ANTHROPOMETRY AND DIET OF MOHAWK SCHOOLCHILDREN IN KAHNAWAKE

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ABSTRACT

Anthropometry, dietary intakes and food preferences of Mohawk children in Kahnawake were studied. Overweight, defined by body mass index at and above the 85th percentile of United States all-race children was 29.6% in boys and 32.8% in girls aged 5 to 12 years; rates were generally lower than those reported for Native North American schoolchildren using same criterion. Compared with U.S. data, there were greater differences in subscapular than triceps skinfold thicknesses, suggesting a more central distribution of subcutaneous fat. Mean energy intakes of Grades 4 to 6 children were adequate to achieve normal growth, and height-for-age and weight-for-height showed no evidence of malnutrition. Mean fat intake as a percentage of total energy was lower than average seen in North American schoolchildren (<35% at $p<0.001$). Twenty percent of children reported consumption of traditional or cultural Mohawk food. Children had a high preference for most of 24 food items assessed.

RÉSUMÉ

À l'aide de mesures anthropométriques, d'entrevues portant sur l'apport nutritionnel et d'un questionnaire sur les préférences alimentaires, une étude a été entreprise auprès d'enfants Mohawk de Kahnawake. Selon le critère du 85^{ième} centile de l'indice de masse corporel à partir de données sur les enfants américains, 29,6% des garçons et 32,8% des filles âgés de 5 à 12 ans auraient un excès de poids. Ces taux sont relativement moins élevés que ceux reportés dans d'autres études utilisant le même critère et portant sur des enfants amérindiens. Lorsque comparé à des données américaines, il existe des différences plus grandes pour les mesures du pli cutané subscapulaire que ceux du triceps. Ceci laisse présumer une distribution plus centrale du gras sous pli cutané. La moyenne de l'apport énergetique des enfants de quatrième, cinquième et sixième élémentaires est considérée comme adéquate pour atteindre une croissance normale. Les indices taille selon l'âge et poids et selon l'âge et taille ne révèlent aucun problème de sous-alimentation. La moyenne de l'apport en matières grasses, exprimée en pourcentage de l'apport énergétique total, se révèle inférieure à ce qui est généralement présenté pour les étudiants nord-américains ($<35\%$ à $p<0.001$). Vingt pourcent des enfants de Kahnawake ont déclaré consommer des aliments traditionnels ou culturels Mohawk. Ils ont également affirmé avoir une disposition favorable pour la plupart des 24 éléments utilisés dans le questionnaire sur les préférences alimentaires.

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I. INTRODUCTION

Kahnawake is a Mohawk territory directly across the St. Lawrence River, south of Montreal, about 19 km from downtown Montreal. In the Mohawk language, Kahnawake means "on the rapids", which refers to the nearby Lachine Rapids. The Mohawk are one of six nations of the Iroquois. The People of Kahnawake call themselves Kahnawakero:non. The total population residing in the community is approximately 6000. Kahnawake is a unique Native community: it has its own hospital and health care, schools and education system, social services, justice and policing, and cooperative financial institution.

Agriculture, especially of corn, is at the cornerstone of the traditional Iroquois food system. Staple foods are "The Three Sisters", corn, beans and squash. Historically, these were important not only from a nutritional standpoint; they encompassed many customs, stories, myths and legends (Eames-Sheavly, 1993). Today, although not as frequently used, this food still holds a strong cultural and spiritual significance. Traditional food comprised of one or more of the Three Sisters includes cornbread, corn soup and stews. In the past, these were complemented by food such as wild meats, berries, fruits, nuts and maple syrup.

In the 1980s, studies conducted at Kateri Memorial Hospital Centre showed high prevalence of diabetes and its complications among adults in Kahnawake (see II.1.2.). Results raised concern among community members for the health of its future generations, and drove the initiation and development of the Kahnawake Schools Diabetes Prevention Project (KSDPP). The KSDPP is funded by the National Health Research and Development Program (Health Canada) for three years and has been implemented as of Fall 1994. It is a school-based health education program with a strong community health promotion intervention, whose aim is to promote healthy eating, physical activity and a positive attitude. The ultimate goal is the prevention of diabetes by encouraging positive lifestyle behaviours from an early age. The KSDPP includes a strong evaluation component. It is within the context of baseline data evaluation of the KSDPP that the study described in this thesis was realized.

The goal of this thesis project was to characterize anthropometry, nutrient and food intakes, and food preferences of Kahnawake schoolchildren. (Specific objectives and hypotheses are described in Section III following the review of the literature.) The most appropriate methods to evaluate these, given time and feasibility constraints were sought from the literature. Previous knowledge in these areas for Native North American schoolchildren was also brought forward as an aid to describe the situation among Kahnawake children. Assessment of anthropometry and diet of children is a broad, dynamic research field in which there are still many unanswered questions. In light of health promotion projects such as the KSDPP, it is becoming increasingly important to be able to do this as accurately as possible.

II. LITERATURE REVIEW

1. Patterns of health and disease in Native North American Peoples

There has been a transition in health and disease patterns in Native North American Peoples over the past few hundred years. Arrival of European settlers introduced infectious diseases that had devastating effects in many populations (Young, 1988). In the 1940s, two surveys in Canada revealed a population on the brink of starvation (Young, 1993). Since then, there has been a reduction in infectious diseases and a dramatic rise in chronic diseases related to obesity, especially non-insulin-dependent diabetes mellitus (NIDDM) (Jackson, 1986; Young, 1988; Byers, 1992).

1.1. Non-insulin-dependent diabetes mellitus (NIDDM) and related health problems

1.1.1. Prevalence of NIDDM and its complications

NIDDM has become a widespread health problem in Native North American Peoples (Gohdes et al., 1993; Young, 1993). In some communities it has reached epidemic proportions (West, 1978; Kuller, 1993). The Pima in Arizona have the highest reported rates of diabetes in the world; half the population over the age of 35 has the disease (Knowler et al., 1991).

Numerous studies have described the prevalence of NIDDM in Native Peoples across Canada and the United States. A wide regional variation has been observed. In an ecological survey of 76% of the Native population of Canada, the age-gender-adjusted prevalence of diagnosed diabetes was 2 to 5 times higher than in non-Natives, in all but three areas (British Columbia, Yukon and the Northwest Territories) (Young et al.,1990). Studies in selected Native groups in Canada such as the Algonquin in Quebec and the Cree and Ojibway Nations in Northwestern Ontario have shown excessive rates of diabetes (Delisle and Ekoé, 1993; Fox et al., 1994). NIDDM has become an important health problem among the James Bay Cree of northern Quebec; it was noted that prevalence increased as latitude decreased (Brassard et al., 1993*a*; Brassard et al., 1993*b*).

Studies in the United States have also shown rates of NIDDM to be higher in Native Americans than in other ethnic groups (Farrell et al., 1993; Gohdes et al., 1993; Martinez and Strauss, 1993; Stahn et al., 1993). From a survey of Indian Health Services (IHS) out-patient records it was estimated that 8.9% of Native Americans 15 years and older were seen for diabetes in 1987 (Gohdes et al., 1993). This percentage may have been underestimated, as it reflected only individuals receiving health care services from IHS. Overall, the prevalence of self-reported diabetes among Native Americans estimated from the Survey of American Indians and Alaska Natives in 1987, was higher than the U.S. all-race rate (Young, 1993).

It has been noted that the prevalence of NIDDM tends to increase with age and is generally higher in women than in men (Young, 1993). NIDDM appears to be occurring at a younger age among Native Peoples (Knowler et al., 1991; Delisle and Ekoé, 1993; Fox et al., 1994).

The health burden of diabetes comes mainly from its complications (Gohdes, 1993). Native Americans experience a very high proportion of diabetes-related end-stage renal disease (Lee et al., 1994). Newman et al. (1990) reported a rate 2.8 times the age-adjusted incidence in Caucasians, with 56% of cases attributable to NIDDM (Newman et al., 1990). A high incidence and prevalence of renal disease and amputations have been reported in Eastern Band Cherokee, and in Plains, Sioux and Eastern Woodlands Nations in North Dakota, South Dakota and Nebraska (Farrell et al., 1993; Stahn et al., 1993).

Cardiovascular disease is a major cause of death among Native North Americans (Alpert et al., 1991). Overall rates of ischemic heart disease and atherosclerosis in Native Peoples in the United States (including Alaska) were lower than in the general population (Welty and Coulehan, 1993). When individual regions were considered, however, there was a wide variation in rates of cardiovascular disease; in many cases these were in excess of the general U.S. population.

Mortality rates associated with diabetes were four times higher in Native Americans than in the U.S. white population (Newman et al., 1993). The authors suggested that these may have been underestimated because of the incomplete recording of diabetes as a cause of mortality on death certificates (Newman et al., 1993).

1.1.2. Obesity

Obesity is an important health problem which makes Native peoples disproportionately susceptible to diabetes, hypertension and cardiovascular disease (Rhoades et al., 1987; Howard et al., 1992). Many studies have reported a high prevalence of obesity in relation to NIDDM (Knowler et al., 1991; Brassard et al., 1993*a*; Muneta et al., 1993; Fox et al., 1994). Although obesity is considered the strongest environmental risk factor in the development of NIDDM, it cannot entirely explain the higher rates of diabetes among Native peoples (Delisle and Ekoé, 1993; Young, 1993).

Prevalence of obesity in American and Alaska Native adults living on or near reservations (n=3200) was estimated with data collected by the National Medical Expenditure Survey in 1987 (Broussard et al., 1991). Obesity was 13.7% in Native men and 16.5% in Native women, compared with rates of 9.1% in U.S. men (all races) and 8.2% in U.S. women (all races). Knowler et al. (1991) described increasing levels of obesity in the Pima since the turn of the century. In a survey of 704 adult Cree and Ojibwa in Northern Canada, a large proportion of individuals in all age-gender groups were obese (Young and Sevenhuysen, 1989).

It is important to consider limitations when comparing or summarizing studies on prevalence of diseases or their risk factors such as obesity. These include differences in study design, cultural and anthropological diversity among groups, geographic dispersion that makes it difficult to include large numbers in surveys, and regional disparities in health care contributing to differences in reported rates (Howard et al., 1992). Definitions of the disease or its risk factors, methods of ascertainment, denominators on which prevalence estimates are based, and reference populations to which results are compared may also be variable between studies (Howard et al., 1992; Young, 1993).

1.1.3. Etiology

The etiology of NIDDM is multifactorial, and includes heredity, obesity, physical inactivity, diet and metabolic factors (Young, 1993). It is generally believed that Native Peoples have a genetic susceptibility to diabetes (and obesity) that has been unveiled by environmental risk factors (West, 1978; Kuller, 1993; Young, 1993). Since first contact with European settlers, Native communities have undergone rapid cultural, dietary and lifestyle changes. In the case of maize-growing Peoples, the traditional corn-based diet high in complex carbohydrates and fibre, and low in fat, has been replaced with a diet high in fat and containing a large proportion of highly processed food. There has also been a transition from very high activity patterns associated with subsistence farming and hunting, manual labour and travel on foot, to a relatively sedentary lifestyle (Zimmet, 1982; Mohs et al., 1985; Rhoades et al., 1987; Szathmary et al., 1987; Young and Sevenhuysen, 1989; Teufel and Dufour, 1990; Broussard et al., 1991; Swinburn et al., 1991; Byers, 1992; Diamond, 1992; Boyce and Swinburn, 1993; Young, 1993).

1.2. Situation in Kahnawake

Kahnawake is not an exception to the high prevalence of NIDDM and its complications observed among Native North American Peoples over the past few decades. In 1981, Drs. Montour and Macaulay of Kateri Memorial Hospital Centre conducted a chart review of 544 Mohawk adults (92% of the population 45 to 64 years of age). They documented a NIDDM rate of 12%, which was more than double that reported in a white American population of similar income and education (Montour and Macaulay, 1985). Thirty percent of the sample had hypertension, which was almost twice that reported in an equivalent white American population. There is a paucity of information on hypertension in Native North Americans, but it has been suggested to be lower than in white populations (Martinez-Maldonado, 1991).

A few years later, complications and associated risk factors of NIDDM were studied using chart review, patient interviews and the measurement of variables such as weight and height (Macaulay et al., 1988; Montour et al., 1989). Subjects included adults with and without NIDDM who had been matched for age and gender. A very high percentage (48%) of individuals with diabetes had ischemic heart disease. Rates of obesity were high both in subjects with diabetes (86%) and in those without (74%), suggesting that even those without NIDDM were at high risk of developing the disease because of their weight status. These results raised concern among community members for the health of its future generations, and drove the initiation and development of the KSDPP.

2. Anthropometry of Native North American schoolchildren

Anthropometric studies in diverse groups of Native North American schoolchildren have generally shown rates of overweight or obesity and secular increases exceeding those reported in non-Native children (Harlan, 1993; Kumanyika, 1993).

2.1. Prevalence of overweight

Studies which have examined the prevalence of overweight or obesity in Native North American schoolchildren in the past decade are summarized in Table 2-1. Caution is needed when using such results to estimate prevalence of overweight or obesity, or to compare across groups, as differences may stem from the use of different assessment methods and criteria (Kumanyika, 1993). Due to selected groups and small sample sizes, there may also be the possibility of sample distortion bias (Kramer, 1988).

Urbanization has been cited as a possible contributor to a higher prevalence of obesity among Native children; children living in or near urban areas are more likely to be removed from their traditional lifestyle (Johnston et al., 1978; Pfeiffer and Dibblee, 1982).

2.2. Secular trends

Several authors have noted a secular increase in adiposity of Native children (Helmuth, 1983; Sugarman et al., 1990; Knowler et al., 1991; Hauck et al., 1992; Malina, 1993; Valdini et al., 1994). At comparable heights, 5- to 18-year-old Pima children weighed 6 to 14 kg more in 1988 than in 1905 (Knowler et al., 1991). Sugarman et al. (1990) reported an increased prevalence of obesity in Navajo children 5 to 17 years of age over a period of 35 years, when data from 1988 were compared with data from 1955: Mean heights increased 6.1% in boys and 4.4% in girls, while mean weights increased 28.8% in boys and 18.7% in girls. Between 1966 and 1982, 6- to 14-year-old Mohawk children from Tyendinaga were taller and heavier than Southern Ontario Iroquois in 1934 (Helmuth, 1983). However, this study was limited by the small number of children within each age-gender group.

2.3. Implications for health and prevention

An increase in childhood obesity may have major implications on the health of Native North American Peoples if it continues into adulthood (Hauck et al., 1992). Obesity is a significant health problem which contributes to high rates of non-insulin-dependent diabetes mellitus and hypertension. It is not known whether obesity in Native North American adults develops in childhood or later in life (Byers, 1992). Studies in other populations have suggested that childhood obesity may track into adulthood (Muramutsu et al., 1990; Casey et al., 1992; Nieto et al., 1992; Clarke and Lauer, 1993; Ernst and Obarzanek, 1994) and may also be associated with increased morbidity and mortality (Mossberg, 1989; Must et al., 1992). There has been a wide range of estimates of the proportion of obese children who become obese adults owing to different study designs, definitions of obesity, ages of subjects, intervals between measurements, and population and cultural differences (Serdula et al., 1993; Canadian Task Force on the Periodic Health Examination, 1994). The degree, duration, and age at onset of obesity affect the probability of its persistence into adulthood (Freedman et al., 1987; Story and Alton, 1991; Dietz, 1994).

Pediatric obesity has been associated with cardiovascular risk factors such as high blood pressure and hypercholesterolemia (Leung and Robson, 1990; Burns et al., 1992; Ernst and Obarzanek, 1994). It has not been proven that obesity in childhood increases the risk of chronic diseases later on in life (Canadian Task Force on the Periodic Health Examination, 1994). The question of whether preventing obesity in children will reduce the risk of chronic diseases in adulthood also remains unanswered. However, a number of reasons would suggest efforts in the prevention of obesity to be highly desirable (Jackson et al., 1991; Harlan, 1993; Serdula et al., 1993). Among these are the burden of diseases such as diabetes and coronary heart disease, particularly in Native communities, and the likelihood that behaviours and lifestyle patterns leading to obesity may be established during childhood (Ernst and Obarzanek, 1994).

School is a potentially useful setting for the primary prevention of obesity (Resnicow, 1993). To date, there have not been many published reports of current intervention and evaluation programs in Native North American communities aimed at the prevention of obesity and its long-term health consequences (Davis et al., 1993; Davis and Gomez, 1993).

Table 2-1 - Prevalence of overweight or obesity in Native North American schoolchildren

Author(s) (year)	Study Population	Criteria to define overweight (ow) or obesity (ob)	Percent overweight (ow) or obesity (ob)
Story et al. (1986*b*)	Eastern Band Cherokee (North Carolina) 13-17 y.o. Boys n=139, girls n=138.	ow - triceps skinfold ≥ 85th percentile white adolescents in TSNS[a]	Boys: 49.7 Girls: 31.6
		ob - triceps skinfold ≥ 95th percentile white adolescents in TSNS	Boys: 16.0 Girls: 12.0
Sugarman et al. (1990)	Navajo 5-17 y.o. Boys n=951, girls n=1018.	ob - weight-for-age ≥ 95th percentile NCHS-CDC reference[b]	Boys: 12.5 Girls: 11.2
Broussard et al. (1991)	Sioux (North Dakota) 9-13 y.o. Boys n=56, girls n=49.	ow - body mass index ≥ 85th percentile NHANES II reference[c]	Boys: 32.1 Girls: 30.6
		ob - body mass index ≥ 95th percentile NHANES II reference	Boys: 3.6 Girls: 6.1
	Winnebago and Omaha (Nebraska) 7-17 y.o. Boys n=275, girls n=224.	ow - body mass index ≥ 85th percentile NHANES II reference	Boys: 32.7 Girls: 34.4
		ob - body mass index ≥ 95th percentile NHANES II reference	Boys: 16.4 Girls: 13.4
	Southwest Arizona (ethnicity not specified) 14-17 y.o. Boys n=59, girls n=83.	ow - body mass index ≥ 85th percentile NHANES II reference	Boys: 74.6 Girls: 78.3
		ob - body mass index ≥ 95th percentile NHANES II reference	Boys: 44.1 Girls: 51.8

Table 2-1 (cont'd) - Prevalence of overweight or obesity in Native North American schoolchildren

Author(s) (year)	Study Population	Criteria to define overweight (ow) or obesity (ob)	Percent overweight (ow) or obesity (ob)
Gilbert et al. (1992)	Navajo 14-18 y.o. Boys n=168, girls n=205.	ow - body mass index ≥ 85th percentile NHANES II reference	Boys: 25 Girls: 33
		ow - triceps skinfold ≥ 85th percentile NHANES II reference	Boys: 26 Girls: 21
		ow - subscapular skinfold ≥ 85th percentile NHANES II reference	Boys: 60 Girls: 41
Jackson (1993)	American Indian schoolchildren as part of height and weight survey in 1990-91 5-18 y.o. Boys n=4921, girls n=4543.	ow - body mass index ≥ 85th percentile NHANES II reference	Both genders: 39.3
		ow - body mass index ≥ 85th percentile HHANES-MA reference[d]	Both genders: 28.6
Bernard et al. (1995)	Eastern James Bay Cree (Quebec) 9-19 y.o. n=144	ow - body mass index ≥ 90th percentile NHANES II reference	Both genders: 38
		ow - body mass index ≥ 90th percentile NHANES II reference	Both genders: 17 (Boys: 9; Girls 24)

[a] Ten State Nutrition Survey (1968-70)
[b] National Center for Health Statistics - Centers for Disease Control
[c] second National Health and Nutrition Examination Survey, all races (1976-80)
[d] Hispanic Health and Nutrition Examination Survey, Mexican-American population (1982-84)

3. Diet of Native schoolchildren

There is a paucity of literature describing the diet of Native North American schoolchildren. Main areas of focus in the few reports available are nutrient and food intakes, and the relationship between diet and anthropometry.

3.1. Nutrient Intake

Several authors have evaluated the nutrient intakes of Native children by comparing them to national reference standards. The mean nutrient intake of 343 Hopi elementary schoolchildren was compared to Recommended Dietary Allowance (RDA) levels and found to be at risk for calcium, vitamins A and B-6, thiamin and ascorbic acid, although a potential underreporting of energy and thus nutrient intake was noted (Kuhnlein and Calloway, 1977). Recently, 96 Hopi children (aged 9-13 years) completed 3-day dietary records (Brown and Brenton, 1994). Their mean macro- and micronutrient intakes were compared to RDAs. Fat, saturated fat and sugars were above, and fiber was below current recommendations. Of all analyzed vitamins and minerals, only vitamin D, calcium and zinc did not meet at least 97% or 100% of the RDA. This study had a low response rate (48%), and therefore may not have been representative of all the children.

During three seasons and in two communities, the 24-hour food intake of 151 preschool northern Manitoba Native children was measured (Ellestad-Sayed et al., 1981). The nutrient content was calculated and compared to recommended levels. Nutrients found most likely to be lacking were vitamin D and iron, with protein and ascorbic acid high relative to standards. The mean nutrient intakes of 143 Native children in Grades 4 and 6 in northern Manitoba, obtained through 24-hour recalls, were compared with the 1983 Recommended Nutrient Intakes (RNI) (Sevenhuysen and Bogert-O'Brien, 1987). Calcium and vitamin A were lower than recommended.

Wein et al. (1993*a*) looked at the daily nutrient intake of Native children aged 8 to 15 years, in two communities in Northern Alberta. Four 24-hour recalls per person were obtained. Nutrients found to be low were calcium, folate, vitamins A and D and zinc. Native children's diets in the community with a school lunch program were more nutrient-dense; total carbohydrate, sugar, dietary fibre, calcium, potassium, zinc, folate, and vitamin D were higher, and total fat, saturated fat and cholesterol were lower.

3.2. Food consumption patterns

The contribution of major food groups to energy and nutrient intakes of Native children has been examined (Ellestad-Sayed et al., 1981; Wein et al., 1992). The principal source of energy both in Northern Manitoba preschool children's diets (Ellestad-Sayed, 1981) and Northern Alberta children's diets (Wein et al., 1992) was found to be cereals.

Twenty-four hour recall data from James Bay Cree schoolchildren were evaluated by determining the number of servings and food groups according to Canada's Food Guide (Bernard et al., 1995). Milk/milk product and fruit/vegetable intakes were lower than recommended. Nine to 11-year old children had a higher score on milk/milk products than older children due to a school milk program.

Food consumption patterns and nutrient adequacy have been studied within the context of school lunch programs (Kuhnlein and Calloway, 1977; Wein et al., 1992). Wein et al. (1992) compared the food intake of 163 Native children (aged 8-15 years, mean age 11.8 years) in two communities in Northern Alberta, one with and one without a school lunch program. The children in the community with the school lunch program, consumed significantly more energy from dairy foods than other children, and this contributed to calcium, and vitamin A and D intakes. Similarly, in diets of Hopi elementary schoolchildren, a large proportion of milk, fruits and vegetables came from government-subsidized school lunch (Kuhnlein and Calloway, 1977).

The nutrient contribution of traditional food has been another area of research. "Country" or traditional food provided a high percentage of nutrients in the diets of schoolchildren in Northern Alberta, namely protein, zinc, niacin, riboflavin and iron, with very little total and saturated fat (Wein et al., 1992). The majority of food items mentioned in 24-

hour recalls by Hopi children indicated a decline in the use of the traditional corn-beans-squash diet (Kuhnlein and Calloway, 1977).

Hopi children were noted to have a very high intake of sweetened beverages such as colas and "Kool-Aid" (Kuhnlein and Calloway, 1977). A high consumption of sugared drinks was also documented more recently among Navajo adolescents aged 14-18 y ears (n=373) (Gilbert et al., 1992). Sweetened soda pop was found to be the most commonly reported food/drink for both genders, its intake as a mean percentage of total energy being approximately 11 %.

3.3. Relationship between dietary intake and anthropometry

At least two studies have attempted to find a relationship between diet and obesity in Native children. There was no significant difference between mean energy intake or meal and snacking patterns between "fat" and "lean" North Carolina Cherokee adolescents aged 13 to 17 years (Story et al., 1986*b*). There was an inverse relationship between BMI and mean energy and fat intake, with heavier Navajo adolescents (upper BMI tertile) aged 14 to 18 years, reporting lower intakes than "leaner" counterparts (Gilbert et al., 1992). However, there is insufficient evidence to disregard the potential impact of dietary intake on adiposity. The possibility of obese adolescents underreporting energy intake has been noted (Bandini et al., 1990; Black et al., 1993). Also, neither of these studies assessed physical fitness or activity levels.

To date, there have been no studies in Native children that have tried to make associations between diet and anthropometry at the individual level. The number of 24-hour dietary recalls required to characterize an individual's intake, particularly in a population as variable as children, would make this logistically difficult when working in community settings (Beaton et al., 1979; Beaton et al., 1983; Nelson et al., 1989; Miller et al., 1991).

4. Food preferences of Native schoolchildren

Some researchers have assessed food preferences as well as food health beliefs of Native children to gain insight on factors affecting food choices. This can be useful in planning interventions such as nutrition education and school feeding programs (Story et al., 1986*a*; Wein et al., 1993*b*). Information on food preferences can also serve as an indicator of the cultural value of foods (Wein, 1995).

The studies are difficult to compare in that the definitions and methodologies used have varied. The first study to look at food preferences in Native children was with Cherokee teenagers (n=257) in North Carolina (Story et al., 1986*a*). Food preference was defined as how often one would choose the food when offered. Choices were "every time", "most of the time", "some of the time", "seldom", "never", "do not know" and "never tasted". The questionnaire included 120 food items. There was a high preference for high-fat and fried food, and a low preference for desserts and sugared food. While some of the culturally Cherokee foods (e.g. bean bread, fry bread) were highly preferred, traditional wild animals and plants were not.

Wein et al. (1993*b*) looked at food preferences and food health beliefs in children aged 8-15 years old, of two Native communities in Northern Alberta, Tallcree (Cree Nation) and Rocky Lane (Beaver Nation). Preference was defined as the "degree of like or dislike for a food", and belief was defined as the "probability that a particular relationship exists". A five-point Likert or hedonic scale was used. Pictures of 24 food items consisting of traditional Native foods and commonly used store-bought foods, were presented to the children for rating in individual interviews. There were no differences between preferences for traditional compared to market foods. Foods from the four groups of Canada's Food Guide were considered healthiest, whereas those of low nutrient density (e.g. chocolate, chips) were given the lowest health value.

The above type of questionnaire was also administered in written form to small groups of Inuvialuit children from Aklavik, Northwest Territories, ranging in age from 10 to 16 years (n=35) (Wein and Freeman, 1992). They ranked 46 food items, the majority of which were traditional foods. There were no significant differences between children's and adults' food preferences.

Social influences on food preferences were examined in James Bay Cree schoolchildren aged 9 to 19 years (n=144) (Bernard and Lavallée, 1993). Children were found to prefer food eaten by their parents, rather than what their peers ate. The authors attempted to examine preference between bush and market foods; the question was not framed well enough to elicit appropriate responses. Other aspects explored were knowledge (what foods the children believed should be eaten for good health) and attitudes (benefits and importance of eating well, perceived barriers to eating well).

5. Assessing anthropometry of children

Anthropometry is a useful tool for assessing the nutritional status of children. In North America, it is unlikely that a significant part of the population experiences energy restriction sufficient to limit growth (Willett, 1990*b*). Rather, there is concern for the increasing prevalence of obesity among children (Freedman et al., 1987; Gortmaker et al., 1987; Malina et al., 1987; Morbidity and Mortality Weekly Report (MMWR, 1994*b*). This has raised the challenge of estimating relative body composition (fatness or adiposity) in children, as well as the determination of a level of adiposity which is excessive, and predictive of later morbidity or mortality (Roche, 1993).

The following discusses issues in the use and interpretation of anthropometry for the assessment of adiposity and growth in children. Basic measures considered are weight, height, triceps and subscapular skinfold thicknesses.

5.1. Assessment of adiposity

5.1.1. Adiposity indices

Weight and height are available in most surveys and data sets. They can be measured with good accuracy, and the methodology has remained unchanged in several decades (Himes and Bouchard, 1989; Willett, 1990*b*; Harlan, 1993). Indices based on weight and height are only approximate indicators of fatness (Flegal, 1990; Kuczmarski, 1993). In theory, a weight-for-height index designed to assess adiposity should be highly correlated with percentage body fat and be uncorrelated with height (Spyckerelle et al., 1988). Independence from height may not be an appropriate criterion for children (Ballew et al., 1990; Flegal., 1993). Unlike in adults, where obesity is generally not differentially associated with height, children who are overweight or overfat by a variety of criteria are often taller than underweight or lean children (Ballew et al., 1990).

There is ongoing debate on the best weight-for-height function to use as a measure of adiposity in children. Ballew et al. (1990) used three weight-for height indices (body mass index (BMI) wt/ht^2, wt/ht^3, and Benn index wt/ht^p (exponent p derived for study sample and is designed explicitly to be independent of height)) as estimates of relative obesity in a multiracial sample of 5- to 10-year-old children. They concluded that it made little difference which index was used; none of them satisfied both criteria of independence from height, and high positive correlation with weight and other measures of fatness. Spyckerelle et al. (1988) compared various adiposity indices based on weight and height in children and adolescents and found them to be similar. They were highly correlated with weight and subscapular skinfolds (SSF), and generally not independent of height. It appears that any weight-for-height index designed to assess adiposity among children must be used with caution (Schey et al., 1984; Flegal, 1990).

BMI has shortcomings as an index of adiposity in children in that it is not independent of height, it is affected by the relative leg length or relative sitting height, and weight may reflect both lean and fat tissues (Garn et al., 1986; Deurenberg et al., 1991;

Harlan, 1993). However, there are several reasons that make it practical. BMI can be used to compare across studies, as it is commonly reported in the literature. Reference data are available for BMI (Rolland-Cachera et al., 1982; Najjar and Rowland, 1987; Spyckerelle et al., 1988). It is a uniform and producible means for identifying differences in trends when assessing population and secular changes (Flegal, 1990; Harlan, 1993). Finally, there is no simple and accurate alternative to BMI (Fung et al., 1990).

The skinfold site most appropriate to assess body fat depends on whether total body fat or percentage body fat is the parameter of interest (Roche et al., 1981; Cronk and Roche, 1982). The best indicators of percentage body fat were found to be triceps skinfold (TSF) measures in girls 6 years of age and older, and in boys 6 to 8 years of age. The most valid indicator of total body fat was SSF in boys, and BMI in girls (Roche et al., 1981).

There are limitations to skinfold thicknesses as indicators of body fat. Measurements are more prone to error, particularly at higher levels of adiposity (Flegal, 1993; Kuczmarski, 1993). Also, not all fat (e.g intraabdominal and intramuscular) is accessible to calipers (Willett, 1990). Distribution of fat may be variable.

Use of a single indicator to estimate body fatness increases the risk of misclassification, as it may not be appropriate for both genders and across ages and ethnic groups (Schey et al., 1984; Gibson, 1990; Nuutinen et al., 1991; Malina, 1993). As children age, developmental differences require that several criteria are used at once to assess adiposity (Schey et al., 1984; Spyckerelle et al., 1988). Himes and Bouchard (1989) evaluated the validity of selected anthropometric indicators used to estimate adiposity in children. They also described the misclassification occurring when these indicators were used to classify obesity, which was defined by total body fat measured by densitometry. (Densitometry, or hydrostatic weighing, is considered the gold standard technique to determine body composition (Willett, 1990*b*).) The preferred indicator of obesity in boys was TSF (SSF and BMI did almost as well), and in girls BMI (SSF did almost as well). According to Frisancho and Flegel (1982), assessment of relative body composition, should be based on evaluations of both BMI and measurements of subcutaneous fat.

Ethnic variation in the distribution of subcutaneous fat may influence the value of certain skinfolds or weight/height ratios. For example, Mexican-American children were found to have a more central distribution of subcutaneous fat (Malina, 1993). Relative to Caucasian children, Mohawk children in Akwesasne also had a more central distribution of body fat, independent of the effects of gender and total body fat (Goran et al., 1995). In these populations, SSF (or other trunk skinfolds) may be more useful indicators than TSF. Ethnic differences in leg or trunk length may have an effect on BMI (Ballew et al., 1990; Malina, 1993).

5.1.2. Definition of obesity

Although the estimation of body fat in children is difficult, it is even more challenging to determine how much fat is too much (Roche, 1993). At present, there is no generally accepted, objective definition that can be used to estimate the prevalence of obesity (Flegal, 1993; Ernst and Obarzanek, 1994). Data on levels of adiposity in childhood that can be linked to levels of adiposity in adulthood known to be associated with increased morbidity and mortality do not exist (Lopez and Mâsse, 1992; Roche, 1993; Obarzanek, 1993; Ernst and Obarzanek, 1994).

In view of the lack of a definition for obesity in children, Flegal (1993) suggested that anthropometric measures such as BMI or skinfold thicknesses be used as continuous variables to study the relationship of body size or composition to health. Comparisons among groups could be made using continuous variables, without classifying children as obese or not obese. Alternatively, statistical definitions based on percentile cut-off points can be used but their limitations need to be recognized (Flegal, 1993). Convention is to define overweight or obesity relative to the 85th percentile of BMI or TSF in a reference population. The 85th percentile varies with age, and does not reflect the same level of adiposity at each age (Flegal, 1993; Kuczmarski, 1993; Ernst and Obarzanek, 1994). For example, at younger ages, obesity would be overestimated at the 85th percentile, and would more likely occur at the 90th or 95th percentile. Similarly, caution needs to be used in interpreting differences across ethnicity, gender, and degree of maturation as being differences in body composition (Flegal, 1993; Kuczmarski, 1993; Malina, 1993).

The paucity of information on the prevalence of childhood obesity may be partly due to the lack of a precise and objective definition (Obarzanek, 1993). The absence of a definition also makes the examination of secular trends of obesity controversial. This is best illustrated by the example of two studies which used data from the same surveys and arrived at different conclusions as to whether obesity in the United States was increasing over time. Using TSF as the criterion of obesity, Gortmaker et al. (1987) found that increases occurred among children of all ages and both genders, and for both blacks and whites. Harlan et al. (1988) used BMI rather than TSF as an indicator of obesity, and found no change in the prevalence of obesity over time for any race-gender-age group. Diificulties in determining if secular changes have occurred are further compounded when trying to compare studies that have used different surveys as anchor points (Kuczmarski, 1993).

5.2. Assessment of growth

Preferred anthropometric measurements for evaluating nutritional status and growth of children are weight-for-height and height-for-age (Gorstein et al., 1994). Weight-for-age is a composite of weight-for-height and height-for-age and fails to distinguish children who are tall and slender from those who are short and heavy. Because of the variable timing of the pubertal growth spurt, weight-for-height has limited value in nutritional status assessment of adolescents; its interpretation is complicated by the fact that body composition is more variable at this age than in younger children, and differences in fatness and muscle mass between boys and girls increase with age (WHO Working Group, 1986).

5.3. Uses and limitations of reference data

There are no internationally recognized references for children's BMI or skinfold thicknesses. Throughout the literature, there are many anthropometric databases that have been used to compare indices of adiposity. Currently, in North American studies, it is conventional to use reference data from the second National Health and Nutrition Examination Survey (NHANES II) conducted in the United States between 1976 and 1980 (Najjar and Rowland, 1987). Data from the American Indian Schoolchildren Height and Weight Survey conducted by IHS in 1990-91 were also compared to those from the Mexican American subsample in the Hispanic Health and Nutrition Examination Survey (HHANES-MA) (Najjar and Kuczmarski, 1989), which was done between 1982 and 1984 (Jackson, 1993). The Mexican-American subsample was chosen because many Mexican-Americans have Native North American ancestry (Samet et al., 1988).

One limitation to comparing to NHANES II is that the data were collected almost two decades ago, and therefore may not be reflective of the current American population. Preliminary findings from the third National Health and Nutrition Examination Survey (NHANES III) (1988-91) indicate the prevalence of overweight among adolescents 12 to 19 years of age has increased (MMWR, 1994*b*). NHANES III data for younger children have not yet been released, but a similar trend is expected. Also, the NHANES II sample did not include Native Americans living on reservations. It is possible there are genetic differences in body composition (Jackson, 1993).

It is emphasized that the NHANES data for percentiles of BMI or skinfolds do not represent standards. The concept of standard leads to difficulty, as it embodies the concept of norm, or implies a value judgement (WHO Working Group, 1986). NHANES data represent a reference for grouping and analyzing data. Using a common reference allows one to make comparisons between groups, study trends over time, evaluate the effectiveness of an intervention, or determine the proportion of individuals below or above a designated cut-off point (WHO Working Group, 1986).

Growth reference curves for children from 2 to 18 years of age were developed by the National Center for Health Statistics (NCHS) and Centers for Disease Control (CDC) using data from a combination of United States Health Examination surveys. They are recommended by the World Health Organization for international use. Data for height-for-age and weight-for-age are available for individuals up to 18 years of age. Data for weight-for-height are available for males up to 138 months (11.5 yrs) of age and less than 145 cm, and for females up to 120 months (10 years) of age and less than 137 cm. This is because weight-for-height is not independent of age in older children. Also, weights and heights of children become more variable as they enter puberty (Gorstein et al., 1994).

There are several advantages to using the NCHS population as a reference. The sample is large and representative and the data are cross-sectional. They include at least 200 well-nourished individuals in each age-gender group, who have achieved their growth potential (WHO Working Group, 1986; Gibson, 1990). Also, data collection procedures were well standardized and fully documented.

It is accepted that there may be some ethnic differences between groups, just as there are genetic differences among individuals (WHO Working Group, 1986). For instance, Native North American children may have growth patterns that differ; they are likely to be heavier at birth and have a weight-for-height ratio greater than the 50th percentile of the NCHS population (Indian and Inuit Health Committee, Canadian Pediatric Society, 1987). However, there are logistical problems in creating local reference values (Gibson, 1990). Given the diversity of Native Peoples across North America, no single growth chart could be produced; individual growth charts for many different cultural areas would be necessary and small numbers would make results unreliable. For practical purposes, the NCHS population is recommended as a reference. If necessary, realistic goals can be determined for a population by raising or lowering cut-off points (WHO Working Group, 1986; Indian and Inuit Health Committee, Canadian Pediatric Society, 1987).

6. Assessing diet of children

6.1. Rationale

It is generally believed that dietary intake of children is a risk factor in the development of chronic diseases, such as cardiovascular disease and diabetes, and that eating habits are established early in life. Therefore, the ability to measure food consumption of children is required, in order to develop and evaluate prevention programs effectively.

Studies which have examined the validity of maternal recall for preschool children have shown mothers' reports to be inaccurate in measuring actual foods eaten, portion sizes and nutrient levels consumed (Basch et al., 1990; Baranowski et al., 1991). It has been found that a consensus recall (child, mean age 5.8 years, assisted by both parents) is more accurate than either the mother or father's recall of a meal observed unobtrusively (Eck et al., 1989). As children get older and consume more meals and snacks out of their parents' company, it can be expected that it becomes increasingly difficult to obtain accurate parental reports. Also, in large-scale school-based interventions, it may not be practical or cost-effective to have parents providing records or recalls of the child's food intake. The possible deficiencies in parents' reports of their children's diets, coupled with the relative ease of conducting dietary assessments in the school environment, contribute to the desirability of obtaining accurate self-reports from the children themselves.

6.2. Methods of assessing diet of children

Principal methods of dietary assessment that have been used in children, as well as information regarding their validity, are described below. The focus is on elementary school-aged children, who have been called upon to respond to inquiries about what they have eaten, usually 8- to 12- year olds (Frank, 1991; Whiting & Shrestha, 1993; Baranowski & Domel, 1994; Frank, 1994).

6.2.1. Food Frequency Questionnaire

A food frequency questionnaire (FFQ) consists of a food list and a response section in which the subject states how often each item was eaten in a given time interval. In adults, some advantages found are its practicality and ease of administration in large scale epidemiologic studies, little training required of interviewers, and minimization of intraindividual variability (Zulkifli and Yu, 1992). One disadvantage is that it is limited by the list of foods. Also, it does not easily lend itself to direct validation, because of the longer time frame it covers (Gibson, 1990).

FFQs have not been applied successfully in elementary schoolchildren. It is believed most children do not have the high cognitive abilities required to average estimates of consumption over time intervals (Whiting and Shrestha, 1993; Baranowski and Domel, 1994).

A 1-day FFQ completed by third to sixth graders had good (82.9%) agreement with direct observations (Baranowski et al., 1986). However, FFQs of longer than one day had poor validity in children younger than 12 years old (Räsänen, 1979). Jenner et al. (1989) found poor agreement between a 1-week FFQ and the reference method of 14 24-hour recalls administered to 11- to 12- year olds. Compared to a 3-day food record and a 24-hour recall in 9- and 10-year old girls, a 5-day FFQ had the greatest proportion of missing foods (foods eaten but not reported) and 'phantom' foods (foods reported but not eaten) (Crawford et al., 1994). It also had a bias for overestimation of energy and nutrients. There was fair reliability (consistency), but minimal validity in both weekly and monthly versions of a fruit and vegetable FFQ completed by fourth and fifth graders when compared to food records (Domel et al., 1994*a*).

6.2.2. Short-term dietary recall and recording methods

6.2.2.1. Twenty-four-hour-recall

The 24-hour recall involves a trained interviewer questionning the subject on his/her exact food intake during the previous 24-hour period or preceding day (Gibson, 1990; Witschi, 1990). Frank et al. (1977) described memory aids and probing questions that may be used to adapt the 24-hour recall for schoolchildren.

A single 24-hour recall is most appropriate to estimate average dietary intake of a large group of children. The disadvantages of this method are: it cannot be used to give a reliable picture of the distribution of intakes in a population, high intraindividual variance causes problems in computing correlations or in the use of regression analysis, and it is statistically conservative when comparing group means, showing no significant differences when they actually exist (Persson and Carlgren, 1984).

6.2.2.2. Estimated food record

In an estimated dietary record, the subject is asked to record, at the time of consumption, a detailed description of all food and beverages consumed (Gibson, 1990; Witschi, 1990). The number of days included may vary; it is usually three to seven days. This method relies less on memory than the 24-hour recall, and may therefore be more accurate (Crawford et al., 1994; Domel et al., 1994). A drawback is the respondent may be sensitized to what is eaten, and this may cause alterations in usual dietary behaviour (Witschi, 1990). In addition, the food record requires high literacy, motivation, and training to complete, limiting its use and making it labour intensive and costly.

6.2.2.3. Limitations of validation studies

The 24-hour dietary recall and the estimated food record can be validated more directly than a food frequency. Also, their errors are independent of those in the 'reference methods', which are typically unobtrusive observation or weighed duplicate portions (Gibson, 1990).

There are several studies that have looked at the validity of 24-hour recall and food record methods in children. These are not without limitations. Generalizability of studies validating methods of dietary assessment for children is often low. This seems to be particularly true when the involvement of parents is required. For example, the recruitment strategy used by Van Horn et al. (1990) resulted in a predominantly white, middle class, educated population. Because of the high degree of compliance required for parents to attend training sessions and to obtain observational data, sample selection bias was also a problem in Lytle et al.'s (1993) study.

The protocol in the study can also influence the degree of accuracy of the children's self-reports. Meredith et al. (1951) conducted 24-hour recalls immediately following the observed lunch, thus maximizing the ability of the children to remember what they had eaten. When children know they are being observed, they may become sensitized to the food they consume and be able to report their intake with greater accuracy (Baranowski et al., 1986; Lytle et al., 1993; Domel et al., 1994*b*).

Training of participants in keeping food records or in visually estimating food portions may also enhance the accuracy of reports (Baranowski et al., 1986; Van Horn et al., 1990; Lytle et al., 1993; Crawford et al., 1994). Resulting validity is not strictly reflective of the dietary assessment method, but also of all the training that has taken place.

Finally, good agreement does not necessarily mean validity; it may merely indicate similar errors in both methods (Gibson, 1990). This was perhaps the case in Van Horn et al.'s (1990) study where children's recalls were compared to parents' observations.

6.2.3. Sources of error in children's self reports of food intake

Despite the limitations in some validation studies, it is still possible to get an appreciation of the many errors which occur in trying to estimate children's diets based on their own self-reports. Similar to adults, there are problems with intraindividual variation, motivation, memory and difficulty assessing portion size (Gibson, 1993; Lytle et al., 1993).

6.2.3.1. Memory of food items eaten

In general, studies have shown that children, especially those younger than 10 years of age, have trouble remembering and identifying what they have eaten. Emmons and Hayes (1973) observed that children had an easier time remembering primary food items, or main course items, than secondary items such as condiments, bread and desserts. Meredith et al. (1951) reported that children had problems identifying the type of fruit juice they had had with their lunch. In Baranowski et al.'s study (1986), children had difficulty recalling foods eaten earliest in the day, presumably because of the longer time that had elapsed. Others did not pay attention to the food they ate, making them unlikely to remember having eaten it later. They also had difficulty distinguishing between lower-fat and whole milk.

6.2.3.2. Estimation of portion size/number of food items

Estimating portion size is believed to be a highly skilled cognitive activity (Baranowski and Domel, 1994). There is no consistency across studies whether under- or over-reporting is more common, or which foods are more often wrongly estimated. Grade 3 children assisted by food records were better able to recall the food items they ate in a day, but had a difficult time quantifying portion sizes (Lytle et al., 1993). The tendency was to overestimate portion sizes; for many foods the recalled portions were more than 100% of those observed. Meredith et al. (1951) reported only 6 out of 94 children could accurately estimate school lunch portion sizes, even though the recalls were taken immediately after the lunch. Van Horn et al. (1990) found that compared to their parents, children under-reported candy (42.9%) and over-reported vegetables, implying that even at a young age, there was the possibility of being influenced by the social desirability of food.

Children have been found to both under- and overestimate the number of foods/servings consumed. Meredith et al. (1951) found under-reporting to be more common, especially as the number of food items consumed at the lunch meal increased. Other authors also found under-reporting more common, but could not detect any specific patterns as to which foods were under-recorded (Baranowski et al., 1986; Domel et al., 1994*b*). In contrast, 8- to 9-year-old Finnish boys over-reported food intake, resulting in the overestimation of nutrient levels consumed (Knuiman et al., 1987).

The tendency to overestimate low intakes and underestimate high intakes, known as the "flat slope syndrome", was observed in 10- to 12-year-old children at summer camps (Carter et al., 1981). The phenomenon of "talking a good diet" is a potential bias when parents are involved in observing their children's diet, as in studies by Van Horn et al. (1990) and Lytle et al. (1993).

6.3.4. Factors to consider in assessing diet of children

The errors in children's self report of diet, although common to those of adults, are further magnified due to a variety of special considerations.

Age is one factor to consider when measuring the dietary intake of children. By 7 or 8 years of age there is a fairly rapid increase in the ability of children to respond to inquiries about their eating behaviour, and by 10 to 12 years of age, children can serve as their own respondents (Frank, 1994). Lack of knowledge and experience with food and its preparation, including measurement, and familiarity with the components of mixed dishes and added ingredients are problems attributable to young age (Lytle et al., 1993; Crawford et al., 1994). Adding even more to the challenge of accurate dietary assessment in young children are low literacy, lack of interest and short attention span (Crawford et al., 1994).

Children live in multiple environments, such as personal, school, home and peer, which influence their eating patterns and nutrient intakes (Frank, 1994). These in turn affect the type of data collection method which is most appropriate to use.

There is little research dealing with children's cognition with respect to food, but it is recognized as an important area in better understanding children's self-reports of diet. A model described by Baranowski and Domel (1994) identifies various cognitive processes such as attention, interpretation, organization, retention, retrieval, and response formulation which may explain several phenomena in the literature on children's reports of their own dietary intake. To date, one study has been documented which pertains to how children remember what they have eaten (i.e. retrieval). Fourth-grade children articulated visual imagery and preference for a food as important factors in aiding their recall (Domel et al., 1994*c*).

Finally, when gathering dietary information from culturally diverse populations of children, including Native North American, there would more than likely be additional factors to consider in planning dietary research (Cassidy, 1994; Hankin and Wilkens, 1994).

7. Macronutrient intakes of children

7.1. Implications for obesity and chronic disease prevention

Macronutrients, in particular energy and dietary fat, are assumed to have implications for childhood obesity and the development of chronic diseases (Health Canada, 1993; Kimm, 1993). It is unclear whether obesity is a function of excessive energy intake. Obese children do not necessarily consume more energy than their lean counterparts (Kimm, 1993). Underreporting of energy intake has been cited as a possible reason for this observation (Bandini et al., 1990; Black et al., 1993). Excessive fat intake, independent of total energy in the diet, has also been proposed as a determinant of obesity (Rolland-Cachera and Bellisle, 1986; Romieu et al., 1988; Eck et al., 1992; Gazzaniga and Burns, 1993; Kimm, 1993). Although difficult to assess, lack of physical activity appears to be critical factor in childhood obesity; it must be considered in the overall energy balance of children (Dietz, 1991; Fontvieille et al., 1993; Gutin and Manos, 1993; Health Canada, 1993; Kimm, 1993; Pate, 1993).

Reducing fat intake has been recommended in the prevention of chronic diseases, in particular cardiovascular disease (Health and Welfare Canada, 1990). Issues related to fat in the diets of children are controversial. Canadian nutrition recommendations do not advocate the reduction of dietary fat in children to 30 percent or less of total energy until linear growth is achieved, as there is insufficient evidence that this will prevent illness in later life (Health Canada, 1993). Furthermore, the nutritional quality of the diet may be compromised. Some studies have shown that when fat was decreased in the diet, sugar (sucrose) intakes increased (Nicklas et al., 1992; Boulton and Margarey, 1995; Vandongen et al., 1995). Difficulty substituting complex carbohydrate for fat, resulting in a reduced intake of energy and vitamins and minerals has also been observed (Vobecky et al., 1988; Stephen and Deneer, 1990; Lifshitz, 1992; Nicklas et al., 1992).

7.2. Current levels of dietary fat intake

There is a limited number of reports describing the dietary intake patterns of children, and these are mainly for select populations (Kimm, 1993). In recent decades, a tendency towards diets lower in fat has been observed in reports of children's macronutrient intakes (Health Canada, 1993). This trend was documented in a review of 40 studies in children, done between 1920 and 1984, that assessed individual dietary intake (Stephen and Wald, 1990). The Bogalusa Heart Study, a long-term epidemiological investigation, used 24-hour recalls to examine dietary intake of 10 year-old children, in six cross-sectional surveys between 1973 and 1988. Although total energy intake remained the same, a decrease from diets providing 38% of energy from fat, to diets providing 35-36% of energy from fat was seen (Nicklas et al., 1993). Dietary intakes of 1- to 10-year-old children (n=1392) in the U.S. Department of Agriculture 1987-88 Nationwide Food Consumption Survey (NFCS) were determined by maternal 24-hour recalls followed by two dietary records. Fat was found to be 35-36% of total energy (Johnson et al., 1994). The National Heart, Lung and Blood Institute Growth and Health Study (NGHS), is a multicenter, longitudinal study of 2379 9- to 10-year-old girls whose baseline dietary data were gathered during 1988 and 1989. Fat as a percentage of total energy was 35.0 ± 5.3 (mean $\pm$ standard deviation) in white girls, and 36.7 ± 5.6 in black girls (The National Heart, Lung and Blood Institute Growth and Health Study Research Group, 1992). Baseline data for the Dietary Intervention Study in Children (DISC) were collected by repeated 24-hour recalls in 8- to 10-year old children (n=663) between 1987 and 1990 (Van Horn et al., 1993). Fat intake was found to be 33.8% of total energy. In the School Nutrition Dietary Assessment Study (SNDAS) fat intake in 6- to 10-year-olds was 34% of total calories (Devaney et al., 1995). Some of the differences in these studies may be attributable to differences in dietary assessment methods and nutrient databases. Overall, a trend towards lower fat intakes providing approximately 34 to 35% of total energy, is evident.

The most up-to-date and representative estimates of daily dietary fat are the NHANES III (Phase 1, 1988-91) data. These data are based on a U.S. national probability sample. NHANES III results showed boys from 6 to 11 years of age (n=868) derived 33.9 ± 0.3 (mean ± standard error) percent of dietary energy from fat, while 6- to 11-year-old girls (n=877) had 34.2 ± 0.5 % energy coming from fat (McDowell et al., 1994; MMWR, 1994*a*).

8. Assessing food preferences of children

8.1. Background

Food preferences are a strong predictor of food choice (Khan, 1981; Axelson and Brinberg, 1989; Birch and Sullivan, 1991). However, there are a number of factors which influence food selection besides simple like or dislike for a food item. A genetic or biologic influence on preference for some foods has been suggested (Rozin and Vollmecke, 1986; Anliker et al., 1991; Falciglia and Norton, 1994). The preference for sweet taste appears to be innate (Birch, 1987; Lähteenmäki and Tuorila, 1994). In adults, concerns related to environmental constraints such as the cost and availability of the food, postingestive consequences of eating the food such as satiety and healthfulness, individual or psychological factors, and culture, have a considerable role in determining food consumption patterns (Rozin and Vollmecke, 1986; Birch and Sullivan, 1991). These can indirectly affect children's food intake and preferences by influencing what food is made available to them, and at which frequency. Nevertheless, children's likes and dislikes, especially in the early years of life, are the primary determinants of food consumption (Birch and Sullivan, 1991; Fisher and Birch, 1995).

Food preference data in children have many uses and implications. They could provide insight into some of the factors influencing food choices (Wein et al, 1993*b*). They could be useful in the development and evaluation of school feeding, and nutrition education programs (Birch and Sullivan, 1991). It has been suggested that children's food preferences and consumption patterns be considered, in order to understand how current dietary fat recommendations can be achieved (Fisher and Birch, 1995). A study with preschool children demonstrated fat preferences to be associated with fat intake, as well as parental adiposity (Fisher and Birch, 1995). Children have been found to prefer foods they are familiar with or that they have been exposed to more often (Birch, 1980; Phillips and Kolasa, 1980; Birch, 1987; Sullivan and Birch, 1990). Kern et al. (1993) found that conditioning may contribute to children's preference for high fat foods.

8.1.1. Definitions

There is no generally accepted definition of food preference that has been used by researchers. Examples include choice of one food over other(s), degree of like or dislike for a food, or preferred frequency (i.e. how often one would like to eat the food). Most of this variation may be explained by the methods that have been used to assess food preferences. Two key issues are 1) the type of task or judgement that has been required of the respondent e.g. an affective rating scale indicating like/dislike vs. a choice rating scale indicating the most liked food given two or more choices, and 2) whether there has been actual tasting of the food, or the subject is responding to the food name or a picture of the food (Axelson and Brinberg, 1989).

8.2. Methods of assessing food preferences of children

Food preferences are often measured using rating scales. These are valuable instruments for converting qualitative, descriptive information into numerical form to which statistical methods of analysis can be applied. The reliability and validity of rating scales present challenges to researchers. It is difficult to validate a rating scale as there is no independent yardstick by which it can be measured (Peryam and Pilgrim, 1957; Tyrer et al., 1993). However, several types of reliability may be looked at, including intra- and inter-rater reliability and test-retest reliability (Fleiss, 1981; Tyrer et al., 1993).

8.2.1. Affective rating scales

The hedonic scale, a special application of the rating scale, is a well-known and generally accepted method for measuring food preference (Peryam and Pilgrim, 1957; Khan, 1981; Stone and Sidel, 1993). Nine-point hedonic scales with end-points labelled 1 (dislike extremely) and 9 (like extremely), and a neutral midpoint, have been found to be valid and reliable in children of at least nine years of age (Stone and Sidel, 1993; Falciglia and Norton, 1994). There has been reluctance to use long scales, particularly with younger children, because of the belief they create confusion with the many words to understand and choices to make (Kroll, 1990). On the other hand, shorter scales may be less discriminating. In a study evaluating rating scales for sensory testing with 5 to 10 year-old children, reducing the scale length from nine to seven points, offered no advantage (Kroll, 1990).

Facial hedonic scales have been used with children (Phillips and Kolasa, 1980; Kroll, 1990; Anliker et al., 1991; Fisher and Birch, 1995). Some have discouraged their use, stating that assigning an affective response to a facial expression, is a much more difficult cognitive task than assigning it to words (Stone and Sidel, 1993).

8.2.2. Choice rating scale

Birch has developed a two-part procedure for obtaining information on food preferences from children as young as three years old (Birch, 1979; Birch, 1980; Birch and Sullivan, 1991). It involves the child first tasting the food and rating it on a three-point hedonic scale (like, dislike, neutral). In the second phase of the procedure the child rank orders the food within each category. The two parts combine to produce a complete rank ordering. This method has been shown to be both valid and reliable in preschool children, and an effective discrimination of preference (Birch, 1979). This order of choice method was adapted for use in 5- to 7-year-old children tasting eight foods and beverages (Anliker et al., 1991). The children were better able to display their preferences than by a five-point hedonic scale.

8.2.3. Stimuli to elicit food preferences

The use of actual foods as stimuli becomes difficult logistically as the number of children and food items increase. However, there are few reliability and validity data on procedures using food names, food models, photographs or drawings of food to elicit preferences (Birch & Sullivan, 1991). Hedonic ratings given by preschool children, after seeing photographs and after tasting, were the same for 11 out of 12 vegetables that were assessed by Phillips and Kolasa (1980).

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As shown in this literature review, the prevalence of NIDDM is increasing among Native North American Peoples and is strongly associated with obesity. It is important therefore to assess the prevalence of overweight in children from a susceptible population, as a step towards developing appropriate preventative measures. While considerable information exists on anthropometry in Native North American schoolchildren, there is none for the Mohawk of Kahnawake. There are few studies documenting diet and food preferences of Native North American children, and their results cannot be generalized across Native communities. Therefore the intent of this thesis is to characterize anthropometry, diet and food preferences of Kahnawake schoolchildren.

III. PURPOSE

9. Objectives

The following were specific objectives of the research described in the following chapters:

In 5- to 12-year-old (Grades 1-6) children:

- To assess the growth and nutritional status of elementary schoolchildren in Kahnawake using anthropometric indices based on weight and height. To estimate adiposity and prevalence of overweight using body mass index (BMI), derived from weight and height, and skinfold thicknesses.

In 9- to 11-year-old (Grades 4-6) children:

- To evaluate the total energy, macronutrient and sucrose intake.

- To describe food sources of energy and macronutrients and overall consumption patterns.

- To describe currently used Mohawk traditional/cultural food.

- To establish a baseline dietary intake against which future dietary studies could be compared to assess changes in food intake.

- To describe food preferences for 24 food items encompassing contemporary as well as traditional/cultural Mohawk food.

- To identify food/nutrition-related concerns and potential food/nutritional problems.

10. Hypotheses

The main research hypotheses are expressed as questions:

Is the prevalence of overweight (defined by ≥85th percentile age-sex specific BMI or >85th percentile age-sex specific TSF or SSF) greater among Kahnawake schoolchildren than in NHANES II or HHANES-MA reference populations?

Do Grades 4 to 6 Kahnawake children have a mean intake of fat significantly different from 35% of total energy (average intake of fat in schoolchildren according to Health Canada (1993))?

IV. METHODS

11. Ethics Approval and Research Agreement

Ethics review for the "Evaluation of the Kahnawake Schools Diabetes Prevention Project (KSDPP)" was completed by the Université de Montréal. This was done prior to submitting the proposal for funding to the National Health Research and Development Program's (NHRDP) Special Competition on Research on Diabetes in the Canadian Aboriginal Population in December 1992.

Several meetings with investigators of the KSDPP were held to design methods for the study described in this document. A proposal was presented to them in the Spring of 1994. In Fall 1994, a research agreement, required of all research conducted by staff and students based at the Centre for Nutrition and the Environment of Indigenous Peoples (CINE), was submitted to the community and signed by representatives of Mohawk Council of Kahnawake, including the Grand Chief, as well as the Director of Educational Services in Kahnawake (Appendix 1). The Human Ethics Review Committee of Macdonald Campus of McGill University approved the research ethics of this thesis.

Data collection for the evaluation of the KSDPP began in Fall 1994. Prior to this, consent forms were sent home with children to be signed by parents. The dietary interview was included on this form. The school year started with a campaign to promote awareness about the project and its activities throughout the community. Meetings were held with principals, school staff and the Kahnawake Combined Schools Committee, informing them of the evaluation activities of the project. On September 1-2, 1994, information booths were set up at the schools for parents and children. In addition, the evaluation team went to each classroom to explain the purpose and nature of the protocol to children and to demonstrate anthropometric techniques.

12. Study Population

The population surveyed was from two elementary schools in Kahnawake, Kateri and Karonhianonha, attended by 90% of the school-aged children in the community. Efforts were made to ensure there was no non-response bias: the physical education teacher at Karonhianonha and the school nurse at Kateri were asked to subjectively rank non-participant children as being either in a lower, middle or upper weight category. The anthropometric evaluation was completed with Grades 1 to 6 (5- to 12-year-olds), and the dietary interview (including 24-hour recall and food preference assessment) was conducted with Grades 4 to 6 (8- to 12-year-olds).

13. Anthropometric Evaluation

13.1. Training

The anthropometric evaluation required training, supervision and ongoing quality control. A nurse practitioner who was a member of the community was trained in standard research anthropometric technique. She was responsible for measurement and recording of data for all the children. Skinfold measurements were repeated on a 10% random subsample (n=41) by a person skilled in anthropometry to check inter-measurer reliability. The two measures were found to have a correlation of 0.99 (Pearson's r).

13.2. Techniques and equipment

Anthropometric measurements were done in a private room at school during the normal school day. All efforts were made to ensure each child felt comfortable prior to beginning any measurements. Age, gender, date of birth and date of measurement were recorded for each child.

13.2.1.. Weight

Weight was measured on an electronic digital scale (Model Seca 770; Germany) to the nearest 0.1 kg. Children were measured without shoes and in light indoor clothing (no jackets, sweaters). The scale was checked periodically for calibration with a set of standard (2, 5 and 10 kg) test weights.

13.2.2.. Height

Stature was measured to the nearest 0.1 cm with a height measuring board (Shorr Productions, Irwin J. Shorr; Olney, Maryland.). The child was standing straight with his head in the Frankfurt Horizontal Plane, feet together, weight evenly distributed on both feet, knees straight, and heels, buttocks and shoulder blades in contact with the vertical surface of the height meter (Lohman et al., 1988; Gibson, 1993). The height measurement was taken at maximum inspiration.

13.2.3. Skinfold thicknesses

Triceps and subscapular skinfold measurements were taken on the right side of the child using Lange calipers (Beta Technology Inc.; Cambridge, Maryland). Measurements were repeated twice for each skinfold and recorded to the nearest 0.5 mm.

For the triceps skinfold (TSF), the child was asked to bend the right arm 90 degrees at the elbow and place the forearm, palm down across the body. The tip of the acromion process and the tip of the olecranon process of the ulna were located and marked. The distance between these two points was measured using a measurement tape. The midpoint was marked directly in line with the point of the elbow and acromion process. Letting the child's arm hang freely by the side, a vertical fold of skin plus the subcutaneous fat was taken 1 cm above the marked midpoint. The skinfold was held between the thumb and index finger while the measurement was taken. The reading at four seconds was recorded (Lohman et al., 1988; Gibson, 1990; Gibson, 1993).

In the measurement of the subscapular skinfold (SSF), the child's right arm was placed behind the back to assist in the identification of the site. The measurement site was marked just below and laterally to the angle of the right shoulder blade, with the shoulder and right arm relaxed at the side of the body. The skinfold was grasped at the marked site with the fingers on top, thumb below and index finger on the site at the lower tip of the scapular. The skinfold angled 45 degrees from the horizontal, in the same direction as the inner border of the scapula. It was held between the fingers for 4 seconds while the measurement was taken.

13.3. Coding and data entry

All anthropometric data were coded and entered by a single person with several years experience in data coding. The software package SPSS for Windows Version 6.10 (Chicago, Il., 1994) was used to enter data. The data entry program had error checks, to ensure values had the right number of digits or were within a specified range. The project coordinator for the evaluation of the KSDPP verified a 10% sample of entered records against the original questionnaires and found no errors related to data entry. The data were cleaned and prepared for statistical analysis.

13.4. Data analysis

The data were analyzed using the statistical software package SAS for Windows version 6.10 (Cary, N.C., 1994). Body mass index (BMI) was derived from weight and height (weight(kg)/height(m)^2). The three values for each skinfold measurement were averaged. Descriptive statistics (means, standard deviations, medians) were calculated for weight, height, BMI, TSF and SSF by age and gender groups.

Mean BMIs for Kahnawake children were compared with age- and gender-specific NHANES II (Najjar and Rowland, 1988), as well as HHANES-MA data (Najjar and Kuczmarski, 1989). Age and gender group means were compared to reference populations using two-tailed t-tests. The p-value of 0.05 (procedure-wise error rate) was divided by 6 (number of age groups per gender) to adjust for multiple comparisons (Bonferroni test) (Zar, 1984). Thus, a more conservative value of 0.008 (real error rate) was considered as being statistically significant.

Percentiles were calculated for BMI and skinfold measurements. Across each gender, statistical significance of difference ($p<0.05$) between corresponding sets of observed percentile values for Kahnawake vs. NHANES II and Kahnawake vs. HHANES-MA, was determined using the Wilcoxon matched-pairs signed-ranks two-tailed test (Zar, 1984; Ryan et al., 1990). The test was applied to 15th, 50th and 85th percentile values for ages 6 to 11 for BMI, TSF and SSF.

The prevalence of Kahnawake schoolchildren's BMI, TSF and SSF values at and below the 15th percentile and at and above the 85th percentile of NHANES II and HHANES-MA was calculated as indicators of the prevalence of under- and overweight (Jackson, 1993). Given the sample size, a level of significance of 5% and power of 80%, the proportion of children above the 85th percentile that could be detected with certainty was at least 20% for boys and girls together, and between 20 and 25% when each gender was considered separately (Lwanga and Lemeshow, 1991).

Epi Info Version 6.02 (Atlanta, Ga., 1994), was used to compute height-for-age, weight-for-height and weight-for-age z-scores (standard deviation units) and percentiles (centiles). Z-scores in the reference population have a normal distribution, a mean of zero and a standard deviation of 1. Percentiles range from zero to 100; the 50th percentile represents the median of the reference population (Gorstein et al., 1994). Z-scores and percentiles are directly related. Both rely on fitted distributions of anthropometric indices across age and height values and are consistent in their interpretation across indices (Gorstein et al.,1994). To compute z-scores and percentiles, first, biologic age in months was calculated from the date of birth and date of measurement. Then, nutrition indices as well as flag codes for extreme values, were added to a file containing the variables age in months, sex, weight and height. Weight-for-height z-scores were calculated for boys to 138 months (11.5 years) and less than 145 cm in height, and for girls to 120 months (10 years) and less than 137 cm in height. Anthropometric calculations for above 2 years of age in Epi Info are based on the growth reference curves developed by the National Center for Health Statistics (NCHS) and Center for Disease Control (CDC) using data from the U.S. Health Examination Surveys, and are those recommended by the World Health Organization (WHO) for international use (Gorstein et al., 1994).

The Epianth Program was used for standard anthropometric analysis to calculate z-score and percentile distributions by age and gender. Analysis of variance was performed in SAS to show the effect of age, gender and their interaction on height-for-age, weight-for-height and weight-for-age z-scores. None of these variables had an effect on either weight-for-height or weight-for-age z-scores, so the distributions for all the children were pooled. However, there was an effect of age on height-for-age z-scores in 8- and 10-year-old children. Data on these are presented separately. Finally, z-scores for height-for-age and weight-for-height were cross-tabulated as described by Waterlow et al. (1977).

14. Dietary assessment

14.1. Twenty-four hour recall interview

Twenty-four hour recall interviews were conducted with Grades 4 to 6 children, from September to November of 1994. They took place on weekdays, during school hours, in a private area where there were a table and two chairs. Children were individually taken out of classrooms to participate in the recall. All interviews were conducted by the author of this thesis, a dietitian trained in dietary interviewing.

Before beginning the interview, a few minutes were taken to establish a rapport with the child. It was emphasized to the child that it was important to be accurate, but that the interview was not a 'test', and the information given would remain anonymous. The purpose of the 24-hour recall was explained, and that it would serve to describe the intake of children as a group, not of any one child. The interviewer explained the process of the interview, and if there were no questions, she began.

The 24-hour recall followed a standardized protocol, similar to that described by Gibson (1993). First, the child was asked to remember all food and beverages consumed the previous day. The interviewer guided the child through the day, from the moment the child got up to the time the child went to bed. Techniques to maximize recall, such as mentioning locations or situations (e.g. "How about during recess...did you have anything to eat or drink then?") were used (Frank et al., 1977). Details on time and place of eating were obtained. When the child had recalled all food and beverages to the best of his/her ability, the list was reviewed to get a more thorough description of each item and the portion size consumed. Probing was used to get details on brand names and types of foods. For instance, to determine the type of milk, the child was asked the colour of its container. As much as possible, information was obtained on food preparation methods (e.g. "Did your mom make the steak in the oven, or in a pan on top of the stove?"). Graduated food models and a bowl, glass, and household measuring cups and spoons were used to aid in the estimation of portion sizes.

At the end of the interview, the child was asked if this represented a usual day's intake, and if any vitamin/mineral supplements were taken. It was felt that the children had difficulty interpreting the question on whether it was a typical day, as far as food intake was concerned. Responses to the question on vitamin/mineral supplementation were not recorded consistently from the start of the survey. Thus, these two questions were omitted from analysis.

The 24-hour recall took an average of 20 minutes per child. The questionnaire used to record the above information is shown in Appendix 4. Four children (two 9 year- and two 10-year old boys) were unable to complete the recall. However, these children participated in the assessment of food preferences (see IV.15)

14.2. Procedures to quantify portion sizes

Several ways were employed to quantify portion sizes reported by children, as accurately as possible. Volumes, weights, and ingredients of market foods were obtained by consulting product labels of food and beverages in grocery stores, as well as at the schools (a variety of snacks were sold during recess periods at both schools). In some cases, nutrition information on market foods was obtained through publications from major food companies. For serving sizes of food from fast-food restaurant chains, reference was made to nutrition information compiled from data from the Nutrition Coordinating Center at the University of Minnesota (Ross Laboratories, 1991).

A food-scale was used to obtain weights of certain foods. Some examples were: pieces of beef or cheese cut to conform to sizes estimated by the children, and submarine sandwiches from a restaurant whose ingredients were taken apart and weighed individually.

To quantify portion sizes of cultural Kahnawake foods like fricasee, la sauce, chicken and dumplings and meat pie, recipes supplied by Kateri Memorial Hospital Centre were used. Traditional corn soup was prepared at the hospital and weighed on a food scale. Cornbread was prepared with a member of the community, and also weighed.

14.3. Coding

Several items on the 24-hour recall questionnaire were coded. Each child was assigned a numeric identification number. Other items coded included age in years, gender, the days of the week numbered from 1 (Monday) to 7 (Sunday) and grade (4, 5 or 6).

Foods in the twenty-four hour recalls were coded using the Minilist (Murphy, S., University of California at Berkeley, 1994). The Minilist is based on the most recent American nutrient data bank, and has been adjusted, at CINE, to Canadian fortification standards. Numeric codes found in the Minilist were assigned to each food. Also included with each food was its weight in grams, and the meal (i.e. 1=breakfast, 2=lunch, 3=supper, 4=snack1, 5=snack2, 6=snack3, etc...). When a food item was missing from the Minilist, if possible, a similar food was coded. Otherwise, a formula was derived using a combination of food codes from the database, in the quantities that would be required to create a nutrient composition equivalent to that found in published reference data (Dubuc and Lahaie, 1994; Health and Welfare Canada, 1988). For example, a portion of fruit yogurt was coded as 80% milk, 5% dry non-fat milk solids and 15% jelly.

As much as possible, food items were coded exactly as they were reported by children. For example, if a child did not recall having butter or margarine in a sandwich it was not added arbitrarily. In certain cases however, assumptions were made to adjust for the limited amount of detail that could be provided on food preparation. They were the following: when salad was reported, one teaspoon of oil or 1 tablespoon of salad dressing was added per cup; one teaspoon of fat was added to each cup of a mixed dish (e.g. rice casserole) or to fried foods (e.g. eggs, steak).

Detailed notes were taken while coding. The coding was checked on every recall to assure accuracy and consistency in the whole process.

14.4. Data entry

Twenty-four hour recall data were entered in Epi Info Version 6.0 (Atlanta, Ga., 1994). General information on each child (e.g. age, gender), as well as the child's food preferences (see IV.15) were entered in a record. This served as the main respondent file. Each food was entered in a separate record, along with its weight, and the meal at which it was consumed. These records were linked to the main file by the respondent (child's) identification number. The entry program included checks to verify if values had the right number of digits and were within a specified range. After each 24-hour recall was entered, it was checked against its coding sheet for errors.

14.5. Analysis

Twenty-four hour recall data and respondent files were exported for analysis into the statistical software package SAS Version 6.10 for Windows (Cary, N.C., 1994). The recall data were merged with the Minilist nutrient database. The nutrients of interest in this study (energy, carbohydrate (including sucrose), protein and fat) were calculated on a per food basis. They were derived by dividing the weight of the food by 100, and multiplying this factor by the quantity of nutrient per 100 grams. Also calculated were nutrient intakes per food per child.

14.5.1. Analysis of nutrient intakes

Descriptive statistics (sample size, mean, standard deviation and standard error) were calculated for the children's intake of energy and nutrients. Children were pooled together in age and gender groups corresponding to those of the Recommended Nutrient Intakes (RNIs) (Health and Welfare Canada, 1990). This was done to allow for a crude comparison of energy intakes reported by Kahnawake schoolchildren to the RNIs. They were not compared statistically as RNIs for energy intake in children and adolescents are maintained as averages. Assessing the adequacy of energy intakes requires careful consideration of energy expenditure (which was not feasible in this study), as well as growth patterns (Health and Welfare Canada, 1990).

Macronutrients, as a percent of total energy intake were determined for boys, girls and all children together. The two-tailed hypothesis that mean percentage energy from fat, was significantly different than 35% (comparable to current levels of fat intake in North American children (Health Canada, 1993)), was tested with a one sample t-test (Zar, 1984). The test had more than 80% power to detect a difference of 2%, at a significance level of $p=0.05$. The percentage energy from dietary fat in boys and girls was also compared with NHANES III, Phase 1 (1988-91) data using a two-tailed two sample t-test (Zar, 1984).

14.5.2. Analysis of food intake

An analysis of food intake in Grades 4-6 Kahnawake children was done using methods described by Block et al. (1995). Frequencies were determined for each food code used in analysis, and were ranked according to the proportion of children who reported them in the 24-hour recall. The percentage that each food contributed to the total intake of energy and macronutrients was calculated. This was derived by dividing the total amount of nutrient in all the servings of the food item, by the total amount of nutrient in all foods consumed (Block et al., 1995). Mentions of traditional/cultural foods were simply counted from the original questionnaires.

14.5.3. Meal patterns and dining out patterns

A variable was coded in each record to identify children who had mentioned dining out (included eating in a restaurant or eating restaurant food at home) on one or more occasion on the recall day. Subsequently, the proportion of children this represented was determined. Mean energy, macronutrient and sucrose intakes were compared between children who dined out and those who did not by use of a two-tailed two sample t-test (Zar, 1984).

14.5.4. Relationship with anthropometry

Children with both 24-hour recall and anthropometry records completed were grouped into lower, middle, and upper tertiles according to their mean BMI, TSF and SSF. Mean energy and nutrient intakes were calculated for each tertile level. For each anthropometric parameter, one way analysis of variance was used to compare the three means.

15. Food preference assessment

15.1. Development of tool

Two meetings were held in Kahnawake in March 1994, to obtain information useful in the design of an instrument to assess food preferences. The criteria of selection for participants in these meetings were that they be Mohawk parents or guardians of elementary schoolchildren, or teachers with knowledge of traditional and cultural Kahnawake food. The first meeting was a workshop attended by twenty-four teachers from Kateri and Karonhianonha Schools; the second was a focus group with parents of the Kahnawake Combined Schools Committee. The focus group was facilitated by the author, and moderated by a member of the community. Questions asked of these two groups were: (1) What food or beverages are regularly consumed by elementary schoolchildren (especially in Grades 4 to 6) as snacks or meals (particularly meals of the 'fast food' type), and (2) What traditional or cultural Mohawk food is being eaten at present in the community, by adults as well as children. The objective was to have the participants create food lists that were as complete as possible, and to then rank these according to how frequently they are used by children.

Twenty-four food items were selected for preference evaluation. Food models (pictures) were obtained from local milk producers (Fédération des producteurs de lait du Québec) for the majority of the food items. Photographs were taken of the remainder, most of which encompassed traditional or cultural Mohawk food, which were prepared in the kitchen of Kateri Memorial Hospital Centre.

15.2. Interview method

Following each 24-hour recall (see IV.14), a rating scale was administered to assess food preferences of children in Grades 4 to 6. A two-part procedure was adapted from the work of Wein et al. (1993) and Birch and Sullivan (1991). In the first part, the pictures of food were presented in a random order to the child. He/she was asked to place each food picture on a large cardboard, onto one of five labelled categories; these were "like very much", "like", "neither like nor dislike", "dislike" and "dislike very much". The interviewer made certain that the child understood what each of the five categories meant before proceeding. Freedom in their responses was also encouraged (Peryam and Pilgrim, 1957). In the second part, the child ranked food items according to his/her preference. For each hedonic category, the food pictures were arranged before the child who was asked "Which food do you like the best?", the selected food was removed and the question repeated until no pictures remained. The two parts combined to produce a complete rank ordering.

Twenty-nine children (two or three children from each of 12 classes) were randomly selected to repeat the food preference assessment. The retests were conducted at the completion of twenty-four hour recalls at each school. Thus, the time between the initial and repeat assessment varied for each child. The size of this subsample was the number of pairs of observations required to reject the hypothesis that a correlation was greater than or equal to 0.50, with 80% power and a Type I error rate of 5% (Zar, 1984; Cohen, 1988).

15.3. Coding and data entry

Food preference data were coded as they were collected (see Appendix 4). The following codes were used for the hedonic scores: 1 for "dislike very much", 2 for "dislike", 3 for "neither like nor dislike", 4 for "like", and 5 for "like very much". Rank order scores were assigned to food items from 1 (signifying the highest preference rating) to 24 (the lowest preference rating). Food items that had never been tasted were assigned missing values. Data were entered in Epi Info Version 6.0 (Atlanta, Ga., 1994).

15.4. Data analysis

All analyses of data were performed using the statistical software package SAS for Windows Version 6.10 (Cary, N.C., 1994).

15.4.1. Description of food preferences

Descriptive statistics (sample size, mean, standard deviation, rank) were obtained for hedonic and rank-order food preference scores. These were based on the number of children who reported having tasted each food.

For both scales, one-way analysis of variance (ANOVA) was performed to examine differences in mean preference scores among food items. Subsequently, Scheffé's multiple contrast procedure (Zar, 1984) was used to test for differences between all pairs of mean food preference scores within the set. Given the number of children whose food preferences were assessed, the mean hedonic scores were estimated with a 95% confidence interval no wider than 1.03 and a power of 95%. The width of the 95% confidence interval for the mean rank-order scores was 5.67 with a power of 95% (Zar, 1984).

Finally, Spearman's rank correlation coefficients for each food were calculated in order to examine the relationship between the hedonic and rank-order scales (Steel and Torrie, 1980; Zar, 1984).

15.4.2. Test-retest reliability

Pearson's product-moment (r), Spearman's rank and intraclass correlation coefficients were all calculated to illustrate test-retest reliability for both hedonic and rank-order scales. In this case, the intraclass correlation coefficient (ICC) is the preferred statistical test of association (Maclure and Willett, 1987; Bartko, 1991; Tyrer et al, 1993). Pearson's r measures the linear relationship between total scores on the test and those on the retest. It is not necessary to have an intercept of 0.0 and a slope of 1.0 to obtain a value of 1.0 (Steel and Torrie, 1980; Piccinelli et al., 1993). Conversely, ICC gives a value of 1.0 only when the first test's scores are exactly the same as the second test's scores; in this case the fitting line has an intercept of 0.0 and a slope of 1.0 (Piccinelli et al, 1993). ICC is superior to Kappa for ordinal data as in this study, in that the former is a measure of approximate agreement, and the latter one of exact agreement. For example, with the ICC, a pair of hedonic scores in adjacent categories is in greater agreement than a pair two categories apart (Maclure and Willett, 1987). Spearman's r is a non-parametric test which compares the rank for each of two variables for each study subject. The closer the ranks, the greater the correlation. It does not assume linearity of the underlying relationship (Steel and Torrie, 1980). To adjust for multiple comparisons across the number of food items that were being tested, p-values for the correlation coefficients were divided by 24. Thus, more conservative values of 0.002 and 0.0004 (real error rates), rather than 0.05 and 0.01 (procedure-wise error rates) were taken to be significant (Zar, 1984).

Reliability of the scales was also examined using methods other than correlation. Agreement was calculated by taking the absolute difference between test and retest scores. Finally, an approach described by Bland and Altman (1986) was used, in which it was tested whether the mean difference between initial and repeat scores was significantly different from zero. Once again, the p-value of 0.05 (procedure-wise error rate) was divided by 24 (number of food items) to adjust for multiple comparisons (Bonferroni test) (Zar, 1984). A more conservative value of 0.002 (real error rate) was considered as being statistically significant.

V. RESULTS

16. Participation

Table 16-1 shows the participation rates of Kahnawake children in evaluation activities of the KSDPP. Of a total of 458 children there were 399 (87.1%) whose parents consented to the evaluation. Relatively few parents refused (4.4%) and most non-participation was due to consent forms which were not returned to school (8.5%). There was good overall participation in anthropometric (86.0%), diet (77.3%) and food preference assessment (79.2%), suggesting these samples were representative of the total population of Kahnawake children.

Efforts were made to determine if there was a non-participation bias. The physical education teacher at Karonhianonha and the school nurse at Kateri were asked to subjectively rank non-participant children as being either in a lower, middle or upper weight category. For the 59 children who had refused participation or whose consent forms had not yet been returned, 9(15%), 36(61%) and 11(19%) of the students were placed in the lower, middle and upper weight ranks respectively (the remaining 3(5%) were unknown). For the 44 children in Grades 4-6 with whom a dietary interview was not completed, 12(27%), 23(52%) and 9(21%) were in the lower, middle and upper weight categories respectively. A few of these children had parental consent to participate in the interview, but were not included due to time/feasibility constraints. The non-participants did not appear to reflect a proportion of the population that was different in terms of its anthropometry (i.e. there was no extreme in any category). This information, albeit subjective, reinforced representativeness of the study sample.

Table 16-1 - Participation rates of Kahnawake children in evaluation activities (Fall 1994)

	Grades 1-3 n (%)	Grades 4-6 n (%)	Grades 1-6
Total number of children	**246 (100%)**	**212 (100%)**	**458 (100%)**
Participation rate	**209 (84.9%)**	**190 (89.6%)**	**399 (87.1%)**
Refusals	11 (4.5%)	9 (4.2%)	20 (4.4%)
Non-response	26 (10.6%)	13 (6.1%)	39 (8.5%)
Children with anthropometric evaluation completed	**207 (84.1%)**	**187 (88.2%)**	**394 (86.0%)**
Children with food preference assessment completed	N/A	**168 (79.2%)**	N/A
Children with 24-hr recall completed	N/A	**164 (77.3%)**	N/A
Children (Grades 4-6) with complete records	N/A	**160 (75.5%)**	N/A

17. Anthropometry

17.1. Descriptive statistics

Three-hundred-and-ninety-four out of 458 (86.0%) Grades 1-6 Kahnawake children participated in the baseline anthropometric evaluation of the KSDPP. Table 17-1 shows their age and gender distribution. The number in each gender and age group ranged from 2 to 43 for boys and 3 to 38 for girls. The average age of boys was 8.84 ± 1.72 years (mean ± standard deviation) (range 5.80 to 12.47), while that of girls was 8.90 ± 1.80 years (range 5.76 to 12.98). For certain anthropometric analyses, there were too few children in the 5 and 12 year old groups; in these cases results are reported for ages 6 to 11.

Sample size and descriptive statistics for weight, height, BMI derived from weight and height, TSF and SSF, by gender and age groups are given in Table 17-2. In boys, the means for weight, BMI and SSF exceeded the medians by amounts that tended to increase with age, indicating an age-related increase in positive skewness. This age-related increase was not observed for height or TSF in boys, and was generally not as consistent in girls. Variability, as seen by the standard deviation, generally tended to increase with age, for all parameters except height, in both boys and girls. Girls had thicker skinfolds than boys.

The mean BMI compared with NHANES II and HHANES-MA reference children is shown for boys in Figure 17-1 and for girls in Figure 17-2. In boys, the BMI appeared to be higher than NHANES II and HHANES-MA at all ages. At age 10 the gap from the reference populations widened, and the variability within the Kahnawake boys' measurements increased. The mean BMI in 10-year-old Kahnawake boys was significantly higher ($p<0.05$) than in NHANES II (Table 17-3). Other age groups did not reach statistically significant differences perhaps due to small sample sizes. As seen in Table 17-3, mean BMI in Kahnawake girls was significantly greater than NHANES II girls in 8 ($p<0.001$) and 10 ($p<0.01$) year olds. It was significantly higher than HHANES-MA

Table 17-1 - Age and gender distribution of Kahnawake children participating in anthropometric evaluation

Age (y)	Boys	Girls	Total
5	5	6	11
6	30	36	66
7	33	23	56
8	43	32	75
9	30	38	68
10	30	27	57
11	26	30	56
12	2	3	5
Total	**199**	**195**	**394**

Table 17-2 - Means (X), standard deviations (SD), and medians (MD) for weight, height, body mass index (BMI), triceps skinfold (TSF) and subscapular skinfold (SSF) thicknesses by gender and age

Gender/ Age Group	n	Weight (kg)			Height (cm)			BMI (kg/m^2)			TSF (mm)			SSF (mm)		
		X	SD	MD	X	SD	MD	X	SD	MD	X	SD	MD	X	SD	MD
Boys																
5	5	21.4	1.8	20.5	115.7	4.0	113.3	16.0	0.9	16.0	7.6	2.2	7.0	4.9	1.2	4.2
6	30	24.9	4.6	24.0	120.9	5.1	120.6	17.0	2.6	16.4	9.2	3.4	8.2	6.0	3.2	5.0
7	33	27.3	6.7	26.5	125.0	5.8	126.5	17.3	3.2	16.6	9.8	4.8	8.3	6.5	5.8	5.0
8	43	30.9	11.0	27.8	129.2	6.0	127.4	18.2	4.6	17.2	12.3	7.4	10.0	8.9	7.5	6.2
9	30	35.0	9.2	32.6	136.8	5.1	136.2	18.6	3.8	17.3	12.6	6.0	11.6	9.0	7.2	6.1
10	30	43.6	12.6	37.7	144.3	5.2	144.3	20.7	4.8	18.5	14.8	7.3	12.2	12.3	8.4	8.0
11	26	47.0	14.9	42.8	145.4	5.8	146.0	23.0	9.9	19.8	15.4	6.8	12.1	12.2	8.9	7.8
12	2	47.6	3.4	47.6	145.0	1.1	145.0	22.7	2.0	22.7	20.6	3.2	20.6	19.6	9.5	19.6
Girls																
5	6	20.0	2.6	20.0	112.5	4.0	112.8	15.8	1.0	15.9	9.8	1.8	10.0	5.5	1.0	5.5
6	36	23.5	4.0	22.6	118.9	6.1	118.4	16.6	2.1	15.9	11.0	3.7	10.2	7.0	3.4	5.2
7	23	26.4	3.3	26.3	126.3	4.3	126.2	16.5	1.3	16.6	10.6	2.7	10.3	7.0	2.4	6.2
8	32	30.4	7.8	27.5	129.5	5.7	128.4	18.0	3.3	16.7	13.6	5.9	12.0	9.8	6.1	7.0
9	38	33.0	6.0	31.8	135.9	5.5	135.0	17.8	2.6	17.9	14.2	4.7	13.0	9.8	5.3	8.2
10	27	45.0	13.3	40.1	144.1	6.6	146.1	21.3	4.8	19.9	18.9	6.7	19.7	15.2	9.0	13.3
11	30	49.2	13.1	47.2	150.1	6.4	152.2	21.7	5.3	20.6	18.4	7.4	15.9	14.9	9.3	12.3
12	3	53.5	15.7	49.0	150.7	5.2	152.0	23.4	6.0	23.3	21.7	8.8	24.7	18.6	12.8	18.0

Figure 17-1 - Mean BMI in Kahnawake boys compared with NHANES II and HHANES-MA boys

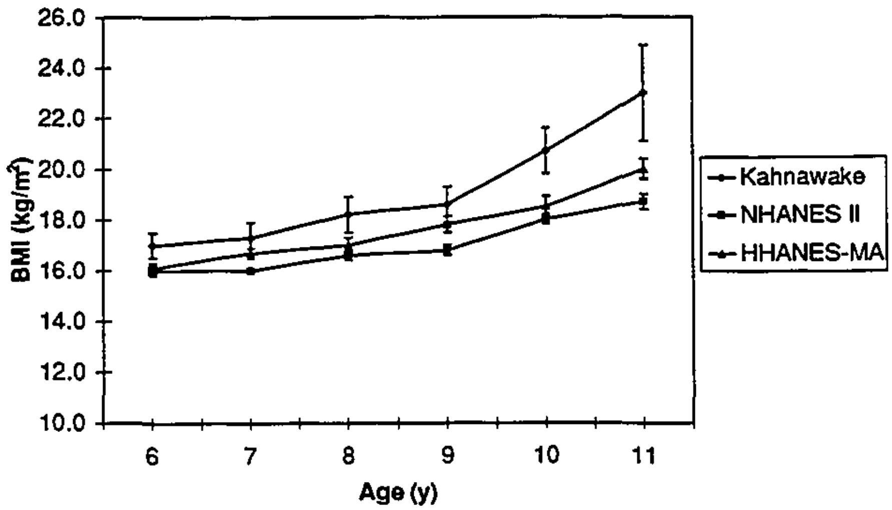


Figure 17-2 - Mean BMI in Kahnawake girls compared with NHANES II and HHANES-MA girls

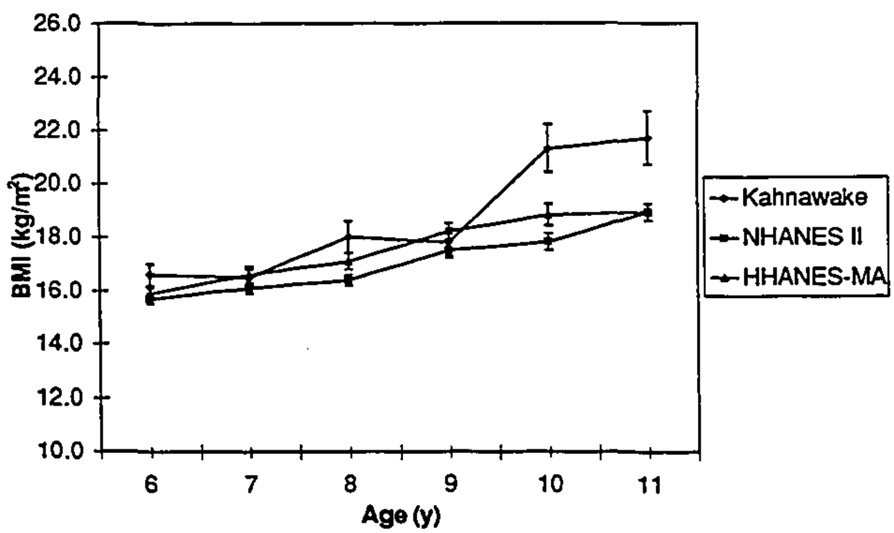


Table 17-3 - Mean BMI of Kahnawake children by gender and age compared with NHANES II[1] and HHANES-MA[2] data

Gender/ Age Group	BMI (kg/m^2)					
	Kahnawake		NHANES II		HHANES-MA	
	Mean	SD	Mean	SD	Mean	SD
Boys						
6	17.0	2.6	16.0	2.2	16.1	2.4
7	17.3	3.2	16.0	1.7	16.7	2.4
8	18.2	4.6	16.6	2.5	17.0	2.8
9	18.5	3.8	16.8	2.4	17.8	3.2
10	20.7	4.8	18.0[a]	2.9	18.5	3.8
11	23.0	9.9	18.7	3.6	20.0	4.1
Girls						
6	16.6	2.1	15.7	1.8	15.9	2.3
7	16.5	1.3	16.1	2.2	16.6	2.6
8	18.0	3.3	16.4[c]	2.5	17.1	3.0
9	17.8	2.6	17.5	3.5	18.2	3.2
10	21.3	4.8	17.8[b]	3.2	18.8	3.6
11	21.7	5.3	18.9	3.8	18.9[a]	3.7

[1]NHANES II - second National Health and Nutrition Examination Survey (1976-80)
[2]HHANES-MA - Hispanic health and Nutrition Examination Survey, Mexican American population (1982-84)

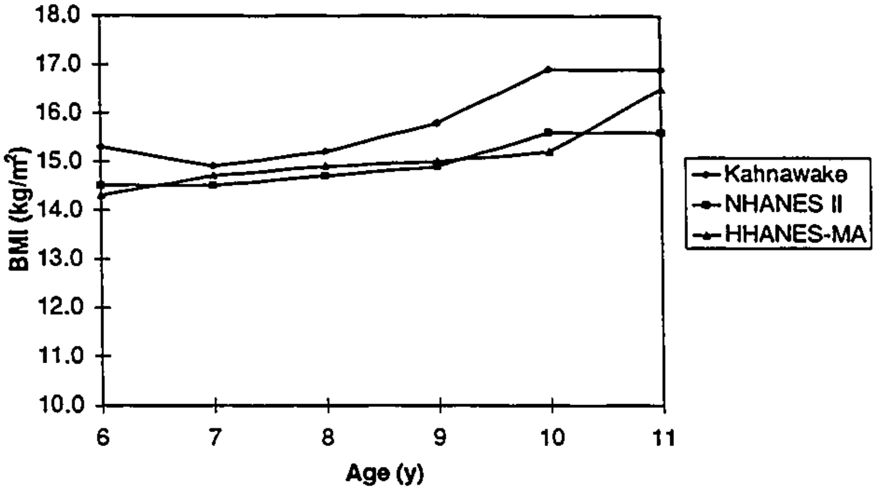
Letters represent statistically significant difference from Kahnawake sample, determined by 2-tailed t-tests and adjusted for multiple comparisons using Bonferroni test : {$^a p<0.05$, $^b p<0.01$, $^c p<0.001$ (procedure-wise error rates): $^a p<0.008$, $^b p<0.002$, $^c p<0.0002$ (real error rates)} in 11-year-old girls ($p<0.05$). Again, other ages may not have reached statistical significance due to small numbers of children.

Figures 17-3 to 17-20 display 15th, 50th (median) and 85th percentile levels by age for boys and girls for BMI, TSF and SSF. They are plotted with corresponding sets of percentile values of the NHANES II and HHANES-MA reference populations. The results of the Wilcoxon test to determine if the *set* of Kahnawake percentile values across each gender, differed significantly ($p<0.05$) from the set of NHANES II or HHANES-MA values for each parameter were as follows: the 15th and median percentile values for BMI were significantly greater than NHANES II and HHANES-MA values (Figures 17-3 to 17-6); 85th percentile values were significantly higher than NHANES II for boys only (Figures 17-7 and 17-8); 15th percentile values for TSF in boys were significantly higher than both NHANES II and HHANES-MA (Figure 17-9). Both girls and boys had sets of 85th percentile values significantly greater than the NHANES II population (Figures 17-13 and 17-14); the 85th percentile level for SSF in girls was significantly higher than NHANES II (Figure 17-20). Other comparisons were not statistically different.

17.2. Prevalence of underweight and overweight

Tables 17-4, 17-5 and 17-6 show the prevalence of children at and below the 15th percentile and at and above the 85th percentiles for BMI, TSF and SSF of the NHANES II and HHANES-MA reference populations. Compared with the NHANES II reference, 7.5% of boys and 7.2% of girls (both 7.4%) had BMIs less than the 15th percentile. When compared with HHANES-MA, 8% of boys and 7.7% of girls (both 7.9%) were under the 15th percentile for BMI. With the exception of 8-year-old boys and 9-year-old girls, less than 10 % of the children were below the 15th percentile BMI of reference populations. For TSF, 7.5% of boys and 9.2% of girls (8.4% both) were under the 15th percentile of NHANES II. The results were 12.1% boys, 11.8% girls (11.9% both) compared to HHANES-MA. Finally, for SSF, 13.6% of boys, 9.2% of girls (11.4% both) were under the 15th percentile of NHANES II; 16.1% boys, 12.3% girls (14.2%

Figure 17-3 - 15th percentile level for BMI in Kahnawake[1], NHANES II and HHANES-MA boys

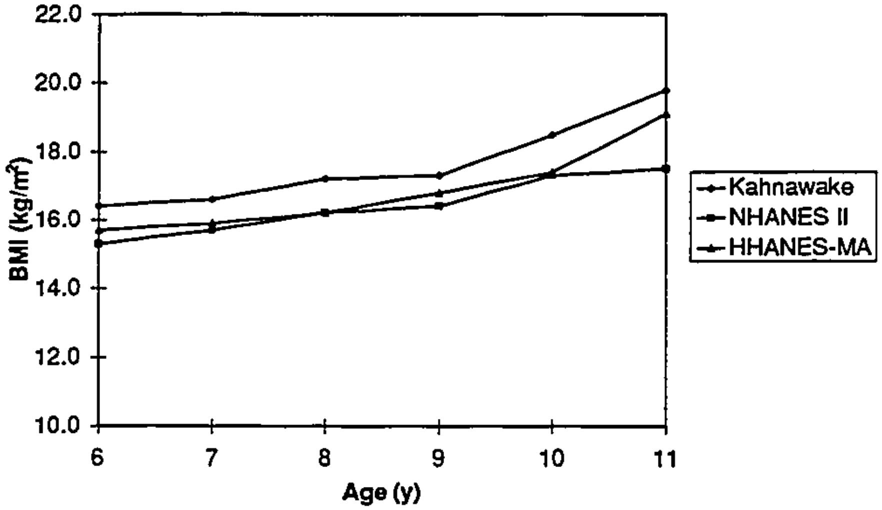


[1]Statistically significantly different from NHANES II and HHANES-MA, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-4 - 15th percentile level for BMI in Kahnawake[1], NHANES II and HHANES-MA girls

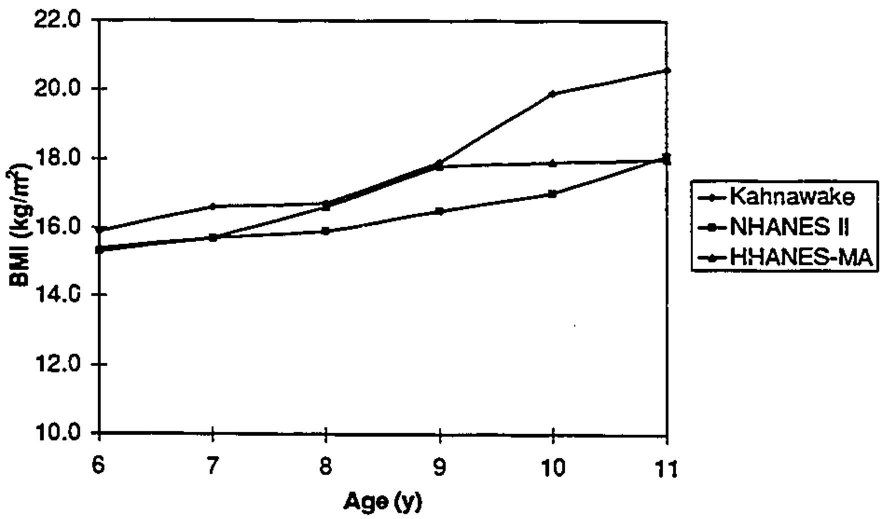
[1]Statistically significantly different from NHANES II and HHANES-MA, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-5 - Median BMI in Kahnawake[1], NHANES II and HHANES-MA boys



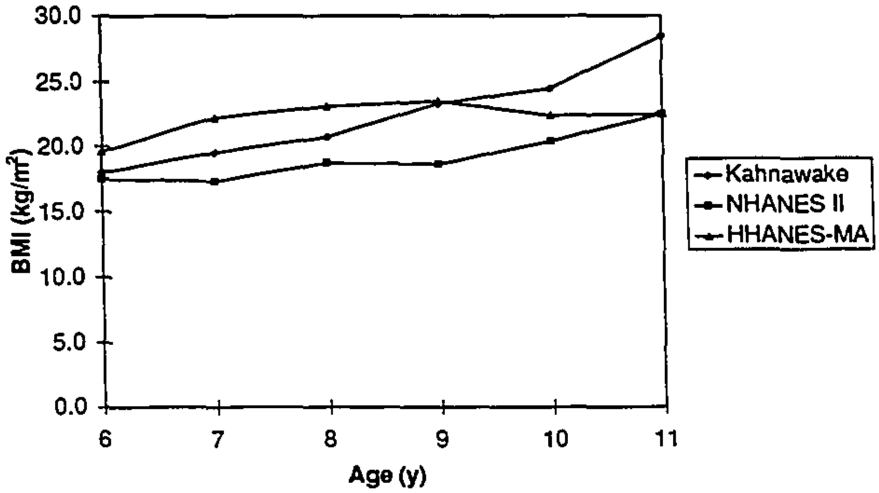
[1]Statistically significantly different from NHANES II and HHANES-MA, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-6 - Median BMI in Kahnawake, NHANES II and NHANES-MA girls



[1]Statistically significantly different from NHANES II and HHANES-MA, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-7 - 85th percentile level for BMI in Kahnawake[1], NHANES II and HHANES-MA boys



[1]Statistically significantly different from NHANES II, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-8 - 85th percentile level for BMI in Kahnawake, NHANES II and HHANES-MA girls

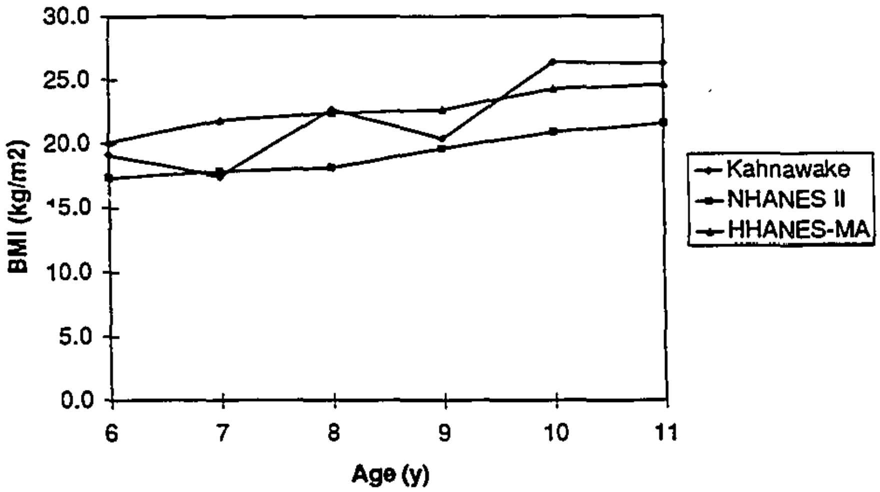
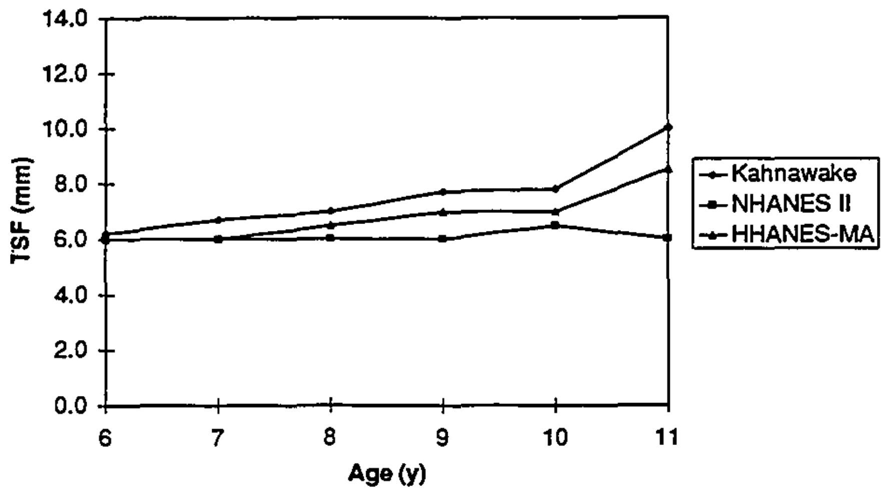


Figure 17-9 - 15th percentile level for TSF in Kahnawake[1], NHANES II and HHANES-MA boys



[1]Statistically significantly different from NHANES II and HHANES-MA, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-10 - 15th percentile level for TSF in Kahnawake, NHANES II and HHANES-MA girls

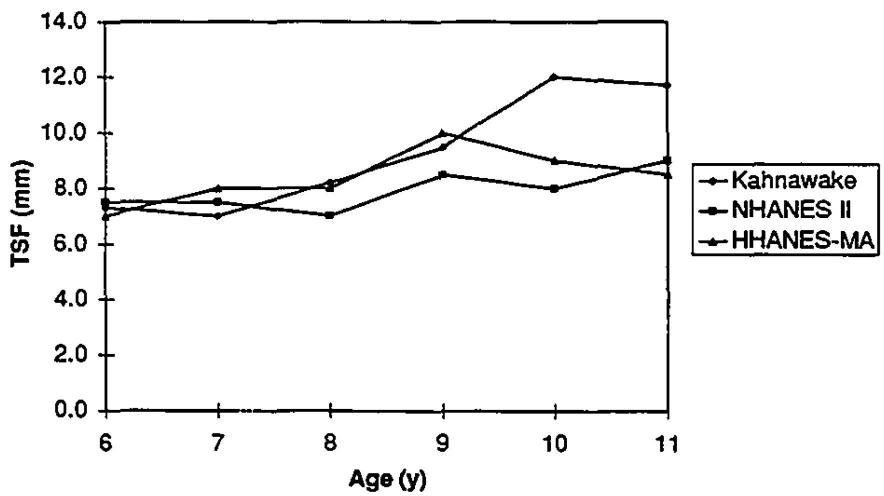


Figure 17-11 - Median TSF among Kahnawake, NHANES II and HHANES-MA boys

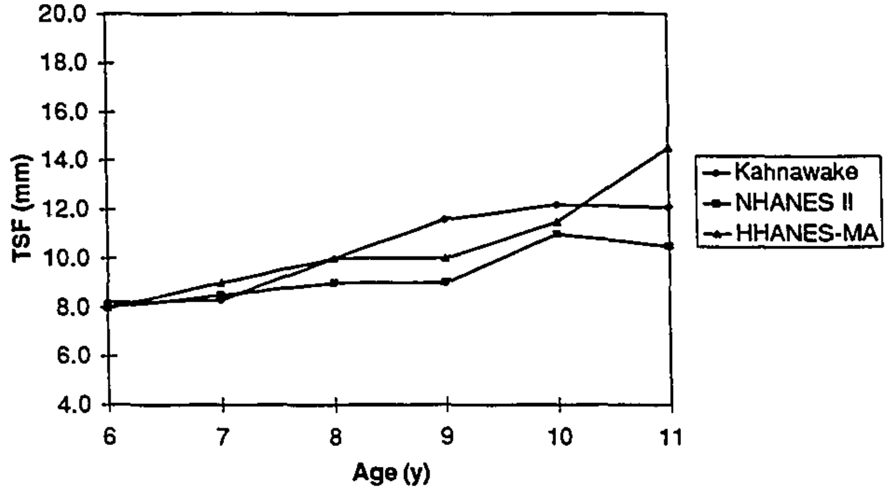


Figure 17-12 - Median TSF among Kahnawake, NHANES II and HHANES-MA girls

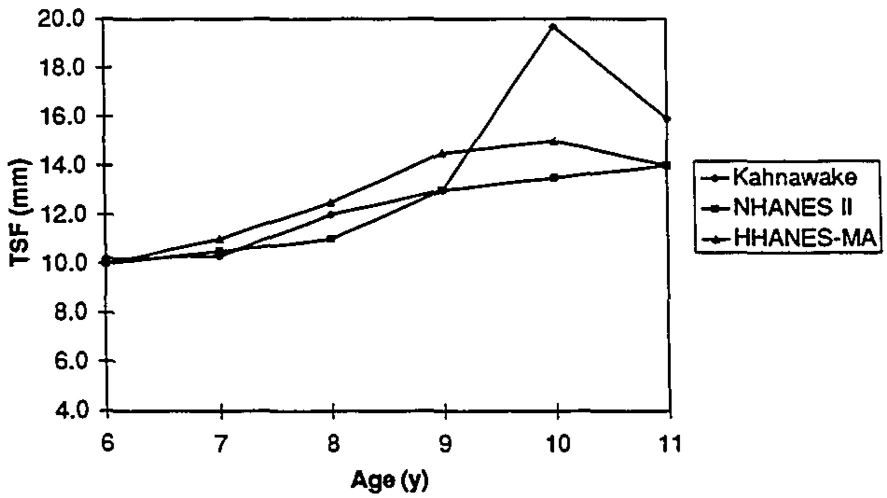
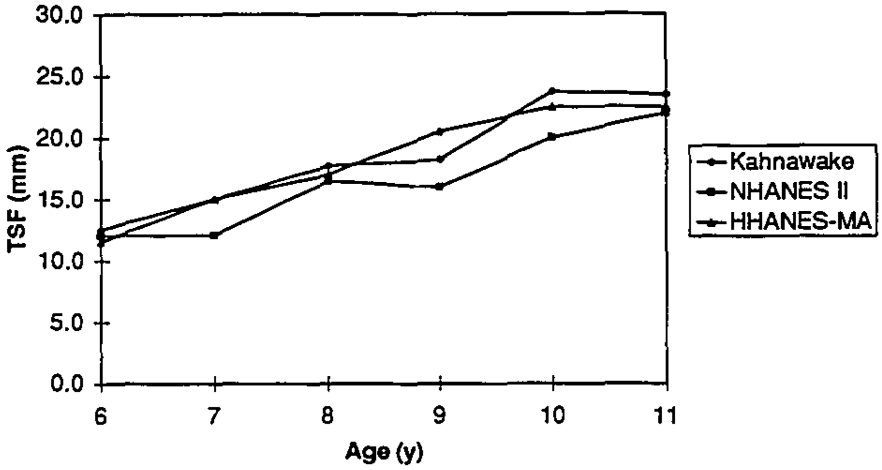
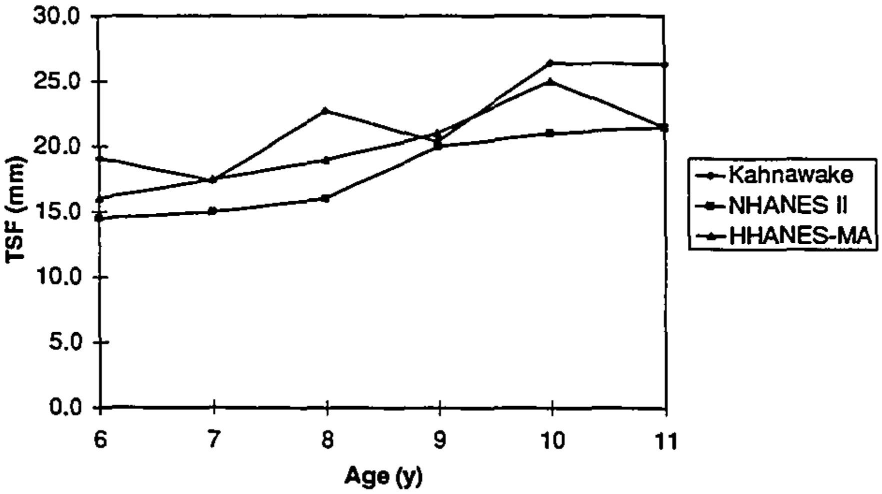


Figure 17-13 - 85th percentile level for TSF in Kahnawake[1], NHANES II and HHANES-MA boys



[1]Statistically significantly different from NHANES II, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-14 - 85th percentile level for TSF in Kahnawake[1], NHANES II and HHANES-MA girls



[1]Statistically significantly different from NHANES II, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

Figure 17-15 - 15th percentile level for SSF in Kahnawake, NHANES II and HHANES-MA boys

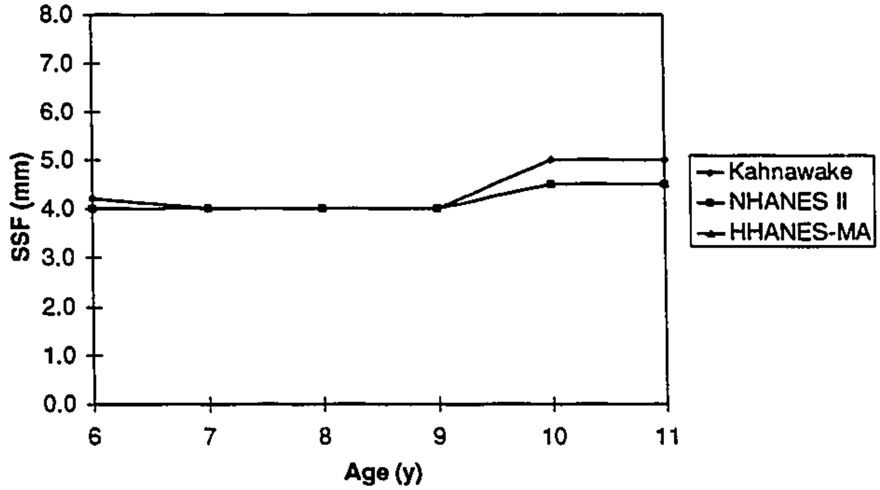


Figure 17-16 - 15th percentile level for SSF in Kahnawake, NHANES II and HHANES-MA girls

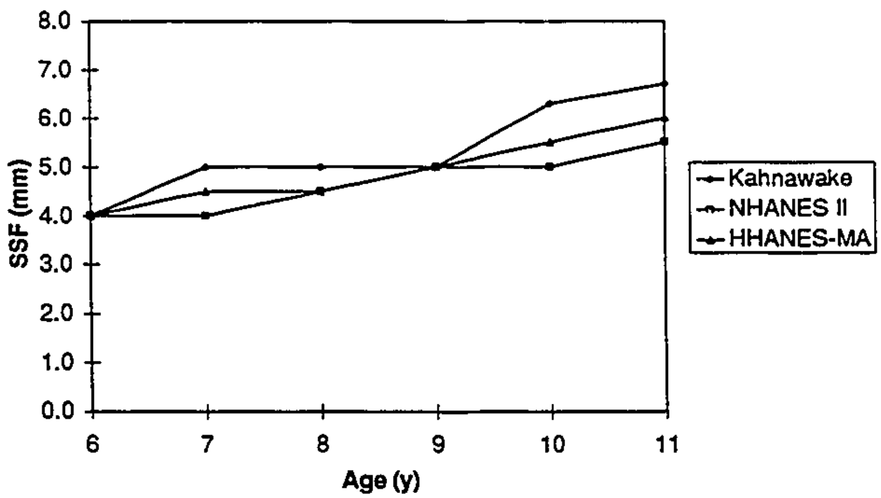


Figure 17-17 - Median SSF among Kahnawake, NHANES II and HHANES-MA boys

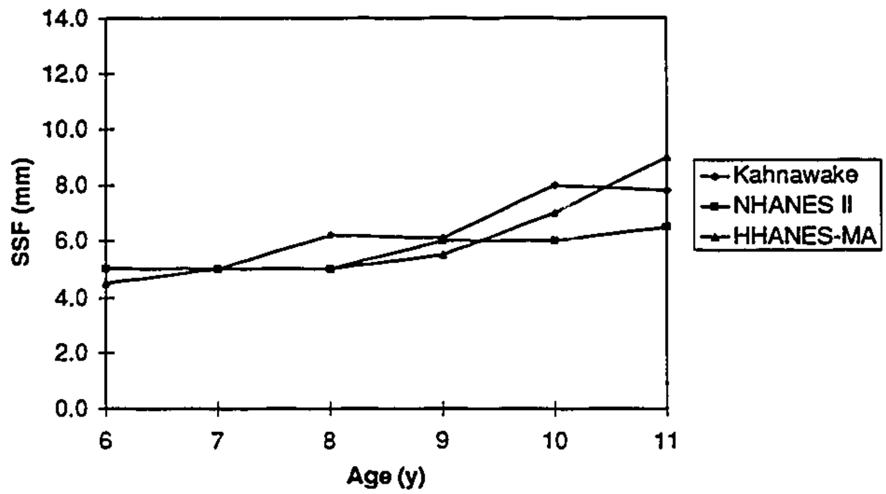


Figure 17-18 - Median SSF among Kahnawake, NHANES II and HHANES-MA girls

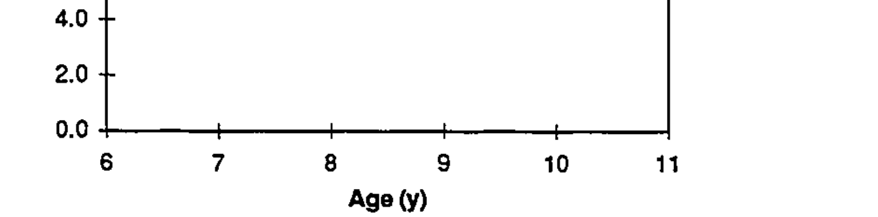


Figure 17-19 - 85th percentile level for SSF in Kahnawake, NHANES II and HHANES-MA boys

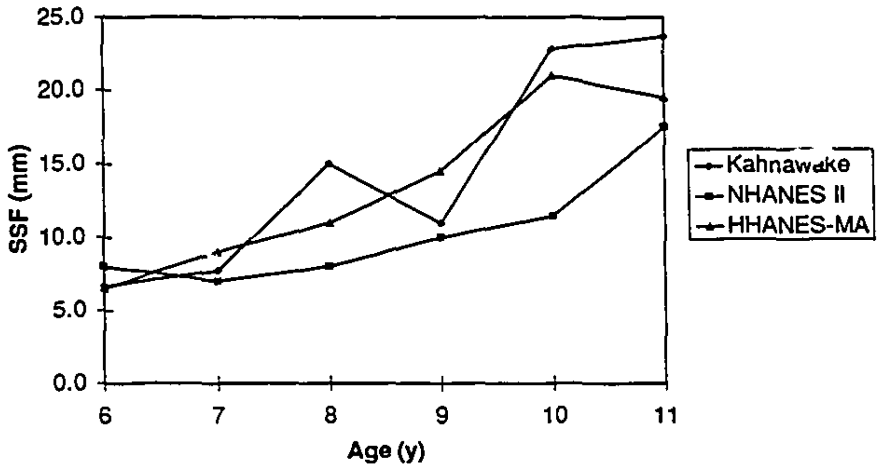
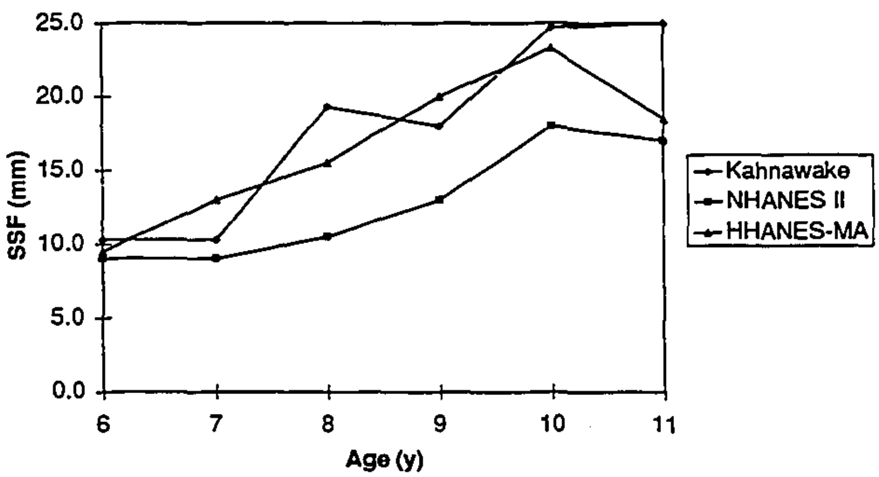


Figure 17-20 - 85th percentile level for SSF in Kahnawake[1], NHANES II and HHANES-MA girls



[1]Statistically significantly different from NHANES II, determined by Wilcoxon matched-pairs signed-ranks two-tailed test ($p<0.05$)

both) were under the HHANES-MA 15th percentile level. Overall, there was a lower prevalence of underweight in Kahnawake than in the reference populations.

Compared with NHANES II, 29.6% of boys and 32.8% of girls (both 31.2%) had BMIs above the 85th percentile. When compared with HHANES-MA, 21.6% of boys and 21.0% of girls (both 21.3%) were above the 85th percentile for BMI. For TSF compared with NHANES II 21.1% of boys and 23.1% of girls (22.1% both) were over the 85th percentile. The results were 17.1% of boys and 21.0% girls (19.0% both) compared to HHANES-MA. For SSF, 24.1% of boys and 27.7% of girls (25.9% both) were greater than the NHANES II 85th percentile level; 17.1% of boys, 16.4% of girls (16.8% both) were above the 85th percentile of the HHANES-MA population. Overall, there were higher rates of overweight than in the NHANES II population, especially when using BMI and SSF as indicators. Prevalence of overweight was slightly higher than the HHANES-MA population, but only by the BMI criterion.

17.3. Comparison with NCHS reference curves

Sample sizes, means, standard deviations and medians of z-scores for height-for-age, weight-for-height and weight-for-age by gender and age are summarized in Table 17-7. Excluded were those children for whom weight-for-height was not calculable because age and height limitations of the CDC/WHO international growth reference curves were surpassed (approximately 18.1% of boys and 41.5% of girls). In some cases weight-for-age z-scores were flagged by Epi Info because they were extreme; these were included in calculations as they did not indicate measurement or recording errors. A neglible number of children had z-scores less than -2.00 standard deviations (1 boy for weight-for-height, and 1 boy and 1 girl for height -for-age).

Figures 17-21 to 17-30 show z-score and percentile distributions for height-for-age (8- and 10-year-old children are presented separately as there was a significant effect of these ages on z-scores), weight-for-height and weight-for-age. Except for 8- and 10-year-olds, height-for-age z-scores appear to be normally distributed (Figure 17-21), with a slightly lower frequency of low height-for-age than in the reference population. Eight-

Table 17-4 - Number (percent) of Kahnawake children at/ below 15th percentile and at/above 85th percentile for BMI of the NHANES II and HHANES-MA populations

Age (y)	BMI at/below 15th percentile						BMI at/above 85th percentile					
	Boys			Girls			Boys			Girls		
	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA
5	5	0 (0.0)	0 (0.0)	6	0 (0.0)	1 (16.7)	5	1 (20.0)	0 (0.0)	6	0 (0.0)	0 (0.0)
6	30	1 (3.3)	1 (3.3)	36	2 (5.6)	2 (5.6)	30	6 (20.0)	6 (20.0)	36	12 (33.3)	9 (25.0)
7	33	2 (6.1)	2 (6.1)	23	1 (4.3)	1 (4.3)	33	9 (27.3)	5 (15.2)	23	2 (8.7)	1 (4.3)
8	43	5 (11.6)	6 (14.0)	32	1 (3.1)	3 (9.4)	43	13 (30.2)	10 (23.3)	32	14 (43.8)	8 (25.0)
9	30	3 (10.0)	3 (10.0)	38	5 (13.2)	4 (10.5)	30	9 (30.0)	5 (16.7)	38	9 (23.7)	2 (5.3)
10	30	2 (6.7)	2 (6.7)	27	2 (7.4)	2 (7.4)	30	12 (40.0)	9 (30.0)	27	12 (44.4)	10 (37.0)
11	26	2 (7.7)	2 (7.7)	30	3 (10.0)	2 (6.7)	26	8 (30.8)	7 (26.9)	30	13 (43.3)	10 (33.3)
12	2	0 (0.0)	0 (0.0)	3	0 (0.0)	0 (0.0)	2	1 (50.0)	1 (50.0)	3	2 (66.7)	1 (33.3)
Total	199	15 (7.5)	16 (8.0)	195	14 (7.2)	15 (7.7)	199	59 (29.6)	43 (21.6)	195	64 (32.8)	41 (21.0)

Table 17-5 - Number (percent) of Kahnawake children at/ below 15th percentile and at/above 85th percentile for TSF of the NHANES II and HHANES-MA populations

	TSF at/below 15th percentile						TSF at/above 85th percentile					
	Boys			Girls			Boys			Girls		
Age (y)	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA
5	5	1 (20.0)	1 (20.0)	6	1 (16.7)	1 (16.7)	5	0 (0.0)	0 (0.0)	6	0 (0.0)	0 (0.0)
6	30	3 (10.0)	3 (10.0)	36	7 (19.4)	5 (13.9)	30	6 (20.0)	7 (23.3)	36	7 (19.4)	2 (5.6)
7	33	3 (9.1)	3 (9.1)	23	4 (17.4)	4 (17.4)	33	7 (21.2)	5 (15.2)	23	1 (4.3)	0 (0.0)
8	43	4 (9.3)	6 (14.0)	32	1 (3.1)	4 (12.5)	43	9 (20.9)	8 (18.6)	32	10 (31.3)	5 (15.6)
9	30	2 (6.7)	4 (13.3)	38	3 (7.9)	7 (18.4)	30	5 (16.7)	3 (10.0)	38	3 (7.9)	1 (2.6)
10	30	1 (3.3)	4 (13.3)	27	1 (3.7)	1 (3.7)	30	10 (33.3)	6 (20.0)	27	12 (44.4)	11 (40.7)
11	26	1 (3.8)	3 (11.5)	30	1 (3.3)	1 (3.3)	26	5 (19.2)	4 (15.4)	30	10 (33.3)	6 (20.0)
12	2	0 (0.0)	0 (0.0)	3	0 (0.0)	0 (0.0)	2	0 (0.0)	1 (50.0)	3	2 (66.7)	1 (33.3)
Total	199	15 (7.5)	24 (12.1)	195	18 (9.2)	23 (11.8)	199	42 (21.1)	34 (17.1)	195	45 (23.1)	41 (21.0)

Table 17-6 - Number (percent) of Kahnawake children at/ below 15th percentile and at/above 85th percentile for SSF of the NHANES II and HHANES-MA populations

Age (y)	SSF at/below 15th percentile						SSF at/above 85th percentile					
	Boys			Girls			Boys			Girls		
	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA	n	NHANES II	HHANES-MA
5	5	2 (40.0)	2 (40.0)	6	1 (16.7)	1 (16.7)	5	0 (0.0)	0 (0.0)	6	0 (0.0)	0 (0.0)
6	30	3 (10.0)	3 (10.0)	36	1 (2.8)	6 (16.7)	30	3 (10.0)	5 (16.7)	36	9 (25.0)	7 (19.4)
7	33	6 (18.2)	6 (18.2)	23	0 (0.0)	1 (4.3)	33	6 (18.2)	2 (6.1)	23	5 (21.0)	0 (0.0)
8	43	9 (20.9)	9 (20.9)	32	4 (12.5)	4 (12.5)	43	13 (30.2)	10 (23.3)	32	10 (31.3)	6 (18.8)
9	30	5 (16.7)	5 (16.7)	38	6 (15.8)	6 (15.8)	30	7 (23.3)	3 (10.0)	38	9 (23.7)	3 (7.9)
10	30	2 (6.7)	2 (6.7)	27	3 (11.1)	3 (11.1)	30	12 (40.0)	8 (26.7)	27	11 (40.7)	7 (25.9)
11	26	0 (0.0)	6 (23.1)	30	2 (6.7)	2 (6.7)	26	6 (23.1)	5 (19.2)	30	8 (26.7)	8 (26.7)
12	2	0 (0.0)	0 (0.0)	3	1 (33.3)	1 (33.3)	2	1 (50.0)	1 (50.0)	3	2 (66.7)	1 (33.3)
Total	199	27 (13.6)	32 (16.1)	195	18 (9.2)	24 (12.3)	199	48 (24.1)	34 (17.1)	195	54 (27.7)	32 (16.4)

Table 17-7 - Mean, standard deviation (SD), and median (MD) of z-scores for height-for-age (HAZ), weight-for-height (WHZ) and weight-for-age (WAZ) by gender and age

Gender/ Age Group	HAZ				WHZ				WAZ			
	n	Mean	SD	MD	n[1]	Mean	SD	MD	n	Mean	SD	MD
Boys												
5	5	0.03	0.83	-0.53	5	0.36	0.59	0.39	5	0.31	0.62	0.05
6	30	0.38	0.89	0.15	30	0.83	1.51	0.50	30	0.93	1.50	0.58
7	33	0.17	0.98	0.43	33	0.82	1.46	0.61	33	0.76	1.64	0.55
8	43	-0.08	1.06	-0.24	43	0.94	1.75	0.42	43	0.66	2.06	0.30
9	30	0.35	0.74	0.30	28	0.52	1.34	0.57	30	0.77	1.45	0.40
10	30	0.71	0.84	0.60	17	0.53	1.12	0.40	30	1.32	1.66	0.68
11	26	-0.14	0.84	-0.05	7	1.82	3.66	0.20	26	0.95	1.70	0.46
12	2	-0.92	0.02	-0.92	-	-	-	-	2	0.58	0.41	0.58
Girls												
5	6	-0.32	0.84	-0.26	6	0.40	0.67	0.50	6	0.12	0.92	0.21
6	36	0.18	1.02	0.11	36	0.71	1.28	0.38	36	0.69	1.15	0.39
7	23	0.56	0.74	0.41	22	0.41	0.58	0.44	23	0.70	0.75	0.54
8	32	0.02	0.92	0.00	29	0.64	1.26	0.31	32	0.57	1.45	0.10
9	38	0.12	0.76	0.05	21	0.38	0.90	0.56	38	0.26	0.87	0.36
10	27	0.43	0.86	0.51	-	-	-	-	27	1.09	1.49	0.65
11	30	0.39	0.87	0.51	-	-	-	-	30	0.96	1.36	0.80
12	3	-0.71	1.08	-0.67	-	-	-	-	3	0.72	1.66	0.26

[1] number of children meeting age and height limitations for weight-for-height of the CDC/WHO international growth reference curves

Figure 17-21 - Height-for-age z-score distribution of Kahnawake schoolchildren (excluding 8- and 10-year-olds) (n=262) compared to reference z-score distribution

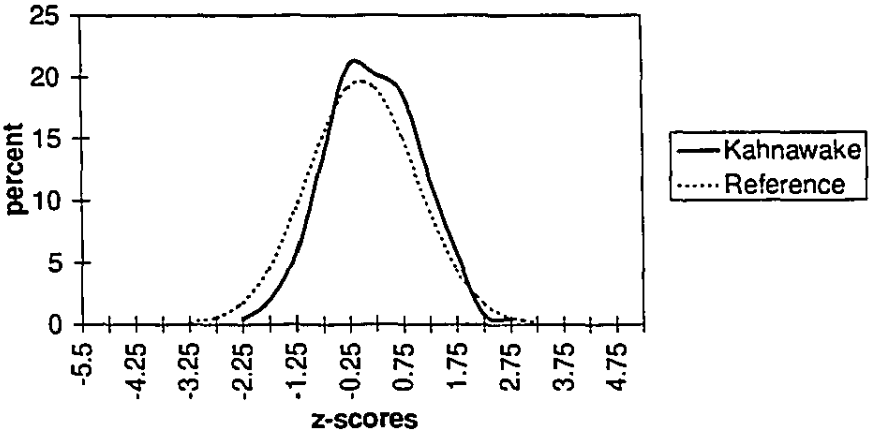


Figure 17-22 - Height-for-age centile distribution of Kahnawake children (excluding 8- and 10-year-olds) (n=262) compared to expected frequency in reference population

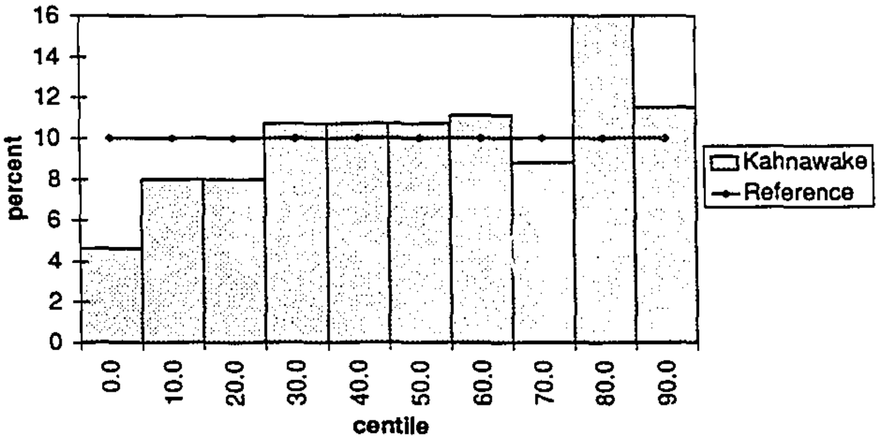


Figure 17-23 - Height-for-age z-score distribution of 8-year-old Kahnawake children (n=75) compared to reference z-score distribution

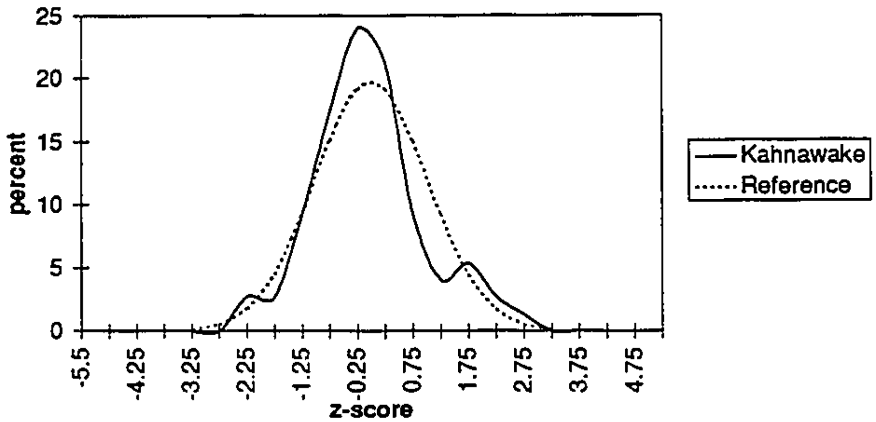


Figure 17-24 - Height-for-age centile distribution of 8-year-old Kahnawake children (n=75) compared to expected frequency in reference population

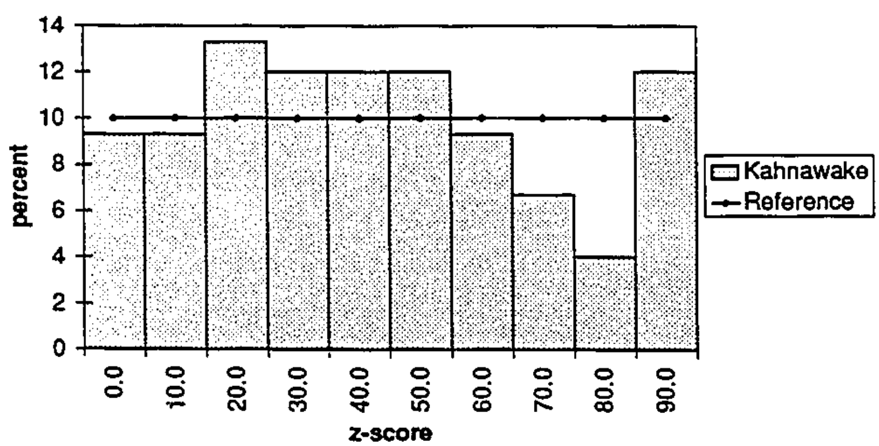


Figure 17-25 - Height-for-age z-score distribution of 10-year-old Kahnawake children (n=57) compared to reference z-score distribution

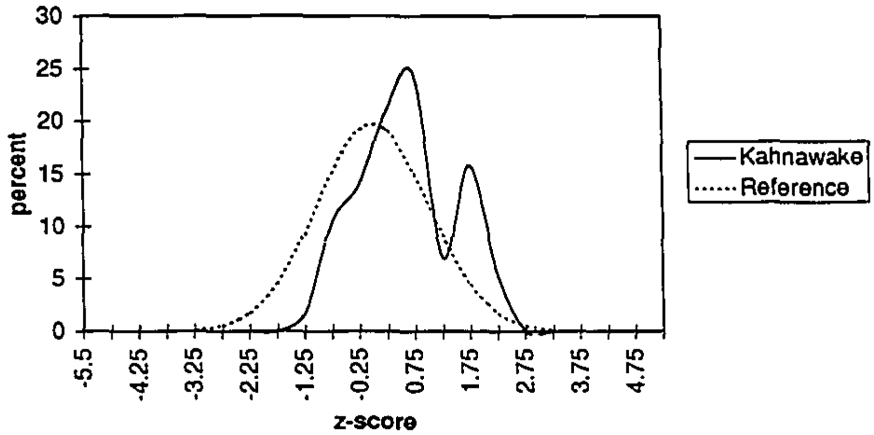


Figure 17-26 - Height-for-age centile distribution of 10-year-old Kahnawake children (n=57) compared to expected frequency in reference population

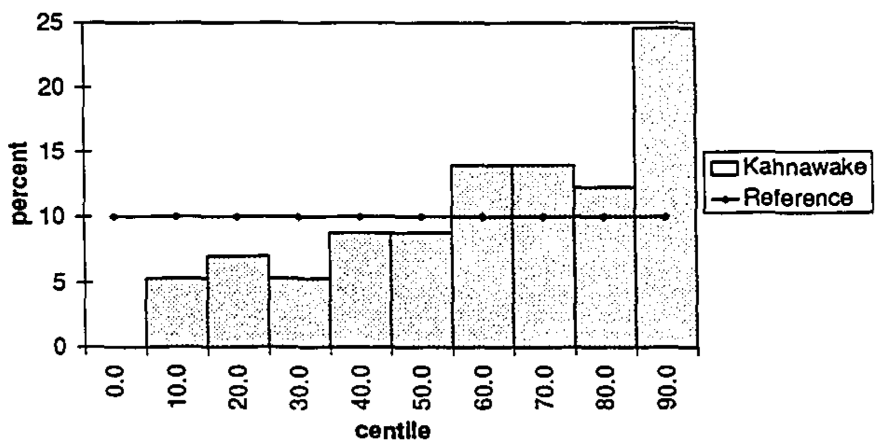


Figure 17-27 - Weight-for-height z-score distribution of Kahnawake children (n=274) compared to reference z-score distribution

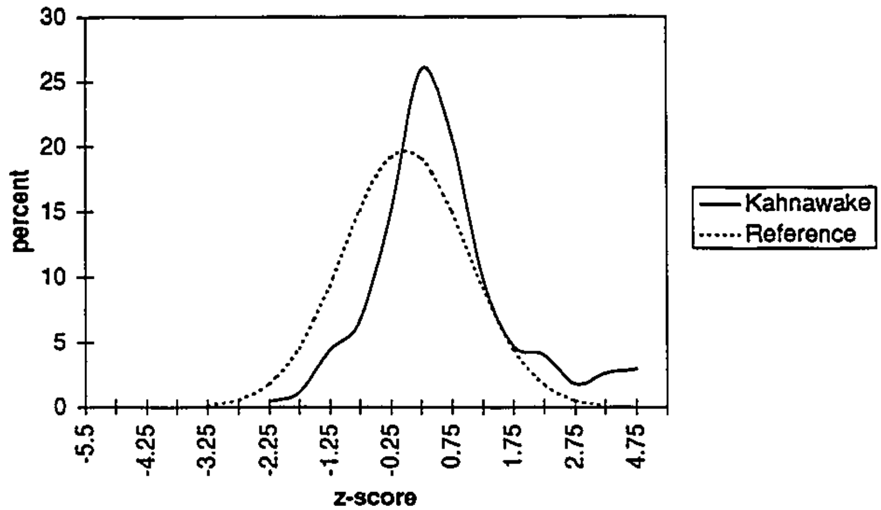


Figure 17-28 - Weight-for-height centile distribution of Kahnawake children (n=278) compared to expected frequency in reference population

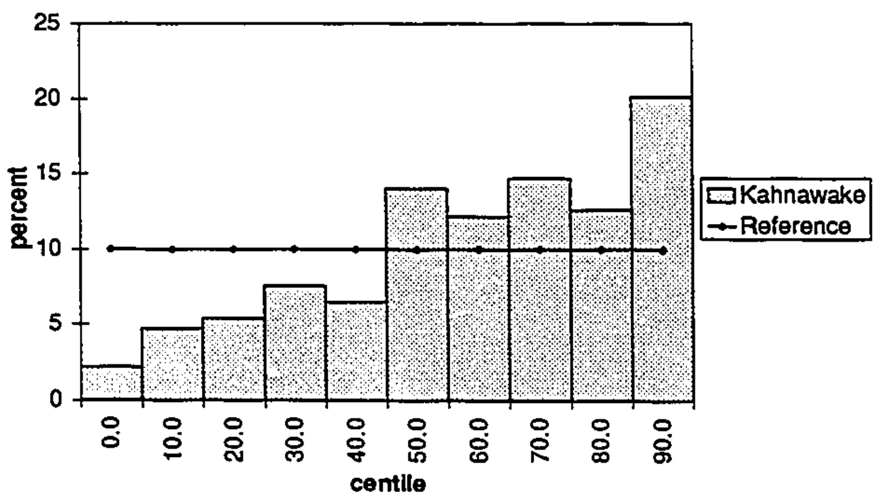


Figure 17-29 - Weight-for-age z-score distribution of Kahnawake children (n=394) compared to reference z-score distribution

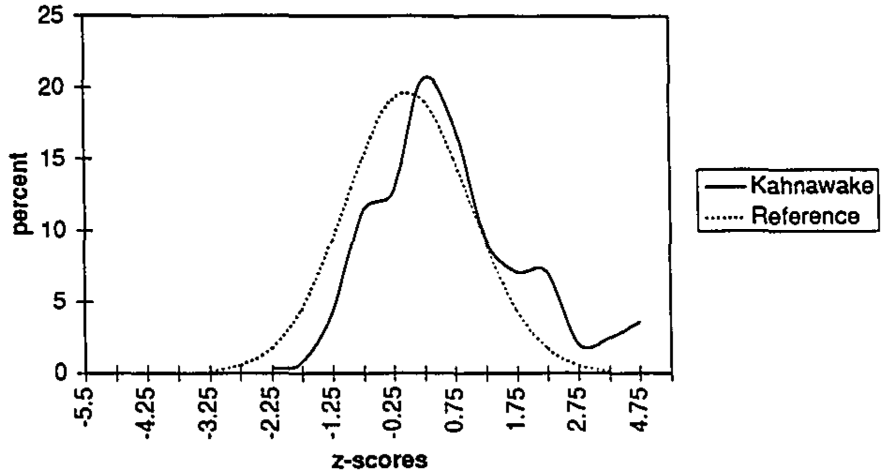


Figure 17-30 - Weight-for-age centile distribution of Kahnawake children (n=394) compared to expected frequency in reference population

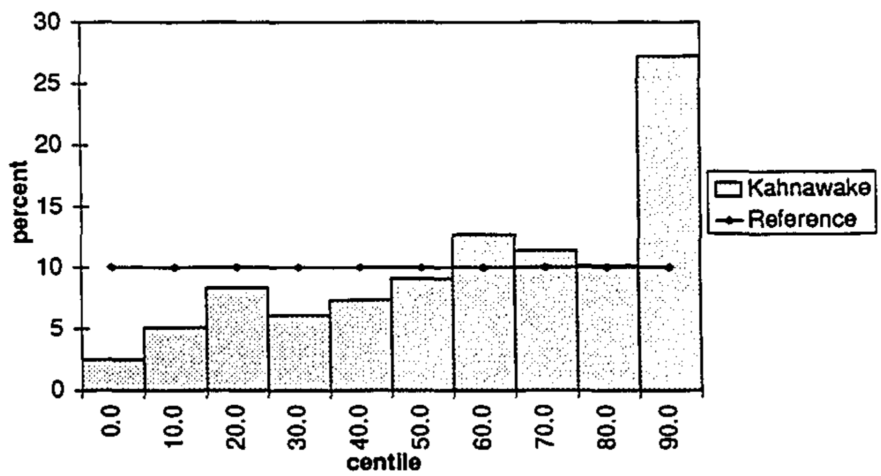


Table 17-8 - Cross-tabulated z-scores of weight-for-height (WHZ) and height-for-age (HAZ) in Kahnawake boys under 11.5 years and 145 cm in height (n=163)[1]

WHZ	HAZ (percentage of population)							
	z≥2.00	2.00>z≥ 1.00	1.00>z≥ 0.00	0.00>z≥ -1.00	-1.00>z≥ -2.00	z≤-2.00	Total	Expected
z≥2.00	0.6	4.3	4.3	4.9	0.6	0.0	**14.7**	2.3
2.00>z≥1.00	0.0	2.5	3.7	5.5	1.8	0.0	**13.5**	13.6
1.00>z≥0.00	0.0	8.0	17.8	16.0	5.5	0.6	**47.9**	34.1
0.00>z≥-1.00	0.0	1.2	7.4	8.0	1.2	0.0	**17.8**	34.1
-1.00>z≥-2.00	0.0	0.6	1.8	3.1	0.0	0.0	**5.5**	13.6
z≤-2.00	0.0	0.0	0.0	0.0	0.6	0.0	**0.6**	2.3
Total	**0.6**	**16.6**	**35.0**	**37.5**	**9.7**	**0.6**	**100.0**	100.0
Expected	2.3	13.6	34.1	34.1	13.6	2.3	100.0	

[1]Age and height limitations of the CDC/WHO international growth reference curves for weight-for-height in males.

Table 17-9 - Cross-tabulated z-scores of weight-for-height (WHZ) and height-for-age (HAZ) in Kahnawake girls under 10 years and 137 cm in height (n=114)[1]

WHZ	HAZ (percentage of population)							
	z≥2.00	2.00>z≥ 1.00	1.00>z≥ 0.00	0.00>z≥ -1.00	-1.00>z≥ -2.00	z≤-2.00	Total	Expected
z≥2.00	0.0	0.9	6.1	2.6	0.0	0.0	**9.6**	2.3
2.00>z≥1.00	0.0	1.8	6.1	7.0	2.6	0.0	**17.5**	13.6
1.00>z≥0.00	1.8	3.5	15.8	19.3	2.6	0.0	**43.0**	34.1
0.00>z≥-1.00	0.0	1.8	10.5	9.6	1.8	0.9	**24.6**	34.1
-1.00>z≥-2.00	0.0	0.0	1.8	2.6	0.9	0.0	**5.3**	13.6
z≤-2.00	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	2.3
Total	**1.8**	**8.0**	**40.3**	**41.1**	**7.9**	**0.9**	**100.0**	100.0
Expected	2.3	13.6	34.1	34.1	13.6	2.3	100.0	

[1]Age and height limitations of the CDC/WHO international growth reference curves for weight-for-height in females.

Table 17-10 - Cross-tabulated z-scores of weight-for-height (WHZ) and height-for-age (HAZ) in Kahnawake children meeting age and height limitations of the CDC/WHO international growth reference curves (n=277)[1]

WHZ	HAZ (percentage of population)							
	z≥2.00	2.00>z≥ 1.00	1.00>z≥ 0.00	0.00>z≥ -1.00	-1.00>z≥ -2.00	z≤-2.00	Total	Expected
z≥2.00	0.4	2.9	5.0	4.0	0.4	0.0	**12.7**	2.3
2.00>z≥1.00	0.0	2.2	4.7	6.1	2.2	0.0	**15.2**	13.6
1.00>z≥0.00	0.7	6.1	17.0	17.3	4.3	0.4	**45.8**	34.1
0.00>z≥-1.00	0.0	1.4	8.6	8.6	1.4	0.3	**20.4**	34.1
-1.00>z≥-2.00	0.0	0.4	1.8	2.9	0.4	0.0	**5.5**	13.6
z≤-2.00	0.0	0.0	0.0	0.0	0.4	0.0	**0.4**	2.3
Total	**1.1**	**13.0**	**37.1**	**38.9**	**9.1**	**0.8**	**100.0**	100.0
Expected	2.3	13.6	34.1	34.1	13.6	2.3	100.0	

[1] 11.5 years and 145 cm for males and 10 years and 137 cm for females.

year-olds appear to have a slightly lower average height-for-age than in the reference population (Figures 17-23 and 17-24). Ten-year-old children have a slightly higher height -for-age than in the reference population (Figures 17-25 and 17-26). The weight-for-height z-score and percentile distributions (Figures 17-27 and 17-28) show more Kahnawake children above the median of the reference than below it. The weight-for-age centile distribution (Figure 17-30) shows more than 25% of Kahnawake children were above the 90th percentile of the reference curves.

Tables 17-8, 17-9 and 17-10 show cross-tabulation in z-scores for weight-for-height and height-for-age for boys, girls and both genders respectively. In general, there were more children in the positive rather than negative z-score ranges than in the reference population.

18. Diet

Twenty-four hour recalls were completed with 164 children. This represented 77.3 % of all children in Grades 4-6 at the two schools surveyed (Table 16-1). The age and gender distribution of these children is shown in Table 18-1. The majority of the children were between 9 and 11 years. Mean (± standard deviation) age was 10.04 ± 0.94 years. The frequency of each day of the week was as follows: Monday, 22.0%; Tuesday, 21.4%; Wednesday, 17.9%; Thursday, 22.6%; Sunday, 16.1%. Eleven out of 168 or 6.5% of the recall days were holidays, i.e. Thanksgiving Monday or Hallowe'en.

18.1. Energy and nutrient intakes

Mean energy, carbohydrate, sucrose, protein and fat intakes are presented in Table 18-2. The children were classed in age and gender groups corresponding to those of the Recommended Nutrient Intakes (RNIs) (Health and Welfare Canada, 1990). Kahnawake children appear to consume enough energy to achieve normal growth.

Table 18-1 - Age and gender distribution of Kahnawake children participating in dietary interview[1,2]

Age (y)	Boys	Girls	Total
8	2	1	3
9	24	31	55
10	26	24	50
11	24	30	54
12	4	2	6
Total	**80**	**88**	**168**

[1]Included 24-hr dietary recall and food preference assessment.
[2]24-hour recalls completed by 164 children.

Table 18-2 - Dietary intakes (mean ± standard deviation) of energy and selected nutrients by gender and age groups for Grades 4-6 Kahnawake children[1]

Dietary component	Boys		Girls	
	8-9 y (n=24)	10-12 y (n=52)	8-9 y (n=32)	10-12 y (n=56)
Energy (kcal)[2]	1908 ± 624	2284 ± 971	2203 ± 835	2216 ± 791
Carbohydrate (g)	270 ± 71	316 ± 115	300 ± 113	310 ± 119
(% kcal)	58.3 ± 9.6	57.1 ± 10.0	55.0 ± 8.9	56.2 ± 9.0
Sucrose (g)	81 ± 38	80 ± 50	92 ± 54	83 ± 41
(% kcal)	18.0 ± 9.6	16.9 ± 9.9	16.7 ± 7.1	15.4 ± 7.1
Protein (g)	73 ± 40	93 ± 58	79 ± 38	74 ± 30
(% kcal)	14.6 ± 4.3	13.5 ± 3.7	14.2 ± 3.2	13.5 ± 3.1
Fat (g)	61 ± 30	81 ± 48	80 ± 37	80 ± 37
(% kcal)	28.0 ± 7.3	30.8 ± 7.7	32.2 ± 6.4	31.9 ± 7.9

[1]Age groups are designated according to RNIs.
[2]RNIs for energy (kcal) are as follows: Boys: 7-9 years=2200, 10-12 years=2500; Girls: 7-9 years=1900, 10-12 years =2200 (Health and Welfare Canada, 1990).

Table 18-3 pools children, across gender and age categories, to show mean macronutrient and sucrose intakes as a percent of total energy. The percentage of energy in the diet coming from dietary fat was significantly lower than the hypothesized 35%, in boys, girls and both genders together ($p<0.001$). The 99.9% confidence interval for the mean fat intake for both genders was 29.0 to 33.0%. The results were also compared to NHANES III, Phase 1 (1988-91) data for 6- to 11-year-old children: Kahnawake girls' fat intake was not statististically significantly different from 6- to 11-year-old NHANES III girls (mean ± s.e.m = 34.2 ± 0.5). However, Kahnawake boys consumed a significantly lower percentage of energy as fat than the NHANES III boys (33.9 ± 0.3) ($p<0.002$). Sucrose was noted to contribute more than 15% of total energy to the diet.

18.2. Food intakes

Tables 18-4 through 18-7 show the ten principal sources of energy, carbohydrate, protein and fat in the diets of Grades 4-6 Kahnawake children. The percentage contribution of each food item to the total children's intake, as well as cumulative percentages are indicated. The foods are ranked in descending order according to their importance as a contributor to overall intake. Also shown is the percentage of children who reported eating each food on the recall day. The most important source of energy (Table 18-4) (and carbohydrate), both in terms of contribution of total kilocalories (8.5%) and percentage of children reporting it (70.1%), was white bread. Beverages (milk, cola and fruit drinks) were also major sources of energy. The top ten carbohydrate sources (Table 18-5) contributed over 50% of total carbohydrate in the sample of Kahnawake children's diets. Simple sugars were predominant. Two percent milk was the most important source of protein (Table 18-6), and provided 10.1% of overall intake. Beef also was the most significant meat source of protein. The top three fat sources were french fries, frankfurters (which also includes bologna, pepperoni) and hamburger (ground beef), accounting for about 24 % of total fat in the children's diet (Table 18-7).

Table 18-3 - Macronutrient intakes (mean ± standard deviation) as a percent of total energy of Grades 4-6 Kahnawake children

Nutrient intake (% energy)	Boys (n=76)	Girls (n=88)	Both (n=164)
Carbohydrate	57.5 ± 9.8	55.8 ± 8.9	56.6 ± 9.4
Sucrose	17.3 ± 9.7	15.9 ± 7.1	16.5 ± 8.4
Protein	13.9 ± 3.9	13.7 ± 3.2	13.8 ± 3.5
Fat	29.9 ± 7.6[a]	32.0 ± 7.4[a]	31.0 ± 7.6[a]

[a]significantly different from 35% ($p<0.001$) (two-tailed one sample t-test)

Table 18-4 - 10 most important dietary energy sources of Grades 4-6 Kahnawake children[1]

Rank	Food	% total energy	Cumulative % of energy	% of children (n=164)
1	White Bread	8.5	8.5	70.1
2	French Fries	6.3	14.8	26.8
3	Milk, 2 %	5.0	19.8	53.0
4	Cola	3.6	23.4	38.4
5	Beef, ground	3.4	26.8	23.2
6	Milk, whole	3.4	30.2	43.9
7	Beef (e.g. steak)	3.2	33.4	18.3
8	Fruit drinks (e.g. crystals)	3.0	36.4	38.4
9	Frankfurter, bologna	2.9	39.3	37.2
10	Pizza	2.6	41.9	13.4

[1]Table shows percentage of energy provided by each food, cumulative percentage provided by list of foods, and percentage of children reporting the food on the day of the 24-hr recall.

Table 18-5 - 10 most important carbohydrate sources of Grades 4-6 Kahnawake children[1]

Rank	Food	% total carbohydrate	Cumulative % of carbohydrate	% of children (n=164)
1	White Bread	11.5	11.5	70.1
2	Cola	6.5	18.0	38.4
3	French Fries	5.7	23.7	26.8
4	Fruit drinks (e.g. crystals)	5.6	29.3	38.4
5	Sugar, white	4.7	34.0	57.9
6	Orange juice, cnd, unsweetened	4.4	38.4	26.2
7	Apple (other fruit) juice	4.2	42.6	26.8
8	Apple (pear, etc)	4.1	46.7	43.9
9	Milk, 2 %	3.5	50.2	53.0
10	Spaghetti noodles	3.2	53.4	12.2

[1]Table shows percentage of nutrient provided by each food, cumulative percentage provided by list of foods, and percentage of children reporting the food on the day of the 24-hr recall.

Table 18-6 - 10 most important protein sources of Grades 4-6 Kahnawake children[1]

Rank	Food	% total protein	Cumulative % of protein	% of children (n=164)
1	Milk, 2 %	10.1	10.1	53.0
2	Beef (e.g. steak)	9.0	19.1	18.3
3	Beef, ground	8.1	27.2	23.2
4	White Bread	7.9	35.1	70.1
5	Chicken, fried	5.9	41.0	12.2
6	Milk, whole	5.2	46.2	43.9
7	Pork	3.6	49.8	9.8
8	Pizza	2.9	52.7	13.4
9	Frankfurter, bologna	2.9	55.6	37.2
10	French Fries	2.3	57.9	26.8

[1]Table shows percentage of nutrient provided by each food, cumulative percentage provided by list of foods, and percentage of children reporting the food on the day of the 24-hr recall.

Table 18-7 - 10 most important dietary fat sources of Grades 4-6 Kahnawake children[1]

Rank	Food	% total fat	Cumulative % of fat	% of children (n=164)
1	French Fries	9.4	9.4	26.8
2	Frankfurter, bologna	7.4	16.8	37.2
3	Beef, ground	6.9	23.7	23.2
4	Beef (e.g. steak)	5.8	29.5	18.3
5	Milk, whole	5.1	34.6	43.9
6	Milk, 2 %	5.0	39.6	53.0
7	Butter/margarine	4.4	44.0	42.1
8	Potato chips	4.0	48.0	20.7
9	Chicken, fried	3.0	51.0	12.2
10	Vegetable shortening	2.9	53.9	23.2

[1]Table shows percentage of nutrient provided by each food, cumulative percentage provided by list of foods, and percentage of children reporting the food on the day of the 24-hr recall.

Figure 18-1 lists all the foods that were used in the analysis of the 24-hour recalls and the percentage of the children who reported consuming them. Thus, foods that were important because of their presence in the diet, and not necessarily because they were high in any one particular nutrient can be seen. Sugar (from sugared cereals, candy, icing, slush, etc.) was the second most frequently mentioned food. Apples were fourth in rank, with 43.9% of the children consuming them. More children (53.0%) mentioned 2% milk than whole milk (43.9%). More children drank milk than soft drinks or fruit drinks. The first vegetable to appear on the list is french fries (13th on the list), followed by canned tomatoes (i.e. in sauces) (ranking 22nd), mashed potatoes (30th) and lettuce (31st). Other vegetables were eaten by a relatively small proportion of the children (less than 10%).

Thirty-two children or 20% mentioned eating foods that are traditional, such as cornbread and corn soup, or cultural, typically Kahnawake foods like 'La Sauce' or 'Meat Pie'. These are shown in Figure 18-2. Brief descriptions of the foods are given in Figure 18-3. The most frequently mentioned traditional food was cornbread, making up 34% of all mentions.

18.3. Meal patterns and dining out patterns

Meal patterns of Grades 4-6 Kahnawake schoolchildren are shown in Table 18-8. The majority of the children ate breakfast (89.6%). Most children reported having at least one snack per day, and 6.1% had more than four snacks per day.

Forty-six out of 164 or 28% of the children reported dining out for one or more meals per day. Energy, macronutrient and sucrose intakes were compared between children who ate or ordered out and those who did not. Sucrose intake was significantly higher in children who ate or ordered out ($p=0.0132$), probably because the beverage often consumed was a soft drink.

Figure 18-1 - Foods used in analysis of 24-hr recalls and proportion of Grades 4-6 Kahnawake children (n=164) reporting them

Food	% of children	Food	% of children
White bread	70.1	Beef (e.g. steak)	18.3
Sugar, white (includes hard candies, slush, sugar in cereals, etc.)	57.9	Ketchup	17.7
Milk, 2%	53.0	Mashed potatoes	16.5
Apple (pear, grape, etc.)	43.9	Lettuce	15.2
Milk, whole	43.9	Chocolate	14.6
Butter/margarine	42.1	Pizza (cheese)	13.4
Cola	38.4	Tea (mostly iced)	13.4
Orange juice, unsweetened (from fz, cnd or fresh)	38.4	Oatmeal	12.8
Fruit drinks (e.g. crystals)	38.4	Chicken, fried ,with skin	12.2
Frankfurter (includes bologna, pepperoni, etc.)	37.2	Spaghetti (other pasta) noodles	12.2
Corn Flakes (includes other ready-to-eat cereals)	32.3	Mozzarella cheese	11.6
Apple (other fruit) juice	26.8	Peanut butter	11.6
French fries	26.8	Processed cheese	10.4
Gravy	26.2	Lard	10.4
Mustard	25.0	Whole wheat bread	9.8
Wheat flakes, shredded wheat, Rice Krispies, Cheerios	24.4	Pork	9.8
Beef, ground	23.2	Ham	9.8
Crackers	23.2	Rice	9.8
Vegetable fat, shortening (in processed foods)	23.2	Mayonnaise	9.8
Chicken noodle soup	23.2	Cheddar cheese	9.1
Vegetable oil	22.6	Onions, cooked	9.1
Tomatoes, cnd	22.0	Orange, raw	9.1
Potato (corn) chips	20.7	Cream cheese, processed cheese spread	8.5
Cookies, assorted	20.1	Chicken, baked, no skin	8.5
Gingerale (includes non-caffeinated carbonated beverages, popsicles)	20.0	Corn (fz or cnd)	8.5
Jelly, jam (also in fruit yogurt)	18.9	Cornmeal/flour	8.5
Flour, all-purpose	18.9	Ice cream	8.5

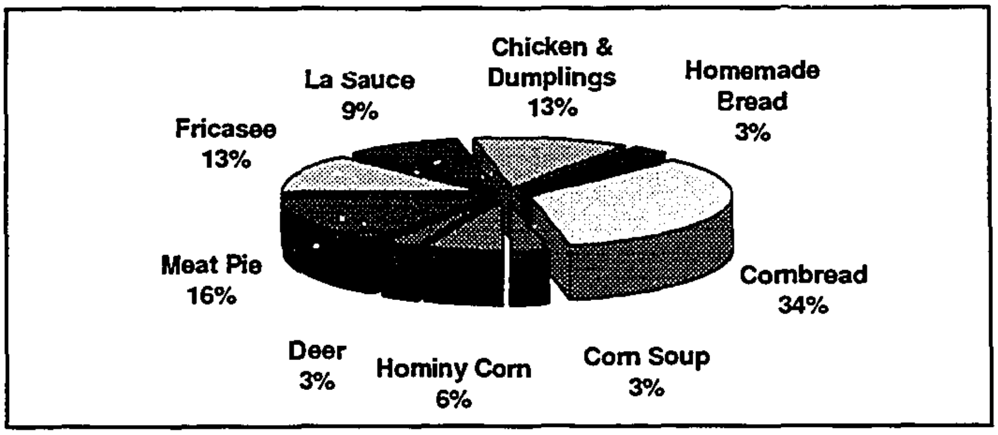
Figure 18-1 (cont'd) - Foods used in analysis of 24-hr recalls and proportion of Grades 4-6 Kahnawake children (n=164) reporting them

Food	% of children	Food	% of children
Non-fat milk solids (in yogurt and yogurt drinks)	8.5	Ice cream cone	3.0
Popcorn	8.5	Cucumber, raw	3.0
Bacon	7.9	Muffin	3.0
Kidney beans	7.9	Green peppers, ckd	3.0
Eggs, fried or boiled	7.9	Sugar, brown	3.0
Vegetable beef soup	7.9	Turkey	3.0
Cocoa mix	7.3	Granola (bar)	3.0
Boiled potato	6.7	Cake, chocolate	2.4
Spaghetti, cnd, w/cheese	6.7	Whipped cream	2.4
Tomato, raw	6.7	Beef vegetable stew	1.8
Banana	6.1	Rye bread	1.8
Macaroni and cheese	6.1	Cantaloupe	1.8
Salad dressing, oil-type	6.1	Peanuts	1.8
Green beans, ckd (from fz, cnd or fresh)	5.5	Green peppers, raw	1.8
Carrots, cooked	5.5	Pudding	1.8
Pancakes or waffles	5.5	Mixed vegetables, fz	1.8
Apple (fruit) pie (includes Pop-tarts)	5.5	Baked beans	1.2
Soy sauce	5.5	Beef, chuck rib	1.2
Egg, scrambled	4.9	Biscuits (homemade bread)	1.2
Milk, skim	4.9	French Bread	1.2
Mushrooms	4.3	Cabbage, cooked	1.2
Pickles, dill or sour	4.3	Cake, coffeecake (includes banana bread, danish pastry)	1.2
Maple syrup	4.3	Chocolate syrup	1.2
Tuna, canned	4.3	Doughnut, cake-type	1.2
Sunflower seeds	3.6	Egg noodles	1.2
Baked potato	3.6	Peach, raw	1.2
Pork sausage, ckd	3.6	Peach, cnd	1.2
Pea soup	3.6	Pineapple, raw	1.2
Spaghetti and meatballs	3.6	Salad dressing, creamy	1.2
Green peas, fz or cnd	3.6	Cream of wheat	1.2
Cabbage, raw	3.0	Beef, dried	0.6
Cake yellow, w/icing	3.0	Beets	0.6
Carrots, raw	3.0	Beef broth/bouillon	0.6

Figure 18-1 (cont'd) - Foods used in analysis of 24-hr recalls and proportion of Grades 4-6 Kahnawake children (n=164) reporting them

Food	% of children	Food	% of children
Cracked wheat bread	0.6	Pickles, sweet cucumber (relish)	0.6
Cake, angelfood/sponge	0.6	Pineapple, canned	0.6
Chili con carne	0.6	Pineapple juice	0.6
Chicken chow mein	0.6	Frozen dinner	0.6
Cookies, fruit filled	0.6	Raisins	0.6
Corn, sweet, boiled	0.6	Salmon	0.6
Corn, cnd, cream-style	0.6	Salt pork	0.6
Doughnut, yeast-type	0.6	Tomato soup	0.6
Jello	0.6	Tomato, boiled	0.6
Fish (baked)	0.6	Turnip	0.6
Molasses	0.6	Walnuts	0.6
Olives	0.6	Milk shake	0.6

Figure 18-2 - Traditional/cultural Mohawk food of Grades 4-6 Kahnawake children[1]



[1] There were a total of 32 mentions in 24-hr recalls.

Figure C.3 - Descriptions of traditional/cultural Mohawk foods mentioned in 24-hr recalls of Kahnawake children

Chicken and Dumplings - chicken stew with flour dumplings dropped into boiling stock; traditionally, dumplings were made from corn meal and cooked with game birds (Parker, 1910)

Cornbread - traditional staple food made from a mixture of cornflour/cornmeal and beans to which water is added, and then formed into dense, round cakes which are boiled

Corn Soup - traditionally prepared with dried corn, basic ingredients today are hominy corn, red kidney beans with a meat garnish of salt pork; other vegetables e.g. turnips, carrots, cabbage are added by many people

Fricasee - cooked ground beef, simmered in water with onions and potatoes and thickened with flour

Homemade Bread - biscuit/bannock

La Sauce - cooked ground beef with sauce-like consistency due to the addition of flour and water

Meat Pie - festive cultural food; pastry filled with ground pork and mashed potatoes

Table 18-8 - Meal patterns of Grades 4-6 Kahnawake children

Meal	No. (%) children eating meal
Breakfast	147 (89.6)
Lunch	157 (95.7)
Supper	152 (92.7)
Snacks - 1	151 (92.1)
- 2	112 (68.3)
- 3	58 (35.4)
- 4	24 (14.6)
- 5	10 (6.1)
- 6	4 (2.4)
- 7	1 (0.6)

Table 18-9 - Energy and nutrient intake (mean ± standard deviation) by BMI tertile in Kahnawake children

Dietary Component	BMI tertile		
	Lower (n=54)	*Middle* (n=53)	*Upper* (n=53)
Energy (kcal)	2185 ± 857	2315 ± 779	2069 ± 909
Carbohydrate (g)	302.6 ± 112.8	318.2 ± 109.9	291.0 ± 114.1
Sucrose (g)	85.2 ± 46.8	96.0 ± 56.0	82.0 ± 45.0
Protein (g)	76.7 ± 40.2	79.3 ± 35.5	74.0 ± 45.6
Fat (g)	77.9 ± 40.4	83.9 ± 37.0	70.8 ± 43.9

Table 18-10 - Energy and nutrient intake (mean ± standard deviation) by TSF tertile in Kahnawake children

Dietary Component	TSF tertile		
	Lower (n=53)	*Middle* (n=54)	*Upper* (n=53)
Energy (kcal)	2183 ± 756	2290 ± 810	2094 ± 976
Carbohydrate (g)	302.8 ± 90.9	319.7 ± 128.4	289.0 ± 113.5
Sucrose (g)	91.8 ± 51.5	89.4 ± 51.2	82.0 ± 46.2
Protein (g)	78.9 ± 42.4	77.8 ± 29.5	73.3 ± 48.0
Fat (g)	75.9 ± 38.7	81.6 ± 36.6	75.0 ± 46.4

Table 18-11 - Energy and nutrient intake (mean ± standard deviation) by SSF tertile in Kahnawake children

Dietary Component	SSF tertile		
	Lower (n=52)	*Middle* (n=54)	*Upper* (n=54)
Energy (kcal)	2193 ± 796	2347 ± 866	2029 ± 872
Carbohydrate (g)	302.3 ± 93.4	324.7 ± 128.3	284.7 ± 109.8
Sucrose (g)	88.4 ± 46.1	95.4 ± 57.2	79.3 ± 43.7
Protein (g)	78.0 ± 43.6	81.4 ± 31.3	70.6 ± 45.1
Fat (g)	77.9 ± 39.6	84.2 ± 39.9	70.6 ± 43.7

18.4. Relationship with anthropometry

Tables 18-9 to 18-11 show mean energy and nutrient intakes by BMI, TSF and SSF tertiles respectively. No statistically significant differences could be found among the three tertile levels for any of the anthropometric parameters. It is noted that in general, there is a trend for children in the middle tertiles to have the highest nutrient intakes, and children in the upper tertile to have the lowest intakes.

19. Food preferences

19.1. Description of food preferences

One-hundred-and-sixty-eight children participated in the assessment of food preferences (Table 18-1). Descriptive statistics for food preference scores determined by the hedonic and rank-order scales are summarized in Tables 19-1 and 19-2 respectively. Mean scores were based on the number of children (n) who reported having tasted each food. The means on the hedonic scale suggested the children, as a group, had a high preference for most of the tested food items. Half of the food items had a mean between 4 and 5 ("like" and "like very much"). Eleven out of 24 had a mean between 3 and 4 ("neither like nor dislike" and "like"). One food, squash, had a mean score of 2.54 (between "dislike" and "neither like nor dislike"). The food items were ranked in descending order of mean scores, 1 representing the highest and 24 the lowest preference ratings. These ranks were similar for the two scales. In both, the six most preferred foods were apple, meat pie, milk, cornbread, spaghetti and pizza. Squash, as well as the being the least preferred food, was also the least familiar: only 91 out of 168 (54%) children reported having tasted squash. Other food items that were relatively unfamiliar to the children were deer meat and boiled dinner, tasted by 61% and 84% of the children respectively.

Table 19-1 - Sample size (n), mean, and standard deviation (SD) of food preferences, and rank from most (1) to least (24) preferred food item determined by hedonic scale

Food	n	Mean	SD	Rank
Apple	168	4.72	0.51	1
Meat Pie	167	4.64	0.63	2
Milk	168	4.60	0.73	3
Cornbread	168	4.54	0.86	4
Spaghetti & Meat Sauce	168	4.38	1.00	5
Pizza	168	4.36	0.78	6
Homemade Bread	158	4.35	0.90	7
Vegetables (raw)	167	4.34	0.94	8
Hotdog	168	4.28	0.80	9
French Fries	168	4.27	0.77	10
Chicken & Dumplings	161	4.09	1.21	11
Hamburger	167	4.03	0.85	12
Cheddar Cheese	164	3.91	1.13	13
Deer Meat	102	3.91	1.34	14
Corn Soup	161	3.90	1.36	15
Soda (soft drink)	167	3.89	1.04	16
Chips	168	3.85	0.87	17
Chocolate	168	3.78	1.02	18
Candy	168	3.65	1.14	19
Whole Wheat Bread	164	3.65	1.34	20
Fish	162	3.31	1.52	21
Baked Beans	162	3.31	1.43	22
Boiled Dinner	142	3.22	1.46	23
Squash	91	2.54	1.2	24

Table 19-2 - Sample size (n), mean, and standard deviation (SD) of food preferences, and rank from most (1) to least (24) preferred food item determined by rank-order scale

Food	n	Mean	SD	Rank
Cornbread	168	6.53	5.77	1
Meatpie	167	7.17	4.93	2
Apple	168	7.92	4.49	3
Milk	168	8.07	6.00	4
Spaghetti & Meat Sauce	168	8.20	5.76	5
Pizza	168	9.67	5.89	6
Vegetables (raw)	167	10.17	5.38	7
Chicken & Dumplings	161	10.36	6.93	8
Corn Soup	161	10.52	7.61	9
Hotdog	168	11.05	5.26	10
Homemade Bread	158	11.19	5.58	11
French Fries	168	11.39	5.18	12
Deer Meat	102	11.72	7.47	13
Hamburger	167	12.42	5.30	14
Whole Wheat Bread	164	12.85	5.09	15
Cheddar Cheese	164	13.62	5.70	16
Soda (soft drink)	167	14.29	5.80	17
Fish	162	14.52	7.24	18
Boiled Dinner	142	15.11	7.11	19
Chips	168	15.48	4.84	20
Baked Beans	162	15.65	6.04	21
Candy	168	15.80	5.62	22
Chocolate	168	15.95	5.56	23
Squash	91	19.12	6.05	24

Figures 19-1 and 19-2 show differences among mean preference scores for the 24 food items determined by one-way ANOVA with Scheffé's test for multiple contrasts between each pair of food items. In each figure, the foods are arranged both horizontally and vertically, in descending order of their mean preference scores. A cross (X) in the cell at the intersection of two foods indicates a statistically significant difference (p=0.05). A blank cell indicates no difference was found. For example, Figure 19-1 shows no difference between the preference for apple and french fries. However, apple is preferred more than candy. General findings from these figures are that traditional Mohawk cornbread is highly preferred, and significantly more so, than wheat bread. Also, snack foods that are nutrient-dense and relatively low in fat, such as apple, raw vegetables and milk are significantly preferred to those that are high in fat and/or sugar, such as chips, chocolate, candy and soda.

Table 19-3 shows the relationship between hedonic scores (obtained in the first part of the assessment) and rank-order scores (obtained in the second part of the assessment) for each of the 24 food items that were rated by the children. The relationship is negative because of the nature of the two scores: as preferences increase, hedonic scores get higher and rank-order scores get lower. Spearman's rank correlation coefficients ranged from 0.38 for whole wheat bread to 0.89 for fish. In general, the hedonic and rank-order scales appear to be highly correlated. Seventeen out of 24 (71%) of the food items had coefficients higher than 0.70, which is regarded as good agreement (Landis and Koch, 1977).

19.2. Test-retest reliability

Food preference assessment was repeated on a subsample of 29 (17%) children. The mean (± standard deviation) age of the children was 9.93 ± 0.96 years (range 8 to 12 years). The time that had elapsed between the test and retest was 10.59 ± 4.56 days and ranged from 0 to 20.

Figure 19-1 - Differences between mean food preference scores determined by hedonic scale[1]

	Apple	Meat Pie	Milk	Cornbread	Spaghetti	Pizza	Homemade Bread	Vegetables	Hotdog	French Fries	Chicken & Dumplings	Hamburger	Cheddar Cheese	Deer Meat	Corn Soup	Soda	Chips	Chocolate	Candy	Whole Wheat Bread	Fish	Baked Beans	Boiled Dinner	Squash
Apple												X	X	X	X	X	X	X	X	X	X	X	X	X
Meat Pie													X		X	X	X	X	X	X	X	X	X	X
Milk															X	X	X	X	X	X	X	X	X	X
Cornbread																		X	X	X	X	X	X	X
Spaghetti																			X	X	X	X	X	X
Pizza																			X	X	X	X	X	X
Homemade Bread																				X	X	X	X	X
Vegetables																			X	X	X	X	X	X
Hotdog																					X	X	X	X
French Fries																					X	X	X	X
Chicken & Dumplings																					X	X	X	X
Hamburger	X																				X	X	X	X
Cheddar Cheese	X	X																						X
Deer Meat	X																							X
Corn Soup	X	X	X																					X
Soda	X	X	X																					X
Chips	X	X	X																					X
Chocolate	X	X	X	X																				X
Candy	X	X	X	X	X	X		X																X
Whole Wheat Bread	X	X	X	X	X	X	X	X																X
Fish	X	X	X	X	X	X	X	X	X	X	X	X												
Baked Beans	X	X	X	X	X	X	X	X	X	X	X	X												
Boiled Dinner	X	X	X	X	X	X	X	X	X	X	X	X												
Squash	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				

[1]crosses (X's) indicate significant differences at $p<0.05$ (procedure-wise error rate) (Scheffe's test for multiple contrasts)

Figure 19-2 - Differences between mean food preference scores determined by rank-order scale[1]

	Cornbread	Meat Pie	Apple	Milk	Spaghetti	Pizza	Vegetables	Chicken & Dumplings	Corn Soup	Hotdog	Homemade Bread	French Fries	Deer Meat	Hamburger	Whole Wheat Bread	Cheddar Cheese	Soda	Fish	Boiled Dinner	Chips	Baked Beans	Candy	Chocolate	Squash
Cornbread								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Meat Pie										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Apple														X	X	X	X	X	X	X	X	X	X	X
Milk														X	X	X	X	X	X	X	X	X	X	X
Spaghetti														X	X	X	X	X	X	X	X	X	X	X
Pizza																X	X	X	X	X	X	X	X	X
Vegetables																	X	X	X	X	X	X	X	X
Chicken & Dumplings	X																X	X	X	X	X	X	X	X
Corn Soup	X																	X	X	X	X	X	X	X
Hotdog	X	X																	X	X	X	X	X	X
Homemade Bread	X	X																	X	X	X	X	X	X
French Fries	X	X																		X	X	X	X	X
Deer Meat	X	X																						X
Hamburger	X	X	X	X	X																			X
Whole Wheat Bread	X	X	X	X	X																			X
Cheddar Cheese	X	X	X	X	X	X																		X
Soda	X	X	X	X	X	X	X	X																X
Fish	X	X	X	X	X	X	X	X	X															X
Boiled Dinner	X	X	X	X	X	X	X	X	X	X	X													
Chips	X	X	X	X	X	X	X	X	X	X	X	X												
Baked Beans	X	X	X	X	X	X	X	X	X	X	X	X												
Candy	X	X	X	X	X	X	X	X	X	X	X	X												
Chocolate	X	X	X	X	X	X	X	X	X	X	X	X												
Squash	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						

[1]crosses (X's) indicate significant differences at $p<0.05$ (procedure-wise error rate) (Scheffe's test for multiple contrasts)

Table 19-3 - Relationship between food preference scores determined by hedonic scale and rank-order scale

Food	Spearman's r
Apple	-0.54
Baked Beans	-0.86
Boiled Dinner	-0.85
Hamburger	-0.76
Candy	-0.76
Cheddar Cheese	-0.84
Chips	-0.70
Chicken & Dumplings	-0.82
Chocolate	-0.72
Cornbread	-0.68
Corn Soup	-0.87
Deer Meat	-0.77
Fish	-0.89
French Fries	-0.76
Homemade Bread	-0.75
Hotdog	-0.65
Milk	-0.66
Meat Pie	-0.68
Pizza	-0.76
Soda (soft drink)	-0.77
Spaghetti & Meat Sauce	-0.72
Squash	-0.65
Vegetables (raw)	-0.70
Whole Wheat Bread	-0.38

Tables 19-4 and 19-5 show intraclass correlation coefficients (ICCs) between test and retest scores for each food on hedonic and rank-order scales. They are presented with Pearson's and Spearman's rank correlations. The sample size represents the number of children with complete pairs of observations. There is not much of a discrepancy among the three correlations for a given food; conclusions regarding statistical significance are generally the same. It is noted that there are more foods that have statistically significant correlation coefficients on the rank-order scale than on the hedonic scale.

Agreement between test and retest scores for the two scales is also demonstrated by reporting the percent agreement, taking into account the magnitude of the difference in ratings for each food at the two testing times (Tables 19-6 and 19-7). These results do not all correspond to the ICCs as can be seen in Tables 19-4 and 19-6. Scores for meat pie have exact agreement in 72.4% of the children, and vary by only one category in the rest, yet have an ICC of only 0.32. Likewise, for apple there is high agreement, but the ICC is low. Results for some food items like hamburger and whole wheat bread, are similar by both methods.

Repeatability was also assessed by whether or not mean differences for each food were significantly different from zero. This is shown for hedonic and rank-order scales in Tables 19-8 and 19-9. Food items were arranged in descending order of p-values; the higher the p-value the less different the mean difference was from zero. None of the mean differences were statistically significant, implying that all food items tested had a high repeatability.

Table 19-4 - Test-retest reliability of food preferences assessed by hedonic scale

Food	n	*Correlation coefficients*		
		Pearson's r	Spearman's r	ICC
Apple	29	0.42	0.38	0.37
Baked Beans	28	0.71[b]	0.72[b]	0.71[b]
Boiled Dinner	21	0.74[b]	0.74[b]	0.69[b]
Candy	29	0.48	0.52	0.49
Cheddar Cheese	28	0.56[a]	0.54[a]	0.57[a]
Chicken & Dumplings	25	0.71[b]	0.71[b]	0.61[b]
Chips	29	0.56[a]	0.53	0.50
Chocolate	29	0.72[b]	0.69[b]	0.72[b]
Corn Soup	25	0.74[b]	0.70[b]	0.71[b]
Cornbread	29	0.75[b]	0.66[b]	0.75[b]
Deer Meat	17	0.70[b]	0.56	0.70[b]
Fish	27	0.76[b]	0.75[b]	0.76[b]
French Fries	29	0.27	0.30	0.28
Hamburger	29	0.40	0.41	0.29
Homemade Bread	26	0.24	0.37	0.41
Hotdog	29	0.36	0.34	0.36
Meat Pie	29	0.36	0.28	0.32
Milk	29	0.49	0.38	0.50
Pizza	29	0.45	0.56[a]	0.40
Soda (soft drink)	28	0.75[b]	0.69[b]	0.74[b]
Spaghetti & Meat Sauce	29	0.79[b]	0.70[b]	0.76[b]
Squash	12	0.64	0.60	0.59
Vegetables (raw)	29	0.64[b]	0.65[b]	0.64[b]
Whole Wheat Bread	29	0.28	0.38	0.18

Letters represent statistical significance, adjusted for multiple comparisons by Bonferroni procedure: {[a]$p<0.05$, [b]$p<0.01$ (procedure-wise error rates); [a]$p<0.002$, [b]$p<0.0004$ (real error rates)}

Table 19-5 - Test-retest reliability of food preferences assessed by rank-order scale

Food	n	*Correlation coefficients*		
		Pearson's r	Spearman's r	ICC
Apple	29	0.50	0.48	0.49
Baked Beans	28	0.79^{b}	0.81^{b}	0.77^{b}
Boiled Dinner	21	0.79^{b}	0.70^{b}	0.79^{b}
Candy	29	0.69^{b}	0.65^{b}	0.69^{b}
Cheddar Cheese	28	0.59^{a}	0.62^{b}	0.59^{b}
Chicken & Dumplings	25	0.72^{b}	0.64^{a}	0.61^{b}
Chips	29	0.77^{b}	0.80^{b}	0.75^{b}
Chocolate	29	0.66^{b}	0.66^{b}	0.67^{b}
Corn Soup	25	0.81^{b}	0.75^{b}	0.80^{b}
Cornbread	29	0.61^{b}	0.66^{b}	0.60^{b}
Deer Meat	17	0.78^{b}	0.78^{b}	0.74^{b}
Fish	27	0.60^{a}	0.64^{b}	0.60^{b}
French Fries	29	0.52	0.55^{a}	0.53^{a}
Hamburger	29	0.54	0.55	0.45
Homemade Bread	26	0.46	0.56^{a}	0.46
Hotdog	29	0.58^{a}	0.34	0.59^{b}
Meat Pie	29	0.52	0.28	0.32
Milk	29	0.75^{b}	0.75^{b}	0.73^{b}
Pizza	29	0.63^{b}	0.66^{b}	0.64^{b}
Soda (soft drink)	28	0.61^{a}	0.65^{b}	0.60^{b}
Spaghetti & Meat Sauce	29	0.58^{a}	0.52^{a}	0.58^{b}
Squash	12	0.87^{b}	0.82^{a}	0.86^{a}
Vegetables (raw)	29	0.65^{b}	0.67^{b}	0.64^{b}
Whole Wheat Bread	29	0.63	0.63^{a}	0.57^{b}

Letters represent statistical significance, adjusted for multiple comparisons by Bonferroni procedure: {$^{a}p<0.05$, $^{b}p<0.01$ (procedure-wise error rates); $^{a}p<0.002$, $^{b}p<0.0004$ (real error rates)}

Table 19-6 - Agreement between test and retest food preference scores on hedonic scale

Food	n	*Percent agreement by absolute difference between hedonic categories* 0	1	2	3	4
Apple	29	69.0	31.0	-	-	-
Baked Beans	28	39.3	50.0	10.7	-	-
Boiled Dinner	21	52.4	33.3	9.5	4.8	-
Candy	29	44.8	37.9	6.9	10.3	-
Cheddar Cheese	28	42.8	46.4	7.1	3.6	-
Chicken & Dumplings	25	52.0	40.0	4.0	4.0	-
Chips	29	51.7	37.3	10.3	-	-
Chocolate	29	62.1	37.3	-	-	-
Corn Soup	25	60.0	32.0	4.0	4.0	-
Cornbread	29	48.3	34.5	13.8	3.4	-
Deer Meat	17	58.8	29.4	11.8	-	-
Fish	27	44.4	40.8	14.8	-	-
French Fries	29	41.4	51.7	6.9	-	-
Hamburger	29	41.4	48.3	6.9	3.4	-
Homemade Bread	26	46.2	46.2	3.8	3.8	-
Hotdog	29	48.3	34.5	17.2	-	-
Meat Pie	29	72.4	27.6	-	-	-
Milk	29	58.6	34.5	3.4	3.4	-
Pizza	29	62.1	34.5	-	3.4	-
Soda (soft drink)	28	42.8	50.0	3.6	3.6	-
Spaghetti & Meat Sauce	29	69.0	24.1	6.9	-	-
Squash	12	58.3	25.0	16.7	-	-
Vegetables (raw, assorted)	29	58.6	34.5	6.9	-	-
Whole Wheat Bread	29	41.4	41.4	6.9	6.9	3.4

Table 19-7 - Agreement between test and retest food preference scores on rank-order scale

Food	n	*Percent agreement by absolute difference between rank-order scores*				
		0	1 to 3	4 to 6	7 to 9	≥ 10
Apple	29	13.8	55.2	27.6	3.4	3.4
Baked Beans	28	10.7	60.7	21.4	7.1	-
Boiled Dinner	21	19.0	42.9	19.0	19.0	-
Candy	29	17.2	27.6	27.6	20.7	6.9
Cheddar Cheese	28	14.3	42.9	17.8	14.3	10.7
Chicken & Dumplings	25	12.0	44.0	16.0	16.0	12.0
Chips	29	13.8	48.3	24.1	13.8	-
Chocolate	29	6.9	44.8	34.5	3.4	10.3
Corn Soup	25	24.0	52.0	12.0	-	12.0
Cornbread	29	10.3	51.7	17.2	13.8	6.9
Deer Meat	17	-	70.6	23.5	-	5.9
Fish	27	22.2	37.0	18.5	14.8	7.4
French Fries	29	-	37.9	34.5	24.1	3.4
Hamburger	29	13.8	37.9	27.6	10.3	10.3
Homemade Bread	26	15.4	38.5	23.1	11.5	11.5
Hotdog	29	17.2	51.7	20.7	6.9	3.4
Meat Pie	29	17.2	48.3	24.1	6.9	3.4
Milk	29	17.2	44.8	24.1	10.3	3.4
Pizza	29	6.9	48.3	31.0	10.3	3.4
Soda (soft drink)	28	14.3	35.7	25.0	14.3	10.7
Spaghetti & Meat Sauce	29	13.8	31.0	24.1	24.1	6.9
Squash	12	50.0	41.7	8.3	-	-
Vegetables (raw, assorted)	29	13.8	37.9	24.1	10.3	13.8
Whole Wheat Bread	29	13.8	34.5	41.4	6.9	3.4

Table 19-8 - Repeatability of hedonic scale by looking at whether mean difference is statistically different from zero (arranged in descending order of p-value)

Food	Mean difference	s.e.m.	p-value
Candy	0.00	0.24	1.00
Homemade Bread	0.04	0.20	0.85
Fish	0.04	0.19	0.85
French Fries	-0.03	0.17	0.84
Chocolate	0.03	0.13	0.77
Cheddar Cheese	0.07	0.20	0.72
Milk	0.07	0.19	0.72
Baked Beans	-0.07	0.18	0.70
Vegetables	-0.07	0.15	0.64
Pizza	0.10	0.15	0.50
Squash	-0.25	0.25	0.39
Cornbread	-0.10	0.11	0.38
Hotdog	-0.17	0.18	0.34
Corn Soup	-0.20	0.25	0.28
Spaghetti & Meat Sauce	-0.17	0.13	0.20
Deer Meat	-0.29	0.29	0.17
Meat Pie	-0.14	0.10	0.16
Chicken & Dumplings	-0.28	0.26	0.15
Soda	-0.18	0.12	0.13
Apple	0.17	0.10	0.10
Chips	-0.31	0.16	0.06
Boiled Dinner	-0.48	0.23	0.04
Whole Wheat Bread	-0.55	0.24	0.03
Hamburger	-0.45	0.18	0.02

{$p<0.05$ (procedure-wise error rate); $p<0.002$ (real error rate)}

Table 19-9 - Repeatability of rank-order scale by looking at whether mean difference is statistically different from zero (arranged in descending order of p-value)

Food	Mean difference	s.e.m.	p-value
Squash	0.00	0.68	1.00
Corn Soup	0.52	0.95	0.95
Candy	-0.07	0.99	0.94
Chocolate	-0.10	0.94	0.91
Hotdog	0.31	0.90	0.73
French Fries	0.41	0.99	0.68
Cheddar Cheese	-0.50	1.04	0.64
Pizza	-0.48	0.93	0.61
Fish	-0.67	1.10	0.55
Spaghetti & Meat Sauce	0.76	1.04	0.47
Homemade Bread	-0.92	1.13	0.42
Soda	1.04	1.00	0.31
Boiled Dinner	1.05	0.94	0.28
Cornbread	-1.03	0.88	0.22
Vegetables	-1.21	0.96	0.22
Chicken & Dumplings	1.40	1.08	0.21
Apple	-0.96	0.68	0.17
Deer Meat	-1.53	1.05	0.16
Milk	-1.21	0.82	0.15
Baked Beans	-1.12	0.67	0.12
Chips	1.34	0.81	0.11
Meat Pie	1.62	0.69	0.03
Whole Wheat Bread	-1.96	0.81	0.02
Hamburger	2.86	0.97	0.01

{$p<0.05$ (procedure-wise error rate); $p<0.002$ (real error rate)}

VI. DISCUSSION

20. Anthropometry

Anthopometric measurements were obtained in 5- to 12-year-old Kahnawake children. Caution must be used in the interpretation of data, particularly in the older children, because of the heightened variability of children's anthropometry as they enter puberty (Gorstein et al., 1994). Indeed, variability of weight, BMI, TSF and SSF increased with age in both Kahnawake boys and girls.

A consistent trend towards positive skewness in weight, BMI, and SSF increasing with age was evident in boys but not in girls. This may suggest that as boys get older, there is a certain proportion who become increasingly heavier.

These data may have the limitation of errors in measurement, particularly the skinfold data. Also, there was a variation (random) in the weight of clothing worn by the children.

20.1. Adiposity

Mean BMIs were compared to NHANES II and HHANES-MA reference data. Generally, they were not found to be significantly different from HHANES-MA. Ten-year-old boys' and 8- and 10-year-old girls' BMIs were significantly greater than in NHANES II populations. In the American Indian Schoolchildren Height and Weight Survey, conducted in 1990-91, children had statistically significant higher mean BMIs for most of the age groups of both genders compared with the NHANES II population (Jackson, 1993). However, numbers of children in specific age-gender groups were much larger than in the present study.

The set of 15th percentile and median BMI values across gender were larger in Kahnawake children than in NHANES II and HHANES-MA reference populations. The set of 85th percentile values were greater than the set of NHANES II values matched for age for boys only; this may be consistent with the observation of age-related positive skewness in Kahnawake boys.

Girls tended to have thicker TSF and SSF than boys, likely due to gender-related metabolic or hormonal differences (Ryan et al., 1990). At age 10, girls had a marked increase in TSF and SSF, and median values quite larger than NHANES II and HHANES-MA. This may be due to the preadolescent "fat wave" characterized by a distinctive rise in TSF in the prepubescent period (6 to 11 years) (Cronk and Roche, 1982; Ryan et al.,1990), or it may be a sign of high adiposity in 10-year-old girls relative to other age groups. As the data represent a cross-section of Kahnawake children, they may reflect occurrences that have had an effect on a single age group of children. In general, examined percentile values for TSF and SSF were not significantly different from HHANES-MA, suggesting fat patterning more similar to Mexican Americans than to U.S. all-races (NHANES II).

Prevalence of overweight in Kahnawake children differed according to which indicator was used, and to whether data were compared with NHANES II or HHANES-MA data. Overall, there were higher rates of overweight than in the NHANES II population, especially when using BMI and SSF as indicators (the prevalence was highest when using BMI, followed by SSF, then TSF). Prevalence of overweight was slightly higher than the HHANES-MA population, but only by the BMI criterion. Overweight was not biologically significant when defined by proportion of children greater than the 85th percentiles for TSF and SSF of HHANES-MA. There were greater differences in subscapular rather than triceps skinfolds compared with NHANES II data, suggesting a more central distribution of subcutaneous fat in Kahnawake children. This was seen in Mohawk children in Akwesasne (Goran et al., 1995), and Mexican-American children (Malina, 1993). Navajo teenagers had a very high prevalence of overweight when the 85th percentile for SSF of NHANES II was used as a criterion (Gilbert et al., 1992).

Overweight was generally similar or lower in Kahnawake children compared with other North American Native schoolchildren where the definition of BMI at and above the 85th percentile of NHANES II was used. There were 29.6% of boys and 32.8% of girls (both 31.2%) in Kahnawake who could be defined as overweight by this criterion. These results were similar to Sioux in North Dakota, slightly lower than Winnebago and Omaha in Nebraska, and far less than teens in Southwest Arizona (Broussard et al., 1991). Prevalence of overweight was 8% higher in Native American schoolchildren across United States who participated in an IHS height and weight survey than in Kahnawake children (Jackson, 1993).

The anthropometric results should be interpreted with caution. Although BMI is a standard measure, it is not independent of height and does not correct for differences in body composition, especially in children (Garn et al., 1986; Deurenberg et al., 1991; Harlan, 1993). The skinfold data collected in this study allow somewhat more ease in interpretation. For instance, 8- and 10-year-old girls have high BMIs and high skinfold thicknesses, suggesting they may have excess body fat. Again, skinfold data have the limitation of being more prone to measurement error (Flegal, 1993).

It is also emphasized that the definition of overweight used in this study (i.e. the cut-off point of 85th percentile) is arbitrary. There is no generally accepted, objective definition of obesity (Flegal, 1993; Ernst and Obarzanek, 1994). Statistical definitions based on percentile cut-offs require caution in interpretation of differences across ethnicity, age, gender and degree of maturation (Flegal, 1993; Kuczmarski, 1993).

Appropriateness of the reference data must also be considered. NHANES II did not include Native Americans living on reservations (Jackson, 1993). There may be genetic differences in body composition between North American Native Peoples and the general population. Also the NHANES II data are almost two decades old, and do not reflect the increases in BMI and weight that have occurred in all United States children. A recent survey of second- and fifth-graders in New York State showed 22.6% of children with a BMI above the 85th percentile of NHANES II reference data (Wolfe et al., 1994). NHANES III (Phase 1, 1988-91) data available for 12- to 19-year-olds show rates of 22% for girls and 20% for boys (MMWR, 1994*b*). In presentation of Kahnawake schoolchildren's anthropometric data, it is stressed that NHANES II and HHANES-MA do not represent standards. They are a common reference with which to make comparisons with other groups, and may facilitate evaluation of the effectiveness of an intervention, or of secular changes. Objectives specific to an ethnic group can be based on

NHANES II as illustrated by *Healthy People 2000* in the United States. These are health promotion and disease prevention objectives, which include an objective to lower prevalence of overweight in adolescents aged 12 to 19 years, to no more than 15% in the general population and no more than 30% in the American Indian population (Jackson, 1993).

20.2. Growth

In general, data for height-for-age, weight-for-height (as well as prevalence of population below 15th percentiles for BMI, TSF and SSF of NHANES II and HHANES-MA) show no evidence of malnutrition in Kahnawake schoolchildren. Overall, children were taller and heavier than the NCHS reference population. The height-for-age z-score disribution is shifted slightly to the right of the reference z-score distribution. A significant effect of age, independent of gender, was found on height for the 8- and 10-year olds. Eight-year-olds had a slightly lower height-for-age than the reference; this may explain in part the high BMIs in this age group. Ten-year-olds had a substantially higher height-for-age than the reference. This may be indicative of an earlier onset of puberty in Kahnawake children than in the reference population. Weight-for-height was limited as an index by the number of children, especially girls, who did not meet age and height limitations set by CDC/WHO. Both weight-for-height and weight-for-age show a greater proportion of children in the higher centile ranges.

21. Diet

These data reflect the dietary intake in fall during the school year, and would perhaps not be representative of intakes during other seasons. Although the literature points to the 24-hour recall as the most appropriate method to use with children this age, it was not feasible to validate it in Kahnawake schoolchildren. However, given the homogeneity of the population, and the results obtained for nutrient intakes it is felt that the method was reasonably valid.

The majority of children in this study were at least 10 years of age and therefore able to serve as respondents on their 24-hour recall intake (Frank, 1994). Children were likely able to remember food items eaten more accurately than they were able to estimate portion sizes or the number of food items eaten, although visual aids appeared to be helpful. Because of their young age, it is expected that there was a lack of knowledge and experience with food and its preparation, including measurement, and the familiarity with components of mixed dishes (Lytle et al., 1993; Crawford et al., 1994). Children were quite knowledgeable on brand names; prepared foods, single-serve items commonly eaten at lunch were coded with ease. In general, children were attentive and well motivated throughout the interview.

21.1. Energy and nutrient intake

The 24-hour recall is believed to underreport total dietary energy, although the effect of this in different population groups and on specific food components is not well understood (Bingham, 1987; MMWR, 1994). Because individual dietary intakes cannot be characterized by a single 24-hour recall, no association can be made with anthropometric measures in this study (Beaton, 1979; Gibson, 1990). Overall, energy intakes of Kahnawake schoolchildren appear to have been sufficient to achieve normal growth, as there was no indication of malnutrition in the anthropometric results. Although not a statistically significant effect, the group of children in the highest tertile for BMI, TSF or SSF had a tendency to report the lowest mean energy intake. Story et al. (1986*b*) were not able to see significant differences in mean energy intakes among TSF tertile groups in Cherokee adolescents. An inverse relationship between mean BMI and mean energy and fat intake, with heavier Navajo teenagers reporting lower intakes than leaner counterparts was observed by Gilbert and colleagues (1992). The possibility of heavier children underreporting or underestimating their energy intake has been suggested

(Bandini et al., 1990; Black et al., 1993). Lack of information on energy expenditure or physical fitness and activity levels make it difficult to ascertain this in the present study.

There was a potential underreporting of dietary fat because of children's lack of knowledge or experience with the amount of fat added in food preparation (Lytle et al., 1993; Crawford et al., 1994). Considering children had not yet reached the end of their linear growth, fat intakes were in line with current nutrition recommendations (Health Canada, 1993). Results were somewhat lower than the average 35% fat intake seen across large U.S. epidemiological surveys (The National Heart, Lung, and Blood Institute Growth and Health Study Research Group, 1992; Nicklas et al., 1993; Johnson et al., 1994). They were more comparable to NHANES III, Phase 1 (1988-91) data for U.S. 6- to 11-year-old children, and the most recent studies of macronutrient intake of children such as DISC and SNDAS which show a trend towards decreased percentages of energy from total dietary fat (Van Horn et al., 1993; McDowell et al., 1994; MMWR, 1994*a*; Devaney et al., 1995; Nicklas, 1995). Although previous 24-hour recall data is not available for Kahnawake children, a similar trend has probably been occurring in this population. Awareness and efforts in the community to lower fat intake were evidenced by the fact more children mentioned 2% than whole milk in their recalls. This decline in the consumption of whole milk and increase in 2% milk supports the trend observed in the general population (Nicklas, 1995).

There are few recent reports on energy and macronutrient intakes of North American Native children. Comparisons to the present study are limited by differences in culture and age of the respondents, as well as in methods of dietary assessment and analysis used. Navajo teenagers were found to obtain 32-33% of total dietary energy from fat (Gilbert et al., 1992). Hopi fifth- and sixth-graders had a mean energy intake level similar to Kahnawake children, but fat intake was higher at 35% of total kilocalories (Brown and Brenton, 1994). Children from Tallcree and Rocky Lane communities in Northern Alberta reported low energy intakes, with mean percentages of energy from dietary fat as high as 38% (Wein et al., 1993).

Sucrose was found to contribute a high percentage of the total food energy of Grades 4-6 Kahnawake children. It was also the only nutrient found to be statistically significantly higher in children who reported dining out for one or more meals per day. This is probably because the beverage often consumed was a soft drink. High sucrose (refined sugar) intakes of 18-19% of total kilocalories have been reported in Hopi children (Brown and Brenton, 1994). The contribution of simple sugars exceeded starch intake in Northern Alberta Native schoolchildren (Wein et al., 1993). The Bogalusa Heart Study showed a decrease in 10-year-old children's mean daily sucrose intake from 98.0 ± 58.1 (mean ± standard deviation) grams (18% of total energy) in 1973 to 73.8 ± 58.1 grams (13% of total energy) in 1988 (Nicklas et al., 1993).

21.2. Food consumption patterns

To target areas for nutrition education interventions, it is interesting and meaningful to look at what foods are contributing to observed nutrient intakes.

White bread was the most frequently consumed food by Grades 4-6 Kahnawake schoolchildren, providing 8.5% of total energy. White bread was also the most frequently consumed food by Northern Alberta Native schoolchildren; bread and cereal products provided a third, meat and alternatives 20%, and vegetable and dairy foods less than 10% of the daily energy intake (Wein, 1992). A high amount of milk and milk products was consumed by Kahnawake children relative to other native children (Ellestad-Sayed et al., 1981; Kuhnlein and Calloway, 1977; Wein et al., 1992; Bernard et al., 1995).

Cola and sweetened beverages reported by Kahnawake children contribute to high sucrose intakes. Regular sweetened pop was the most commonly reported food or drink for both male and female Navajo teenagers; 93% boys and 86% girls had soda at least once per day, with a third of all subjects drinking at least 720 mL (Gilbert et al., 1992). A high intake of cola or sweetened beverages was also noted in Hopi children (Kuhnlein and Calloway, 1977).

There was not enough specific reporting by the children on types of fat consumed to allow for a calculation of fatty acid intake. However, the top protein and fat sources in the diet of Kahnawake schoolchildren would suggest that saturated fat intake was above recommended levels (Health and Welfare, 1990). Trans-fatty acids would also be present due to the high intake of prepared or processed foods.

A low frequency of vegetables was reported by Kahnawake schoolchildren. This is in agreement with what has been seen across North American populations and age groups. Low intake and variety of fruit and vegetables was observed in US adults: ninety-one percent did not meet dietary guidelines for fruit and vegetable consumption (Patterson et al., 1990). Wolfe and Campbell (1993) looked at diet quality in a sample of children from New York State and noted that most children's diets did not contain the recommended number of servings of fruits and vegetables: vegetables they did consume consisted mainly of potatoes and tomato sauce as in the present study. Low intakes of fruits and vegetables were seen in Northern Alberta (Wein et al., 1992), Hopi (Brown and Brenton, 1994), and James Bay Cree children (Bernard et al., 1995). Availability and cost of fresh produce, and the acceptance into cultural dietary patterns may contribute to low intakes in some native communities.

Similar to what was observed in Hopi by Kuhnlein and Calloway (1977), wheat products were consumed much more frequently than corn products by Kahnawake children on a daily basis. Nevertheless, food or dishes unique to Iroquois and/or Kahnawake culture were mentioned in the recalls of one fifth of the children interviewed. (Seven percent of children reported consuming cornbread, a very nutritious, low-fat, complex carbohydrate food.) Several factors may contribute to the decline of traditional food use among Mohawk people of Kahnawake: among these are the many years since first contact with European settlers, the proximity to a major city, the decrease in land available for growing traditional staple foods, and changes in the environment that have reduced fish and game populations. Substitution of traditional food with refined, market food of lower nutrient density has been observed in Hopi children (Kuhnlein and Calloway, 1977; Brown and Brenton, 1994). A high proportion of many nutrients in the diets of Northern Alberta Native children from Tallcree and Rocky Lane communities came from traditional food (Wein et al., 1992).

Ninety percent of children in Kahnawake reported eating breakfast. This frequency may actually be higher, as it is not adjusted for the change in meal patterns that likely occurred on Sundays. There were fewer breakfast-skippers in Kahnawake than in fifth-graders in New York State; Wolfe et al. reported rates of 16% (1994). In the past few years, schools in Kahnawake have made many efforts to promote breakfast including nutrition education and interventions. The fact that the majority of children consumed a nutritious breakfast may be partly a result of these actions.

Most Kahnawake children had at least 1 or 2 snacks per day. Children 1-19 years reported eating at least one snack per day in the USDA's Continuing Survey of Food Intakes by Individuals (CSFII) (Crockett and Sims, 1995). In a study of 290 Grade 5 to 6 children, 87.2% snacked at least once per day, with most snacking 2-3 times daily, and 28.7% snacked 4 times per day (Cross et al., 1994). Unlike in this study, Cross et al. excluded beverages from their definition of snack.

In light of the nutrition intervention activities of the KSDPP, it is significant that almost a third of the children recalled dining out at least one or two meals per day. A recent paper by Crockett and Sims (1995) discusses the changes in eating patterns that have occurred in the United States: half of food expenditures are for food and beverages served outside the home, with 34% of the total food dollar spent on fast foods. Children play a deciding role in whether the family dines out and where. Baked or fried chicken, pasta, hamburgers, hotdogs and take-out pizza are very common. Also, there is a growing number of "convenience" foods, single-serve items and "microwaveable" entrees which are appearing on dinner tables (Crockett and Sims, 1995). Influences of North American eating patterns were definitely apparent in the dietary study of Grades 4-6 Kahnawake schoolchildren.

There are areas where further research may be done. It would be useful to collapse foods that appeared in the recall into food groups using a typology such as that adapted by Basch et al. (1992). For instance, sweetened beverages could be collapsed into one group rather than three. Vegetable or fruit servings could be calculated per person and comparisons could be made with recommendations. This would allow a clearer picture of the frequency of consumers for food items that are similar. A more in depth analysis could be done of what foods are consumed at specific meals and when eating out, in order to target areas for education and intervention. Analysis of food is an important part of nutrition research, because it is more practical in education to focus on specific food items and dietary patterns rather than on nutrients (Willett, 1990*a*).

22. Food preferences

The rating scales used to assess food preferences in this study had the advantages of being easy to understand, administer and score. Also, they converted qualitative information into numerical data which allowed the application of statistical tests (Tyrer et al., 1993). However, the data were still subjective. There is no way of confirming if the scales measured what they were supposed to measure, as there is no independent measure of food preferences.

It was felt the food pictures made the activity visually appealing and fun for the children. The research design was not set up to see if eliciting food preferences through pictures rather than actual tasting had an effect on responses. In fact, few studies have tackled this question (Phillips and Kolasa, 1980; Birch and Sullivan, 1991). It was noted, at times children interpreted food pictures too literally (e.g. "I like candy, but not that kind", or "I don't like that pizza because it has green peppers on it"). In these cases, the children were told to think of the picture as representing the food in general (e.g. all types of candy). But what about the children who didn't make such comments? It is unknown if similar factors motivated their food preference ratings.

Overall, the scales measured food preferences reliably in a subsample of Kahnawake fourth- to sixth-graders. The rank-order scale had better test-retest reliability than the hedonic scale. Reliability of a particular food varied with the statistical method used to estimate it. It is unclear which of the three tests of reliability, ICC, percent agreement, or mean difference from zero, was the best measure to use in this study. Further research is needed. It is also uncertain what made a particular food more reliable than another. It is possible that the interpretation of the food picture may have changed on the second test. For instance, the picture of whole wheat bread may have been rated one time as white bread and the other time as whole wheat bread.

Children reported a high preference for most of the 24 food items assessed. Because there was only a single 24-hour recall per child, it was not possible to associate food preferences with food consumption. However, it is possible, in a general way, to compare preferences to overall food patterns in the study sample.

Results were slightly different depending on whether the hedonic or rank order scale was used. The rank-order scale was more discriminating than the hedonic scale, supporting what has been observed by Birch (1979) and Anliker and colleagues (1991). The two scales are highly correlated with one another. Considering that the rank-order scale is better to able to discern food preferences and has greater repeatability, the little extra time that it takes to administer seems warranted.

It was of interest that children had higher preference for snack foods that are nutrient-dense and relatively low in fat, such as apple, raw vegetables and milk, than for high in fat and/or sugar foods, such as chips, chocolate, candy and soda. Although, there was a high number of consumers of apple and milk, chips, candy and soda were eaten with a greater frequency than raw vegetables. This may be because of the easier access and availability of such foods compared to raw vegetable sticks. There may also have been an effect of the children knowing the interviewer was a dietitian, and so reporting a high preference for a food they knew was "good for them". It is felt that this effect was minimal because of the spontaneity with which the children responded.

Both cultural and traditional Kahnawake foods were highly preferred, especially meat pie and cornbread. Cherokee teenagers were found to prefer cultural foods like fry bread over traditional wild game and plants (Story et al., 1986*a*). Similar to the results of Wein and associates (1993), Kahnawake children did not have a distinguishable preference for traditional food compared to market food. Almost half the children had never tasted squash; those who had, expressed a low preference for it. Squash was not mentioned in any of the 24-hour recalls, and is likely not commonly consumed by community members. It is well accepted, that children will prefer foods they are familiar with or that they have been exposed to more often (Phillips and Kolasa, 1980; Birch, 1987; Sullivan and Birch, 1990; Fisher and Birch, 1995). In view of the fact that squash is one of the "Three Sisters" and traditional staple food of the Mohawk people, this presents an opportunity for a major promotion.

Food preference has been found to be strong determinant of food choice, especially in very young children (Khan, 1981; Axelson and Brinberg, 1989; Birch and Sullivan, 1991). The results of this study may mean environmental factors such as media, peer and parental influences, exposure to and availability of food are also playing a role in food consumption (Bernard and Lavallée, 1993; Sullivan and Birch, 1990; Fisher and Birch, 1995).

Insight into children's food preferences is a valuable tool that may be of use in the development and evaluation of nutrition education programs (Birch and Sullivan, 1991). It has been suggested that children's food preferences may track longitudinally (Kelder et al., 1994). There is also evidence that children's preference for and consumption of dietary fat may be influenced by familial factors such as the availability and exposure to high-fat food (Kern et al., 1993; Fisher and Birch, 1995). Food preference has a greater influence than knowledge of dietary recommendations in determining food consumption in young children (Murphy et al., 1995). In light of these findings, it appears worthwhile to explore children's food preferences and determine a way to influence them early in life. However, as was revealed in this study, interpretation of food preference assessment results presents many challenges. More work is needed to determine the best methods to use (and may be under which circumstances) to be able to draw appropriate interpretations and conclusions.

VII. SUMMARY AND CONCLUSIONS

This was a descriptive study of the anthropometry, diet and food preferences of Kahnawake schoolchildren. It reflects the situation in fall of 1994, and not changes that may have occurred since then as a result of the intervention of the KSDPP.

Research objectives were met. The anthropometry findings showed that 5- to 12-year-old Kahnawake children were not undernourished. They were generally taller and heavier than NCHS reference populations. Overweight, defined by BMI at and above the 85th percentile of NHANES II was 29.6% in boys and 32.8% in girls aged 5 to 12 years; rates were generally lower than those reported for Native North American schoolchildren using the same criterion. Compared with NHANES II data, there were greater differences in subscapular than triceps skinfold thicknesses, suggesting a more central distribution of subcutaneous fat. Prevalence of overweight was slightly higher than HHANES-MA children, but only by the BMI criterion, and not by TSF or SSF.

Grades 4 to 6 Kahnawake children appeared to have adequate dietary energy intakes. Fat intakes were in line with current nutrition recommendations. They were significantly lower than 35% of total energy (35% is an arbitrary number deemed as the average fat intake of North American schoolchildren from reports on macronutrient intakes). Fat intakes of girls were similar to NHANES III data. Boys' fat intakes were significantly lower than NHANES III. Sucrose contributed more than 15% of total energy to the diet. Sucrose intake was significantly higher in children who reported dining out for one or more meals per day.

Similar to what has been reported for the general population, intake of vegetables was low, although Kahnawake children reported a high preference for raw vegetables. Twenty percent of the children consumed traditional or cultural Mohawk food. Forty-six percent of the children had never tasted squash, and those who had reported a low preference for it. Promotion of favourite nutrient-dense foods, such as raw vegetables, and of both cultural and nutritional benefits of traditional Mohawk foods, such as squash, represents specific examples of applications of the food preference data.

The results of the dietary assessment in this study could be of use in designing other instruments to aid in the evaluation of diet. The assessment of food preferences requires further work to determine the best methods of statistical analysis and interpretation. Significance of food preference techniques and their results may also be realized with further study in diverse cultural settings.

Anthropometry and diet have a complex interaction with physical activity that was not evaluated in this study. Although not statistically significant, the middle tertile of children in each of the three anthropometric measures consistently appeared to have the highest energy intake. This suggests the middle tertile children may have been the most physically active.

The findings of this study identify opportunities for the encouragement of healthy behaviours and lifestyle patterns, which have implications for the broader objective of preventing diabetes in future generations of Kahnawakero:non. Strategies suggested by this research include enhancing physical activity and promoting intake, acceptance and preference for a variety of healthy foods through demonstration and increased availability.

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IX. APPENDICES

1. Research agreement

CINE
Centre for Nutrition and the Environment of Indigenous Peoples

In concert with Indigenous Peoples, CINE will undertake community-based research and education related to traditional food systems. The empirical knowledge of the environment inherent in indigenous societies will be incorporated in all of its efforts.

Assembly of First Nations
Council for Yukon Indians
Dene Nation
Inuit Circumpolar Conference
Inuit Tapirisat of Canada
Metis Nation of the NWT

Host:
Mohawk Council of Kahnawake
P.O. Box 720
Kahnawake, Qc. J0L 1B0

McGill
Macdonald Campus of McGill University
21,111 Lakeshore
Ste-Anne-de-Bellevue, Qc
Canada, H9X 3V9
Tel.: (514) 398-7544
Fax: (514) 398-1020

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RESEARCH AGREEMENT[1]

"Anthropometry and Diet of Mohawk Schoolchildren"

The researchers, as named, and the community of Kahnawake agree to conduct the named research project with the following understandings[2]:

1. The purpose of this research project, as discussed with and understood by the community, is:

- To assess the height, weight and body fat of elementary schoolchildren in Kahnawake from 6-12 years of age (Grades 1-6) using anthropometric indices.

- To establish a baseline dietary intake in children 9-12 years of age (Grades 4-6) against which future dietary studies could be compared to assess changes in food intake.

- To determine food preferences of Grades 4-6 children as they relate to high fat/high sugar food and traditional Mohawk food.

- To identify food/nutrition related concerns and potential food/nutritional problems in Grades 4-6 children in the community.

- To complement and reinforce the evaluation of the Kahnawake Schools Diabetes Prevention Project (KSDPP) and to help refine/enhance the nutrition education component of the intervention program of the KSDPP.

2. The scope of this research project (that is, what issues, events, or activities are to be involved, and the degree of participation by community residents), as discussed with and understood by Mohawk in this community, is:

This research project is taking place within the context of the NHRDP-funded project "Evaluation of the Kahnawake Schools Diabetes Prevention Project (KSDPP)".

The issues in this project are nutritional and will be addressed through organizational meetings with community members, anthropometric measurements of Grades 1-6 children, and dietary interviews of Grades 4-6 children which will be conducted in Fall 1994.

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[1]An agreement of this nature is required of all CINE-based research conducted in communities by staff and/or students.

[2]This agreement follows the guidelines of the Dene/Métis model agreement published in B. Masuzumi and S. Quirk. A participatory research process for Dene/Métis communities: exploring community-based research concerns for Aboriginal Northerners. Dene Tracking, September 1993.

Children who will participate as respondents will volunteer 10-15 minutes for the anthropometric measurements and approximately 20-25 minutes for the dietary interview.

3. Methods to be used, as agreed by the researchers and the community, are:

A member of the community will be employed by the Kahnawake Schools Diabetes Prevention Project to perform the anthropometric measurements. As the dietary interview is not part of the KSDPP Evaluation Team's original protocol submitted to NHRDP, there are no funds to hire a member from the community to conduct the interviews. Mary Trifonopoulos, dietitian, M.Sc. candidate at McGill University, formerly employed by the Kateri Memorial Hospital Centre, will conduct the interviews.

The anthropometric measures which are collected for this project are: height, weight, triceps skinfold and subscapular skinfold. The dietary interview takes 20-25 minutes to administer, is confidential and voluntary. It consists of a recall of food and drinks consumed in the day preceding the interview, as well as a rating of 24 food items (a game-like activity using food pictures).

4. Community training and participation, as agreed, is to include:

Mary Trifonopoulos will conduct the training of the community nurse so that she can do the anthropometry, and will assist her in doing the measurements.

The development of this project is based on sincere communication between community members and researchers. All efforts will be made to incorporate and address local concerns and recommendations at each step of the project.

At the end of the project, the researchers will participate in community meetings to discuss the results of the analysis with community members.

5. Information collected is to be shared, distributed, and stored in these agreed ways:

The data collected are confidential and no name is attached to a record. Copies will be kept at CINE where the data will be converted to an electronic form. The data will be kept on diskettes at the Kahnawake Education Center and at CINE for the duration of this project. At the end of the project, data and results will be returned to the community in the form they prefer. The researchers and CINE will be available to answer questions and assist community members in interpreting the data, results and conclusions. Should community members decide to use these data for different purposes, beyond the objectives of this particular project, the researchers and CINE will assist them in doing so, if it is requested. Similarly, if any data from this project are considered for future use by CINE, this will be fully discussed with the community, as designated by the Kahnawake Combined Schools Committee, Dr. Ann Macaulay and the Supervisory Committee of the KSDPP, the Community Advisory Board of the KSDPP, and/or the Grand Chief and Council.

Following completion of data management, a thesis at the Master's level will be written at McGill University, School of Dietetics and Human Nutrition. A final report will be distributed after approval from community members (the Community Advisory Board of the KSDPP).

6. Informed consent of individual participants and the community are to be protected in these agreed ways:

Active consent forms for the evaluation of the KSDPP will include the anthropometry and dietary interviews. These will be sent home to parents of Grades 1-6 children at Kateri and Karonhianonhnha Schools.

7. The names of participants and the community are to be protected in these agreed ways:

The anthropometric measurements and dietary interviews are confidential. In no instance will the name of a respondent be attached to a record.

8. Project progress will be communicated to the community in these agreed ways:

In late spring/summer 1995, the results of the project conducted during the fall will be presented to the Kahnawake Combined Schools Committee, the Supervisory Committee of the KSDPP, the Community Advisory Board of the KSDPP, the Chairman of the Board, the Executive Director and the Director of Professional Services of Kateri Memorial Hospital Centre, the Director of Education in Kahnawake, and others in the community (e.g. staff of schools, parents).

The researchers will be available during the course of the project to address particular questions that may arise.

9. Communication with the media and other parties (including funding agencies) outside the named researchers and the community will be handled in these agreed ways:

For any public communication on project progress and findings, the researchers will be aware of their responsibilities and commitments to Kahnawake.

FUNDING, BENEFITS & COMMITMENTS

Funding

The researchers for this particular project have acquired funding and other forms of support for this research project from:

1) Fonds de recherche en santé du Québec (FRSQ) for the researcher-student's time and salary.

2) CINE for researcher location and data management facilities.

3) NHRDP for collection of the anthropometric data.

The funding agency has imposed the following criteria, disclosure, limitations, and reporting responsibilities on the researchers.

No limitations are placed on the researchers for this project by the funding agencies: reports must be submitted, however, to each agency.

Benefits

The researchers wish to use this research project to benefit in these ways (for instance, by publishing the report and articles about it):

Manuscripts will be prepared for publication in peer-reviewed, likely nutrition journals. The contents of these will be discussed with those concerned before publication. A scientific presentation will be made at the 3rd International Conference on Diabetes and Indigenous Peoples in May, 1995, in Winnipeg, Manitoba, with approval of the Community Advisory Board of the KSDPP. It is a requirement that all graduate students present their results in oral and written forms for peer-review audiences.

Benefits likely to be gained by the community through this research project are:

Educational

- Training in anthropometric technique.

- Understanding of children's food and nutrition patterns for the community's various education programs.

Informational

The community at large, by focusing on the dietary practices of the children, will learn about the health and cultural attributes of food practices. The information generated by this project will assist individuals in making informed decisions as to their diets and food practices. It will help target areas of concern in the nutrition education intervention of the KSDPP. The data generated by this project will be kept in the community, should it be useful in the future to address new questions or compare changes in dietary practices. The anthropometric data will be useful in the currently planned evaluation of the KSDPP.

Financial

The community has the benefit of the researchers' knowledge, expertise, time and data management facilities at no cost.

Commitments

The community's commitment to the researchers is to:

- Recommend capable and reliable community members to collaborate in this project.

- Keep informed on the project progress, and help in leading the project towards meaningful results.

The researcher's main commitment to the community is to:

- Inform the community as to the project progress in a clear, specific and timely manner.

- Act as resource to the community for nutrition-related questions, and for this overall project design and management.

2. Anthropometric data questionnaire

ANTHROPOMETRIC MEASUREMENT DATA SHEET

Student Name	

Examiner's name: ______________________

Recorder's name: ______________________

School: Karonhianónha ☐ Kateri ☐ Quinte Mohawk ☐

Grade: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐

Sex: Girl ☐ Boy ☐

Date of Birth (month/day/year): ______ / ______ / ______

Project I.D. Number: | __ | __ | __ | __ | __ | __ |

Date of Measurement (month/day/year): ______ / ______ / ______

Time of Measurement (hour:minute): ______ : ______

Side for Skinfold & B.I.A. Measurement: Right ☐ Left ☐

Instrument of Measure (Caliper)	Measurement			Observation
Skin Fold Sites (one decimal)	1	2	3	
1. Tricep (mm)	__ __, __	__ __, __	__ __, __	
2. Subscapular (mm)	__ __, __	__ __, __	__ __, __	

Instrument of Measure (one decimal)	Result	Observation
Waist Circumference (cm)	__ __ __, __	
Hip Circumference (cm)	__ __ __, __	
Height (cm)	__ __ __, __	
Weight (Kg)	__ __ __, __	
Bioelectrical Impedance Analyser	Resistance: __ __ __ Reactance: __ __ __	

3. Re: raw anthropometric data

This thesis project was conducted in collaboration with the Kanien'keha:ka (Mohawk) community of Kahnawake, represented by the Community Advisory Board, the Board of Directors of the Kateri Memorial Hospital Centre and the Kahnawake Combined Schools Committee, and the Supervisory Board of the KSDPP. A "Code of Research Ethics" has been established outlining the obligations of the Kanien'keha:ka community, and community-based and academic researchers with respect to the KSDPP. Concerns, interests or questions related to all phases of the project, including raw anthropometric data analyzed in this thesis, should be referred to one of these parties. The author of this thesis may be contacted for further information.

4. Dietary interview questionnaire

DIET OF KAHNAWAKE SCHOOLCHILDREN
INDIVIDUAL 24-HOUR RECALL

School ______ (1=Kateri, 2=Karonianonha)   Grade _____ (4-6)   Respondent's gender ____ (1=Female, 2=Male)

Respondent's ID # ________   Date of birth ________ (year/month/day)

Date of interview ________ (year/month/day)

Day of the week __________

TIME	PLACE	FOOD NAME	DESCRIPTION (how prepared, brand name)	AMOUNT

RESPONDENT ID # ______

TIME	PLACE	FOOD NAME	DESCRIPTION (how prepared, brand name)	AMOUNT
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____

Vitamin/mineral supplements? Yes _____No ____
If yes, brand name? __________

Was yesterday a "usual day"?
Yes___
No ____ (please explain)

RESPONDENT ID # ________

FOOD PREFERENCE ASSESSMENT

Food	Hedonic Rating[a]	Rank within category[b]	Complete Rank Order[c]
apple			
baked beans			
boiled dinner			
candy			
cheddar cheese			
chips			
chicken & dumplings			
chocolate			
cornbread			
corn soup			
fish			
french fries			
hamburger			
homemade bread (biscuit)			
hotdog			
meat pie			
milk			
pizza			
soda (cola)			
spaghetti & meat sauce			
squash			
vegetable sticks (raw)			
venison			
whole wheat bread			

[a]1=dislike very much, 2=dislike, 3=neither like nor dislike, 4=like, 5=like very much

[b]1=like the most within category, n=like the least within category

[c]1=like the most, n=like the least