaruna, we will gain insight into the relationships between traditional food and human health.

3.3 Methods

3.3.1 Participatory Health Research

This study is the result of collaboration between the Center for Indigenous Peoples' Nutrition and Environment (CINE) of McGill University, Canada, the Instituto de Investigación Nutricional (IIN) of Lima, Peru and ODECOFROC (Organization for Development of the Frontier Communities of Cenepa), a non-governmental organization representing the Lower Cenepa communities.

3.3.2 Ethics

This study was based on the principles of Participatory Health Research following the Planning and Management framework specific to Indigenous Peoples (Sims and Kuhnlein, 2003). Informed consent was obtained on 3 levels; 1) an umbrella written research agreement with ODECOFROC; 2) informed written consent and research agreement with the 4 communities and 2 annexes included; and 3) individual oral consent or parental consent for all subjects including key informants. Ethics Approval was given by the Faculty of Agricultural and Environmental Sciences Committee on Human Research Ethics Review Board at McGill University as well as from the Institutional Ethics Board for the IIN, in Lima, Peru.

3.3.3 Study Communities

The study took place in 6 remote communities along the lower Cenepa River in the Amazonas District of Peru, South America. It is estimated that approximately 38,500 Aguaruna live in Peru and 8,000 along the Rio Cenepa. The Aguaruna communities involved in the study included Cocoaushi [Annex of Wawaim, (638, population, 101 families), Mamayaque (350 people, 65 families), Nuevo Tutino (110 people, 22 families), Tuutin (350 people, 61 families), Pagki (60 people, 10 families) and Nuevo Kanam (Annex of Tuutin) (217 people, 47 families) (SICNA, 1999) (Figure 1.0).

The study took place in the months of April and May, 2004. In the Aguaruna culture the seasons are referenced by both animal and plant food sources, with the hunt of animals following under the domain of men's roles and the harvest of plants corresponding to the responsibilities of women. The months of April and May are known as *Sakamtín*, meaning time when the wild animals are thin and fishing is very difficult. In terms of vegetation these same months are defined as *Kutsatín*, which is known as the season "del chaparrón", or heavy rains, and defined by the harvest of the "sachapapa" (Galdo Pagaza *et al., undated).*

3.3.4 Study Overview

A total of 49 women were included in the study. Of these women 36 had children between the ages of 3 and 6 (23 had both). The research with mothers and children was comprised of: 1) repeat 24-hour dietary recalls; 2) food frequency questionnaires; 3) anthropometry and 4) child health reports. When a mother had more than one child between the ages of 3 and 6, one was randomly selected using a coin toss. A market study was conducted to compare pricing of local and imported food items. All interviews were conducted in Spanish with translation to Awajún (Aguaruna language).

3.3.5 Sample Recruitment

Inclusion in the sample required a mother to be 1) self-identified as Aguaruna and 2) at least one child under the age of 6. Women who were working as community nutrition promoters, indicating they had received capacity building in nutrition, were excluded from the study. Additionally, women who had lived outside of the Cenepa region for more than 4 months consecutively for reasons other than visiting family were excluded. This automatically excluded the few women who earned a salary as either teachers or health workers, as they would have received training outside of the lower Cenepa region. All women meeting the entry criteria from the lower Cenepa communities of Cocoaushi (Annex of Wawaim), Mamayaque, Nuevo Tutino, Tuutin, Pagki and Nuevo Kanam (Annex of Tuutin) were invited verbally to participate in the study by local nutrition promoters and community leaders. Transportation by boat was provided to those individuals within the community limits living on the other side of the river. Additionally, interviewers walked to more remote houses up to a distance of one hour travel time. Reasons for refusal included lack of time due to subsistence practices, skepticism of study and need to care for an ill family member.

3.3.6 Free Food List and Short List

In order to establish the Aguaruna food system, a free food list was obtained through interviews with 9 individuals recognized as having knowledge of the local food system from the 6 study communities. The items from these interviews were presented to 25 adults in 3 community focus group meetings of 2.5 hours in duration, in

Mamayaque, where a consensus as to the accessibility, preferences (likes) and seasonality of Aguaruna food items for the lower Cenepa region was established. Following the food list which was comprised of 219 items, 5 community experts in hunting(men) and harvesting(women) were interviewed to establish preparation, related costs, amount harvested per household and community per year, seasonal accessibility by month, popularity and cultural importance of all items in the Free Food List. Based on this exercise a short-list of 34 potential micro-nutrient food items, was created for the April-May study to be used in the: 1) food frequency questionnaire; 2) card sort; 3) complementary food attributes for infants; 4) food attributes for children ages 2 to 12; and 5) food taste scores. This thesis includes data from the food frequency questionnaire.

3.3.7 Dietary Recalls

A total of two 24-hour dietary recalls was obtained from 49 mothers and 34 children with a separation of 3-4 days between repeat recalls (Basiotis et al, 1987). During the interview, several cassava, *sachapapa*, bananas and plantains with known weights were used as references, as has been shown to improve the quality of dietary recalls (Cypel *et al.* 1997). Cups, plates and bowls, and pinig *(bowl for drinking)* found in the communities were used as references for quantifying food consumption. Women were also asked to bring bowls and plates to the second interview for measurement if it was not identical to the references. A food balance scale with precision of 1 g was also used during the interviews, and women and community members were asked to bring specific local food items to help establish reference weights. Where possible five to ten of each fruit or vegetable or invertebrate was weighed and averaged to obtain crude and edible weights. For wild animals the different cuts and body parts were measured with indication as to portion size for adults and children by a group of women in the community. In cases of less available foods the local reference weights were established after the recalls. For each food item the preparation method was recorded as well as the individual in charge of preparation and source of the food. Community focus groups helped establish local portion sizes and preparation methods. Mothers reported foods consumed for themselves and for their children. To enhance recall ability, for mothers and children the daily activities such as school attendance for children and going to the chacra for both women and children, were recorded chronologically and used as prompts to help define which foods were consumed.

Dietary recall data were reviewed, cleaned and food codes were added corresponding to the IIN (Instituto de Investigacion Nutricional) food composition table of Peruvian foods. Eleven food items were added from other tables using the international literature for food composition (USDA, 2004, Wu Leung *et al*, 1972, Wu Leung and Flores, 1961, and Herrera *et al.*, undated). Using available genus and species information as well as local descriptions, the following substitutions were made: zinc-36 foods, fiber-2 foods, calcium-3 foods, vitamin C-8 foods, vitamin A-24 foods and iron-3 foods.

Daily intake for each nutrient for each individual was obtained by averaging the repeat 24 hour recalls on non consecutive days. Means individual intakes were then used to find a mean intake for the groups; mothers, lactating mothers, children 3 to 4 years, and children 4 to 6 years. As local standards on nutrient requirements were not available, group means, medians, and quartiles were compared to the DRI reference standards (EAR, AI, AMDR) for macronutrients, vitamins and minerals (IOM, 2000c, IOM 2000c, IOM 1997, IOM 2002). Energy and protein intakes were compared to the WHO suggested references (WHO, 1985).

3.3.8 Traditional Food Diversity

A Traditional Food Diversity Score (TFDS) was calculated by assigning a 1 point value to each local food in the diet as reported in 24 hour recalls. An individual's TFDS was the sum of points given to food items reported in repeat 24 hour recalls. These TF included all foods obtained through cultivating, hunting, gathering, fishing and raising animals. TFDS were then related to an individual's mean daily nutrient intake as calculated from the two 24 hour recalls, using a non-parametric Spearman's rho correlation. Statistical analysis using the parametric Pearson Correlation gave similar results.

3.3.9 Food Frequency Questionnaire

A total of 34 food items were included in the Food Frequency Questionnaire. The trained interviewer asked mothers how frequently the 34 items were generally, consumed in the current season. Each mother was also asked if the household ate each of the 34 foods in the previous seven days. A reply of "yes" was assigned a value of 1, while "no" was assigned a value of 0. Researchers totaled these values to estimate the Weekly Diversity Score (WDS). Information was collected for a measure of dietary diversity and is not intended as an estimate of quantitative consumption.

3.3.10 Nutrient Contributions of Local Foods

To establish the current importance of certain foods in women's and children's diets, we analyzed the recalls to rank how foods contributed overall energy, protein and fat to the diet. We repeated the analysis for total calcium, iron, zinc, vitamin C and vitamin A (RE).

3.3.11 Market Survey

During the study season of April to May a market survey was conducted in 4 of the 6 study communities to see which local TF and MF could be purchased in Peruvian Nuevo Soles (sol) worth 0.36 to the Canadian Dollar (CAD). We performed an inventory of all seasonally available MF and then asked vendors the price of each. We also priced available local produce and game meat in the same 4 communities. We confirmed these prices with community members in a focus group. Where possible we averaged prices between communities, although we noted very little variation. Relative nutrient /price value of both TF and MF were calculated by dividing the nutritional composition of the foods by the price per 100 g edible weight.

3.3.12 Anthropometry

For children ages 3 to 6, height, weight and mid-upper arm circumference values were obtained. The anthropometric measurements for adult women included height, sitting height, weight and mid-upper arm circumference. Sex and age of children as well as the mother's age, were reported by the mother. Anthropometry was not available for 2 children.

Height was measured using a vertical measuring board with an inserted metric ruler, with a horizontal headboard. Given the uneven nature of the mud floors in some of the communities, a level was used to find a flat surface to minimize error in measurement. Subjects were asked to place their heels together with weight distribution centered. The subject was positioned erectly with the line of vision parallel with the floor with arms hanging freely. Heels, buttocks, back and head were in contact with the vertical board. The horizontal board was brought down to the topmost point of the head as the head positioned was maintained. Subjects were barefoot and in light clothing with hair ties removed. The height was recorded with a precision of 0.1cm (WHO, 1995).

Sitting Height was performed with the use of a measuring stick and level with two observers. The woman was asked to sit on a table with legs hanging over the edge and hands placed upon her thighs. The woman was positioned as erect as possible with pressure applied simultaneously on the lumbar region and sternum, followed by pressure on the mastoid process. The line of vision was parallel to the ground. The level was placed on the top most point of the head and a measuring stick was used to measure the distance between this point and the table. One observer maintained the posture and the level, while the other performed the measurement with the measuring stick. This is an adaptation to a sitting board given the remote setting, low roofs and uneven mud floors. The sitting height was recorded with a precision of 0.1cm (WHO, 1995).

Weight was measured using a level and a digital Salter® bathroom scale. A level was used to determine a flat ground given the surface was uneven mud floor. The scale was calibrated using a 5.00 kg weight. Women were weighed in undergarments and a skirt and shirt. Reference clothing was measured and an estimated weight of 200g was subtracted from the mother's weight. Children were weighed in light clothing (with the use of reference clothing was estimated to be 100g), a value which was subtracted from the obtained weight. Diapers were not used in the study communities. Women and children were weighed by standing on the scale independently. The weight was recorded with a precision of 100g (WHO, 1995).

Mid-Upper Arm Circumference (MUAC) was obtained using a graduated, inelastic, flexible measuring tape. The subject was standing erectly with arms hanging freely at sides with palms facing medially. The measuring tape was placed at the midpoint determined to be the distal point of the olecranon process and the lateral point of the acromion. The measuring tape was placed snugly to the skin without compressing the skin. The MUAC was recorded with a precision of 0.1cm (WHO, 1995).

3.3.13 Children's Health Information

Thirty-five mothers were asked to recall their child's health history during the past month, from 2 years of age to the present age and the age of 0-2 years. The information pertained to: vitamin A supplementation; night blindness and recognition of photos of Bitot's spots, corneal xerosis, and corneal ulcerations and keratomalacia (Blum *et al.*, 1997); parasites and helminthes and treatment with antihelmintic medication; diarrhea episode frequency and duration; dengue incidence and duration; malaria infection and duration; and incidence and duration of colds, influenza and fever. We used ANOVA to establish if relationships existed with reported health and anthropometry z-scores.

3.3.14 Statistical Analysis

All statistical analysis was performed using SPSS 11.0 for Windows (SPSS, 2001).

3.4 Results

3.4.1 Dietary Intake

An analysis of repeat 24 hour recalls suggested general dietary adequacy for Aguaruna women and children. The dietary recall analysis was done for 19 women, 23 lactating women, 19 children aged 3 to 4 and 17 children aged 4 to 6 (Tables 3.1 to Table 3.4).

Energy and protein intakes are compared with the suggested requirements from the WHO (1985) using an activity level assumed to be moderately active. This activity level was determined among the Tatuyo people who also live in the Northwestern Amazon, and practice swidden horticulture (Dufour, 1984). For the 4 to 6 year olds in our study, the suggested WHO energy and protein requirements of kcal/ kg body weight, and protein/kg body weight for boys 5 to 7 were multiplied by the mean Aguaruna weight for this group. Children under 4 in our study were compared to the kcal and g protein/kg body weight requirements for boys age 3-5, multiplied by the mean Aguaruna weight (WHO, 1985).

Energy intakes were quite high. Median and 25th percentile energy intakes exceeded the suggested requirements for all groups. There was, however, large standard deviation in daily energy intake between individuals. This may be partially explained by a subsistence strategy of eating produce and game when it is available, as there are essentially no storage or preservation methods that in the Aguaruna food system. This can lead to high variation within an individual's daily intake

Protein intake seems adequate for mothers and children, and is above the WHO suggested requirements for each group (median intakes were above the requirements).

This may be appropriate given that much of the protein was from plant sources and not as absorbable as milk and egg which were used to calculate the requirement (WHO, 1985).

The Acceptable Macronutrient Distribution Ranges (AMDRs) for adults are 45 to 65% carbohydrate, 10 to 35% protein and 20 to 35% fat. The median distributions for women and lactating women respectively were 71.1% and 69.9% carbohydrate, 12.1% and 13.0% protein, 12.1% to and 16.5% fat. Fat intakes were lower than recommended for women and lactating women as a percent and this may be a result of the high overall energy intake coming from plant based dietary staples.

Energy distributions of children's diets from carbohydrate, protein, and fat were compared to the AMDRs (IOM, 2002). Median contributions of carbohydrate were 69.3% and 57.9 % among 3 to 4 years olds and 4 to 6 year olds respectively. The 4 to 6 year olds were within 45 to 65% suggested distribution while 3 to 4 year olds were slightly above. For protein the AMDR is 5 to 20% for younger children, which puts the median protein contribution of both Aguaruna groups of children within the appropriate ranges: for the 3 to 4 year olds the median was 11.7%, and for the 4 to 6 year olds the median was 10.1%. The AMDR for fat is 30 to 40% for 1 to 3 year olds, which was above the median of 20.5% fat intake of the 3 to 4 year olds, while the 4 to 6 year olds were at the upper end of the suggested AMDR with a median intake of 35.4%. The AMDR for 4 to 18 years is 25 to 35%.

All groups had median calcium intakes below the suggested AI values, however this not necessarily indicate population inadequacy (IOM, 1997). Women had the 25th percentile intakes above the EAR for zinc, while the median zinc intakes were just above the EAR for lactating women (IOM, 2000b). Iron and zinc intakes at the 25th percentiles of Aguaruna children were above the EARs. Among women and lactating women the 25^{th} percentile intakes of iron were above the EAR. Overall, this suggests general sufficiency in these minerals in the Aguaruna diet. Vitamin C consumption in all study groups exceeded the EARs (IOM, 2000c). With the exception of lactating women, mean and median intakes of Vitamin A (measured in retinol equivalents) were at or above the EARs. The mean intake of lactating women was just below the EAR, which gave insufficient reason to assume inadequacy among this group (IOM, 2000b).

The most common food preparation method for the Cenepa Aguaruna was boiling, which was done for foods such as cassava, plantains, bananas, *sachapapa*, taro, Mauritian palm fruit, peach palm, palm heart, *suri*, eggs and animals. Many fruits and vegetables including bananas, papayas, oranges, Mauritian palm fruit, *sachamango*, *macambo* and palm heart were eaten raw. It should also be noted that children and adults enjoyed eating raw *suri*. *Chapo* and *pururuca* were prepared drinks made from boiled ripe bananas. If sugar was added it was called *pururuca*, otherwise the basic water and banana mixture is referred to as *chapo*. *Masato* continued to be a preparation with great cultural importance as well as the most time consuming and labour intensive of all preparations, using either cassava or peach palm. Preparations called "soup" included boiled palm heart, animals, *suri, eep*, and/or mushrooms, and referred to an item being served in the water in which it was boiled. Juices were most commonly made by the women working at the school "kitchen" and included fruit, water and sugar. *Patarashka* was the process of wrapping items such as mushrooms, *suri*, snails, *eep*, and macambo seeds into banana leaves and cooking them on hot coals. Roasting was done by placing food directly on the coals as was done with plantains and *sachapapa* or by putting the food on a small stick skewer, as for *macambo* seeds and small birds.

Over ninety-one percent of mothers' foods reported in the 24-hour recalls were prepared by the mother herself, 6.5% were provided from donated foods and 1.3% foods were given by the grandmother or mother-in-law, 0.3% was from a neighbour and 0.3% was purchased. Children had 79.9% of food prepared by their mothers, 18.0% provided from donated foods, 1.4% from a relative, and 0.5% purchased, and 0.1% from a neighbour (Figure 3.2).

3.4.2 Traditional Food Diversity

The TFDS ranged from 2 to 20 for the women with a median of 9 and a mean of 9.5 ± 3.5. For children the TFDS ranged from 2 to 17 with a median of 8 and mean of 8.7 ± 3.6. Statistical analysis indicated that higher TFDS was associated with higher nutrient intakes for many vitamins and minerals in both women and children (Table 3.6). Greater TFDS was associated with higher dietary protein, fiber, calcium, iron, thiamine, riboflavin and vitamin A among women and children. Higher dietary fat, phosphorous, zinc, niacin, ascorbic acid and folic acid were correlated with greater diversity scores for the women. There was no relationship between TFDS and total energy intake in either group.

The TFDS, as determined through the 24 hour recall exercises, correlated positively to the WDS. The correlation coefficient between the 2 diversity scores was 0.47 ($p<0.01$ 2-tailed) for mothers, and 0.56 ($p<0.01$ 2-tailed) for children.

3.4.3 Nutrient Contribution of Local Foods

The high dietary energy sources of cassava, bananas, *sachapapa* and *masato* were consumed daily by the majority of the population in large amounts (Table 3.7), and consequently do provide many nutrients. More micronutrient dense foods were successful in providing vitamins and minerals to the population, even though consumed in smaller portions by fewer individuals.

To define the individual food sources of nutrients in the diet analysis was done to rank the foods in terms of quantity of nutrient provided to the two groups: mothers and children as demonstrated (Tables 3.8a to 3.9j).

Cassava provided the majority of dietary protein and fat and was consumed by all women in average daily amounts of over 1kg. Armadillo, although only consumed by 9 women in an average portion size of 180g, made the next greatest protein contribution. Agouti (rodent) was also one of the top 15 protein contributors for women. Chicken, turkey and chicken egg, raised at the household level, contributed much protein. Good plant sources of protein and fat included palm heart, peanuts and *macambo* seeds for women and additionally *sachamango* for children. *Suri* should be noted was a unique and valuable source of animal fat for both women and children, with a serving size of approximately 4 x 10g larva, supplied significant amounts of fat to the population. Fruits from the Mauritian and peach palms were major contributors of fat to the diet.

Donated milk (canned milk), consumed by 8 women and 10 children, was a large contributor of group dietary calcium. In terms of local foods, calcium was supplied primarily by cassava, however, other important more calcium dense local food sources included palm heart, *sachamango*, *maca*, taro and sweet potato. Donated beans also provide calcium to children.

Suri was the only animal source of iron which ranked among the top ten for children, while agouti and armadillo ranked highly for women. *Maca* is the most iron dense of the tubers, and was ranked 6^{th} for women with only one woman consuming 356g. In addition to the dietary staples; sugar cane, taro and palm heart were plant sources of iron for women. Beans, plantain, palm heart, taro and cocona provided iron for children.

Zinc was provided by the staple tubers and bananas and additionally by donated beans and rice for children, while key local micronutrient dense sources were raw peanuts, *macambo* seeds, armadillo, turkey and *suri*. Papaya and oranges provided vitamin C to both groups, while additional sources for women included cassava leaves, and *eep* (leafy greens) and *sachamango*, sweet potato and coco fruit for children.

Vitamin A was provided mainly by non-staple sources including agouti, peach palm *masato*, sweet potato, paca, and armadillo for both groups as well as collared peccary for the mothers and chicken liver, chicken egg and papaya for children. In both groups, evaporated milk contributed significantly.

Wild game meats including armadillo, agouti, paca and collared peccary played a significant role in providing dietary fat, protein, iron, zinc as well as vitamin A.

Donated foods including white rice, beans, evaporated milk, canned tuna and sugar (for children's juice) provided energy and nutrients, however, these nutrients were also available in local foods. According to elder interviews and community focus groups, local sources were more culturally acceptable. Individuals who consumed more donated foods did not have significantly different energy intake, which suggested that imported foods did not supplement the diet, but rather replaced local foods. The lunch time meal of rice, beans and tuna was provided by the PRONAA to give students a healthy mid day meal while at school and served this purpose. Thus, donated foods may be able to play a role in potential seasonal micronutrient availability shortfalls in the food supply. Short falls were not observed in the study season.

Potential initiatives for enhancing micronutrient density of the diet should focus on the diversification of *chacras* so as many households as possible include foods such as raw peanuts, sweet potatoes, taros, peach palm fruit, *maca*, *macambo* seeds, *sachamango* which, in addition to energy, also provide essential vitamins. *Suri* is another food item which showed promise in providing protein, fat, iron and zinc.

3.4.4 Market Survey

As community members earn low wages for government sponsored jobs (teachers, health workers and local political positions) food purchase increases. With a shift from traditional lifestyle, the food patterns would also change to increase MF. Table 3.10 shows relative nutrient /price value of both TF and MF in the lower Cenepa area. According to the market survey analysis, the best kcal/sol energy foods were peanuts (5590 kcal/sol), cassava (3240 kcal/sol), *suri* (1280 kcal/sol), sugar (1267 kcal/sol) and rice (1196 kcal/sol). Some of the best protein values were peanuts (241 g/sol), snails (169 g/sol) and suri (85 g/sol) which were followed by the mild meats wild boar (42 g/sol), armadillo (41 g/sol), and deer (38 g/sol). Highest fat per sol sources were peanuts (482 g/sol), vegetable oil (143 mg/sol), *suri* (96 g/sol) Mauritian palm fruit (50 g/sol). Vegetable oil was the 2nd best value of fat per sol, however, it does not supply other minerals or vitamins. Snails (1580 mg/sol), peanuts (660 mg/sol), cassava (500mg/sol), and Mauritian palm fruit (148 mg/sol) were the best values for calcium. Iron was highest per price unit for *suri* (53.5 mg/sol), snails (20.0 mg/sol) and armadillo (15.6 mg/sol). Cassava (614 mg/sol) and oranges (461 mg/sol) were the best value for vitamin C. Mauritian palm fruit (1527 μg RE/sol) was clearly the best value for vitamin A while peach palm fruit (350 μg RE /sol) armadillo (321 μg RE /sol) , chicken egg (273 RE μg/sol), snails (260 μg RE /sol) were also good sources.

The concept of empty calories was illustrated by nutrient value of soda pop which provides only energy, and the vegetable oil which only provides energy and fat. Sugar, cookies and crackers also showed little vitamin or mineral benefit. Rice and tuna were the most nutrient dense MF options, although not the best value of nutrient for their cost. Additionally, rice may limit overall diversity in the diet at a household level as rice is prepared alone whereas tubers can be boiled with other ingredients, or the water can be used subsequently (Mauritian peach palms, *suri*, wild meat, chicken or palm heart). Tuna also introduces waste (empty can) into a very ecologically sound diet with only biodegradable refuse.

As money is introduced into the communities, value must be given to these traditional foods on all levels: cultural, environmental and nutritional.

3.4.5 Anthropometry

Mothers

The subjects were 49 mothers ranging from 16 to 61 years of age with a mean age of 27.2 years ± 9.0 SD. The anthropometry for the one mother under 18 years of age was excluded from analysis. The mean standing height for the Aguaruna women was measured to be 148.4 cm ± 4.7 SD and a range of 139.2 to 163.5 cm. The mean weight for this group is 48.1 kg ± 5.6 SD, with a range from 37.7 to 61.5 kg. Calculations of BMI for this population estimated a mean of 21.8 kg/m^2 ±1.9 SD. The range for measured BMI was 18.23 to 26.16 kg/m^2. Only one woman was below the 18.5kg/m^2 measure indicative of mild chronic undernutrition (WHO, 1995). There were 3 women above the BMI of 25.0 kg/m^2 suggesting moderate overweight (WHO, 1995) (Figure 3.3). The mean sitting height was 77.5 cm ± 3.92 SD, with range of 70.4 to 85.6 cm. The Cormic Index for this group as calculated as sitting height/ standing height was 0.53 ± 0.01 SD with range 0.51 to 0.56. The Cormic adjusted standardized BMI (BMI_{std}) was calculated by adding the difference between the observed BMI (BMI_{ob}) from the population estimated BMI (BMI_{es}) to the using the following formula from Collins *et al.*2000:

$$BMI_{std} = BMI_{0.52} + (BMI_{ob} - BMI_{es})$$

Where: $BMI_{0.52}$ is the BMI at an estimated Sitting Height to Standing Height ratio of 0.52. Using the computation $BMI_{0.52} = 1.19\ (52 - 40.34) = 21.54$. The BMI_{es} women is calculated by using the Equation $BMI_{es} = 1.19 * \text{Cormic Index} * 100 - 40.34$.

For Aguaruna women the equation used was $BMI_{es} = 1.19\ (53) - 40.34$ and was equal to 22.73. The BMI_{ob} is the observed BMI as calculated by measured standing height and weight.

Using the Cormic Index adjustment the BMI, a mean 20.57 kg/m^2 ± 1.83 SD was calculated. The range of values for the adjusted-BMI was 17.04 to 24.97 kg/m^2. By implementing the adjusted Cormic Index for this population there were 6 women with

BMI calculations < 18.5 kg/m^2 and there are no individuals classified as overweight with a BMI >25.0 kg/m^2 (Figure 3.4).

The mean for mid upper arm circumference (MUAC) was 24.83 cm ± 1.74 SD, with a range of 22.0 to 29.0 cm. There were no women below the MUAC of 22.0 cm below which can be indicative of poor nutritional status (WHO, 1995). There were no cases of individuals being below both BMI and MUAC cut-offs, which has been suggestive of undernutrition (James *et al.* 1994) (Figure 3.5). The measurement of MUAC was correlated with BMI and found to have a correlation coefficient of 0.663 ($p < 0.01$). The MUAC was more strongly correlated with the Standardized BMI with a coefficient of 0.729 ($p<0.01$).

Children

Of the 36 children in total, there were 8 children (22%) with height-age z-scores (HAZ) below - 2 SDs, 6 children (17%) below -3 SDs, and 3 children (8%) under the – 4 SDs of the NCHS standard. Using these criteria the estimated, prevalence of stunting was therefore 49 % and severe stunting was 26 % in the population. The HAZ ranged from -4.52 to 0.56, with a mean z-score of -2.18 ± 1.16 SD (Figure 3.6 to 3.7). The weight-for-height z-scores (WHZ) ranged from -1.24 and 1.71 with a mean 0.00 and a standard deviation of 0.70 (Figure 3.8 to 3.9). Mid upper arm circumference (MUAC) measurements were between 13.2 cm and 17.7cm with a mean of 15.27 cm ±1.00 SD. The MUAC for Height Z-scores in children ranges from -2.21 to 1.12 with a mean of -0.97 ± 0.75 SD (WHO, 1997) (Figure 3.10). There was no significant difference between the HAZ, WHZ or MUAC for Height Z-Scores of boys and girls. There was a correlation coefficient of 0.619 ($p<0.01$) for the relationship between MUAC and WHZ.

Among the children in the study there was no evidence of acute malnutrition as determined by wasting with a WHZ of less then -2SDs and/or a MUAC of less than 12.5 cm (James et al, 1994). All HAZ, WHZ, and MUAC-for-height z-scores were calculated using Epi Info Version 3.3 (CDC, 2004).

3.4.6 Children's Health Information

According to mothers, only 1 of the 35 children had been given a vitamin A supplement, but the supplementation for this one child could not be confirmed with health records. It should be noted that Peru does not have a national vitamin A supplementation program (FAO, 2000). Night blindness was not reported as a problem in any children. There was only one mother who said she has seen a child resembling keratomalacia from the photos shown of Bitot's spots, corneal xerosis, and corneal ulcerations and keratomalacia. Eighty percent of mothers reported that their children had parasites at time of the study, 20% were unsure, and 37% of the children had been given Albendazol in the last month. All of these children were reported to still have parasites at the time of the interview. Ninety-two percent of children had parasites between the age of 3 and time of interview, while 73% of mothers reported that children had parasites during the first two years of infancy, 21% said their child did not have parasites during infancy, and 6% were unsure. Fifty four percent of the children had ever received medication for parasites or worms. Forty percent of the children had an episode of diarrhea within the previous month, and 35% had an episode of fever, cold, nausea or influenza-like symptoms in the same time period. No relationship was found between reported health and anthropometry.

3.5 Discussion

TFSs have been essential to sustaining health of Indigenous Peoples. This study aimed to define the Aguaruna TFS and its nutritional and cultural importance for lower Cenepa communities. Overall, the TFS proved to be vital to the physical and cultural survival of the Aguaruna, since they consumed only minimal (<1%) amounts of imported foods. During the study season, known by the Aguaruna as the period of restricted fishing and thus greatest scarcity in the food supply (Galdo Pagaza *et al., undated)*, there was evidence of general seasonal dietary adequacy from analysis of anthropometry and repeat 24 hour dietary recall data.

Anthropometry values of weight-for-height as determined by BMI for mothers and WHZ scores among children, suggested no indication of population acute malnutrition. There were no cases of wasting, in comparison with the prevalence of wasting of 2% at the National level in Peru, and the highest rate in Peru of 8.2% reported in the Amazonas region (FAO, 2000). The MUAC measurements in women as well as the MUAC-for-height z-scores in children also suggested a healthy population. This is similar to findings among other groups in the Amazon, as reviewed by Dufour (1992). Weight-for-height from the Curripaco and Yanomani of southern Venezuela the Alto Xingu region of Brazil, and both the Yanomani, and Tukano of the Columbian Amazon, suggested that most children were within normal range of the 80% standard of the Harvard growth standards and the 50^{th} percentile of the NCHS growth curves.

Contrasting results to the current study was previous work done in the North Western Amazon. Berlin and Markell (1977) reported high prevalence of thinness among the Aguaruna, while Behrens (1984) found thinness among the Shipibo. The average weight for height of adults (calculated as a BMI ranged between 22.2 and 25.0 kg/m^2) for numerous groups evaluated from Amazonia indicated normal nutritional status. The Aguaruna were the exception as many of the individuals were estimated to have a BMI of less than 18.5 kg/m^2, while 35% of children age 1 to 5 were below the NCHS 80th percentile (Berlin and Markell, 1977).

The extremely low HAZ scores among Aguaruna children (-4.52 to 0.56) might cause concern for chronic undernutrition. Stunting is considered to be the result of poor diet and high infection rates during early childhood (Martorell and Habicht, 1986). If the dietary data is accurate for the study season which was presumed to be the season of highest scarcity, other factors may be involved in shorter stature of Aguaruna children. Mothers did not report malaria or dengue fever as a concern for their children's health. Parasitic and helminthe infections in the children were reported by 80% of mothers (20% unsure), with insufficient Abendozol (anthelmintic medication) reported as a health concern by community members and local health workers. Among the Naporuna Amazonian school children in Ecuador, parasitism was reported at 82.0% with *Entamoeba coli* and *Ascaris lumbricoides* most prevalent (Quizhpe *et al.*, 2003). Virtually all of the Chivacoa Indigenous People of Venezuela were found to have parasites; however there was no relationship between number of different species of parasites in an individual and nutritional status (Holmes and Clark, 1992). Berlin and Markell (1977) reported high levels of Aguaruna parasitism including the helminthes hook worm, whip worm as well as protozoa (*Ascaris Lumbricoides*, *Entamoeba Histoytica* as the most prevalent), without nutritional status consequences. The authors attributed this to the high quality of the diet in terms of energy, iron and protein.

Previous studies had difficulties in obtaining ages for children, so height-for-age comparisons for the Northwestern Amazon were not readily available (Berlin and Markell, 1977). Holmes and Clark (1992) found the short stature of children in the Venezuelan Amazon was a successful adaptation to the environment, and children grew at same rate as the NCHS reference populations. Consideration should be given to findings that, with the exception of two groups, adults indigenous to the Amazon region have been described as generally healthy, while being on average shorter than the 10^{th} percentile of the NCHS standard (Dufour, 1992).

As calculated from the repeat 24 hour recalls, the estimated dietary intakes of energy, protein, iron, zinc, vitamin C and vitamin A were above the suggested DRIs, however the DRIs are intended for healthy populations, and may not be appropriate for this population, which reported high parasitism (IOM, 2000a). The only intakes which fell below the recommendation, was that of calcium for women and children. Dietary calcium may have been underestimated, by food composition not accounting for the consumption of small fish bones and various animal tissues.

Under-reporting and over-reporting have been recognized challenges in nutrition research; however with the exception of the doubly labeled water method for calculating energy intake there is no gold standard for estimating dietary nutrient intake (Westerterp and Goris, 2002). The 24 hour recall should not be discounted as an important tool (Beaton, 1994). Errors for nutrient and energy intake were minimized by: use of local bowls, real food models, standardization of local food weights and portion sizes and community discussions. With the exception of *masato*, Aguaruna food preparation methods are quite basic and involve mostly single foods, usually boiled or roasted, making it easy to record all foods consumed. The women were also very connected with the food supply and daily food security in knowing the weights and amounts of food consumed. Aguaruna women physically selected and carried all the daily cassava, fruits and vegetables harvested from the *chacra* and prepared and served meals.

The nutritional importance of traditional food diversity during the study season was demonstrated through the relationship of women's and children's greater ability to consume recommended nutrient intakes with higher diversity scores. Various studies around the world have found positive associations between dietary diversity and nutritional intake in various populations including women and men in rural Western Mali (Torheim *et al.*, 2004), Korean adolescents (Kye *et al.*, 2004), 10 to 18 year olds in Tehran (Mirmiran *et al.*, 2004) and in urban Mali (Hatloy *et al.* 1998). Most other studies looking at dietary diversity have focused on overall dietary diversity, either measured by food groups or individual food items over a fixed period of time (Ruel, 2002). Given the objectives of this specific study were to define importance of the Aguaruna TFDS, as well as the extremely high traditional food makeup of the diet, the TFDS was an appropriate measure for this group of Indigenous People.

Although not observed in this study, possibly due to very small sample sizes, dietary diversity has been positively linked to growth in Mali (Hatloy *et al.*, 2000) and Ethiopia (Arimond and Ruel, 2002). It has been difficult to define relationships between single nutrients and growth deficiencies, however, a positive relationship between child growth and dietary diversity prevailed in various developing nations (Onyango, 2003).

It has been suggested that caution must be taken when promoting dietary variety in some environments as the message of diversity could be wrongly interpreted and result in consumption of many low nutrient dense inexpensive foods, and perpetuate the nutrition transition and its health consequences (Maunder *et al.*, 2001). As increasing variety and quantity of market foods may become available in the Cenepa region, community groups and leaders should promote consuming diverse local micronutrient dense TF and ensure quality in the MF that is imported to the area.

In addition to the TFDS, diversity was observed in an analysis of ranking the weight, energy and nutrient contributions of all foods. The Aguaruna lower Cenepa TFS offered several unique nutrient dense food sources contributing to overall dietary sufficiency. Raw peanuts were important for energy, protein and the largest contributor of fat, with a portion size a fraction of that of cassava. In addition to cassava, other important tubers contributing energy as well as nutrients were *sachapapa*, taro and sweet potato. Along with staple bananas, a variety of fruits contributed to nutrient adequacy, including papaya, *sachamango*, coco fruit, macambo seeds, peach palm and Mauritian palm fruit.

Palms proved high dietary and cultural value. The Mauritian palm fruit was very high in fat (25 g/100g) and vitamin A (763 μg RE/100g), in addition to being a modest source of calcium (74mg/100g). Peach palm was also a good source of vitamin A (140 μg RE/100g) as well as a nutritious variation of typical cassava *masato* when prepared into peach palm masato (IIN, 2004). The value of genus *Elaeis* palm fruits has previously been recognized in food-based approaches to preventing hypovitaminosis A in tuber based diets (Solomonos and Orozco, 2003). The palm heart proved an important source of protein, calcium, iron, zinc in addition to the cultural importance of the palm tree providing thatch for housing (Brown, 1984). The cultivation of palm trees is related to another culturally cherished food: the suri. These larvae, weighing approximately 12 g is assumed to be high in protein (34 g/ 100g), fat (39 g/100g) and iron (21mg) based on food composition for beetle larvae of the same genus (Ramos-Elorduy *et al.,* 1997, Finke, 2002 and Paoletti et al, 2003). Dufour (1987), studied insect consumption among the Tukanoan Indigenous People of the Vaupes region of Colombia, and found these insects contributed to diet in amounts comparable with other animals. Men and women respectively, obtained as high as 12% and 26% of animal protein from insects. Tukanoans seasonally included invertebrates in the diet and consumed greater quantities when fish and game were less available (Dufour, 1987). Berlin and Markell (1977), reported 58% of protein came from fish, but this was a negligible source of dietary protein for our season of heavy rain and resulting high rivers for the Aguaruna, which hindered local fishing methods. Unlike the Tukanoans in the low fishing season, invertebrates were not consumed in great quantities by the lower Cenepa Aguaruna. The *suri* deserves attention as a means of local food security because of the cultural acceptability and high taste appeal among women and children (Brown, 1984). Invertebrate consumption was part of the TFS of 32 other Amerindian groups in the Amazon basin (Paoletti *et al.*, 2000).

Wild game had great nutritional and cultural significance for the lower Cenepa Aguaruna. This study was conducted in the Aguaruna season designated as armadillo (*Dasypus sexcinctus*). This animal provided a source of dietary iron, protein, fat, zinc and vitamin A, especially for the women (29 g of protein, 5.4 g of fat, 10.9 g of iron and 225 μg RE for every 100g)(Wu Leung and Flores, 1961). Other important game meats in the study were agouti, paca, coati and peccary. The importance of wild meat as a source of food security and protein for people subsiding in tropical forests has been recognized (Bennett, 2002). Hunting became more difficult following the introduction of Jesuit schools which was accompanied by a shift in settlement patterns. This resulted in population growth. As many people were living close together and clearing the land surrounding newly formed communities, *el monte* became even farther travel. The protein sources from game meat and birds became harder to obtain for reasons of over hunting decreased density of animals in proportion to the size of communities. Johnson found that over a span of 4 years from 1970 to 1973, the time required for hunting animals had increased 5 fold (Johnson, 1974).

Indigenous Peoples in the Brazilian Amazon have experienced the consequences of a nutrition transition with the introduction of modern farming systems and cash cropping which was accompanied by a decrease in traditional activities, increased market dependence and an overall decrease in diet quality (Zorini and Lombardi, 2002). Alto Mayo Aguaruna communities (composed partly of Aguaruna migrating from Cenepa) experienced a decrease in dietary quality as a result of mono-cropping of rice and decrease in traditional *chacra* land use practices (Johnson, 1974). It was calculated that a *chacra* of 0.25 hectares sustained a family of 10 along the Cenepa river for at least one year (Berlin and Berlin, 1978); however, in 1978 Alto Mayo communities had entered rice cultivation and *chacra* requirements ranged from 1.0 hectors to 10 hectors of *chacra* per family (Johnson, 1974). Obesity, a symptom of a nutrition transition was reported among Venezualan Indigenous Peoples who had gone acculturation defined by a change of diet and abandoning heavy exercise involved in gathering food (Holmes and Clark, 1992).

Valuing local foods and the food culture of the Aguaruna as well as other Indigenous groups should be promoted within communities and incorporated into the framework of larger programs (i.e. food donations) for cultural, physical and spiritual health. This approach requires a conscious effort to ensure that priorities are appropriate for local perceptions and the ecosystems approach for health, by recognizing unique foods for specific populations rather than exploiting Indigenous Peoples' resources for the general population. In our market survey we examined the prices of TFs and their nutritional values per unit of price in comparison with imported foods. We found much greater nutritional value per unit price for the TF, suggesting internal trade could have greater health benefits for community members who earn some money, as an alternative to purchasing market foods, which also give the added burden of waste management from packaging.

Almost all traditional dietary patterns can sufficiently meet and in many cases exceed the nutrient requirements of a population group. Exceptions occur when socio-economic factors affect agricultural production and limit capacity to purchase food, or in cases where food choice is restricted by cultural practices (FAO/WHO, 2002). The nutrition transition for Indigenous Peoples can be a result of directed changes such as food donation and introduction of MF as well as non directed changes such as climate change, external pressures on land or decrease in available terrain for hunting, gathering and shifting agriculture (FAO/WHO, 2002). Both impacts need to be addressed in policy and interventions in order to honour the Aguaruna's right to subsistence practices.

Findings from this study describe the TFS of the Aguaruna, and highlight its cultural and nutritional value. Overall anthropometry, with the exception of height-for-age values among children, indicates healthy nutritional status for the lower Cenepa women and children. This is supported by dietary intake data from 24 hour recalls. The value of diversity of TF to meet nutrient needs is reported with emphasis on unique nutrient dense components of the food system. Policies, health promotion activities and ecosystem protection can ensure that subsistence lifestyle and diverse traditional foods are available for the Aguaruna, as well as Indigenous Peoples globally.

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Figures and Tables

Figure 3.1: Map of the Rio Cenepa and Aguaruna Study Communities

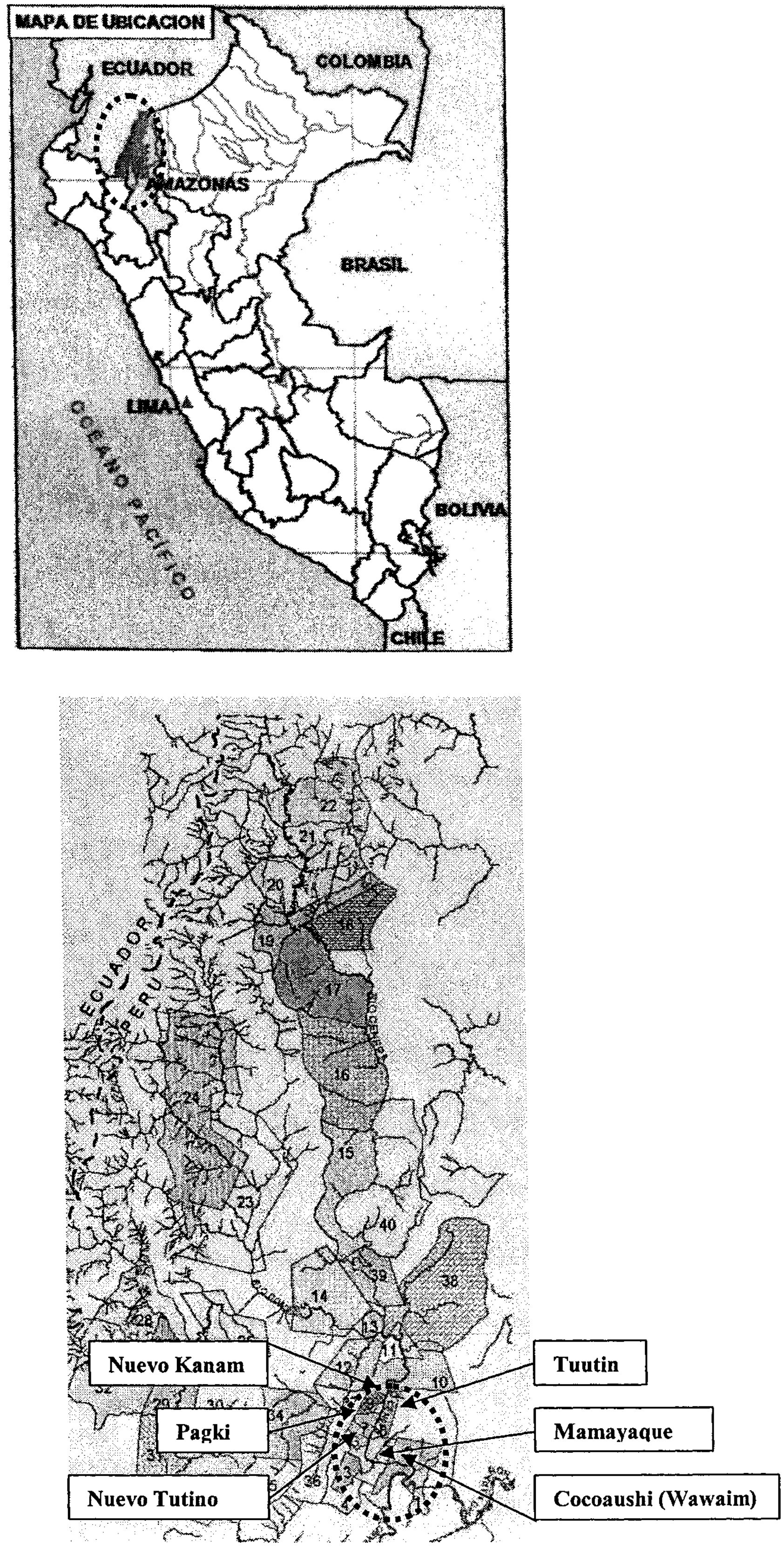

Figure 3.2: Division of Responsibility for Food Preparation by Percent of Food Items Consumed Daily

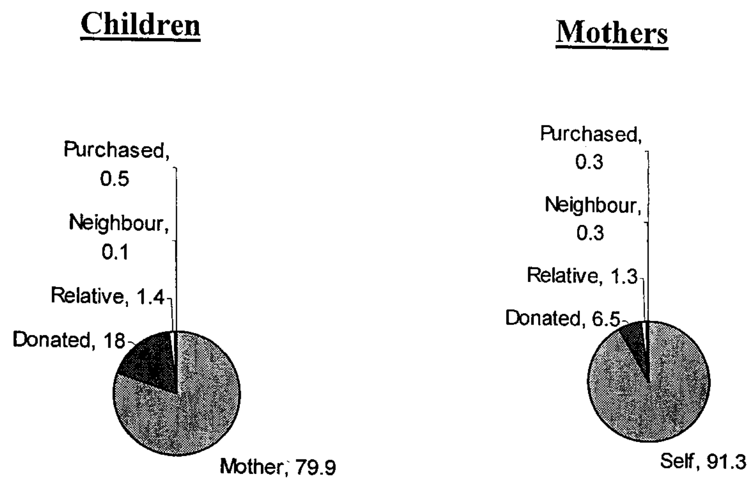

Figure 3.3: Observed BMI in Women

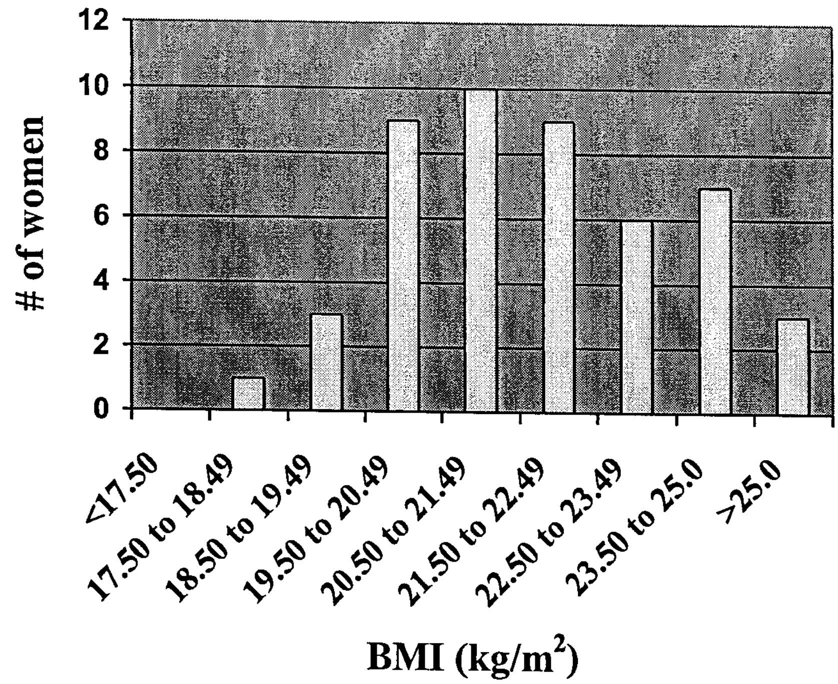

Figure 3.4: Cormic Adjusted BMI in Women

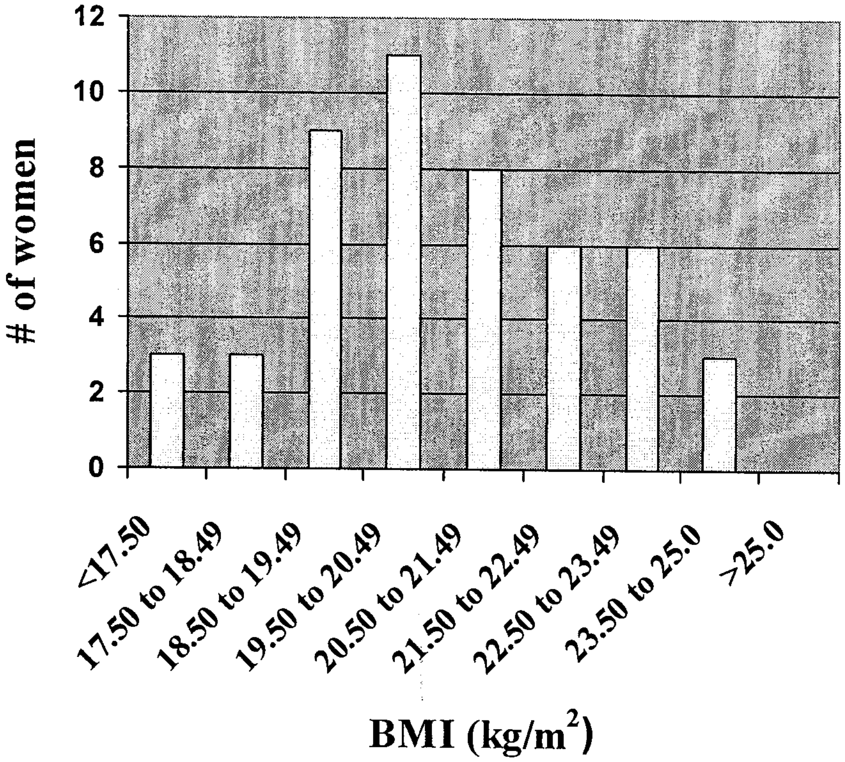

Figure 3.5: MUAC in Women

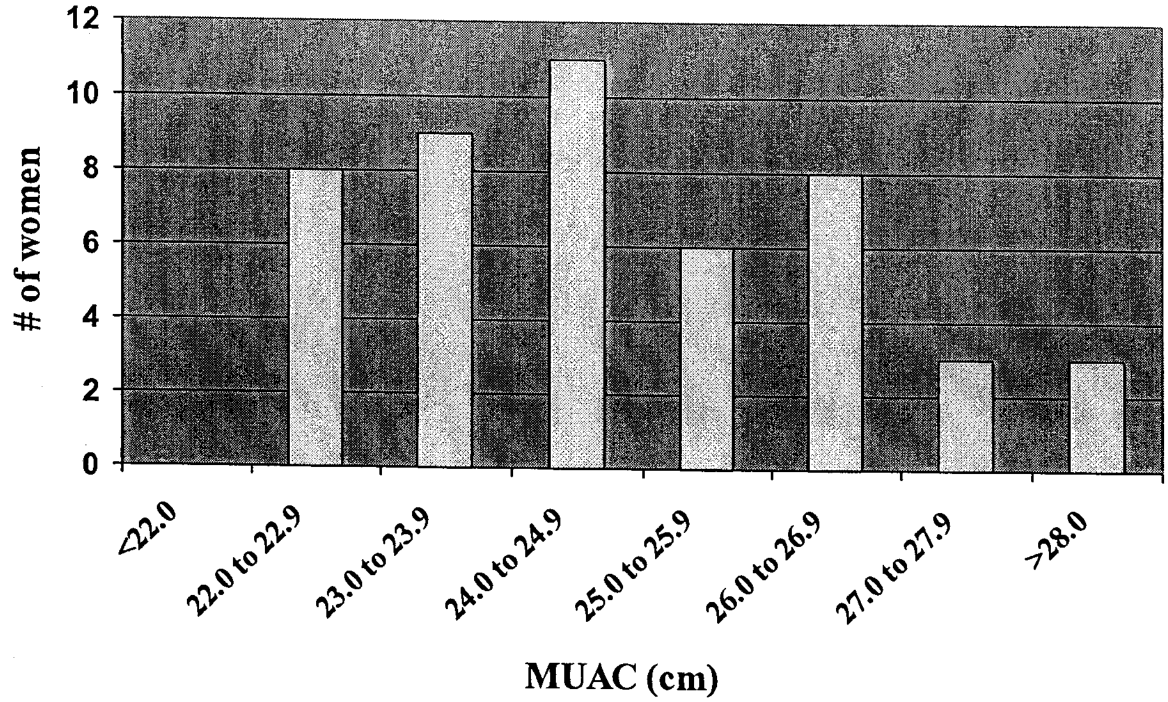

Figure 3.6: Height –for-Age Z-Scores for Girls Age 3 to 6 years (n= 17)

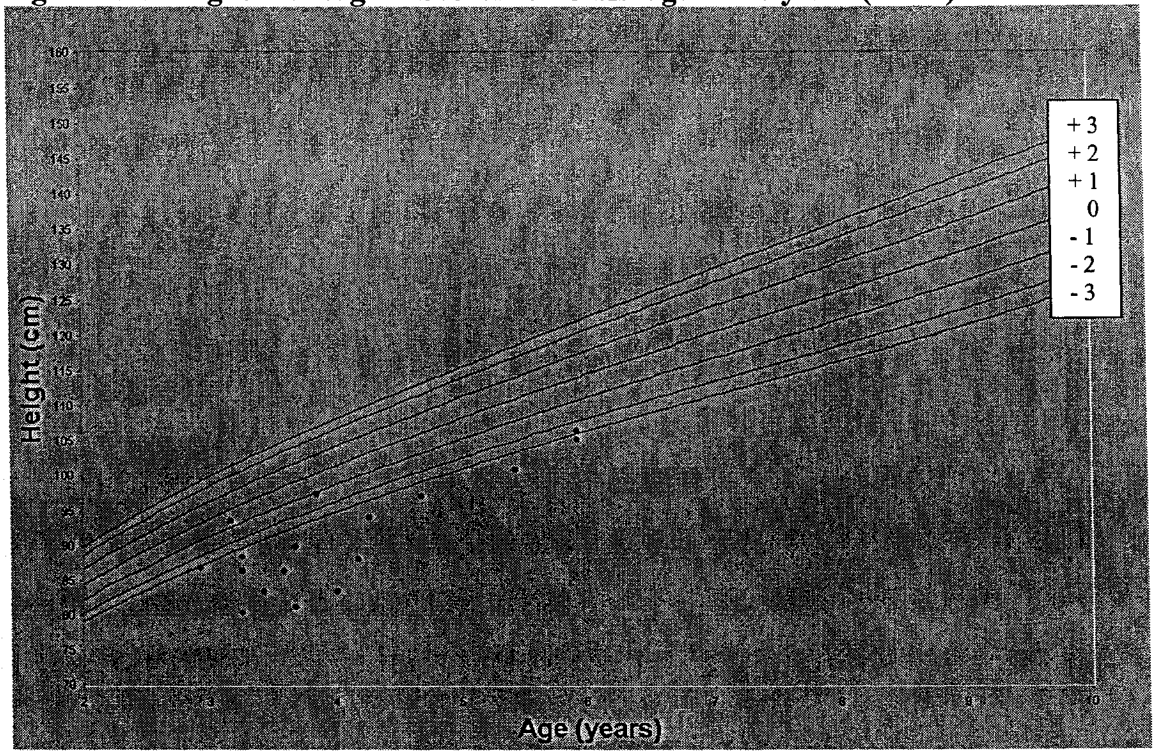

Figure 3.7: Height-for-Age Z-Scores for Boys Age 3 to 6 years (n= 17)

Figure 3.8: Weight-for-Height Z –Scores for Girls Age 3 to 6 years (n=17)

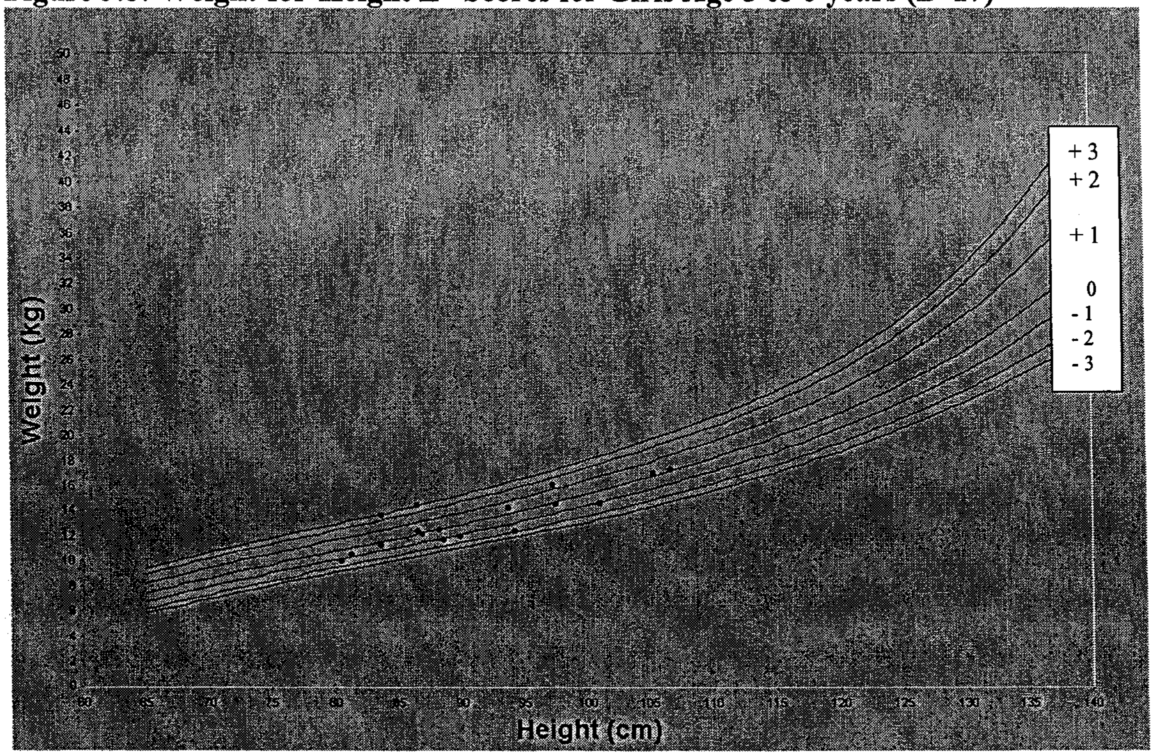

Figure 3.9: Weight-for-Height Z- Scores for Boys Age 3 to 6 years (n=17)

Figure 3.10: MUAC-for-Height Z Scores for Children Age 3 to 6 years

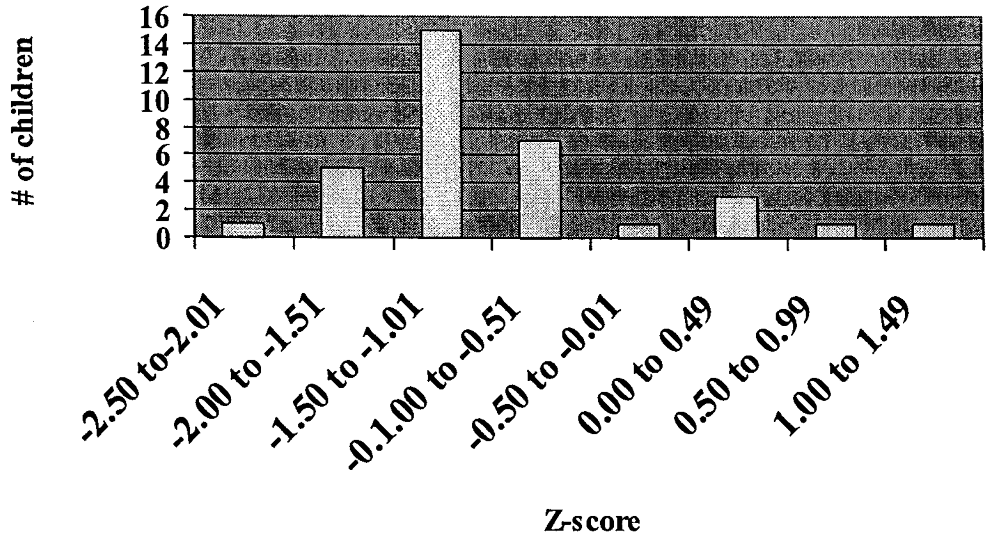

Table 3.1: Dietary Intake of Non-Lactating Mothers from Repeat 24 Hour Recalls (n = 19)

Nutrient	Median	25th Percentile	75th Percentile	Mean±SD	Reference Intake
Energy (kcal/day)	3207	2716	5121	3738±1729	1900 [a]
Total Protein (g/day)	64.2	32.6	80.2	62.6±30.8	35.8 [a]
% Energy from Protein	11.5%	10.1%	14.5%	12.3±3.7	10- 35% [b]
Animal Protein (g/day)	18.4	9.8	42.0	25.6±23.4	n/a
Vegetable Protein (g/day)	28.0	22.7	52.2	37.0±21.9	n/a
Total Fat (g/day)	25.7	16.7	44.5	30.6±20.6	n/a
% Energy from Fat	12.1%	8.1%	35.9%	20.6±15.5	20- 35% [b]
Animal Fat (g/day)	6.4	1.9	12.4	9.2±10.1	n/a
Vegetable Fat (g/day)	12.7	6.5	31.2	21.4±19.8	n/a
Carbohydrates (g/day)	708	574	1078	819±404	n/a
% Energy from Carbs.	71.1%	51.1%	80.2%	66.6±16.4	45- 65% [b]
Calcium (mg/day)	706	442	1079	797±465	1000 [e]
Iron (mg/day)	21.4	16.7	32.9	25.3±14.1	8.1 [c]
Animal Iron (mg/day)	2.2	0.7	9.7	4.8±5.3	n/a
Zinc (mg/day)	12.9	7.9	18.7	15.5±12.9	6.8 [c]
Animal Zinc (mg/day)	1.4	0.4	4.2	4.4±6.9	n/a
Ascorbic Acid (mg/day)	438	315	788	536±321	50 [d]
Retinol (μg RE/ day)	759	334	3295	1904±2206	500 [c]

[a](WHO, 1985), [b]AMDRs (IOM, 2002), [c]EAR (IOM, 2000b) [d]EAR (IOM, 2000c) [e] AI (IOM, 1997)

Table 3.2: Dietary Intake of Lactating Mothers from Repeat 24 Hour Recalls (n = 23)

Nutrient	Median	25th Percentile	75th Percentile	Mean±SD	Reference Intake
Energy (kcal/day)	3546	2516	4401	3739±1437	2185 [a]
Total Protein (g/day)	49.1	34.8	75.3	56.1±25.1	41.8 [a]
% Energy from Protein	13.0%	10.2%	13.7%	12.9±3.6	10- 35% [b]
Animal Protein (g/day)	16.9	12.2	32.4	23.0±16.4	n/a
Vegetable Protein (g/day)	29.5	17.8	40.8	33.1±18.7	n/a
Total Fat (g/day)	22.7	16.4	47.9	36.3±32.0	n/a
% Energy from Fat	16.5%	11.9%	22.7%	18.2±9.7	20- 35% [b]
Animal Fat (g/day)	13.4	6.9	24.7	15.4±11.3	n/a
Vegetable Fat (g/day)	9.1	5.8	18.2	20.9±28.8	n/a
Carbohydrates (g/day)	802	533	1051	815±324	n/a
% Energy from Carbs.	69.9%	64.0%	77.4%	70.0±11.5	45- 65% [b]
Calcium (mg/day)	616	398	982	729±373	1000 [e]
Iron (mg/day)	22.2	16.2	29.8	25.8±16.1	6.5 [c]
Animal Iron (mg/day)	2.2	0.4	8.6	5.5±6.3	n/a
Zinc (mg/day)	10.5	6.0	21.6	15.3±11.0	10.4 [c]
Animal Zinc (mg/day)	1.7	1.0	14.6	7.1±9.1	n/a
Ascorbic Acid (mg/day)	507	339	697	525±227	100 [d]
Retinol (μg RE/ day)	520	323	1249	891±900	900 [c]

[a](WHO, 1985), [b]AMDRs (IOM, 2002), [c]EAR (IOM, 2000b) [d]EAR (IOM, 2000c) [e] AI (IOM, 1997)

Table 3.3: Dietary Intake for Children Age 3 to 4 years from Repeat 24 Hour Recalls (n = 19)

Nutrient	Median	25th Percentile	75th Percentile	Mean±SD	Reference Intake
Energy (kcal/day)	2307	1659	3255	2466±1014	1199 [a]
Total Protein (g/day)	46.4	26.5	71.0	49.0±27.0	13.7 [a]
% Energy from Protein	11.7%	9.1%	12.5%	11.6±3.7	5- 20% [b]
Animal Protein (g/day)	12.6	4.9	23.5	17.6±18.4	n/a
Vegetable Protein (g/day)	31.1	18.4	39.0	31.4±18.3	n/a
Total Fat (g/day)	18.9	9.7	31.7	24.0±21.0	n/a
% Energy from Fat	20.5%	12.5%	32.3%	22.8±14.3	30-40% [b]
Animal Fat (g/day)	6.5	2.0	13.9	9.3±10.1	n/a
Vegetable Fat (g/day)	10.3	7.8	16.3	14.7±14.2	n/a
Carbohydrates (g/day)	467	371	699	530±229	n/a
% Energy from Carbs.	69.3%	53.4%	82.6%	68.0±15.5	45- 65% [b]
Calcium (mg/day)	464	255	808	559±356	500 [e]
Iron (mg/day)	17.6	10.7	22.9	17.6±7.9	3.0 [c]
Animal Iron (mg/day)	0.67	0.3	4.8	2.6±2.7	n/a
Zinc (mg/day)	9.0	5.2	19.4	11.7±7.7	2.5 [c]
Animal Zinc (mg/day)	1.2	0.2	6.7	3.6±4.5	n/a
Ascorbic Acid (mg/day)	297	207	372	286±107	13 [d]
Retinol (μg RE/ day)	574	154	1655	1138±1599	210 [c]

[a](WHO, 1985), [b]AMDRs (IOM, 2002), [c]EAR (IOM, 2000b) [d]EAR (IOM, 2000c) [e] AI (IOM, 1997)

Table 3.4: Dietary Intake for Children Age 4 to 6 years from Repeat 24 Hour Recalls (n = 17)

Nutrient	Median	25th Percentile	75th Percentile	Mean±SD	Reference Intake
Energy (kcal/day)	2726	2060	3216	2886±1128	1377 [a]
Total Protein (g/day)	45.8	36.7	53.0	50.3±23.0	15.3 [a]
% Energy from Protein	10.1%	9.3%	11.7%	10.7±3.0	5- 20% [b]
Animal Protein (g/day)	7.8	5.6	14.7	11.4±9.2	n/a
Vegetable Protein (g/day)	32.6	25.4	46.9	38.9±19.7	n/a
Total Fat (g/day)	26.5	13.8	51.4	35.1±26.8	n/a
% Energy from Fat	35.4%	13.1%	39.6%	28.5±14.5	25- 35% [b]
Animal Fat (g/day)	5.0	2.3	11.9	8.0±9.3	n/a
Vegetable Fat (g/day)	12.7	9.6	46.0	27.1±25.4	n/a
Carbohydrates (g/day)	563	427	708	613±247	n/a
% Energy from Carbs.	57.9%	52.2%	74.2%	62.5±13.8	45- 65% [b]
Calcium (mg/day)	362	265	717	484±254	800 [e]
Iron (mg/day)	15.7	11.4	20.3	17.2±8.4	4.1 [c]
Animal Iron (mg/day)	0.9	0.3	2.7	1.8±1.9	n/a
Zinc (mg/day)	7.2	5.9	12.0	9.3±5.7	4 [c]
Animal Zinc (mg/day)	0.6	0.2	2.2	1.7±2.5	n/a
Ascorbic Acid (mg/day)	247	158	491	354±215	22 [d]
Retinol (μg RE/ day)	401	189	657	601 ±597	275 [c]

[a](WHO, 1985), [b]AMDRs (IOM, 2002), [c]EAR (IOM, 2000b) [d]EAR (IOM, 2000c) [e] AI (IOM, 1997)

Table 3.5: Most Frequent Preparation Methods in 24-hour Recalls

Mothers		Children	
Boiling	40.2%	Boiling	35.9%
Raw	14.4%	Raw	12.7%
Chapo/Pururuca	11.7%	*Chapo/Pururuca*	11.9%
Masato	11.0%	*Masato*	8.7%
Soup	4.6%	Juice	5.4%
Juice	4.0%	Cooked Cereals	5.0%
Patarashka	3.6%	Roasting	3.7%
Roasting	3.4%	Soup	2.9%

Table 3.6: Spearman's Rho of Traditional Food Diversity Scores and Nutrient Intakes

Nutrients:	Women n= 49	Children n= 35
Protein	0.49 **	0.39*
Fat	0.49**	0.33 (p = 0.054)
Fiber	0.60**	0.55**
Calcium	0.53**	0.47**
Phosphorous	0.52**	0.29 (p = 0.096)
Iron	0.45**	0.35*
Zinc	0.29*	0.24 (p = 0.162)
Thiamine	0.55**	0.46**
Riboflavin	0.49**	0.40*
Niacin	0.38**	0.26 (p = 0.130)
Ascorbic Acid	0.43**	0.33 (p = 0.054)
Folic Acid	0.30*	0.07 (p = 0.682)
Retinol Equivalents	0.40**	0.50**

*significant at the p <0.05 level (2-tailed) **significant at the p<0.01 level (2-tailed)

Table 3.7: Top 15 Foods Contributing to Weight of Diet in Women and Children

Women (n = 49)		Children (n = 35)	
Food	Total Weight (g)	Food	Total Weight (g)
Cassava	118279	Cassava	41429
Masato	51742	Banana	23770
Banana	34573	*Masato*	17061
Sachapapa	15924	*Sachapapa*	15539
Peach Palm *Masato*	11757	Plantain	6104
Sugar Cane	9333	Taro	3965
Plantain	9193	Papaya	3569
Papaya	6917	Peach Palm *Masato*	3521
Palm Heart	5424	Palm Heart	3386
Taro	4936	Evaporated Milk	3020
Cocona	3823	Sweet Potato	3018
Sweet Potato	3710	White Rice	2861
Guinea Banana	3362	Sugar Cane	2320
Peach Palm Fruit	2153	Cocona	2272
Pineapple	2150	Orange	2126
Orange	2062	Guinea Banana	1668

Table 3.8a: Top 15 Foods Contributing Energy for Women

Women (n = 49)			
Food	Total Energy for 2 days (kcal)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	191612	1271 ± 879	93 (49)
Banana	28696	629 ± 439	55 (40)
Masato	19144	1176 ± 669	44 (31)
Sachapapa	17835	838 ± 790	19 (15)
Plantain	13973	340 ± 205	27 (25)
Sugar Cane	7653	406 ± 327	23 (19)
Raw Peanuts	6373	163 ± 145	7 (5)
White Rice	6265	134 ± 61	13 (11)
Peach Palm *Masato*	5526	1470 ± 1790	8 (7)
Taro	5035	548 ± 295	9 (9)
Sweet Potato	4304	618 ± 754	6 (5)
Evaporated Milk	4184	191 ± 175	15 (8)
Macambo Seeds	4160	69 ± 77	10 (8)
Guinea Banana	4034	224 ± 234	15 (13)
Peach Palm Fruit	3962	308 ± 291	7 (6)

Table 3.8b: Top 15 Foods Contributing Energy for Children

Children (n = 35)			
Food	Total Energy for 2 days (kcal)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Cassava	67115	647± 504	64 (35)
Banana	19729	495 ± 365	48 (31)
Sachapapa	17404	863 ± 983	18 (13)
White Rice	10271	130 ± 65	22 (16)
Plantain	9278	291 ± 193	21 (18)
Masato	6313	569 ± 262	30 (20)
Raw Peanuts	5189	116 ±107	8 (5)
Yellow Beans	4247	80 ± 31	16 (12)
Taro	4044	566 ± 600	7 (6)
Sweet Potato	3501	755 ± 916	4 (3)
Evaporated Milk	3363	279 ± 212	10 (10)
Chicken	2965	109 ± 47	13 (10)
Sachamango	2814	125 ± 84	7 (6)
White Sugar	2117	23 ± 13	24 (18)
Macambo Seeds	2053	68 ± 41	5 (4)

Table 3.8c: Top 15 Foods Contributing Protein for Women

Women (n = 49)			
Food	Total Protein for 2 days (g)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	946	1271 ± 879	93 (49)
Armadillo	521	180 ± 104	10 (9)
Banana	519	629 ± 439	55 (40)
Chicken	317	174 ± 88	14 (14)
Sachapapa	287	838 ± 790	19 (15)
Raw Peanuts	275	163 ± 145	7 (5)
Turkey	248	164 ± 61	4 (3)
Evaporated Milk	202	191 ± 175	15 (8)
Palm Heart	158	387 ±420	14 (13)
White Rice	229	134 ± 61	13 (11)
Chicken Egg	121	75 ± 79	12 (12)
Macambo Seeds	118	69 ± 77	10 (8)
Agouti	113	116 ± 17	5 (5)
Masato	103	1176 ± 669	44 (31)
Peach Palm *Masato*	94	1470 ± 1790	8 (7)

Table 3.8d: Top 15 Foods Contributing Protein for Children

Children (n = 35)			
Food	Total Protein for 2 days (g)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Banana	357	495 ± 365	48 (31)
Cassava	331	647± 504	64 (35)
Yellow Beans	290	80 ± 31	16 (12)
Sachapapa	280	863 ± 983	18 (13)
White Rice	235	130 ± 65	22 (16)
Raw Peanuts	224	116 ±107	8 (5)
Turkey	181	208 ± 146	4 (3)
Evaporated Milk	163	279 ± 212	10 (10)
Palm Heart	115	282 ± 325	12 (12)
Chicken	189	109 ± 47	13 / (10)
Canned Tuna	88	19 ± 8	19 (13)
Chicken Egg	86	53 ± 25	12 (9)
Sachamango	65	125 ± 84	7 (6)
Taro	63	566 ± 600	7 (6)
Plantain	61	291 ± 193	21 (18)

Table 3.8e: Top 15 Foods Contributing Fat for Women

Women (n = 49)			
Food	Total Fat for 2 days (g)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Raw Peanuts	550	163 ± 145	7 (5)
Macambo Seeds	375	69 ± 77	10 (8)
Evaporated Milk	249	191 ± 175	15 (8)
Sachapapa	239	838 ± 790	19 (15)
Cassava	237	1271 ± 879	93 (49)
Chicken	226	174 ± 88	14 (14)
Sachamango	156	171 ± 79	5 (5)
Turkey	141	164 ± 61	4 (3)
Banana	104	629 ± 439	55(40)
Armadillo	97	180 ± 104	10 (9)
Suri	77	67 ± 31	3 (3)
Chicken Egg	75	75 ± 79	12 (12)
Peach Palm Fruit	69	308 ± 291	7 (6)
Mauritian Palm Fruit	65	65 ± 57	4 (3)
Masato	52	1176 ± 669	44 (31)

Table 3.8f: Top 15 Foods Contributing Fat for Children

Children (n = 35)			
Food	Total Fat for 2 days (g)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Raw Peanuts	447	116 ±107	8 (5)
Sachapapa	233	863 ± 983	18 (13)
Evaporated Milk	193	279 ± 212	10 (10)
Macambo Seeds	185	68 ± 41	5 (4)
Chicken	174	109 ± 47	13 (10)
Sachamango	160	125 ± 84	7 (6)
Cassava	83	647± 504	64 (35)
Canned Tuna	74	19 ± 8	19 (13)
Banana	71	495 ± 365	48 (31)
Suri	58	38 ± 15	4 (4)
Chicken Egg	53	53 ± 25	12 (9)
Vegetable Oil	48	3 ± 2	18 (12)
Mauritian Palm Fruit	28	37 ± 12	3 (3)
Turkey	24	208 ± 146	4(3)
Palm Heart	24	282 ± 325	12 (12)

Table 3.9a: Top 10 Foods Contributing Calcium for Women

Women (n = 49)			
Food	Total Calcium for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	29570	1271 ± 879	93 (49)
Palm Heart	7485	387 ± 420	14 (13)
Evaporated Milk	7048	191 ± 175	15 (8)
Masato	5692	1176 ± 669	44 (31)
Peach Palm *Masato*	2587	1470 ± 1790	8 (7)
Taro	2468	548 ± 295	9 (9)
Sachamango	1838	171 ± 79	5 (5)
Banana	1729	629 ± 439	55 (40)
Maca	1629	356	1 (1)
Papaya	1591	629 ± 351	11 (10)

Table 3.9b: Top 10 Foods Contributing Calcium for Children

Children (n = 35)			
Food	Total Calcium for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Cassava	10357	647± 504	64 (35)
Evaporated Milk	5665	279 ± 212	10 (10)
Palm Heart	4673	282 ± 325	12 (12)
Taro	1983	566 ± 600	7 (6)
Sachamango	1879	125 ± 84	7 (6)
Masato	1877	569 ± 262	30 (20)
Yellow Beans	1248	80 ± 31	16 (12)
Sweet Potato	1237	755 ± 916	4 (3)
Banana	1189	495 ± 365	48 (31)
Papaya	821	510 ± 395	7 (6)

Table 3.9c: Top 10 Foods Contributing Iron for Women

Women (n = 49)			
Food	Total Iron for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	591	1271 ± 879	93 (49)
Masato	310	1176 ± 669	44 (31)
Banana	207	629 ± 439	55 (40)
Armadillo	196	180 ± 104	10 (9)
Sachapapa	111	838 ± 790	19 (15)
Maca	104	356	1 (1)
Palm Heart	92	387 ± 420	14 (13)
Agouti	81	116 ± 17	5 (5)
Sugar Cane	65	406 ± 327	23 (19)
Taro	59	548 ± 295	9 (9)

Table 3.9d: Top 10 Foods Contributing Iron for Children

Children (n = 35)			
Food	Total Iron for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Cassava	207	647± 504	64 (35)
Banana	143	495 ± 365	48 (31)
Sachapapa	109	863 ± 983	18 (13)
Masato	102	569 ± 262	30 (20)
Yellow Beans	97	80 ± 31	16 (12)
Palm Heart	58	282 ± 325	12 (12)
Taro	48	566 ± 600	7 (6)
Cocona	34	151 ± 164	15 (11)
Suri	32	38 ± 15	4 (4)
Plantain	31	291 ± 193	21 (18)

Table 3.9e: Top 10 Foods Contributing Zinc for Women

Women (n = 49)			
Food	Total Zinc for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	402	1271 ± 879	93 (49)
Armadillo	286	180 ± 104	10 (9)
Palm Heart	202	387 ± 420	14 (13)
Masato	106	1176 ± 669	44 (31)
Suri	104	67 ± 31	3 (3)
Banana	55	629 ± 439	55 (40)
Sachapapa	38	838 ± 790	19 (15)
Raw Peanuts	37	163 ± 145	7 (5)
Turkey	37	164 ± 61	4 (3)
Macambo Seeds	23	69 ± 77	10 (8)

Table 3.9f: Top 10 Foods Contributing Zinc for Children

Children (n = 35)			
Food	Total Zinc for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Cassava	141	647± 504	64 (35)
Palm Heart	126	282 ± 325	12 (12)
Suri	78	38 ± 15	4 (4)
Banana	38	495 ± 365	48 (31)
Sachapapa	37	863 ± 983	18 (13)
Yellow Beans	36	80 ± 31	16 (12)
Masato	35	569 ± 262	30 (20)
White Rice	33	130 ± 65	22 (16)
Armadillo	32	66 ± 25	3 (3)
Raw Peanuts	30	116 ±107	8 (5)

Table 3.9g: Top 10 Foods Contributing Vitamin C for Women

Women (n = 49)			
Food	Total Ascorbic Acid for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Cassava	36312	1271 ± 879	93 (49)
Papaya	3299	629 ± 351	11 (10)
Masato	2173	1176 ± 669	44 (31)
Orange	1903	229 ± 125	9 (8)
Banana	1487	629 ± 439	55 (40)
Plantain	956	340 ± 205	27 (25)
Cassava Leaves	841	97 ± 40	3 (3)
Peach Palm *Masato*	576	1470 ± 1790	8 (7)
Eep	519	22 ± 26	8 (7)
Sachapapa	494	838 ± 790	19 (15)

Table 3.9h: Top 10 Foods Contributing Vitamin C for Children

Children (n = 35)			
Food	Total Ascorbic Acid for 2 days (mg)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Cassava	12719	647± 504	64 (35)
Orange	1962	266 ± 162	8 (5)
Papaya	1702	510 ± 395	7 (6)
Banana	1022	495 ± 365	48 (31)
Masato	717	569 ± 262	30 (20)
Plantain	635	291 ± 193	21 (18)
Sachapapa	482	863 ± 983	18 (13)
Sweet Potato	302	755 ± 916	4 (3)
Sachamango	242	125 ± 84	7 (6)
Coco Fruit	236	66 ± 44	4 (3)

Table 3.9i: Top 10 Foods Contributing Vitamin A for Women

Women (n = 49)			
Food	Total Retinol for 2 days (μg RE)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 98 (# women)
Agouti	26010	116 ± 17	5 (5)
Peach Palm *Masato*	23161	1470 ± 1790	8 (7)
Sweet Potato	22446	618 ± 754	6 (5)
Paca	13815	51 ± 33	6 (6)
Plantain	11645	340 ± 205	27 (25)
Collared peccary	6480	48 ± 46	3 (2)
Evaporated Milk	4174	191 ± 175	15 (8)
Armadillo	4039	180 ± 104	10 (9)
Banana	3457	629 ± 439	55 (40)
Peach Palm Fruit	3014	308 ± 291	7 (6)

Table 3.9j: Top 10 Foods Contributing Vitamin A for Children

Children (n = 35)			
Food	Total Retinol for 2 days (μg RE)	Mean Daily Intake for Consumers (g)	Days in 24-h Recall max 70 (# children)
Sweet Potato	18259	755 ± 916	4 (3)
Paca	7965	35 ± 25	5 (5)
Plantain	7732	291 ± 193	21 (18)
Agouti	7425	55 ± 5	3 (3)
Peach Palm *Masato*	6936	587 ±623	6 (6)
Evaporated Milk	3419	279 ± 212	10 (10)
Banana	2377	495 ± 365	48 (31)
Chicken Liver	2343	69	1 (1)
Papaya	1309	510 ± 395	7 (6)
Chicken Egg	1213	53 ± 25	12 (9)

Table 3.10: Price of Traditional Food and Market Food in Peruvian Nuevo Soles (1 nuevo sol = 0.36 CAD/0.30 USD)

Food	Price sol/kg	Energy kcal/100g	Protein g/100g	Fat g/100g	Calcium mg/100g	Iron mg/100g	Ascorbic Acid mg/100g	Retinol µg RE/ 100g	Energy kcal/sol	Protein g/ sol	Fat g/sol	Calcium mg/sol	Iron mg/sol	Ascorbic Acid mg/sol	Retinol µg RE/sol
Traditional Food															
Armadillo	7	179	29	5.4	30.0	10.9	0	225.0	256	41.4	7.7	42.8	15.6	0	321.4
Wild Boar	7	146	29.5	2.2	20.0	3.5	0	2.0	209	42.1	3.1	28.6	5.0	0	2.9
Deer	8	158	30.2	3.2	7.0	4.5	1.0	1.0	198	37.8	4.0	8.8	5.6	1.3	1.3
Chicken	10	108	9.3	7.5	6.0	0.5	0.8	20.5	108	9.3	7.5	6.0	0.5	0.8	20.5
Chicken Egg	7	141	13.5	8.4	34.0	1.1	3.0	191	201	19.3	10.7	48.5	1.6	4.3	272.9
Snails	1	79	16.9	0.8	158.0	2.0	7.8	26.0	790	169.0	8.0	1580.0	20.0	78.0	260.0
Suri	4	512	34	38.5	2.0	21.0	1.0	1.0	1280	85	96.3	5.0	52.5	2.5	2.5
Peanuts	1	559	24.1	48.2	66.0	1.5	1.3	3.3	5590	241	482.0	660.0	15.0	13.0	33.0
Oranges	2	40	0.6	0.2	23.0	0.2	92.3	13.3	200	3	1.0	115.0	1.0	461.5	66.5
Cassava	0.5	162	0.8	0.2	25.0	0.5	30.7	1.67	3240	16.0	4.0	500.0	10.0	614.0	33.4
Mauritian Palm Fruit	5	283	2.3	25.1	74.0	0.7	23.1	763.3	566	4.6	50.2	148.0	1.4	45.2	1526.6
Peach Palm Fruit	4	184	2.8	3.2	27.0	1.0	22.6	140	460	7.0	8.0	67.5	2.5	56.5	350.0
Market Food															
White Rice	3	359	8.2	0.5	6.0	0.8	0.9	0	1196	27.3	1.7	20.0	2.7	3.0	0
Brown Sugar	3	380	0	0	5.0	0	0	0	1267	0	0	16.7	0	0	0
Canned Tuna	13	288	24.2	20.5	7.0	1.2	0	18.7	240	20.2	17.1	5.8	1.0	0	15.6
Vegetable Oil	7	884	0	100.0	0	0	0	0	1263	0	142.9	0	0	0	0
Crackers	10	428	9.2	14.7	20.0	0.8	0	0	428	9.2	14.7	20.0	0.8	0	0
Cookies	10	438	6	12.7	38.0	0.6	0	0	438	6.0	12.7	38.0	0.6	0	0
Soda Pop	7	41	0	0	0	0	0	0	58.6	0	0	0	0	0	0

* Banco de Credito Peru (BCP) Exchange Rate April 2004

4.0 Conclusions

In this study we defined the TFS of the Aguaruna and explored relationships between dietary quality and dietary diversity. We investigated the distribution of nutrients in the diet with a focus on nutrient dense foods and compared the local foods to imported foods. Anthropometric measurements and children's health questionnaires were conducted to better understand the nutritional status of the populations.

To assess dietary intake of the Rio Cenepa communities, repeat 24 hour recalls were conducted. We focused on women and children, who are generally at a higher risk for nutrient deficiencies (FAO/WHO, 2002), and whose health is of higher concern for the Aguaruna communities (INS, 2000). Mean and median intakes were above the suggested references for macronutrients and micronutrients except for calcium. Using anthropological methods and weighed household food intake, a previous study found general dietary adequacy in all nutrients. To the best of our knowledge this is the first study to use estimated individual intakes to estimate group intakes of Aguaruna women and children.

We found that traditional food diversity was associated with significantly higher nutrient intakes in women and children. Using a diversity score calculated from the repeat 24 hour recalls, we demonstrated that greater diversity was associated with higher dietary protein, fiber, calcium, iron, thiamine, riboflavin and vitamin A among women and children. Higher dietary fat, phosphorous, zinc, niacin, ascorbic acid and folic acid were correlated with greater diversity scores for the women. Previous studies around the world have demonstrated that increased dietary diversity improves the nutrient profile of the diet (Hatloy *et al.* 1998; Kye *et al.*, 2004; Mirmiran *et al.*, 2004; Torheim *et al.*, 2004), and a positive relationship with growth (Onyango, 2003). However, we did not find significant relationship of diet and growth in our study.

Analysis of the nutrient distribution of the diet showed that the dietary staples (cassava, bananas, *sachapapa* and *masato*), which were consumed in high volumes, provided the majority of energy and weight of the diet, as well as many nutrients. However, there were also many unique micronutrient dense foods which provided protein, fat, vitamins and minerals, in very small portion sizes. Examples included: wild meats, local fruits including palm fruits and *suri* (larvae harvested from rotting palm trees).

The results from the market survey of this study demonstrated the potential for decrease in dietary quality, from incorporation of low-nutrient dense MF. We found that local foods could be purchased within the communities and provided higher nutrient value per unit price than did purchased MF.

We assessed nutritional status using anthropometry. Based on distribution of MUAC, BMIs in women and WHZ in children, there was no indication of concern seasonal energy deficiencies or acute malnutrition. This contrasts results of Berlin and Markell (1977), which reported thinness among the Aguaruna. Like many other groups in the Amazon (Dufour, 1992), our study found the Aguaruna of short stature. Health of children, as reported by mothers did suggest parasitic and helminthe infections were a concern for this population.

Aguaruna in remote Amazon communities continued to experience the benefits of their traditional diet and lifestyle. In demonstrating high dietary quality and traditional food diversity in an almost purely subsistence setting, we have been able to clearly demonstrate the nutritional benefits of TFSs. A comparison of nutritional value of TF and MF available in the Cenepa region, highlighted the potential decrease in dietary quality which can result when TF are replaced by less nutrient dense MF. Traditional food systems around the world need to be protected and promoted to ensure Indigenous Peoples their right to subsistence lifestyle and good health.

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Appendices

Appendix 6.1

Glossary

Glossary

Chacra: This is the term used to describe the fields where the women go to do their shift agriculture. This is where all of the Aguaruna cultivation takes place.

El Monte: This is the term used to describe the wild which is uncultivated. This is the area of the jungle where the Aguaruna men go to hunt and where both men and women gather plants.

Masato: Masato is a premasticated cassava drink. The women prepare this lightly-fermented drink by chewing cassava and allowing the saliva to mix with the cassava. The women then let the cassava and saliva sit overnight. Water is added the next day and it is served. For a social event the masato is left to sit for up to 4 days for greater potency.

ODECOFROC: (Organizaci6n de Desarrollo de las Comunidades Fronterizas del Cenepa). The Development Organization for the Frontier Communities of Cenepa. This is an Aguaruna association based out of Mamayaque which is dedicated to improving the lives of Aguaruna along the Cenepa, through environmental, economic, educational and nutritional activities.

PRONAA: (Programa Nacional de Apoyo Alimentario). National Program for Food Support. This is the program run by the Peruvian government which supplies food, usually a donation of materials for a lunch time meal or canned milk, to women and children.

Rio Cenepa: The Cenepa River flows all the way from the border with Ecuador, into the Marañon River, which flows into the Amazon River.

Suri: The suri is a larva which is found in the trunks of rotting fallen palm trees. It is of the genus *Coleopterus*. It is an important cultural food for the Aguaruna and is thought to be delicious, especially among children.

Appendix 6.2

Micronutrient Dense Food Short List

Aguaruna Short Food List for Qualitative Interviews

Aguaruna	Spanish	English	Scientific Names
Eep	Eep	Leafy Greens	*Araceae*
Ugkuch	Ugkuch	Leafy Greens	*Piperaceae*
Mamá Duke	Hoja de Yuca	Cassava leaves	*Manihot esculenta*
Tsemantsem	Tsemantsem	Leafy Greens	*Asclepiadaceae*
Esem	Hongos	Mushrooms	N/A
Iju	Chonta	Palmheart	N/A
Yuwí	Zapallo	Squash	*Cucurbita maxima*
Mamá / Yujumak	Yuca	Cassava	*Manihot esculenta*
Pántam	Plátano	Banana	*Musa balbisiana X*
Inak	Chupé	N/A	N/A
Wakam	Macambo	N/A	*Carica papaya*
Najag	Naranja	Orange	*Annanas comosus*
Kukuch	Cocona	Cocona	*Solanum coconilla*
Uyai	Pijuayo	Peach Palm	*Chrysophyllum cainito*
Achu	Aguaje	Mauritia Palm	*Mauritia peruviana*
Apai	Sachamango	N/A	N/A
Chapi	Yarina	N/A	*Phytelepas sp.*
Wakampé Jigkañi	Semillas de Macambo	N/A	*Carica papaya*
Duse	Maní	Peanut	*Arachis hypogea*
Kuchi	Cerdo	Pig	*Sus scofra*
Bukin /Dukush	Suri	Palm Larvae	*Coleopterus sp.*
Atash	Pollo	Chicken	*Gallus gallus*
Kuwau	Rana	Frog	*Colostethus*
Namak	Pescado	Fish	N/A
Atashúnujinji	Huevo de Gallina	Chicken's egg	*Gallus gallus*
Tsuntsu	Caracol	Snail	*Pom ácea sp.*
Kuntinu Ampuji	Visceras de Animales	Animal Organs	N/A
Pituk	Pituca	Taro	*Colocasia esculenta*
Manchup	Manchup	N/A	*Araceae*
Idauk	Camote	Sweet Potato	*Ipomea batatas*
Eté Téji	Huevos de Avispa	Wasp Larvae	*Hymenoptera Brachygastra*
Yampits	Paloma de la Selva	Jungle Pigeon/Dove	*Zenaida asiatica*
Yapagkam	Paloma del Monte	Wild Pigeon/Dove	*Columbidae Columba subvinacea*
Chipi	Loro Chiquito	Small Parrot	N/A

N/A indicates nomenclature was not available or unknown

Appendix 6.3

Aguaruna Food List

^Bold type indicates item mentioned in 24-hour recalls
*Blanks indicate nomenclature is not known

Aguaruna Food List References

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Aguaruna Food List-Roots and Tubers

Aguaruna^	Spanish*	English*	Scientific Name*
Tubers			
Mama/ Yujumak	Yuca	Cassava/Manioc	*Manihot esculenta* *Euphorb.*[2]
Kégkeg	Sachapapa	Yam	*Dioscorea trifida*[2]
Kéghegkeg	Sachapapa Morada		*Dioscorea sp.*°
Nambau	Ashipa	Yam Bean	*Pachyrrhizus tuberosu Leg.*[2]
Pituk	Pituca	Taro	*Colocasia esculenta* *Arac.*[2]
Sanku	Huitina	Cocoyam	*Xanthosoma spp.* *Arac.*[2]
Idauk	Camote	Sweetpotato	*Ipomea batatas Convoluca*[2]
Chiki	Maranta	Arrow Root	*Maranta ruiziana*[2]
Tunka			*Araceae* *Xanthosoma sp.**
Maca	Maca	Maca	*Lepidium peruvianum Chacon*[1]
Manchup			*Araceae* *Caladium bicolor**
Kiyam	Papachina		
Uju/ Mun Uju			*Burseraceae**
Tsegkup			*Dioscorea s.**
Kegkegkee	Sachapapa del Monte		

*(Hamilton Beltran, 2004), °(Berlin and Berlin, 1978), [1](Yockteng *et al.*, 1987), [2](Berlin and Markell, 1977)

Aguaruna Food List - Animals

Aguaruna^	Spanish*	English*	Scientific Name*[a]
Fish			
Aguékian	Zúngaro tigre	Catfish	*Siluriformes Pimelodids Pseudoplatysoma fasciatum*
Baus/Bauts		Catfish	*Siluriformes Cetóposids*
Butta	Mota	Catfish	*Siluriformes Pimelodids*
Champuejan		Pike	*Characiformes Characids*
Chuviu	Anashi		*Perciformes Luciocefalids Luciocephalus sp.*
Dukúm	Bagre Chico	Catfish	*Siluriformes Astroblepidae*
Huampi	Sábalo macho		*Characiformes Caracínidos Brycon*
Huampikus	Chambira		*Characiformes Hepsetinidos Cynodon sp.*
Huásusum	Poecílidos	Livebearer	*Cyprinodontiformes Poecilidos Rivulus sp.*
Kaéjam	Carachama Chiquita	Catfish	*Siluriformes Loricardidids*
Kagka	Boquichico		*Characiformes Prochilodidos Prochilodus sp.*
Kamít	Paco-Gamitana		*Characiformes Charácidos Brycon sp.*
Kantash, Huapujúsh	Bujurque		*Perciformes Cichlasoma sp.*
Kashap	Raya		*Rayiformes Potamotrigonidos Potamotrygon hystrix*
Katish	Lisa		*Characiformes Prochilodidos Leoprinus*
Kigigi			*Siluriformes Diplomistidos*
Kujancham dei	Dentón		*Characiformes Charácidos Cynodon gibbus*
Kumpóau	Bagre Mediano	Catfish	*Siluriformes Pimelodids*
Kunchi	Bagre	Catfish	*Siluriformes Pimelodids*
Kunkuí	Huassaco		*Characiformes Eritrinidos Hoplias malabaricus*
Kusea	Sábalo		*Characiformes Charácidos Brycon sp.*
Mamayak	Mojarra		*Characiformes Charácidos Moenkhausia*
Nanki Putu	Carachama Delgado Grande		*Siluriformes Loricardididos*
Nayúmp	Carachama		*Siluriformes Loricardididos*
Pakásh	Carachama		*Siluriformes Loricardididos*
Paomít	Palometa		*Characiformes Serrasalmidos Mylosoma*
Puepuén	Carapo		*Gymnotiformes Gimnótidos*
Putu	Carachama, Cashca		*Siluriformes Loricardididos Canthopomus sp.*
Sacham	Carachama Chiquita		*Siluriformes Loricardididos*
Shajam Tsutsum	Cashca		*Siluriformes Loricardididos Loricaria*
Shuvi	Carachama Mediano		*Siluriformes Loricardididos Ancistrus sp.*
Sinkijuásh	Shirué		*Siluriformes Callichtyidos Coridoras*
Suyam			*Characiformes Charácidos Roeboides sp.*
Titín	Shiripira	Catfish	*Siluriformes Pimelodids Sorubim*
Tsajun			*Characiformes Caracínidos*
Tujunk			*Characiformes Caracínidos*
Tujushík	Cahuara		*Siluriformes Dorádidos Pseudo-doras*
Tunké	Zúngaro	Catfish	*Silurirormes Pimelodids Psuedopimelodus sp.*
Yutuí	Zúngaro	Catfish	*Siluriformes Pimelodids Rhamdia*
Yuví	Poecílidos	Livebearer	*Cyprinodontiformes Poecilidos*

[a]All fish scientific names (Guallart, 1976)

Aguaruna Food List - Birds

Aguaruna^	Spanish*	English*	Scientific Name*
Birds			
Tugtumpiu			
Tuswam			
Tuwish	Loro	Parrot	
Tuwits			
Ugkun			
Ushap			
Huachú	Pavo del Monte	Wild Turkey	*Gracidae Aburria aburri*[1]
Waga	Perdíz	Grouse/Partridge	
Wakants	Maracaraco		
Yampis/ yámpits	Paloma de la Selva	Dove	*Zenaida asiatica*°
Yapagkam	Paloma del Monte	Wild Pigeon/Dove	*Columbidae Columba subvinacea*[1]
Yukupau			

Berlin and Berlin, 1978), [1](Yockteng et al. 1987), [3](Brown, 1984)

Aguaruna Food List - Birds

Aguaruna^	Spanish*	English*	Scientific Name*
Birds			
Achayachik			
Atásh	Gallina	Chicken	*Gallus gallus*°
Aúnts	Pucacungo	Spix's Guan	*Gracidae Penelope jacquacu*[1]
Ayachui	Montete		
Chikui			
Chipi	Loro Chiquito	Small Parrot	
Chiwa	Trompetero		
Chiwchiwa			
Chuwí	Oropéndola		*Icterus sp.* °
Inkancham			
Jempe	Picaflor	Humming Bird	
Jempekit			
Jempemu			
Kajuntsan			
Kanampus			
Kejua	Tucán Chico	Small Tukan	
Kigtachik			
Kijuáncham		Violaceous Jay	*Cyanocorax violaceous*°
Kijus	Pericos	Parakeet	
Kugchacham			
Kuintam	Carpintero Chico	Small Woodpecker	
Kunchau			
Kúte			
Kuwau	Loro	Parrot	
Mantset			
Patu	Pato	Duck	
Pinish	Tucán Chico	Small Tukan	
Pipjuan			
Pisumash			
Puush	Perdíz Chico	Grouse/Partridge	
Sawake			
Sekush/ Sécuch	Perdíz Azulada	Grouse/Partridge	*Tinamidae Tinamus tao*[1]
Semanchuk			
Seuk			
Shik			
Shimpa			*Columbidae Leptotila rufaxilla*[1]
Sugka	Gallito de las Rocas		
Takaikit			
Tatasham	Carpintero	Woodpecker	
Tawai			
Tayu			*Steatornis caripensis*[3]
Teesh			
Tiju/ Tiuju			*Galbulidae Monasa nigrifrons*[1]
Timantin			
Tsabau Yampis	Paloma Chica	Small Pigeon/ Dove	
Tsukangá	Tucán	Tukan	*Ramphastidae Ramphastos cuvieri*[1]

(Berlin and Berlin, 1978), [1](Yockteng et al. 1987), [3](Brown, 1984)

Aguaruna Food List - Animals

Aguaruna^	Spanish*	English*	Scientific Name*
Mammals			
Japa	Venado	Deer	*Cervidae Mazama sp.*[2]
Kañuk	Añuje	Agouti	*Dasyprocta aguti*[1]
Kashai	Majas	Paca	*Cuniculus paca*[2]
Kúchi	Cerdo	Pig	*Sus scofra*°
Yakum	Mono	Monkey	*Allouatta seniculus*[2]
Kuji	Mono	Monkey	*Callicebus sp.*[2]
Washi	Mono	Monkey	*Ateles sp*[2]
Kúshi	Achuni	Ringtailed Coati	*Procyonidae Nasua nasua*[1]
Pabau	Sachavaca/Tapir	Tapir	*Tapiridae Tapirus terrestris*[1]
Páki	Huangana	White-lipped Peccary	*Tayassuidae Tayassu pecari*[1]
Shushui	Armadillo	Armadillo	*Tolypeutes mataco*[2]
Utu	Cuy	Guinea Pig	*Cavia porcellus*[3]
Waiwásh	Ardilla	Squirrel	*Sclurus sp.*°
Wápajush	Conejo	Rabbit	*Lepridae Sylvilagus brasiliensis*[1]
Yunkipác	Sajino	Collared Peccary	*Tayassuidae Tayassu tajacu*[1]
Amphibians and Reptiles			
Kuwau	Rana	Frog	*Colostethus*[3]
Kugkuim	Tortuga	Amazon River Turtle	*Podocnemis unifilis*[3]
Nantana	Largarto	Lizard	*Polychrotidae*[3]
Puwach	Rana	Frog	*Colostethus*[3]
Shell Fish			
Majúsh	Camarón	Shrimp	*Macrobrachius brasiliensi*°
Tsuntsu	Caracol	Snail	*Pomácea sp.*°
Ujik	Cangrejo	Crab	*Pelanus laturus*°
Insects			
Amugtai	Torito	Beetle	
Bukín	Suri/ Larva de Palma	Palm Larva	*Coleopterus sp.*°
Éte téji	Huevos de Avispa	Wasp Larva	*Hymenoptera Brachygastra*[3]
Maya	Hormiga del árbol	Ant	*Hymenoptera Formicidae*[3]
Tsampun	Mamá del Suri		*Coleopterus sp.*°
Week	Curuvince		

erlin and Berlin, 1978), [1](Yockteng et al., 1987), [2](Berlin and Markell, 1977),
(Brown, 1984)

Aguaruna Food List - Fruits and Vegetables

Aguaruna^	Spanish*	English*	Scientific Name*	
Fruits				
Uyai	Pijuayo	Peach Palm	*Chrysophyllum cainito*	*Palmae.*[2]
Wakam	Macambo		*Carica papaya/ candamarcensis*	*Stercul.*[2]
Wakam pun jinkayi	Semillas de Macambo		*Carica papaya*	*Stercul.*[2]
Wampushik	Inga	Inga	*Inga nobilis*	*Leg.*[2]
Wañam painim				
Yampak			*Theophrastaceae*	*Clavija sp.**
Coco de Cacao	Coco de Cacao	Chocolate Bean	*Theobroma cocao*	
yumung	Límon	Lime/Lemon	*Citrus sp.*	*Ruta.*[2]
kai	Palta	Avocado	*Persea sp.*	*Laurac.*[2]
Pantam	Plátano de Seda	Banana		
Arasá	Arasá			
pina	Piña	Pineapple	*Saccharum officinarum*	*Bromel.*[2]
Pantam	Plátano de Isla			
kistian pitu	Pan de Árbol	Breadfruit	*Artocarpus atilis*	*Morac.*[2]
pangaat	Caña de Azúcar	Sugarcane	*Saccharum officinarum*	*Gram.*[2]
Vegetables				
Achu	Aguaje	Mauritian Palm	*Mauritia peruviana*	*Palmae.*[2]
Batae	Chambira	Palmheart	*Astrocaryum chambira*	*Palmae.*[2]
kaikua	Caigua		*Cyclanthera pedata*	*Cucurb.*[2]
Dat sat sam	Verdura Verde	Leafy Greens	*Astrocaryum chambira*	*Palmae.**
Eep/ Idaimas	Verdura Verde	Leafy Greens	*Arecaceae*	*Philodendron sp.**
Esem	Hongos	Mushrooms		
Jima	Ají	Chile Pepper	*Capiscum annuum, c. frutescens*	*Solan.*[2]
Kupat				
Manchup			*Arecaceae*	*Caladium bicolor**
Namag	Hoja de Yuca	Casava Leaves	*Manihot esculenta*	*Euphorb.*[2]
Sanku	Huitina	Cocoyam	*Xanthosoma spp.*	*Arac.*[2]
Shiim			*Arecaceae*	*Socratea exhorriza**
Shimpi	Palmera	Palm	*Euphorbiaceae*	*Caryodedron orinocensis**
Shashak shaa	Maíz	Corn	*Zea mays**	
Sonat	(un flor)	(a flower)		
Tintuk			*Arecaceae*	*Phytelephas**
Tomatillo	Tomate	Tomato		
Tunka			*Arecaceae*	*Xanthosoma sp.**
Ugkuch	Verdura Verde	Leafy Greens	*Piperaceae**	
Ungurahui				
Uwan	Huicungo		*Arecaceae*	*Astrocaryum sp.**
Uyai	Pijuayo	Palmheart	*Chrysophyllum cainito*	*Palmae.*[2]
Yayu / Sake	Huasai		*Arecaceae*	*Euterpe precatoria**
Yuwí	Zapallo	Squash	*Cucurbita maxima*[2]	
Dusé	Maní	peanut	*Arachis hpogea*°	

^(Berlin and Berlin, 1978), [1](Yockteng *et al*., 1987),
[2](Berlin and Markell, 1977), [3](Brown, 1984)

Aguaruna Food List - Fruits and Vegetables

Aguaruna^	**Spanish***	**English***	**Scientific Name***	
<u>Fruits</u>				
Achu	Aguaje	Mauritian Palm	*Mauritia peruviana*	*Palmae.*[2]
Akagnum			*Theobroma sp.*	*Stercul.*[2]
Anuna	Anona	Anona	*Rollinia microcarpa*	*Annon.*[2]
Apai	Sachamango			
Apeich				
Batae	Chambira		*Astrocaryum chambira*	*Palmae.*[2]
Caimito				
Chapi	Yarina		*Phytelepas sp.*	*Palmae.*[2]
Charichoelo				
Chimi			*Moraceae*	*Pseudolmedia sp.**
Dack pau				
Dapujuk			*Fabaceae**	
Duam	Lechecaspi		*Couma macrocarpa.*[3]	
Dupi				
Guineo	Grano de Oro	Piniya		
Inák	Chupé			
Kunchai				
Kukush/ Shiwankush	Cocona		*Solanum coconilla*[2]	
Kumpia	Achira del Monte	Achira del Monte	*Renealmia alpinia*	*Zingib.*[2]
Kunakip			*Theophrastaceae*	*Clavija sp.**
Kushikan	Huacarapona		Sterculiceae	*Herrania mariae**
Munchi	Grenadilla			
Naam	Sachamaní		*Euphorbiaceae Caryodedron orinocensis**	
Najan	Naranja	Orange	*Annanas comosus*	*Ruta.*[2]
Namuk	Secana	Secana	*Sicana odorifera*	*Cucurb.*[2]
Naranjillo	Naranjillo			
Pantam	Plátano	Banana	*Musa balbisiana X*	*Musa.*[2]
Papai	Papaya	Papaya	*Sicana odorifera*	*Carica.*[2]
Taperiwa	Guanabana	Sapote	*Spondias sp.*	*Sapotac.*[2]
Seetash	Plátano	Banana	*Musa balbisiana X*[2]	
Shagkuina			*Moraceae**	
Shajimat				
Shawi	Guyaba	Guava	*Psidium guayava*	*Myrt.*[2]
Shiim			*Arecaceae Socratea exhorriza**	
Shimpi			*Euphorbiaceae Caryodedron orinocensis**	
Shiwag Kukush	Cocona	Cocona	*Solanum stramonifolium*	*Solan.*[2]
Shuiña	Uvilla	Gooseberry		
Supinim				
Takash Pantam	Sachaplátano			
Tayutím	Kunchai			
Tejesh				
Tintuk			*Arecaceae*	*Phytelephas**
Tumpu	Tumbo			
Ujunts				
Ungurahui				
Uwan	Huicungo		*Arecaceae*	*Astrocaryum sp.**

(Berlin and Berlin, 1978), [1](Yockteng *et al.*, 1987),
[2](Berlin and Markell, 1977), [3](Brown, 1984)

Appendix 6.4

Dietary Recall Forms

Nombre preparación:

Tiempo de comida

Ingredientes	Cantidad	Conversión a gramos	Neto (g)

Número de raciones : ____________________

Nombre preparación:

Tiempo de comida

Ingredientes	Cantidad	Conversión a gramos	Neto (g)

Número de raciones: ____________________

Nombre preparación:

Tiempo de comida

Ingredientes	Cantidad	Conversión a gramos	Neto (g)

Número de raciones : ____________________

Nombre preparación:

Tiempo de comida

Ingredientes	Cantidad	Conversión a gramos	Neto (g)

Número de raciones : ____________________

Instituto de Investigación Nutricional

Nombre del Niño: ______________________________

Dirección: ______________________

1. CODIGO: ___ ___ ___

2. FECHA: ___ ___ / ___ ___ / ___ ___
(Día / Mes / Año)

3. NRO. RECORDATORIO: ___ ___

4. NRO. DE HOJA: _____ 5. SEXO: ____

6. COD. ENC: ___ ___

FORMULARIO 11

REGISTRO DEL CONSUMO DEL NIÑO
RECORDATORIO DE 24 HORAS

7. Hora (hh/mm)	8. Tipo de Comida	9. Nº Prep.	Nombre de la Preparación	10. Tipo Prepar.	Ingredientes	11. Código del alimento	Medida Casera (Cantidad)			12. Tiempo Duración	13. Gramos Consumido	14. Enc. Prepar.
							Servida	No Consum.	Consumida			

C:\PROYECTO 211\FORMATOS\FORMULARIO 4 - TOY PLAY (PSIC).doc (23/09/02)

RECORDATORIO DE 24 HORAS (INFANTE, NIÑO, ADULTO)

Nota: Completar 2 Recordatorios de 24 horas (usar formato por duplicado) para cada entrevistado dentro de una semana

Nombre: ______________________ No. ________ Comunidad: ______________ Entrevistadora: ____________

Génereo: ( ) Masculino ( ) Femenino Edad:______

Estado: ( ) Niño 0-2 y ( ) Niño 3-5 y ( ) Niño 6-12 y ( ) Gestante ( ) Madre Lactante ( ) Madre No-gestante/lactante

Autoidentificación: Indígena: ____________ Otro______________(especificar)

Fecha ________ (día/mes/año)

Día de recordatorio ____________(día/mes/año)

Ayer fue un día "usual"?: ( ) Si ( ) No ( ) Enfermo ( ) Otro (especificar): ____________

Está tomando algún suplemento de vitaminas/minerales?: ( ) No ( ) Sí
Si es sí, por favor especificar:: ______________________ Frecuencia: ____________________

Appendix 6.5

Anthropometry and Health Form

Información de Salud para Madres y Niños

Investigadora y Traductor: ____________

Fecha:____________

Informacion de Salud

Este formulario sera hecho para todos ninos de 3 a 5 anos de edad y las madres siguiendo el consento.

Communidad: ____________________

Participante #: ______ **Sexo: M / F** (Escoje uno) Fecha de nacimiento : _________

Edad: ______________ (anos y meses)

Talla:_________ (en cm precision de 0.1cm) **Peso :** ___________ (kg {0.1 kg})

Talla cuando esta sentada/o: _________ (en cm {0.1cm}) [Mujeres solamente]

Circumferencia del brazo (MUAC): ________(en cm {0.1cm}) [ninos y mujeres]

En general tu hijo/hija esta en buena salud? Si/ No (Escoje uno)

Lo cual de los siguentes describa la salud de tu hijo/hija?

1. **Esta en Buena salud todo el tiempo y esta en mejor salud que los otros ninos______**
2. **Esta en buena salud la mayoria del tiempo ________**
3. **Enfermo/Enferma a menudo _______**
4. **Muy enfermo/ enferma _______**

Informacion Medica

Information por parte de la madre sobre el nino:	Suplementacion de vitamina A? (que dosis)	Night Blindness, Bitots's Spots or corneal Xerosis? SI/NO/NO SABE (Muestren las fotos y pregunta si no tiene dificultad a ver o ubicarse en la noche)	Malaria Cuantos veces y para cuantos dias	Diarrhea Cuantos veces y cuantos dias cada vez?	Parasitos SI/ NO/NO SABE Albendazol? SI/NO	Resfriado/ influenza/ fiebre SI/NO	Dengue ? SI/NO
Durante el mes pasado?							
Edad de 0-2 anos							
Edad de 3-5 anos							

Hay mas informacion sobre este nino/madre que tenemos que revisar: Si/No________

Appendix 6.6

McGill University Ethics Certificate

MCGILL UNIVERSITY
FACULTY OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

CERTIFICATE OF ETHICAL ACCEPTABILITY FOR RESEARCH INVOLVING HUMANS

ıproval Period: MARCh 10, 2004 - MARCh 10, 2005 REB #: 830-0304

ıe Faculty of Agricultural and Environmental Sciences Ethics Review Committee consists of 4 members ɔminated by the Faculty of Agricultural and Environmental Sciences Nominating Committee and elected by aculty, an appointed member from the community and an individual versed in ethical issues.

he undersigned considered the application for certification of the ethical acceptability of the roject entitled:

'itamin A and Zinc in the Agyaruna Food System of the Peruvian Amazon

ıs proposed by:

\pplicant's Name Marion Leslie Roche   Supervisor's Name Dr. Harriet V. Kuhnlein

Applicant's Signature ___   Supervisor's Signature ___

Degree / Program / Course Master's of Science (Thesis)   Granting Agency (ies) CIHR

Grant Title(s): Global Health Project

The application is considered to be:

A Full Review ______   An Expedited Review X

A Departmental Level Review ______________________
Signature of Chair / Designate

Peter Jones
Chair, Faculty of Agricultural and Environmental Sciences Ethics Review Committee
School of Dietetics and Human Nutrition
Tel: (514) 398-7547; Fax: (514) 398-7739

Mar 10 /04
Signature / date

Last update March 2003

Appendix 6.7

ODECOFROC Community Agreement and Translation

Use of the Information

All the information collected is confidential and the names of the participants interviewed will not be revealed to anyone outside of the team of nutritionists on the project.

At the end of the project, the nutritionists are going to share the knowledge through a short course in nutrition.

The IIN is going to give a final report of the project with the results to each community along with ideas of ideas for future plans.

The IIN and CINE have a commitment to share the results of the scientific work with academic and international audiences.

Hilary Creed-Kanashiro
Nutritionist
Principal Investigator

Fermin Apikai Chimpa
PRESIDENT-ODECOFROC

Irma Tuesta Cerron
COORDINADORA NACIONAL

Felimón Mayan Yampis
SECRETARIO-ODECOFROC

THE PROJECT OBJECTIVES ARE:

- To understand and document the Aguaruna Traditional Food System.
- To learn the different species of the foods.
- To prepare documentation to return to the Community to be disseminated in international meetings for the protection of Indigenous environments.

In the future if funds become available.

- To develop, a promotion intervention on the foods that could improve the health of the population within the culture and environment context, based on the information collected.

How will the work be carried out?

We are going to work through meetings with the Organization, and members of the community members and interviews with various people in four (4) communities, in order to discuss the local foods.

We are going to interview approximately 50 mothers with children under the age of 5 years in the 4 communities about the food of the families, mothers and children.

We are going to weigh and measure the height of some of the children.
The interviews and meetings will take place with Aguaruna (Ahuajun) translators.
We are going to ask oral consent for each person interviewed. Each person is free to participate or not.

We are going to collect some traditional foods, plants and animals, which will be scientifically identified and nutrient analysis in some cases.

The work is going to take place over a period of 7 weeks.

INSTITUTE FOR NUTRITIONAL RESEARCH (IIN)

Av. La Molina, 1885.
Lima.
Telephone: 1-3496023

AGREEMENT FOR A RESEARCH PROJECT ON THE FOODS OF THE AGUARUNA BETWEEN ODECOFROC, THE WOMEN'S NUTRITION PROGRAM AND THE IIN.

The researchers of the IIN, under the responsibility of nutritionist Hilary Creed-Kanashiro, with the nutritionists Miluska Carrasco, Melissa Abad, Sandra Vidal and Marion Roche, with the communities of the Rio Cenepa and organization ODECOFROC, are going to collaborate in the implementation of this project.

The IIN is in coordination with Sr. Fermin Apikai and Sra. Irma Tuesta of ODECOFROC.

This is a project made possible in coordination with CINE, Centre for Indigenous Peoples' Nutrition and Environment, of McGill University, under the responsibility of Dr. Harriet Kuhnlein.

The work is a continuation of the work carried out over the 3 previous years by Sra. Irma Tuesta and the nutritionists of the IIN Rossina Pareja and Miluska, who gave courses in nutrition for the Community Promoters.

Purpose

The respective purpose of this project is to understand and document the Aguaruna Food System in order to protect the good nutritional practices and the nutritious foods from the area, with a goal of recognizing the most nutritious foods in order to improve the nutrition of the population. In order to move forward in the Nutrition Courses it is necessary to learn more about the local foods.

Uso de la información.

Toda la información recolectada es confidencial y no se va a dar a conocer los nombres de las personas entrevistadas fuera del equipo de nutricionistas del proyecto.

Al final del proyecto, las nutricionistas van a compartir el conocimiento a través de un curso corto de nutrición.

El IIN va dar un informe al final del proyecto de los resultados a cada comunidad con las ideas de planes futuros.

El IIN y CINE tienen el compromiso de compartir los resultados de trabajos cientificos con audiencias académicas e Internacionales.

Hilary Creed de Kanashiro
Nutricionista Investigadora Principal.

Fermín Apikai Chimpa
PRESIDENTE-ODECOFROC

Irma Tuesta Cerrón
COORDINADORA NACIONAL

Felimón Mayan Yampis
SECRETARIO-ODECOFROC

LOS OBJETIVOS DEL PROYECTO SON:

- Conocer y documentar el sistema tradicional de alimenta — ción de la Aguaruna.
- Aprender los diferentes especies de los alimentos.
- Analizar el contenido nutricional de algunos alimentos - tradicionales.
- Preparar documentación devolver a la Comunidad y para - compartir en reuniones Internacionales para la protección del ambiente Indigena.

En el futuro si se consigue fondos.

- Desarrollar, a base de la información recolectada, una - intervención de promoción de alimentos que mejoren la - Salud de la población dentro de su cultura y ambiente.

¿ Cómo se va a realizar el trabajo ?

Vamos a trabajar a través del reuniones con la Organización, con miembros de las Comunidades y entrevistas con diferentes personas en cuatro (4) Comunidades, para conversar sobre el alimentación del lugar.

Vamos a entrevistar a 50 madres de las 4 comunidades con — niños menores de 5 años para conversar de la alimentación de la familia, las madres y los niños.

Vamos a pesar y medir la talla de algunos niños.

Las entrevistas y reuniones se van a hacer con Aguaruna traductores.

Vamos a pedir consentimiento verbal a cada persona entrevistada. Cada persona es libre de participar o no.

Vamos a recolectar algunos alimentos tradicionales, plantas y animales, para ser identificación Cientifica y análisis de nutrientes en algunos casos.

El trabajo se va a realizar durante un periodo de 7 semanas.

INSTITUTO DE INVESTIGACION NUTRICIONAL (IIN)

Av. la Molina, 1885.
Lima.
Telf. 1-3496023

CONVENIO DE UN PROYECTO DE INVESTIGACION SOBRE LOS ALIMENTOS DE LOS AGUARUNA ANTE ODECOFROC, EL PROGRAMA DE MUJERES NUTRICION Y EL IIN.

DOCUMENTAR LOS SISTEMAS TRADICIONALES DE ALIMENTACION DE LOS AGUARUNAS DEL BAJO CENEPA.

Los investigadores del IIN, siendo Nutricionista Hilary Creed-Kanashiro la responsable, con las Nutricionistas Miluska Carrasco, Melissa Abad, Sandra Vidal y Marion Roche, con Comunidades del Río Cenepa y Organización ODECOFROC, van a colaborar en la realización del Proyecto.

El IIN esta coordinando con Señor Fermin Apikai y la Señora Irma Tuesta de ODECOFROC.

Es un proyecto realizado en coordinación con CINE, Centro para la Nutrición y Ambiente de Personas Indigenas, de la Universidad Mcgill, Canada, siendo Dra.Harriet Kuhnlein la responsable.

El trabajo es una continuación de la labor realizada en los últimos 3 años por Sra. Irma Tuesta y las nutricionistas del IIN Rossina Pareja y Miluska Carrasco donde dieron curso de Nutrición a las Promotoras de las Comunidades.

PROPOSITO

El proposito del respeto es conocer y documentar el sistema de alimentación de los Aguaruna para poder proteger las buenas prácticas de alimentación y los alimentos nutritivos de la zona, con la finalidad de conocer los alimentos más nutritivos para mejorar la Nutrición de la Población. Para poder avanzar con los Cursos de Nutrición es necesario aprender más de los alimentos del lugar.

Appendix 6.8

Script for Individual Oral Consent and Translation

CENEPA, Verbal consent

The consent will be given in oral form for each of the participants interviewed and also in inviting participants to the focus group meetings.

Good Day Sir/Mme: My name is ____________ and I work with the project on food and nutrition of the Institute for Nutritional Research, in coordination with ODECOFROC and their women's group represented by Sra. Irma Tuesta. We have worked in the nutrition courses with Sra. Irma Tuesta and the women's group, but in order to improve this capacity building, we would like to know more about the foods which are used here and all of your local products. Therefore the purpose of this project is to gain and understanding of the food system here in lower Cenepa, with regards to the all of the foods that are produced here, and how they are used by families, and above all by women and young children. The results will help in the future capacity building projects about good nutrition based on the most nutritious foods available in the region.

I would like to talk with you on 3 or 4 occasions during the next few weeks about food and health in your community. You are free to answer or refrain from answering any questions. Participation is voluntary. Are you interested in participating in this project?

YES/NO

Thank you very much.

Name of the Interviewer:

Name of the Interviewee:

Name of the translator:

Date:

CENEPA, Cosentimiento verbal

El consetimiento va a ser en forma verbal para cada una de las participantes entrevistadas y al inviter a los participantes a las reuniones del grupo focal.

Buenos días Señor(a): Mi nombre es __________ y trabajo con el proyecto de alimentación y nutrición del Instituto de Investigación Nutriticional, en coordinación con ODECOFROC y el grupo de mujeres con representación por Sra. Irma Tuesta. Hemos venido trabjando con cursos de nutrición con Sra. Irma Tuesta y el grupo de mujeres, pero para poder mejorar las capacitaciones, necesitamos concocer mas sobre los alimentos que se usan aquí, sobre todo aquellos producidos por Uds. Por lo tanto este proyecto tiene como finalidad conocer el sistema de alimentación aquí en el Bajo Cenepa, sobre todo los alimentos que producen aquí, y cómo los usan en la familia, sobre todo las mujeres y los niños menores. Los resultados van a ayudar a programas de capacitación en el futuro sobre una buena alimentación utilizando a base de los alimentos mas nutritivos que tienen en la zona.

Quisiera conversar con Usted en 3 o 4 oportunidades durante las proximas semanas sobre alimentación y salud en su comunidad. Usted está libre de contestar o no cualquiera de las preguntas. ¿Está Ud. interesado/a en participar en este proyecto?

SI/NO

Mucas Gracias.

Nombre de la entrevistada:

Nombre de la entrevistadora:

Nombre del traductor:

Fecha:

Appendix 6.9

ODECOFROC Letter of Support for Research and Translation

"International Decade of the Rights of Indigenous Peoples"

Mamayaque, May 21, 2004

Dear Miss Marion Leslie Roche;

The Organization of the Frontier Communities of Cenepa, ODECOFROC, gives our consent to the work that you have completed in cooperation with us.

From April 1st to May 21st, 2004, you have worked as a nutritionist and representative of CINE, of McGill University in Canada and the Institute for Nutritional Research in Lima, Peru. In the Aguaruna communities of Cocoashi (Annex of Wawaim), Mamayaque, Nuevo Kanam, Nuevo Tutino, Tuutin and Paki you have worked with women and children in dietary recalls, anthropometry and qualitative research. In addition, you have interviewed elders of the aforementioned Communities. As an organization we give our consent on behalf of the Aguaruna people of the Rio Cenepa for you to continue in your research.

Very sincerely,

ODECOFROC

FERMIN APIKAI CHIMPA
PRESIDENTE

"DECENIO INTERNACIONAL DE LOS DERECHOS DE LOS PUEBLOS INDIGENAS"

Mamayaque, 21 de Mayo del 2004.

Estimada Srta. Marion Leslie Roche.

La Organización de Desarrollo de las Comunidades Fronterizas de El-Cenepa, ODECOFROC, da conocimiento del trabajo que Usted ha logrado con cooperación de nuestra parte.

Desde el 01 de Abril hasta el 21 de Mayo del año 2004.- Usted ha trabajado como nutricionista y representante del C.I.N.E. de la Universidad de McGill de Canadá y del Instituto de Investigación Nutricional de Lima Perú. En las Comunidades Aguaruna de Cocoashi(Anexo de Wawaim), Mamayaque, Nuevo Kanam, Nuevo Tutino, Tuutin y Pagki ha trabajado con mujeres y niños en recordatorios alimentarios antropometria e investigación cualitativa. Además ha entrevistado a personas de la 3ra. edad de las Comunidades mencionadas. Como Organización damos consentimiento por parte de la gente Aguaruna del Río Cenepa para que pueda seguir en su investigación.

Muy Atentamente.

Desarrollo de las Comunidades Fronterizas de El Cenepa ODECOFROC PRESIDENTE MAMAYAQUE

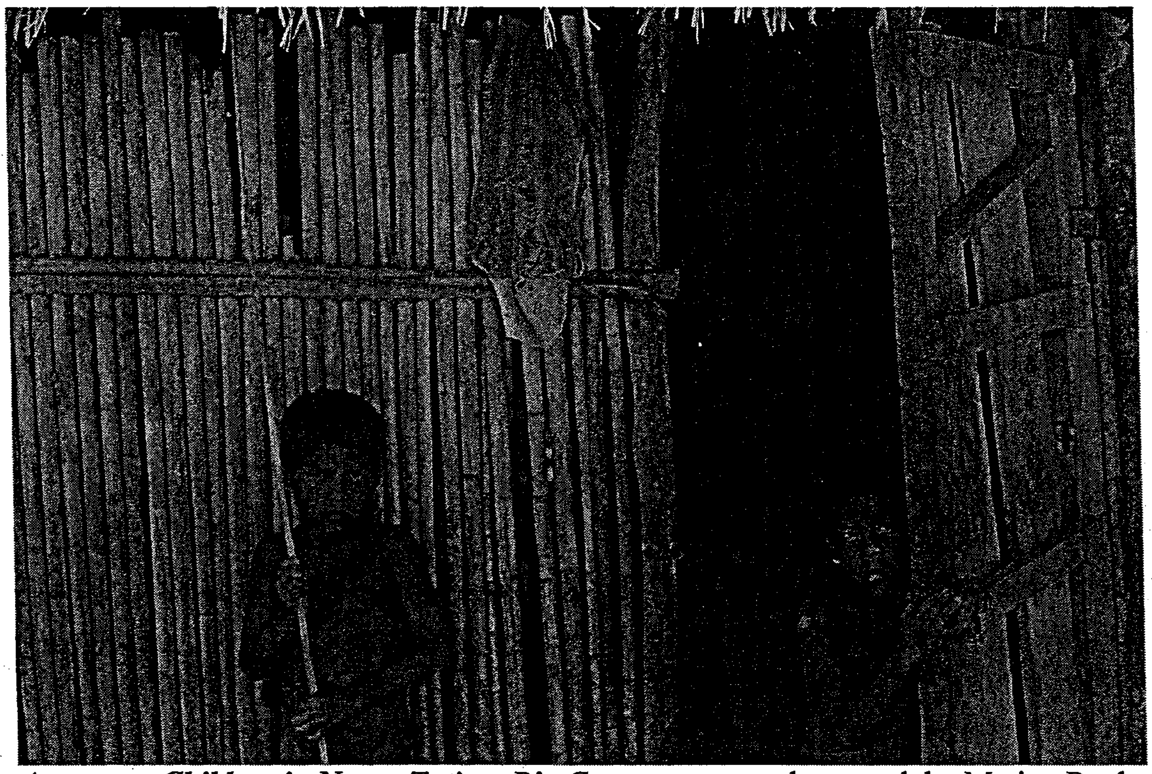
ODECOFROG

FERMIN APIKAI CHIMPA
PRESIDENTE

:de: Mamayaque, Cenepa, Condorcanqui, Amazonas - Perú • Sede en Lima: Islas Canarias Mz. J6 Lote 20, Cedros de Villa; Chorrillos
Telefax: (01) 254-2490 / Casilla Postal 40, Lima 9 - Perú

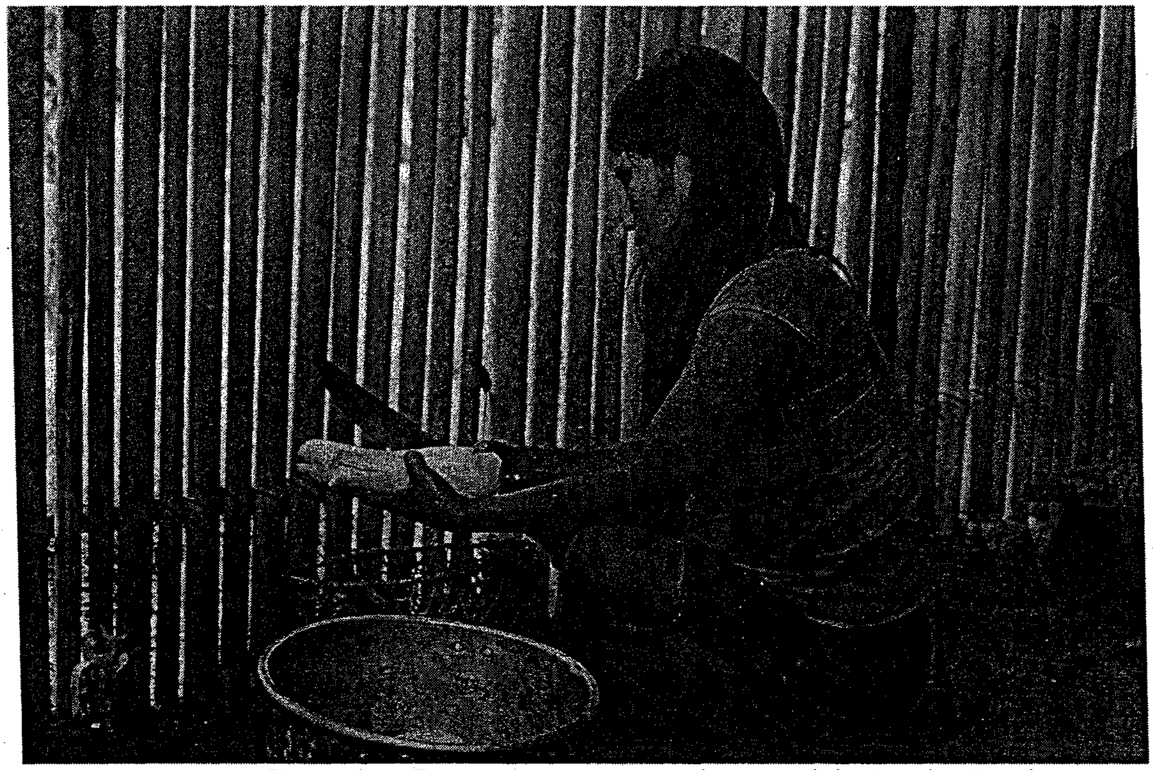
Appendix 6.10

Photographs from Cenepa



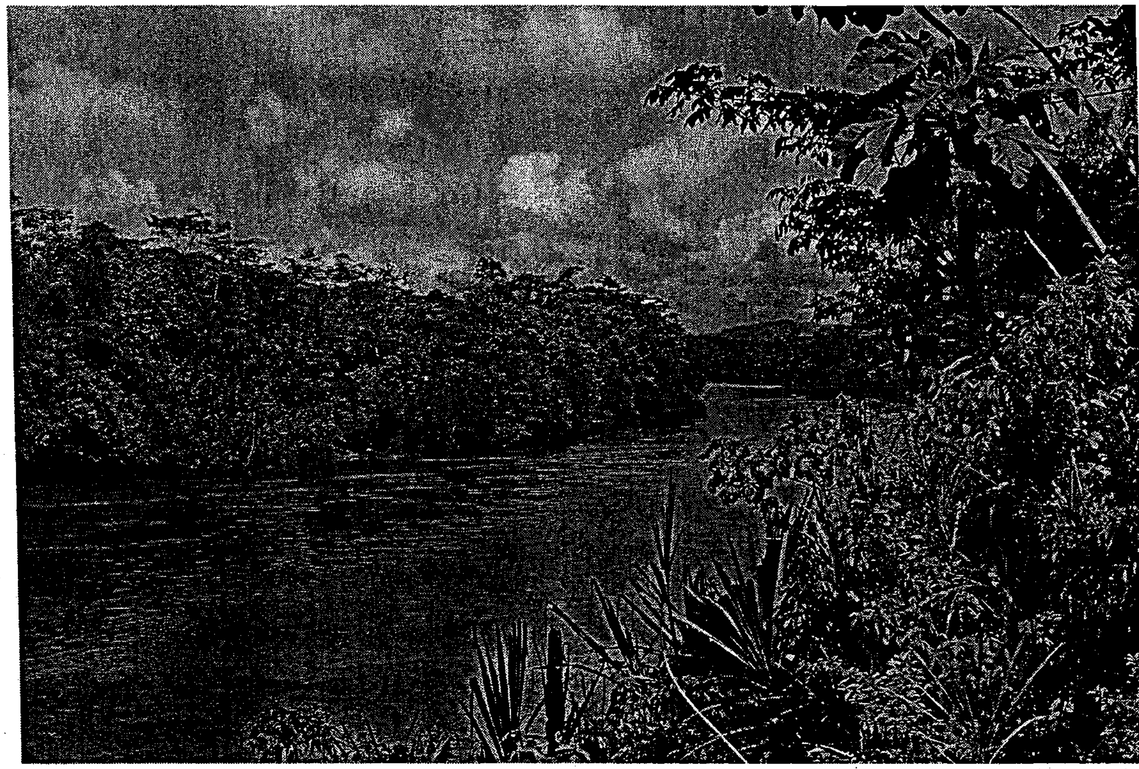
Aguaruna Children in Nuevo Tutino, Rio Cenepa photograph by Marion Roche

Aguaruna Children in Mamayaque photograph by Marion Roche



Aguaruna woman Preparing Cassava photograph by Marion Roche

A traditional Aguaruna stove heating a cassava-filled clay pot covered with banana leaves photograph by Marion Roche



The Rio Cenepa May 2004 photograph by Marion Roche

A typical Aguaruna house in Cocoaushi photograph by Marion Roche

Appendix 6.11

Waivers from Manuscript Co-authors

Dear McGill University,

This letter is to acknowledge my agreement for the publication of the Master of Science thesis of manuscript of Marion Leslie Roche of School of Dietetics and Human Nutrition, McGill University and CINE. I acknowledge that this thesis contains a manuscript titled **Traditional Food, Dietary Diversity and Nutritional Status of the Aguaruna in the Peruvian Amazon,** for which I am a co-author along with Irma Tuesta and Hilary M. Creed-Kanashiro. I give permission to waive copyright for the publication of this thesis.

signature ______________ date 17 Feb 05

Dr. Harriet V. Kuhnlein
CINE
21, 111 Lakeshore
Ste-Anne-de-Bellevue, QC
H9X 3V9

Tel: (514) 398 7671
Fax: (514) 398 1020

17/02/2005

Dear McGill University,

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signature date 17/2/05

Hilary M.Creed-Kanashiro
Instituto de Investigación Nutricional
Av. La Molina 1885, Lima 18 – Peru

Telephone: (51 -1) 349 – 6023
Fax: (51-1) 349 – 6025
Email: hmcreed@iin.sld.pe

Signature date 17/2/05

Por: Irma Tuesta Cerrón
Racimos Ungurahui
Calle Canarias Mz J6 Lote 20
Urb. Cedros de Villa
Chorillo
Lima 9

Uso de la información.

Toda la información recolectada es confidencial y no se va a dar a conocer los nombres de las personas entrevistadas fuera del equipo de nutricionistas del proyecto.

Al final del proyecto, las nutricionistas van a compartir el conocimiento a través de un curso corto de nutrición.

El IIN va dar un informe al final del proyecto de los resultados a cada comunidad con las ideas de planes futuros.

El IIN y CINE tienen el compromiso de compartir los resultados de trabajos científicos con audiencias académicas e Internacionales.

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Nutricionista Investigadora Principal.

Fermín Apikai Chimpa
PRESIDENTE-ODECOFROC

Irma Tuesta Cerrón
COORDINADORA NACIONAL

Felimón Mayan Yampis
SECRETARIO-ODECOFROC

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signature ______ date 17 Feb 05

Dr. Harriet V. Kuhnlein
CINE
21, 111 Lakeshore
Ste-Anne-de-Bellevue, QC
H9X 3V9

Tel: (514) 398 7671
Fax: (514) 398 1020

17/02/2005

Marion Roche

INSTITUTO DE INVESTIGACION NUTRICIONAL
Av. La Molina 685; La Molina, Lima, Perú
Telf: 51-1-3496023 Fax: 3496025.
Email: hmcreed@iin.sld.pe
Apartado Postal 18-0191, Lima 18 - Perú

FAX

DATE (FECHA): 17.2.05
TO (A): CINE Marion Roche/ Harriet Kuhnlein
FAX No. 001 514 398 1020
FROM (DE): Hilary Creed-Kanashiro
SUBJECT (ASUNTO): Consent signatures
No. of pages including cover sheet: 02

Dear Marion,

Here comes the signed consent letter.

Let me know if you need anything further; I shall be out of Lima 20 – 23 Feb.

Again, very many CONGRATUALTIONS!

Dear McGill University,

This letter is to acknowledge my agreement for the publication of the Master of Science thesis of manuscript of Marion Leslie Roche of School of Dietetics and Human Nutrition, McGill University and CINE. I acknowledge that this thesis contains a manuscript titled **Traditional Food, Dietary Diversity and Nutritional Status of the Aguaruna in the Peruvian Amazon,** for which I am a co-author along with Irma Tuesta and Dr. Harriet V. Kuhnlein. I give permission to waive copyright for the publication of this thesis.

signature date 17/2/05

Hilary M.Creed-Kanashiro
Instituto de Investigación Nutricional
Av. La Molina 1885, Lima 18 – Peru

Telephone: (51 -1) 349 – 6023
Fax: (51-1) 349 – 6025
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Signature date 17/2/05

Por: Irma Tuesta Cerrón
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Hilary Creed-Kanashiro	Fermin Apikai Chimpa
Nutritionist	PRESIDENT-ODECOFROC
Principal Investigator	
Irma Tuesta Cerron	Felimón Mayan Yampis
COORDINADORA NACIONAL	SECRETARIO-ODECOFROC