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Eating habits and nutrient intakes of 10-15 year old children in the North West Province

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Abstract

During adolescence, the nutritional needs are higher than at any other time in the lifecycle. Childhood food practices persist into late adolescence and children's food preferences predict their food consumption patterns. Therefore, it is important to understand what influences their preferences and how they change over time.

The main objective of this part of the THUSA BANA study was to investigate the eating habits of children aged 10-15 years in the North West Province (NWP). A cross-sectional design was used to investigate the eating habits of the children. A single, random sample, stratified for gender (male/female) and ethnic group (black, white, coloured, indian) was drawn from schools (primary/secondary) in the five regions in the NWP. Dietary intake data (24-h recall method) were used to evaluate the adequacy of nutrient intakes, while frequencies and mean quantities of food intakes and an eating habits questionnaire were used to establish patterns of intake to identify dietary practices.

Overall the diets of children 10-15 years of age were deficient in various micronutrients. The RDA/AI's were not met for vitamin A, C, E, folate, pantothenic acid, biotin, calcium, magnesium, zinc and copper. The intake of fibre was low. Girls skipped breakfast more often than boys and children from informal settlements skipped breakfast more often than children from rural and urban areas. A significantly lower BMI was found for the children having breakfast when observing all the children, but not for different age and gender groups. The reason given most for skipping breakfast was not being hungry in the morning, but food availability which may have also played a role. The skipping of breakfast was associated with a lower diet quality. A low intake of fruit and vegetables and high intake of snacks were apparent. The intake of snacks, such as chips, cheese curls and sweets were reported more frequently than fruit or vegetables.

Small milk portions and large portions of cold drink were reported, suggesting that cold drink is replacing milk in the diet. Overweight children consumed smaller portions of milk, though no correlation between calcium intake and BMI was found. Overweight boys consumed more carbonated cold drink and overweight girls consumed more squash, showing cold drink intake may be positively related to overweight. The snacks consumed were not nutrient dense and were consumed very regularly. The high intake of snacks may contribute to the low micronutrient and fibre intake. The importance of fruit, vegetables, milk, breakfast and high nutrient dense snacks needs to be emphasized with both the children and their parents.

Key words: adolescents, children, dietary intake, breakfast, snacks, eating habits, transition, milk, fruit and vegetable intake, cold drink consumption, overweight.

Eetgewoontes en nutriëntinnames van 10-15 jaar oue kinders in die Noordwes Provinsie

Opsomming

Gedurende die tienerjare is die behoefte aan nutriënte hoër as in enige ander stadium in die lewensiklus. Eetgewoontes in die kinderstadium word oorgedra na adolessensie en voorspel volwasse eetgewoontes. Daarom is dit belangrik om te verstaan wat hul voorkeure beïnvloed en hoe hul eetgewoontes oor tyd verander.

Die hoofdoelwit van hierdie deel van die THUSA BANA studie was om die eetgewoontes van 10-15 jaar oue kinders in die Noord Wes Provinsie (NWP) te ondersoek. 'n Kruissnit navorsingsontwerp is gebruik om die eetgewoontes van kinders te ondersoek. 'n Ewekansige steekproef gestratifiseer vir geslag (manlik/vroulik) en etniese groep (swart/wit/kleuling/indiër) is vanuit skole (primêr/sekondêr) in die vyf streke van die NWP gekies. Dieetinname data (24-uur herroep metode) is gebruik om die toereikendheid van nutriënte te bepaal en 'n eetgewoonte vraelys is gebruik om patrone van inname te bepaal en eetgewoontes te identifiseer.

Die inname van 10-15 jaar oue kinders was ontoereikend vir verskeie mikronutriënte. Die ADI/GI (Aanbevole Daaglikse Inname/Genoegsame Inname) vir vitamiene A, C, E, folaat, pantoteensuur, biotien, kalsium, magnesium, sink en koper is nie bereik nie. Die inname van vesel was ook baie laag. Meisies en kinders van informele vestings het ontbyt meer oorgeslaan as seuns en kinders van plattelandse en stedelike gebiede. 'n Betekenisvolle laer LMI is gevind by kinders wat ontbyt eet wanneer al die kinders bestudeer is, maar nie vir die verskillende ouderdoms- en geslagsgroepe nie. Die rede wat die meeste gegee word vir oorslaan van ontbyt was nie honger nie, maar voedsel beskikbaarheid kon ook 'n rol gespeel het. Die oorslaan van ontbyt was geassosieer met 'n laer kwalitiet dieet. Die lae inname van groente en vrugte en hoë inname van peuselhappies was opmerklik. Peuselhappies soos skyfies, kaaskrulle en lekkergoed was meer gereeld gerappoteer as vrugte en groente. Die kinders het

klein melkporsies en groot koeldrankporsies gerapporteer, wat daarop dui dat koeldrank melk in die diet vervang. Oorgewig kinders het kleiner hoeveelhede melk gedrink, maar daar was geen korrelasie tussen melk en LMI nie. Oorgewig seuns het meer gaskoeldrank gedrink en oorgewig meisies meer aanmaakkoeldrank, wat aandui dat koeldrankinname positief verwant is met oorgewig. Die peuselhappies wat kinders eet was nie nutriëntdig nie en dit is baie gereeld geëet. Die hoë inname van peuselhappies mag bydra tot die lae mikronutriënt- en veselinname. Die belangrikheid van vrugte, groente, melk, ontbyt en nutriëntdigte peuselhappies moet beklemtoon word by beide kinders en hul ouers.

Sleutelwoorde: tieners, kinders, dieetinname, ontbyt, peuselhappies, eetgewoontes, oorgangsfase, melk, vrugte en groente inname, koeldrankinname, oorgewig.

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List of abbreviations

24-h recall	Twenty Four Hour Recall
%E	Percentage from total Energy
AI	Adequate Intake
BMI	Body Mass Index
CATCH	Child and Adolescent Trial for Cardiovascular Health
CSFII	Continuous Survey of Food Intake by Individuals
CHD	Coronary Heart Disease
FDA	Food and Drug Administration
g	Gram
IU	International Units
kJ	Kilojoules
mg	Milligram
MUAC	Mid-upper arm circumference
n	Number of subjects
NCHS	National Centre for Health Statistics
NFCS	National Food Consumption Survey
NHANES	National Health and Nutrition Survey
NHANESIII	Third National Health and Nutrition Survey
NS	Not Significant
NWP	North West Province
p	Level of statistical significance
RDA	Recommended Daily Allowance
RE	Retinol Equivalents
SANFCS	South African National Food Consumption Survey
SAVACG	South African Vitamin A Consultative Group
SD	Standard Deviation
THUSA	Transition and Health
μg	Micrograms
US	United States
USA	United States of America
USDA	United States Department of Agriculture
WHO	World Health Organisation

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Chapter 1

1.1 Introduction

During adolescence, the nutritional needs are higher than at any other time in the lifecycle. Failure to consume an adequate diet during this time can potentially affect growth and sexual maturation (Story *et al.*, 2002:S40). Often, irregular meals, snacking, eating away from home, and following alternative dietary patterns characterize the food habits of adolescents (Spear, 2000:265). The physical, developmental and social changes that occur during adolescence can markedly affect eating behaviours and nutritional health (Story *et al.*, 2002:S40).

Childhood food practices persist into late adolescence, therefore, nutrition education during childhood can have long range positive impacts on eating habits (Branen & Fletcher, 1999:304). Adolescence is a very impressionable time of life (Dwyer *et al.*, 2001:801) and eating habits are influenced by family, peers, the media and also a search for identity, strive for independence and acceptance (Spear, 2000:264).

The prevalence of obesity and overweight among adults and children is on the increase worldwide (WHO, 1998). Very little information is available on the nutritional status of children 10-15 years old in South Africa. The relationship between overweight and eating habits has been studied, but the results are inconsistent (Nicklas *et al.*, 2003:15).

Transition in nutrition is an important factor that must be kept in mind. With transition comes a marked shift in the structure of the diet and distribution of body composition (Popkin, 1995:80). According to Vorster (1995:81), it is often assumed that urbanization will increase dietary variety and benefit nutritional status. Food availability, economic factors, educational, social and cultural factors

influence food choices, nutritional status and health in all population groups (Vorster, 1995:81).

According to Skinner *et al.* (2002:1638), children's food preferences predict their food consumption patterns. Therefore, it is important to understand what influences their preferences and how it changes over time.

1.2 Hypothesis

In order to reach the objective of this study, the following hypothesis was formulated:

The eating habits of children in the NWP are not adequate to meet their nutritional requirements.

According to the literature, it seems that children may tend to eat food or snacks with lower nutritional values than needed for growth and maturation. In order to investigate this, the objective and goals are stated in the next section of this chapter.

1.3 Objectives

The main objective of this study was to investigate the eating habits of children aged 10-15 years in the North West Province (NWP).
Secondary goals were to:

1. Compare the intake of nutrients from food by children in the NWP with their nutritional needs.
2. Investigate the breakfast patterns of the children in the NWP and determine the reasons for breakfast skipping and how it influences nutritional status and nutrient intake.
3. Determine types of food most frequently eaten.

4. Assess the difference between the foods eaten by normal weight and overweight children.
5. Assess the influence of transition on the food intake of children.
6. Compare the eating habits of children from different races.
7. Assess snack intake and the influence of snacks on micronutrient intake and nutritional status.

1.4 Structure of the dissertation

This mini-dissertation begins with a preface and acknowledgements, to thank all the people involved in the study and acknowledge their contribution. An abstract in English and Afrikaans is given, followed by a list of tables, figures and abbreviations.

Chapter 1 is an introduction and explains the aims of the THUSA BANA study. Chapter 2 gives a review of literature on the dietary intakes and eating habits of children. Chapter 3 describes the study in the format of an article. A short introduction, which includes the aim of the study, is given, followed by the methodology, results, discussion, conclusion and recommendations. Chapter 4 acts as a concluding chapter, in which a short summary of the most important aspects of the study is given.

All forms and questionnaires used during the study are attached as Annexure. The references used for all the chapters are listed at the end of the mini-dissertation, according to the guidelines of the North-West University.

Chapter 2

2.1 Introduction

The rapid physical growth in adolescents creates an increased demand for energy and nutrients. The physical, developmental and social changes that occur during adolescence can markedly affect eating behaviours and nutritional health. The total nutrient needs during adolescence are higher than at any other time in the lifecycle, and failure to consume an adequate diet during this time can potentially affect growth and sexual maturation (Story *et al.*, 2002:S40).

According to Branen and Fletcher (1999:304), it is clear that childhood food practices persist into late adolescence. Nutrition education during childhood can have long range positive impacts on eating habits (Branen & Fletcher, 1999:304).

Adolescence is a very impressionable time of life. Eating patterns established during adolescence shape the diet later in life (Dwyer *et al.*, 2001:801). Skinner *et al.* (2002:1638) summarised that children's food preferences predict their food consumption patterns. Therefore, it is important to understand what influences their preferences and how it changes over time.

2.2 Nutrient consumption

2.2.1 Macronutrients and food choices

In a study on Flemish adolescents, the results showed significantly higher intakes of protein, refined sugars, total fat and saturated fats and significantly lower intakes of complex carbohydrate and fibre than recommended by the Belgium dietary guidelines (Matthys *et al.*, 2002:370-371). In focus group discussions with Belgian adolescents, factors that influenced food choices included: hunger, food cravings, appeal of food, convenience, food availability, habit, cost and the media. The major barriers to include more fruit, vegetables and dairy products in the diet

were a limited availability of these foods and taste preference for other foods (Neumark-Sztainer *et al.*, 1999:929).

A study by Fisher *et al.* (2000:246) showed that milk intake among young girls decreased and soft drink intake increases from middle childhood to adolescence.

2.2.2 Micronutrients

According to the South African Vitamin A Consultative Group (SAVACG), one in three children (age 1-6 years old) had a marginal vitamin A status (serum vitamin A concentration less than 20 µg/dL). About 1% of children had vitamin A concentrations above 50 µg/dL. According to international criteria, South Africa was identified as having a serious public health problem, because of the national prevalence (33%) of marginal vitamin A status. The prevalence of vitamin A deficiency was higher in the rural areas (Labadarios & van Middelkoop, 1995). Although the SAVACG research was conducted on 1-6 year olds, the data can be used to indicate the status of vitamin A, iron and iodine in older children.

The recommended dietary allowance (RDA) of iron for girls and boys 9-13 years of age is 8.0 mg/day. For girls aged 14 to 18 years, the RDA for iron is 15 mg/day and for boys aged 14 to 18 years 11 mg/day (Trumbo *et al.*, 2002:1623). There are, however, two important concerns with respect to the dietary intake of iron. The first is iron deficiency and the other is iron overload. Both of these problems have important public health consequences. Iron deficiency anemia is the most prevalent nutritional problem in the world today. According to the SAVACG report, 20% of children in South Africa aged 1-6 years were anaemic, 6% were moderately anaemic and 20% were severly anaemic. The group also found that 10 % of children were iron depleted or deficient, 5% was severely iron deficient or depleted and 5% had iron deficiency anaemia. The prevalence was higher in the urban areas (Labadarios & van Middelkoop, 1995).

Young children and pregnant and lactating teenagers are at greatest risk for iron deficiency anaemia. Iron deficiency anemia impairs immunity and reduces the physical and mental capacities of people of all ages, and in young children, even

mild anemia can impair intellectual development. Anemia in pregnancy is also an important cause of maternal mortality in adolescents, increasing the risk of hemorrhage and sepsis during childbirth (Whittaker *et al.*, 2001:249).

In South Africa, three out of twenty 1-6 year olds appear to have had an underlying folate or vitamin B12 deficiency (Labadarios & van Middelkoop, 1995). Folate derivatives are essential for all cells as biochemical cofactors and serve as acceptors and donors of single carbon units in a wide variety of reactions involved in amino acid and nucleotide metabolism. Deficiency of the vitamin can cause reductions in serum and erythrocyte folate, megaloblastic changes in the bone marrow and anemia. Human requirements for folate are increased in a number of physiological conditions such as pregnancy, lactation and infancy, and megaloblastic anemia from folate insufficiency may occur during teenage pregnancy. Folates occur in foods mainly as reduced polyglutamate derivatives. The form of folate used as a food fortificant is the highly bioavailable, oxidized monoglutamate form, folic acid (Whittaker *et al.*, 2001:249). Good sources of folate include lean beef, potatoes, wholewheat bread and dried beans (Combs, 2000:94). Grain products fortified with folic acid can be good sources of folic acid for children.

In 1996, the Food and Drug Administration (FDA) concluded that 1000 µg folate/day is the safe upper limit of folate intake for the general population (Food and Drug Administration. 1996:8797). The ability of folate to mask the anemia of vitamin B_{12} deficiency is the most widely recognized adverse effect of high intakes of the vitamin (Nielsen, 1998). In the presence of excess folate and inadequate vitamin B_{12}, the megaloblastic anemia of vitamin B_{12} deficiency may not develop, thus "masking" one of the early symptoms of a vitamin B_{12} deficiency and delaying its diagnosis and treatment. However, other adverse effects of vitamin B_{12} deficiency continue to progress and severe and irreversible neurologic damage may occur. Because the effects of high intakes of folic acid are not well known, other than complicating the diagnosis of vitamin B_{12} deficiency, the US Public Health Service recommends that care should be taken to keep total folate consumption at less than 1000 µg/day, except under the supervision of a physician (Whittaker *et al.*, 2001:247).

According to the SAVACG report, 1% of 1-6 year olds in South Africa had a visible goiter. These results must be interpreted with caution since the assessment of visible goiter on its own is subjective and may underestimate the prevalence of iodine deficiency (Labadarios & van Middelkoop, 1995).

The first National Food Consumption Survey (NFCS) showed a great majority of South African children consuming a diet poor in nutrients. The survey was done on children 1-9 years of age (Steyn & Labadarios, 1999). The intakes of micronutrients of children 7-9 year old in South Africa is summarised in Table 2.1.

Table 2.1. The micronutrient intakes of children 7-9 years of age in South Africa as determined in the National Food Consumption Survey by means of the 24-h recall method (Steyn & Labadarios, 1999).

NUTRIENT	<67% RDA (%)	MEAN (SD)
Calcium (mg)	84	315 (279)
Phosphorus (mg)	14	678 (324)
Iron (mg)	58	6.9 (5.2)
Zinc (mg)	72	5.8 (3.8)
Selenium (µg)	69	16.9 (22.7)
Magnesium (mg)	7	212 (102)
Vitamin A (RE)	79	493 (1328)
Vitamin E (IU)	64	5.1 (5.4)
Thiamin (mg)	17	0.8 (0.4)
Riboflavin (mg)	56	0.8 (1.0)
Niacin (mg)	38	8.5 (6.2)
Vitamin B6 (mg)	34	0.7 (0.5)
Vitamin B12 (µg)	49	3.5 (13.2)
Folate (µg)	53	166 (140)
Vitamin C (mg)	70	48 (257)

RDA, recommended daily allowance, SD, standard deviation; mg, milligram, RE, Retinol Equivalents, IU, International Units, µg, microgram.

According to the dietary data from the four USDA surveys (the 1965 and1977-178 National Food Consumption survey and the 1989-1991 and 1994-1996 Continuing Survey of Food Intakes by Individuals), the calcium intake of 11-18 year olds dropped significantly from 1965 (1100mg) to 1996 (960mg), ($p<0.001$), meeting 74% of the RDA for calcium (Cavadini *et al.*, 2000:21).

2.3 Obesity

Overweight and obesity in children and adolescents is an important public health problem, as obesity has its onset in childhood. Observations on the evolution of obesity during childhood and young adulthood are important (Nicklas *et al.*, 2001:600). An estimated 50% of obese adolescents become obese adults (Pearson *et al.*, 2003:645).

2.3.1 Pathophysiology and causes

Obesity is defined by the presence of excess adipose tissue. The percentage of adipose body tissue varies in normal individuals by gender and age. The percentage of adipose tissue in children is around 12% at birth, increasing to 25% around 5 months, and then decreasing to 15%-18% during puberty (Roche *et al.*, 1981:2831). When the percentage of adipose tissue exceed 40%, a child is at risk for being overweight or obese (Rudolph *et al.*, 2003).

Overweight and eventually obesity are caused by an imbalance between energy intake and expenditure, but the specific reasons behind this phenomenon in adolescents are unclear (Janssen *et al.*, 2004:365).

Possible causes of overweight may include the following:

- Greater inactivity (Dietz & Gortmaker, 1985:807; Dwyer *et al.*, 2001:801), specifically:
    - More time spent on television watching (Dietz & Gortmaker, 1985:807, Dwyer *et al.*, 2001:801).
    - Recreational computer use (Robinson, 1999:1561).

- Increased overall energy and fat intakes (Stewart *et al.*, 1999:112; Dwyer *et al.*, 2001:801).
- Low intakes of calcium, fibre, fruit, vegetables and whole grains (Kramer-Atwood *et al.*, 2002:1228).
- Race, lower socio-economic status, uneducated parents and single mothers may play a role (Hernandex *et al.*, 1998:68).
- Numerous genes are currently linked or associated with a predisposition to excess adiposity (Chagnon *et al.*, 2003:343).

The data are inconsistent on whether obese children consume more calories or expend fewer calories than non-obese children (Rudolph *et al.* 1996). This could be due to genetic make up. According to Chagnon *et al.* (2003:343), the range of actions of candidate genes is extremely varied, reflecting the many pathways influencing total body energy balance and fat distribution.

Berkeling *et al.* (1992:355) reported that overweight children ate faster and slowed their eating less at the end of a meal than normal weight children did. They also indicated that overweight children reported less hunger before a meal than normal weight children (Berkeling *et al.*, 1992:355).

According to Hernandex *et al.* (1998:68), two genetic contributors that may influence childhood obesity are low metabolic rate and increased fat cell number. Brownell and Wadden (1992:505) found that metabolic rates represent up to 60-70% of daily energy expenditure. They concluded that those individuals with a low resting metabolic rate might gain more weight than those individuals with a normal or elevated resting metabolic rate. According to Hernandex *et al.* (1998:68), the size of the adipocyte may be involved in appetite control and weight loss maintenance as an adult, if the adult had childhood onset obesity.

Dietz (1997:1884s) suggested that there are two critical periods of childhood development of overweight. Stages of development that coincide with increasing body mass index (BMI, weight in kilograms divided by height in metres squared, kg/m2) are age 4-6 years, when BMI rises because of developmental growth spurts and again during adolescence, when body fat increases secondary to

pubertal development. Increased risk for developing obesity during developmental growth spurts may relate to greater expression of food preferences among 4-6 year olds, whereas adolescent risk likely coincides with increased adiposity during the maturation process.

2.3.2 Measurement of overweight in children

In 2002, the US (United States) National Center for Health Statistics (NCHS) published revised growth charts representing a larger number of children with more ethnic diversity, including breast and formula fed infants (Kucsmarzki *et al.*, 2002:183). New cut off points for childhood overweight, based on BMI were included (Cole *et al.*, 2000:1240).

Overweight children are now defined as having a BMI higher than the 95th percentile for age and sex, or having an age-specific BMI corresponding to a BMI of 30 at the age of 18 (Cole *et al.*, 2000:1240). See addendum E for BMI charts.

Calculating growth velocity can be helpful in the evaluation and management of overweight children. The child's weight is measured at two points and the change in weight is divided by the length of time between measurements (Gahagan, 2004:11). Average growth velocity by age and gender is shown in Table 2.2.

2.3.3 Consequences of obesity in childhood and adolescence

Obesity in childhood and adolescence is associated with a range of psychosocial and medical complications that are both immediate and long-term. Cross-sectional studies show an inverse relationship between weight and both self-esteem and body image, particularly in adolescence (French *et al.*, 1995:479). In adolescent girls, excess weight is related to body dissatisfaction, drive for thinness and bulimia (Friedman *et al.*, 1995:57).

Table 2.2. The average growth velocity of boys and girls 2 to 18 years of age in grams per month (Gahagan, 2004:13)

Age (y)	Boys		Girls	
	50th percentile*	95th percentile*	50th percentile*	95th percentile*
2-3	190	189	192	256
3-4	173	208	155	224
4-5	165	235	142	226
5-6	168	271	155	261
6-7	180	315	193	328
7-8	204	366	250	419
8-9	236	423	302	494
9-10	276	474	341	544
10-11	322	517	367	569
11-12	373	552	382	568
12-13	431	577	381	541
13-14	485	593	348	482
14-15	495	583	283	392
15-16	449	542	182	267
16-17	351	474	69	123
17-18	214	371	0	0

y: years, * in grams per month.

Childhood obesity causes rare orthopedic problems, including slipped femoral capital epiphyses and tibia vara, which occur with greater frequency in obese children (Loder, 1996:8). Obese children have a higher rate of more minor abnormalities, including increased susceptibility to ankle sprains, knock knees, and flat, wide feet (Baur & O'Connor, 2004:338). An increasingly recognized hepatic complication of pediatric obesity is non-alcoholic fatty liver disease (Guzzaloni *et al.,* 2000:772). Gastroesophageal reflux and gastric emptying disturbances are further complications (Baur & O'Connor, 2004:338).

Obesity is also the major cause of gallstones in children without other medical problems (Baur & O'Conner, 2004:338). Overweight asthmatic children experience more severe respiratory symptoms than do lean asthmatic children (Belmarich *et al.*, 2000:1436). Obstructive sleep apnea may occur in obese children and is usually associated with adenotonsillar hypertrophy and insulin resistance (de la Eva *et al.*, 2002:654). Central obesity in childhood is associated with risk factors for heart disease and type 2 diabetes, including dyslipidaemia (elevated levels of triglycerides and total and low-density lipoprotein cholesterol and reduced levels of high density lipoprotein cholesterol), hypertension, hyperinsulinaemia, and insulin resistance (Freedman *et al.*, 1999:1175). The incidence of type 2 diabetes has increased dramatically in recent years, particularly in obese children with a family history of diabetes (Pinhas-Hamiel *et al.*, 1996:235).

The most significant long-term consequence of childhood obesity is its persistence into adulthood, with all of the attendant health risks. This is more likely with the onset of obesity in late childhood or adolescence, with increased severity of obesity and when one or both parents are obese (Whittaker *et al.*, 1997:337). Obesity in early life is associated with several risk factors for coronary heart disease, hypertension and diabetes in adulthood (Nicklas *et al.*, 2001:600). Overweight in adolescence has also been shown to have a significant association with long-term mortality and morbidity, even independent of adult weight status (Must & Strauss, 1999:S2).

2.3.4 Obesity and eating patterns

Nicklas *et al.* (2003:9) found that the total gram amount of food/beverage consumed, particularly from snacks and total gram consumption of low-quality foods were positively associated with overweight status in ten year olds. Consumption of sweets and specifically sweetened beverages and meat was positively associated with overweight status.

Wang (2004:176) reported that the prevalence of overweight among American children has doubled from 1977 to 1996. At the same time the trends in food consumption changed as summarised in Table 2.3.

Cavadini *et al.* (2000:21) and Wang (2004) found that grain intake increased from 1977 to 1996, but is primarily from high fat mixed dishes, such as pizza, macaroni cheese and certain ethnic foods. In contrast with the results of Wang (2004), Cavadini *et al.* (2001:21) found the consumption of raw fruit declined, but fruit juice consumption increased, keeping the number of fruit servings stable from 1965 to 1996. Overall vegetable consumption increased from 1965 to 1996 and soft drink consumption rose sharply (Cavadini *et al.*, 2000:22).

Table 2.3. Trends in US adolescents' food intake patterns 1977-1996 (Wang, 2004:178)

	1977 – 1978	1989-1991	1994-1996	TREND
Energy (kJ)	8 800	8 800	9 600	↑
Total Fat (% E)	37	34	33	↓
Saturated fat (% E)	14	13	12	↓
Carbohydrate (% E)	47	51	54	↑
Fruits (servings)	1.1	1.2	1.4	↑
Vegetables (servings)	3.0	3.0	3.3	↑
Fruits and vegetables (servings)	4.1	4.2	4.7	↑
Soft drinks (% E)	3.7	5.7	8.0	↑

kJ: kilojoule, % E: percentage from total energy, ↓: decreasing trend, ↑: Increasing trend

Some evidence shows breastfeeding to have a protective effect against overweight. In Czech children 6 to 14 years of age, a reduced prevalence of overweight and obesity in the breastfed children was found. This provides further evidence for the metabolic programming during a critical time window early in life (Waterland & Garza, 1999:179). Possible reasons for the protective effect are lower energy density of the breastmilk compared to formula milk (Whitehead,

1995:239) and, therefore, a better self-control of food consumption in breastfed children.

The Children and Adolescent Trial for Cardiovascular Health (CATCH) Main Trial showed that overweight students (eighth graders) were more likely to omit breakfast and eat two rather than more meals a day than those who were not overweight (Dwyer *et al.*, 2001:801).

2.4 Breakfast consumption

Breakfast consumption has been identified as an important factor in the nutritional well-being of children (Nicklas *et al.*, 1998: 757s). The skipping of breakfast, which is common among adolescents, may affect concentration, learning and school performance and lead to dietary inadequacies (Nicklas *et al.*, 2000:314). Nicklas *et al.* (2000:314) found that up to 19% of 15 year olds skip breakfast. Breakfast consumption makes an important nutrition contribution to total daily intake of 9^{th} grade students (Nicklas *et al.*, 2000:314).

The study by Wesnes *et al.* (2003:331) compared the effect of breakfast cereal, a glucose drink and no breakfast on memory and attention. It showed that skipping breakfast impairs attention and episodic memory, and this impairment increases in magnitude during the morning. Carbohydrate in the form of a breakfast cereal reduced the deficit by more than half and may prevent the deficit altogether. A glucose drink improved alertness, which faded after 90 minutes and no benefits was seen on memory and attention (Wesnes *et al.*, 2003:331).

A higher percentage of children who do not consume breakfast do not meet two thirds of the RDA for vitamins A, E, B_6 and folate (Nicklas *et al.*, 1993:886; Sampson *et al.*, 1995:195). Nicklas *et al.* (1993:886) found the most apparent difference being calcium, phosphorus, magnesium, riboflavin, vitamin B_{12} and folate intakes.

Children in the highest BMI quintile ate less at breakfast and more at dinner than their leaner peers. Children with lower caloric intake at breakfast and the afternoon snack were also more likely to be heavier. Skipping breakfast was associated with poorer food choices during the rest of the day and with an increased risk for obesity (Gahagan, 2004:12).

2.5 Cold drink consumption

Data from the 1977-1979 and 1994 US Department of Agriculture (USDA) Continuing Surveys of Food Intake by Individuals (CSFII) indicate that consumption of soft drinks has increased by 74% and 65% respectively for adolescent boys and girls (Borrud *et al.*, 1997:4).

Diets high in sugars have been associated with various health problems, such as dental caries, dyslipidemias, obesity, bone loss and fractures and poor diet quality (Johnson & Frary, 2001:2767s). A study done by Harnack *et al.* (1999:439) found that energy intake was positively associated with soft drink consumption. This may contribute to the increased frequency of obesity and its co-morbidities (e.g. type 2 diabetes), observed in children (Deckelbaum & Williams, 2001:239s).

Mattes (1996:1133) suggested that sugar sweetened drinks such as soft drinks promote obesity because compensation at subsequent meals for energy consumed in the form of a liquid could be less complete than energy consumed in the form of solid food. Troiano *et al.* (1995:185) suggested high soft drink intake may lead to excessive energy intake, which may contribute to childhood obesity, a growing problem worldwide.

Evidence suggests that a high intake of added sugars, especially of sugar sweetened beverages, is associated with a reduction in diet quality and reduces the chances for achieving nutrient adequacy (Johnson & Frary 2001:2755s). According to Guthrie and Morton (2000:43), carbonated soft drinks provide little or no nutritional value beyond calories and represent the largest contributor of added sugars to the diet. Guenther (1986) found a negative association between cold

drink consumption and milk, calcium, magnesium, riboflavin, vitamin A and vitamin C intakes in US teenagers.

In a study on ten-year olds, Nicklas *et al.* (1999:522) found that the total grams of fruit and fruit juices consumed increased significantly between 1973 and 1988, the percent contribution to sucrose intake increased significantly and the percent contribution to fructose intake decreased. This shift indicates an increase in consumption of fruit and fruit juices with added table sugar.

Although there has been a decrease in the fat intake between 1973 and 1988, a decrease in fat intake may be associated with an increase in sugar intake. This is particularly true when there is an increase in the consumption of fruit/fruit juices, skimmed chocolate milk and lower fat snack/dessert choices which may not necessarily be lower in energy, because the fat has been replaced with sugar (Nicklas *et al.*, 1999:527). Rajeshwari *et al.* (2005:211) found that children with a higher sweetened beverage intake also had a higher total energy intake than children with a lower sweetened beverage intake.

Nicklas *et al.* (1999:527) found a negative association between sugar consumption and vitamins D, B6, E, thiamin, riboflavin, calcium, iron and zinc. This inverse relationship reflects decreased consumption and inappropriate food substitutions. An earlier study on the same population showed that children with the highest total sugar intake consumed less meats and dairy products than those with the lowest total sugar intake (Nicklas *et al.*, 1993:930).

A study conducted by Rampersaud *et al.* (2003:99) showed that older American children and adolescents (>12 years) consumed more carbonated soft drinks than milk. Harnack *et al.* (1999:439) found that the percentage energy from protein consumed was lower in the highest cold drink consumption group when compared to non-consumers. Riboflavin, vitamin A, calcium, phosphorus and the ratio of calcium to phosphorus were inversely associated with cold drink consumption (Harnack *et al.*, 1999:439).

2.6 Milk consumption

Calcium is a major component of bone. During growth, adequate dietary intake of calcium is considered critically important for the acquisition of strong and healthy bone (Black *et al.*, 2002:675). The milk intake in childhood plays a role in the bone density of adults. In the short term milk intake augments height and bone gain (Black *et al.*, 2002:675). The adolescent growth period is a critical time for bone mineral accretion (Bailey, 1997:s191).

In a study using data from the Third National Health and Nutrition Survey (NHANESIII), Kalkwarf *et al.* (2003:263) found that milk intake in childhood and adolescence is associated with increased bone mass and density in adulthood, and this effect was independent of current milk intake or calcium intake. Current dietary calcium intake from food was more consistently associated with bone health measures than dietary calcium intake plus calcium intake from supplements or antacids (Tucker, 2003:11). A decrease in milk consumption coincides with an increase in consumption of non-nutritive beverages (Barzel, 1999:1431; Whiting *et al.*, 2001:1113) such as carbonated beverages, thereby lowering calcium at a critical time. The study by Whiting *et al.* (2001:1113) supports the theory that low nutrient dense beverages replaced milk and, therefore, affected bone mass. They demonstrated that girls, but not boys have reduced bone mineral accrual when low nutrient dense beverages replace milk beverages. This effect was due to the boys having a higher calcium intake as well as a higher activity level.

Milk provides a variety of nutrients (protein, phosphorus, vitamin D, zinc and magnesium) in addition to calcium that may have positive effects on bone growth and mineralization (Kalkwarf *et al.*, 2003: 263). This natural complex of nutrients may have a greater effect on enduring skeletal integrity than calcium given in a short-term supplementation programme (Tucker 2003:11).

Fisher *et al.* (2000:249) found that in families where the mother consumed more milk, the daughters were more likely to consume milk when compared to families where mothers consumed less milk.

The recommendations for dietary calcium intake for children and adolescents have been increased to maximize peak bone mass and reduce the risk of osteoporotic fracture (Trumbo *et al.*, 2002:1623). Dietary behaviours developed in childhood such as the intake of milk and calcium have been shown to persist into adulthood (Kalkwarf *et al.*, 2003:257). Cavadini *et al.* (2000:21) investigated the dietary data from the four USDA surveys and found that milk intake decreased from 1965 to 1996, and the decline was not compensated for by other dairy products.

Zemel *et al.* (2000:1132) found that increased calcium intake in adults resulted in a reduction in body fat. Their study indicated that low calcium diets favour increased efficiency of energy storage and higher calcium diets reduce energy efficiency and instead, favour increased thermogenesis. Novotny (2003) found that amongst 9-14 year old girls in Hawai, those with a higher calcium intake had on average a lower body weight. Although this is still a theory, evidence suggests high calcium diets may protect against obesity.

2.7 Snacking

In a study on Flemish adolescents, Matthys *et al.* (2002:374) found snacks to be an important source of free sugars and saturated fatty acids.

Snacking is associated with increased caloric intake and many snack foods have little nutritional value (Gahagan, 2004:13). Nielsen *et al.* (2002A:370) found that children between the ages of 2 and 18 years have shown an increase in the calorie intake with a shift of their intake from decreased meal calories to increased snack calories. Calorie intake has also shifted from foods eaten at home to foods eaten outside the home.

In another study, Nielsen *et al.* (2002B:112) found that there has been a significant increase in the consumption of salty snacks, french fries, and soft

drinks. They concluded that education should focus on choosing healthful foods taken outside of the home and on the snacking habits of children.

In a prospective study on 9-14 year olds, Field *et al.* (2004) found that snack foods did not predict weight change among the boys, but snack foods had a weak inverse association with weight change in girls. Boys consumed more snack foods than the girls.

2.8 Conclusion

The literature shows low intakes of vitamin A, B12, C, folate, iron and calcium in South Africa and worldwide among children. This low intake may lead to various nutritional deficiencies.

Obesity is an emerging problem worldwide. The prevalence of overweight and obesity amongst children in both developed countries developing countries. Breakfast is considered to be the most important meal of the day, though it is a meal frequently skipped by children. The skipping of breakfast results in substantial deficits in dietary intake of a variety of essential nutrients and an increased risk of obesity. When viewing the foods consumed worldwide, the literature shows a decrease in fruit and vegetable consumption, while the intake of low nutrient dense snack foods is increasing. The intake of cold drinks is also increasing, while milk intake is decreasing, leading to high sugar intakes and a low intake of calcium. Overall, the eating habits of children do not meet their nutritional requirements.

Chapter 3

3.1 Introduction

The rapid physical growth in adolescents creates an increased demand for energy and nutrients. (Story *et al.*, 2002:S40). Nutrition education during childhood can have long range positive impacts on eating habits (Branen & Fletcher, 1999:304). When looking at the macronutrient intake, Matthys *et al.* (2002:370-371) found significantly higher intakes of protein, refined sugars, total fat and saturated fats and significantly lower intakes of complex carbohydrate and fibre than recommended by the dietary guidelines in Belgium adolescents. Micronutrient intake in South African children does not meet the Recommended Daily Allowance (RDA) for most micronutrients. According to the South African Vitamin A Consultative Group (SAVACG), one in three children (age 1-6 years old) had a marginal vitamin A status (Labadarios & van Middelkoop, 1995). The same report indicated that 10% of children were found to be iron depleted or deficient, 5% were severely iron deficient or depleted and 5% had iron deficiency anaemia. Also 15% of 1-6 year olds appear to have had an underlying folate or vitamin B12 deficiency (Labadarios & van Middelkoop, 1995).

Overweight/obesity in children and adolescents is an important public health problem, since obesity has its onset in childhood (Nicklas *et al.*, 2001:600). An estimated 50% of obese adolescents become obese adults (Pearson *et al.*, 2003:645). Overweight and obesity are caused by an imbalance between energy intake and energy expenditure, but the exact reasons behind this phenomenon in adolescents are unclear (Janssen *et al.*, 2004:365). Overweight, sedentary lifestyles, high intakes of energy (relative to energy expenditure), dietary fat, saturated fat, added sugars and sodium are associated with most of the nutritional problems experienced (Kramer-Atwood *et al.*, 2002:1228).

Childhood obesity causes major health problems, including rare orthopedic problems such as slipped femoral capital epiphyses and tibia vara, which occur with greater frequency in obese children (Loder, 1996:8). Obese children have a

higher rate of more minor abnormalities, including increased susceptibility to ankle sprains, knock knees, and flat, wide feet (Baur & O'Connor, 2004:338). An increasingly recognized hepatic complication of pediatric obesity is non-alcoholic fatty liver disease (Guzzaloni *et al.,* 2000:772). Gastroesophageal reflux and gastric emptying disturbances are further complications (Baur & O'Connor, 2004:338).

Obesity is also the major cause of gallstones in children without other medical problems (Baur & O'Conner, 2004:338). Overweight asthmatic children experience more severe respiratory symptoms than do lean asthmatic children (Belmarich *et al.,* 2000:1436). Obstructive sleep apnea may occur in obese children and is usually associated with adenotonsillar hypertrophy and insulin resistance (de la Eva *et al.,* 2002:654). Central obesity in childhood is associated with risk factors for heart disease and type 2 diabetes, including dyslipidaemia (elevated levels of triglycerides and total and low-density lipoprotein cholesterol and reduced levels of high density lipoprotein cholesterol), hypertension, hyperinsulinaemia and insulin resistance (Freedman *et al.,* 1999:1175).

Breakfast consumption has been identified as an important factor in the nutritional well-being of children (Nicklas, 1998:757s). The skipping of breakfast, which is common among adolescents, may affect concentration, learning and school performance and lead to dietary inadequacies (Nicklas *et al.,* 2000:314). Nicklas *et al.* (2000:314) found that up to 19% of 15 year old Americans skip breakfast.

The consumption of soft drinks is increasing worldwide. In America, the consumption of soft drinks has increased by 74% and 65% respectively for adolescent boys and girls (Borrud *et al.,* 1997:4). Several researchers (Troiano *et al.,* 1995:1085; Mattes, 1996:1133; Deckelbaum & Williams, 2001:239s) suggested that high soft drink intake may lead to excessive energy intake, which may contribute to childhood obesity which is a growing problem worldwide. A study conducted by Rampersaud *et al.* (2003:99) showed that older American children and adolescents (>12 years) consumed more carbonated soft drinks than milk, thereby suggesting that soft drinks are replacing milk in the diet.

Calcium is a major component of bone. During growth, adequate dietary intake of calcium is considered critically important for the acquisition of strong and healthy bones (Black *et al.,* 2002:675). The milk intake in childhood plays a role in the bone density of adults. The adolescent growth period is a critical time for bone mineral accretion (Bailey, 1997:s191). Whiting *et al.* (2001:1113) found that milk consumption decreased with the increased consumption of low nutrient dense beverages. This supports the theory that low nutrient dense beverages replaced milk and, therefore, affected bone mass. Zemel *et al.* (2000:1132) found that increased calcium intake in adults resulted in a reduction in body fat. Their study indicated that low calcium diets favour increased efficiency of energy storage and higher calcium diets reduce energy efficiency and instead, favour increased thermogenesis (Zemel *et al.,* 2000:1137).

Matthys *et al.* (2002:374) found snacks an important source of free sugars and saturated fatty acids. Snacking is associated with increased caloric intake and many snack foods have little nutritional value (Gahagan, 2004:13).

3.2 Objective

The main objective of this study was to investigate the eating habits of children aged 10-15 years in the North West Province (NWP).
Secondary goals were to:

- Compare the intake of nutrients from food by children in the NWP with their nutritional needs.
- Investigate the breakfast patterns of the children in the NWP, and determine the reasons for breakfast skipping and how it influences nutritional status and nutrient intake.
- Determine types of food most frequently eaten.
- Assess the difference between the foods eaten by normal weight and overweight children.
- Assess the influence of transition on the food intake of children.
- Compare the eating habits of children from different races.

- Assess snack intake and the influence of snacks on micronutrient intake and nutritional status.

3.3 Research design and methods

This research project formed part of the THUSA BANA study. THUSA, an acronym for "Transition and Health during Urbanisation of South Africans", is also a Setswana word which means "help". The word BANA is the Setswana word for "children". Together, it means "Help the children". The THUSA BANA project was a multi-disciplinary project inclusive of different schools within the Faculty of Health Sciences of the North-West University, Potchefstroom Campus. The schools that formed part of the project were the School for Physiology and Nutrition, School for Biokinetics, Recreation and Sport Sciences, and The School for Psychosocial Behavioural Sciences. Each of the schools was responsible for gathering their own applicable data in their various specialized fields. Demographic, anthropometric and dietary data as well as all relevant indicators of obesity were identified and reported in this part of the study.

3.3.1 Design and ethical aspects

A single cross-sectional design was used for the study. The study was approved by the Ethics Committee of the North-West University, Potchefstroom Campus (project number 00M10). Parents or guardians completed informed consent forms (Addendum A) one week before the start of the study to give permission for the subjects to participate in the project. The consent forms explained the experimental procedures according to the design of the THUSA BANA study thoroughly. Confidentiality was assured by indicating that no names would be used in releasing research results and only numbers would be used for identification purposes.

3.3.2 Subjects and sampling

The population consisted of 10 – 15 year old boys and girls attending school in the North West Province (NWP). One hundred children per age group were required for statistical significance and for each gender group – a total of 1200 children (Bellizzi, 1999). A list of schools was obtained from the North West Department of Education, grouped into five regions and 12 school districts. Each district represents 4 – 7 circuits, with approximately 20 schools (minimum 14, maximum 47) per circuit. Forty-four schools were selected randomly from five regions in the Province, using a 2 digit random number. The sample was stratified for gender (male/female), type of school (primary/secondary) and ethnic group. The sample was compiled from a population consisting of the four main ethnic groups (black, white, Indian, coloured) in the NWP. An equal number of children from each age group had to be included, therefore, the total number was planned to be 1336 children, consisting of 960 black, 240 white, 68 Indian and 68 coloured children.

The sample consisted of two high schools and four primary schools from traditional black schools in each of the five regions. One secondary school and one primary school from traditionally white schools from each region, but one secondary school and two primary schools from traditional Indian and coloured (mixed ancestry) schools were included from only regions three and four, where most Indian and coloured people live. The boys and girls between the ages of 10 and 15 years were then chosen systematically at random at each school (n=1336). A total of 1257 subjects were included in the final sample, 608 boys and 649 girls, at a response rate of 94.1%. The final sample consisted of 919 black children, 191 white children, 78 Indian children and 69 coloured children. There were 79 non-responders, which could be attributed to either the parents and/or the children not giving consent to participate in the study, children being unavailable due to sport or the writing of tests.

3.3.3 Stratification

Subjects were stratified according to gender (male and female) and age (10-15 years) in their respective stratum of urbanisation.

In South Africa, rapid urbanisation is taking place. Especially Africans are leaving underdeveloped rural areas to seek a better life in urban areas. In 1993, about 48.3% of the South African population was urbanised, compared to 53.7% in 1996. During this period the percentage of urbanized Africans increased from 35.8% to 43.3%, while there was a slight decrease in the figures for whites and only small increases in those for coloureds and Indians (Anon, 1998).

Subjects were grouped into three strata of urbanization using criteria based mainly on where the schools were situated. Criteria for each stratum were as follows:

Stratum 1: This stratum consisted mainly of rural people living in traditional African villages with a tribal head or on a farm.

Stratum 2: This stratum mainly consisted of subjects living in informal housing areas also known as "squatter camps" found adjacent to all major towns and cities. Most people living in these areas had moved from rural areas and farms, therefore, representing people in the most rapid phase of transition.

Stratum 3: This stratum consisted of subjects from the established urban townships, as well as upper class urban subjects living in affluent westernized circumstances.

3.3.4. Methods

3.3.4.1 Demographic information

Demographic data were collected using a structured demographic questionnaire. The questionnaire included questions on age, gender, grade at school, stratum of urbanisation, access to facilities such as water, electricity, computer, television and radio. Questions about educational level of the family members and occupation of the father were also asked to obtain an estimate of the family income (Addendum B).

3.3.4.2 Dietary intake and eating habits

3.3.4.2.1 Twenty-four-hour recall

A 24-hour recall recording form was compiled in a similar manner to those reported in the literature (Lee & Nieman, 2003:107) (Addendum C). The 24-h recall was administered by trained interviewers. The children were questioned in their home language. Food portion sizes were estimated with the aid of a validated photograph book (Venter *et al.*, 2000), plastic food models and examples of food packaging materials. Data were computerised and analysed using the Foodfinder Computer Programme (MRC, 1991).

3.3.4.2.2 Eating Habits

The eating habits questionnaire was used to collect data on eating habits of these children. The questionnaire was formulated with reference to scientific literature to include relevant questions (Dwyer *et al.*, 2001). The questionnaire contained questions on the number of meals the subject consumed per day, if they consumed breakfast and reasons if not. The questionnaire also included questions about feeding schemes in the school, eating television meals, lunch-boxes, pocket money to buy food at school, snacking habits, lunch and supper intakes and special diets (Addendum D). The tested questionnaire was administered by a trained interviewer in the subjects' home language.

3.3.4.2.3 Frequency of particular foods

The frequencies of particular foods consumed as reported in the 24-h recall of food intake, together with the portion size consumed on the particular day, were calculated to establish a pattern of intake for the group. The portion sizes consumed by each child on the research day was added and a mean food portion size for the particular food was calculated. This was done for the different strata of urbanisation, normal weight and overweight for male and female subjects, respectively, as well as for each ethnic group. By this, poor eating habits of specific groups could be identified.

3.3.4.3 Anthropometric measures

Anthropometric measurements were taken by trained postgraduate Biokinetics students. The following measurements were taken:

3.3.4.3.1 Height

Height was measured using a stadiometer. The subjects were required to stand in an upright position without shoes, with feet together and heels against the wall. The top of the ear and the outer corner of the eye were in a line parallel to the floor, the Frankfort plane. The recorder lowered the horizontal bar of the stadiometer to rest flat on top of the head and the measurement was taken and recorded immediately (Norton & Olds, 1996).

3.3.4.3.2 Weight

A calibrated electronic scale was used to measure the weight of the subjects (Precision Health Scale, A&D Company Japan). Body weight was measured to the nearest 0.01 kg. Subjects were weighed in light underwear without shoes. The observed weight was recorded immediately.

3.3.4.3.3 Mid-upperarm circumference (MUAC)

The midpoint between the acronium process and the olecranon process was located and marked on the back of the arm, while the subject held the arm at a 90° angle. The MUAC was then measured with a flexible, nonstretchable measuring tape (Lufkin ®) to the nearest 0.1 cm, while the arm was hanging loosely (Robinson *et al.*, 1982:335).

3.3.4.3.4 Skinfold measurements

Skinfold measurements were done using a spring loaded Harpenden skinfold caliper. The caliper measured the thickness of the skinfold andcan be used to calculate subcutaneous fat. The tester identified certain landmarks on the body of the subject by palpation and made a mark on the subject's body. The tester then lifted the two layers of the skin and subcutaneous fat with the thumb and index finger of the left hand and the caliper was placed over the skinfold approximately one centimetre below the thumb and index finger and the measurement was taken. Skinfolds were taken in this manner at the triceps and subscapular sites (Harrison *et al.*, 1988:56; Norton & Olds, 1996:44).

3.3.5. Statistical analysis

All data were computerized and descriptive statistics were used to present the eating habits and nutrient intake data. Children were classified as breakfast eaters (eating breakfast every day on most days) or non-breakfast eaters (eating breakfast seldom or never) and compared with job level of the parent, age, MUAC (Mid-upper arm circumference), Body Mass Index (BMI), sum of skinskinfolds (triceps + subscapular) and stratum of urbanisation. Partial correlation between calcium intake, BMI and the sum of skin folds, with adjustment for age and total energy intake were calculated.

Subjects were classified as overweight or non-overweight by using the Cole (2000) standard of body mass index and triceps skinfolds for age, gender and ethnic group (white and non-whites) (NCHS, 1971-1974). The chi-square test was used to assess the association between breakfast consumption and:

- ✓ age group
- ✓ gender
- ✓ job level of the parent/caregiver
- ✓ stratum of urbanisation.

The Whitney Mann-test was used to test for differences between the following variables for breakfast eaters and non-breakfast eaters:

- ✓ energy and macronutrient intake, respectively
- ✓ micronutrient intake
- ✓ MUAC
- ✓ BMI
- ✓ sum of triceps and subscapular skinfolds.

The SAS system for Windows Release 8 (2000) and Statistica were used for statistical analysis.

3.4. Results

3.4.1 The macronutrient and micronutrient intakes

To explore macro and micronutrient intakes in 10 -15 year old children is very important, as South Africa has a high incidence of micronutrient deficiencies (Strachan, 1999:5) and malnutrition (Vorster & Venter, 1992:95), as well as overweight children in this age group (Jinabhai *et al.,* 2003:358). The children was grouped according to age, because the RDA/AI differs for children aged 10-13 years and for 14-18 years.

Table 3.1 summarises the macro and micronutrient intakes of 14-15 year olds, and table 3.2 of 10-13 year olds. It is then compared to the recommended daily allowance (RDA) and adequate intake (AI) for the nutrients.

The median intake of the total group of 10-13 year old children was lower than 67% of the AI for fibre, calcium, pantothenic acid and biotin and below 67% of the RDA for vitamin A, folate, vitamin C and vitamin E. The girls 10-13 years of age's median iron intake was below 67% of the RDA for iron. The median intake of the total group of 14-15 year old children was below 67% of the AI for fibre, calcium, pantothenic acid and biotin and below 67% of the RDA for vitamin A, folate, vitamin C and vitamin E (Table 3.1 and 3.2).

Table 3.1. The macro and micronutrient intake of children 14 – 15 years of age by means of the 24-h recall method.

Nutrient	Median intake	Lower quartile	Upper Quartile	RDA/AI	Median intake <67% RDA/AI
Boys:					
Energy (kJ)	7560	5964	9485	Values differ according to activity	
Total protein (g)	61.2	45.9	78.4		
Plant protein (g)	30.0	20.800	40.300		
Animal protein (g)	31.35	24.900	39.300		
Total Fat (g)	49.7	34.200	72.300		
Total Carbohydrate (g)	288.1	218.600	355.700		
Fibre (g)	17.0	10.00	23.000	38*	Yes
Added sugar (g)	28.9	14.900	56.700		
Calcium (mg)	320	194.000	588.000	1300*	Yes
Vitamin B_{12} (µg)	2.0	0.600	3.500	2.4#	No
Iron (mg)	7.9	5.400	11.400	11#	No
Magnesium (mg)	248.0	161.000	300.000	410#	Yes
Zinc (mg)	6.990	5.310	10.90	11#	Yes
Copper	0.850	0.600	1.200		
Vitamin A (µg)	189.0	99.000	355.000	900#	Yes
Thiamin (mg)	0.890	0.730	1.270	1.2#	No
Riboflavin (mg)	0.990	0.50	1.990	1.3#	No
Nicotinic acid (mg)	11.80	7.800	15.900	16#	No
Vitamin B_6 (mg)	0.97	0.669	1.26	1.3#	No
Folate (µg)	156.0	101.000	227.000	400#	Yes
Vitamin C mg	14.0	6.000	39.000	75#	Yes
Vitamin E (mg)	4.910	2.860	8.900	15#	Yes
Pantothenic acid (mg)	2.530	1.770	3.580	5.0*	Yes
Biotin (µg)	11.900	8.000	19.00	25*	Yes
Nutrient	**Median intake**	**Lower quartile**	**Upper Quartile**	**RDA/AI**	**Median intake <67% RDA/AI**
Girls:					
Energy (kJ)	7864.3	5713	9429	Values differ according to activity	
Total protein (g)	63.2	44.5	77.9		
Plant protein (g)	30.0	20.60	40.300		
Animal protein (g)	33.5	24.90	37.300		
Total Fat (g)	56.4	33.60	73.300		
Total Carbohydrate (g)	283.1	201.600	353.700		
Fibre (g)	16.0	9.60	20.00	26*	Yes
Added sugar (g)	40.9	15.50	54.700		
Calcium (mg)	401.4	184.000	572.000	1300*	Yes
Vitamin B_{12} (µg)	2.6	0.800	3.800	2.4#	No
Iron (mg)	8.7	5.400	11.200	15#	Yes
Magnesium (mg)	232.4	152.000	289.000	360#	Yes
Zinc (mg)	8.25	5.10	10.77	9.0#	No
Copper	0.850	0.600	1.200		
Vitamin A (µg)	197.0	118.000	333.000	700#	Yes
Thiamin (mg)	1.01	0.660	1.220	1.0#	No
Riboflavin (mg)	1.49	0.560	2.190	1.0#	No
Nicotinic acid (mg)	12.46	7.90	16.400	14#	No

Table 3.1. The macro and micronutrient intake of children 14 – 15 years of age by means of the 24-h recall method (continued)

Nutrient	Median intake	Lower quartile	Upper Quartile	RDA/AI	Median intake <67% RDA/AI
Vitamin B_6 (mg)	1.04	0.59	1.27	1.2#	No
Folate (µg)	177.0	96.000	218.000	400#	Yes
Vitamin C mg	14.5	6.000	37.000	65#	Yes
Vitamin E (mg)	8.21	2.560	10.400	15#	Yes
Pantothenic acid (mg)	3.60	1.90	3.970	5.0*	Yes
Biotin (µg)	16.40	8.400	19.900	25*	Yes

n=1257, RDA: Recommended daily allowance, AI: Adequate intake; # Recommended daily allowance * Adequate Intake, µg, microgram, mg, milligram, g, gram, kJ, kilojoules

Table 3.2 The macro and micronutrient intake of children 10 – 13 years of age by means of the 24-h recall method.

Nutrient	Median intake	Lower quartile	Upper Quartile	RDA/AI	Median intake <67% RDA/AI
Boys:					
Energy (kJ)	7643	5777.00	9446.00	Values differ according to activity	
Total protein (g)	58.9	44.60	76.80		
Plant protein (g)	31.3	21.60	41.60		
Animal protein (g)	23.5	14.5	30.317		
Total Fat (g)	47.0	31.5	70.6		
Total Carbohydrate (g)	284.3	212.7	357.6		
Fibre (g)	15.00	9.50	20.70	31*	Yes
Added sugar (g)	29.900	14.90	54.20		
Calcium (mg)	350	196.00	553.00	1300*	Yes
Vitamin B_{12} (µg)	1.8	0.80	3.20	1.8#	No
Iron (mg)	7.50	5.00	10.30	8.0#	No
Magnesium (mg)	228.00	171.00	296.00	240#	No
Zinc (mg)	6.85	4.81	9.82	8.0#	No
Copper	0.86	0.60	1.19		
Vitamin A (µg)	190.00	102.00	363.00	600#	Yes
Thiamin (mg)	0.94	0.68	1.28	0.9#	No
Riboflavin (mg)	1.03	0.55	2.19	0.9#	No
Nicotinic acid (mg)	10.4	7.10	15.10	12#	No
Vitamin B_6 (mg)	0.837	0.55	1.30	1.0#	No
Folate (µg)	142.0	92.00	206.00	300#	Yes
Vitamin C mg	12.0	6.00	41.00	45#	Yes
Vitamin E (mg)	5.010	3.07	9.42	11#	Yes
Pantothenic acid (mg)	2.680	1.92	3.93	4.0*	Yes
Biotin (µg)	11.800	8.1	19.7	20*	Yes

Table 3.2 The macro and micronutrient intake of children 10 – 13 years of age by means of the 24-h recall method (continued)

Nutrient:	Median intake	Lower quartile	Upper Quartile	RDA/AI	Median intake <67% RDA/AI
Girls:					
Energy (kJ)	7072	5522.00	8860.00	Values differ according to activity	
Total protein (g)	55.80	43.70	72.60		
Plant protein (g)	28.80	20.60	38.30		
Animal protein (g)	26.20	14.90	39.80		
Total Fat (g)	45.60	29.9	70.4		
Total Carbohydrate (g)	269.4	197.30	329.7		
Fibre (g)	13.50	9.30	18.60	26*	Yes
Added sugar (g)	27.50	14.90	50.70		
Calcium (mg)	317.00	170.00	511.00	1300*	Yes
Vitamin B_{12} (µg)	2.10	0.90	3.60	1.8#	No
Iron (mg)	7.20	5.10	10.00	8.0#	No
Magnesium (mg)	205.00	156.00	261.00	240#	No
Zinc (mg)	6.96	4.73	9.87	8.0#	No
Copper	0.82	0.60	1.15		
Vitamin A (µg)	182.00	103.00	353.00	600#	Yes
Thiamin (mg)	0.88	0.65	1.22	0.9#	No
Riboflavin (mg)	0.96	0.51	2.03	0.9#	No
Nicotinic acid (mg)	10.60	7.10	14.80	12#	No
Vitamin B_6 (mg)	0.814	0.57	1.23	1.0#	No
Folate (µg)	133.0	92.00	210.00	300#	Yes
Vitamin C mg	11.0	4.00	33.00	45#	Yes
Vitamin E (mg)	5.510	3.08	9.29	11#	Yes
Pantothenic acid (mg)	2.610	1.86	3.61	4.0*	Yes
Biotin (µg)	12.200	8.00	18.10	20*	Yes

n=1257, RDA: Recommended daily allowance, AI: Adequate intake; # Recommended daily allowance, * Adequate Intake, µg, microgram, mg, milligram, g, gram, kJ, kilojoules

3.4.2 Breakfast patterns

Table 3.3 describes the number of subjects eating and skipping breakfast according to stratum.

Table 3.3. Number of children eating breakfast and skipping breakfast according to stratum of urbanisation

Stratum	Total	Subjects eating breakfast	Percentage (%)	Subjects not eating breakfast	Percentage (%)
Rural	449	387	86.20%	62	13.80%
Informal Settlement	224	174	77.70%	50	22.30%
Urban Area	583	484	83.00%	99	17.00%

Table 3.4 describes the breakfast eating patterns of 10 – 15 year old boys and girls.

Table 3.4. Number of children eating breakfast and skipping breakfast according to gender

Gender	N	Subjects eating breakfast	Percentage (%)	Subjects not eating breakfast	Percentage (%)
Boys	607	510	84	97	16
Girls	649	535	82.4	114	17.6

Table 3.5 describes the reasons children gave for not eating breakfast.

Table 3.5. Reasons why children skipped breakfast by ethnic group

Reason	Black children (n=162)	White children (n=29)	Coloured children (n=12)	Indian children (n=8)	All children (n=211)
No time to eat	50 (31%)	5 (17%)	4 (33%)	5 (63%)	64 (30%)
Mother does not have time to prepare food	13 (8%)	0	0	0	13 (6%)
No food available in the morning	36 (22%)	0	3 (25%)	0	39 (18%)
Want to lose weight	5 (3%)	2 (7%)	0	1 (13%)	8 (4%)
Feel stressed in the morning	1 (1%)	8 (28%)	0	2 (25%)	11 (5%)
Not hungry in the morning	57 (35%)	14 (48%)	5 (42%)	0	76 (36%)

The reason most black, white and coloured children gave for not eating breakfast was that they did not feel hungry in the morning. Most Indian children skipped breakfast because they had no time to eat. When looking at the total group of children skipping breakfast, it was because they did not feel hungry in the morning, followed by no time to eat.

Figure 3.1 shows the percentage of subjects eating and skipping breakfast.

A larger portion of children from informal settlements skipped breakfast (22.3%) than from urban areas (17%) or rural areas (13.8%). More girls (17.6%) were skipping breakfast than boys (16%), although the difference was not significant (p=0.453). More children of parents who were office workers were skipping breakfast (16.8%), while 19% of children with parents in domestic or contract work skipped breakfast. Children from households working in the informal sector and professional sector were having breakfast most frequently.

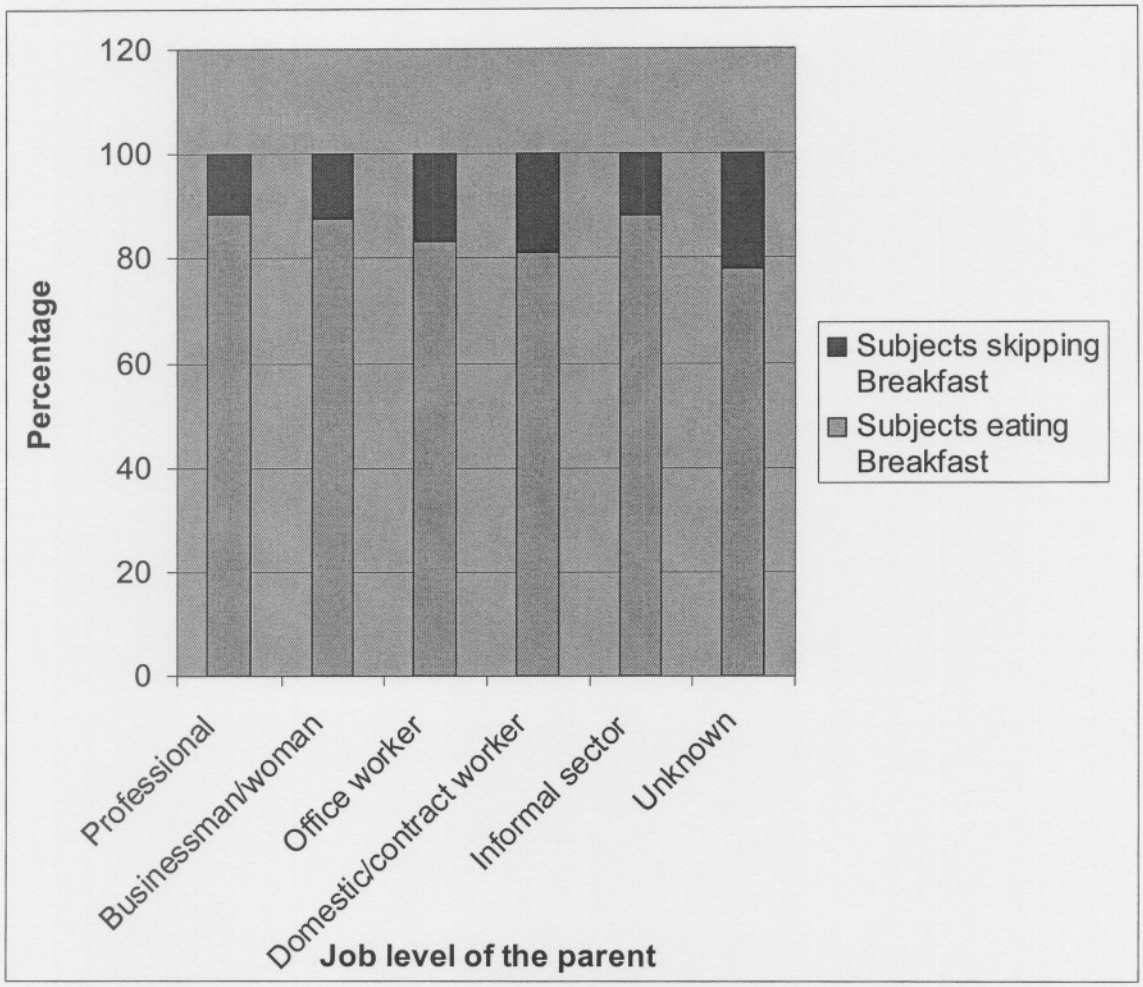

Figure 3.1: Percentage of subjects eating and skipping breakfast according to the job level of the parents in the THUSA BANA study.

Table 3.6 describes the relation between breakfast patterns and anthropometric variables.

Table 3.6. The comparison for age, mid-upper arm circumference (MUAC), body mass index (BMI) and sum of skinfolds (mean±SD) for the 10 – 15 year old children eating and not eating breakfast

Variable	Eat breakfast	Skip breakfast	p-value
All children	n=1035	n=209	
Age	12.36±1.67	12.68±1.80	0.012
MUAC	20.45±3.32	21.03±3.38	0.027
BMI	17.39±3.27	18.07±3.53	0.007
Sum of skinfolds	21.70±13.16	23.38±13.73	0.09
Girls, 10-13 years	N=376	N=69	
MUAC	19.90±2.82	20.47±3.17	NS
BMI	16.96±2.96	17.70±3.39	NS (0.06)
Sum of skinfolds	22.65±10.85	25.37±13.27	NS (0.06)
Girls, 14-15 years	N=153	N=44	
MUAC	23.20±3.10	20.47±3.17	NS
BMI	20.11±3.57	17.70±3.39	NS
Sum of skinfolds	33.30±16.68	33.72±15.13	NS
Boys, 10-13 years	N=360	N=61	
MUAC	19.15±2.92	19.16±3.13	NS
BMI	16.38±2.62	16.65±3.30	NS
Sum of skinfolds	17.09±9.05	17.93±11.71	NS
Boys, 14-15 years	N=146	N=36	
MUAC	22.00±3.27	22.05±2.73	NS
BMI	18.14±3.46	18.43±2.98	NS
Sum of skinfolds	18.49±15.14	16.03±4.21	NS

NS: not significant (p>0.05), BMI, Body Mass Index., MUAC, mid-upper arm circumference

Table 3.6 shows that older children were more likely to skip breakfast than younger children (p=0.011). The mean MUAC of the children that skipped breakfast was significantly greater than the children that ate breakfast (p=0.027). Children who had breakfast had a significantly lower BMI than the children who skipped breakfast (p=0.007). The sum of skinfolds for children who skipped breakfast was greater than for children who ate breakfast, although the difference was not significant (p=0.095). Subsequent statistical analyses were done for the different gender and age groups separately. For the boys 10-13 and 14-15 years,

there were no significant differences between the groups who consumed breakfast and the groups who skipped breakfast for BMI, sum of skin folds and MUAC. The sum of skin folds was smaller for the boys 14-15 years of age who skipped breakfast, however, it was not significant. The girls 14-15 years of age had a lower MUAC and BMI for the group skipping breakfast and a bigger sum of skin folds, again these findings were not significant. In the girls group aged 10 -13 years, the BMI and sum of skin folds tended to be greater for girls who skipped breakfast than those who ate breakfast. The MUAC was also bigger for the girls 10-13 years who skipped breakfast, but not significantly so.

Table 3.7 describes the macro and micronutrient intakes of 10 to 15 year old breakfast eaters and those skipping breakfast. Children who skipped breakfast had significantly lower intakes of energy, total protein, total fat, total carbohydrates, fibre, calcium, iron, magnesium, zinc, copper, thiamin, nicotinic acid, vitamin B_6, folate, and vitamin C ($p<0.05$). The intakes of vitamin B_{12}, vitamin A, riboflavin, vitamin E and biotin were also lower when compared to children having breakfast, although the differences were not significant.

The items most frequently consumed by the children shown in Table 3.8 were white sugar, whole milk, maize meal, white bread, brown bread, margarine, white rice and coffee, with little difference between boys and girls. Fresh milk was the second most frequently consumed food for both boys and girls, with a slightly bigger portion size for the boys (200.9±173g) than for girls (183.4±152.6g).

Table 3.7 Comparison of the macronutrient and micronutrient intakes of children eating breakfast and those not eating breakfast in the THUSA BANA study

	Subjects eating breakfast (n=1045)				Subjects not eating breakfast (n=209)				p-value
	Median	Percentile 25.000	Percentile 75.000	**Median intake** <67% RDA/**AI**	Median	Percentile 25.000	Percentile 75.000	**Median intake** <67% RDA/AI	
Energy (kJ)	7522	5906	9320		6180	4771	8391		0.0000
Total protein (g)~	59.1	45.5	76.8	No	49.4	37.5	68.2	No	0.0000
Plant protein (g)	30.9	22	40.9		24	16.1	35		0.0000
Animal protein (g)	25.5	15.5	39.8		22.9	13.1	37.1		0.0499
Total Fat (g)	48.5	32.7	71.6		39.5	25.8	60.9		0.0002
Total CHO (g)~	279.2	213.2	347.6	No	233	166.4	301.9	No	0.0000
Fibre (g)~	14.8	10	20.3	Yes+	10.6	6.4	16.4	Yes+	0.0000
Added sugar (g)	29.1	14.9	54.2		29.4	14.9	49.8		0.6130
Calcium (mg)~	333	185	545	Yes+	317	150	514	Yes+	0.0457
Vitamin B_{12} (µg)#	2	0.8	3.6	No	1.9	0.6	3.1	No	0.0859
Iron (mg)#	7.7	5.3	10.6	Yes**	6.3	4.1	9.6	Yes~~	0.0003
Magnesium (mg)#	223	166	287	Yes~~	179	131	255	Yes~~	0.0000
Zinc (mg)#	7.19	4.98	10.33	Yes *	5.89	4.12	8.73	Yes~~	0.0001
Copper #	0.890	0.63	1.22		0.69	0.490	1.04		0.0000
Vitamin A (µg)#	194	106	359	Yes+	171	86	338	Yes+	0.1125
Thiamin (mg)#	0.94	0.68	1.26	No	0.8	0.550	1.09	Yes*	0.0000
Riboflavin (mg)#	0.99	0.52	2.09	No	0.950	0.540	2	No	0.6605
Nicotinic acid (mg)#	11	7.6	15.4	No	9.2	6.2	13.4	Yes~~	0.0001
Vitamin B_6 (mg)#	0.877	0.579	1.277	No	0.762	0.509	1.105	Yes~~	0.0006
Folate (µg)#	145	96	215	Yes+	112	65	190	Yes+	0.0000
Vitamin C mg#	13	5	38	Yes+	10	5	27	Yes+	0.0387
Vitamin E (mg)#	5.32	2.98	9.42	Yes+	4.82	2.7	9.02	Yes+	0.2839
Pantothenic acid (mg)~	2.62	1.870	3.7	Yes+	2.72	1.81	4.07	Yes~~	0.3851
Biotin (µg)~	12.2	7.9	19	Yes+	12.1	8.7	20.3	Yes+	0.3234

RDA: Recommended daily allowance; AI: Adequate Intake, #Recommended daily allowance, ~Adequate Intake; *Below RDA/AI for boys 14-15 years only, **Below RDA/AI for girls 14-15 years only; ~~Below RDA/AI for boys and girls 14-15 years only; +Below RDA/AI for boys and girls 10-13 and 14-15 years
µg, microgram, mg, milligram, g, gram, kJ, kilojoule

3.4.3. Frequency and types of food chosen

A comparison of the frequency of foods consumed between males and females is shown in Table 3.8.

Table 3.8. Frequency of foods consumed by gender of the children in chronological order.

	BOYS (n=608) Food	Mean portion size	SD		GIRLS (n=649) Food	Mean portion size	SD
1	White Sugar	24.6	16.9	1	White sugar	21.9	15.6
2	Whole milk	200.9	173.0	2	Whole milk	183.4	152.6
3	White maize meal	201.9	129.7	3	White maize meal	159.4	90.0
4	White bread/rolls	161.8	108.7	4	White bread/rolls	143.9	98.2
5	Brown bread/rolls	154.9	102.6	5	Brown bread/rolls	132.5	79.6
6	Hard margarine	15.8	12.1	6	Hard margarine	14.6	11.4
7	White rice, cooked	159.6	92.4	7	White rice, cooked	153.7	88.2
8	Instant coffee	296.1	200.0	8	Instant coffee	280.8	153.9
9	Rooibos tea	296.7	129.7	9	Chicken, with skin	60.1	26.5
10	Cold drink, carbonated	396.0	248.6	10	Savory snack (Niknaks,Fritos)	38.1	18.8
11	Polony	28.4	23.4	11	Rooibos tea	337.5	766.2
12	Tea	288.9	132.0	12	Polony	25.1	20.1
13	Chicken, with skin	56.0	22.51	13	Cold drink, carbonated	321.0	177.5
14	Savory snack (Niknaks,Fritos)	45.4	35.36	14	Tea	256.8	88.3
15	Potato chips, deep fried	128.1	91.96	15	Tomato and Onion, stewed	46.2	29.8
16	Sunflower oil	6.2	2.6	16	Mango Atchar	43.3	23.2
17	Mango Atchar	50.1	30.4	17	Sunflower oil	6.1	2.7
18	Tomato and Onion, stewed	38.8	26.8	18	Boiled potato	89.7	59.7
19	Peanut butter	19.3	17.3	19	Potato chips, deep fried	95.7	46.4
20	Potato, boiled without skin	84.4	63.9	20	Cheese	30.7	21.9
21	Marmelade/ jam	14.3	13.6	21	Enriched maize meal	144.4	72.0
22	Enriched maize meal	155.3	96.5	22	Cold drink, squash, diluted	249.5	214.0
23	Cold drink, squash, diluted	233.2	201.1	23	Apple, raw	167.2	68.1
24	Cheese	35.5	23.7	24	Vetkoek, homemade	215.4	144.0
25	Vetkoek, homemade	204.7	103.2	25	Marmelade/ jam	14.7	20.6
29	Apple, raw	172.8	72.5	26	Fudge	20.8	19.17

SD: Standard deviation

The first fruit eaten by girls was an apple, which is 23rd on the frequency list, but for the boys the first fruit is only 29th on their list. For the boys and girls, savoury snacks (Fritos, Niknaks-type) appeared 14th and 10th respectively. The boys had bigger mean portion sizes 45.4g (SD 35.4) than the girls 38.1g (SD 18.8). No other snack foods were under the first 25 foods on the frequency lists. Table 3.9 describes the fruit consumption of 10 to 15 year old children in the North West Province. Carbonated cold drinks appeared 10th on the boys' list, with a mean portion size of 396g (SD ±248.6) and 13th on the girls' list, with a portion size of 321.0 g (SD ±177.5). The boys and girls reported similar portion sizes for diluted squash.

Table 3.9 describes the fruit consumption of 10 to 15 year old children in the North West Province.

Table 3.9. The fruit consumption by gender of the 10-15 year old children (n=1257)

Fruit	Number of Boys eating the specific fruit	Number of Girls eating the specific fruit
Apple, raw	44	61
Banana, raw	39	38
Orange, raw	29	38
Pear, raw	13	6
Naartjie, raw	4	6
Apricot, raw	1	
Grapes raw	1	1
Watermelon, raw	1	1
Pineapple, raw	1	
Pawpaw, raw		3
Peach, raw		1
Kiwi fruit		1
TOTAL EATING FRUIT	**133 (21.9%)**	**156 (24%)**
FRUIT JUICE		
Orange juice	29	42
Apple juice	2	2
Guava juice	2	4
Mango juice	2	3
Grape juice	2	
Mango and Orange juice	1	1
Litchi juice	1	1
Pineapple and Mango juice	1	
Average fruit juice		5
Granadilla juice		1
Peach and orange juice		1
Peach juice		1
TOTAL DRINKING JUICE	**40**	**61**
TOTAL OF FRUIT AND JUICE	**173**	**217**

If one assumes that each of the subjects consumed one fruit portion daily, only 133 (21.9%) of the male subjects consumed fruit. If fruit juice was included as fruit, only 28.5% of the boys in the study consumed fruit. About one-quarter of the 649 girls, (n=156, 24.0%)

consumed fruit. If fruit juice was regarded as fruit, only a third (33.4%) of the girls in the study consumed fruit. Of the total subjects, 289 (23.0%, n=1257) consumed fruit, while only 390 (31.0%, n=1257) consumed fruit or fruit juice on the day of the dietary recall.

When comparing overweight girls to normal weight girls, the frequency of foods consumed is shown in Table 3.10.

Table 3.10.The frequency of foods consumed by normal weight and overweight girls

Normal weight GIRLS (n=577)				Overweight GIRLS (n=65)			
	Food	Mean portion size	SD		Food	Mean portion size	SD
1	White sugar	21.6	15.6	1	White sugar	25.5	15.0
2	Whole milk	187.0	152.8	2	Whole milk	152.2	149.5
3	White maize meal	161.6	90.5	3	White bread/rolls	168.7	119.5
4	White bread/rolls	140.7	95.0	4	White maize meal	134.4	81.3
5	Brown bread/rolls	130.8	79.1	5	Brown bread/rolls	148.8	84.2
6	Hard margarine	14.5	11.1	6	Hard margarine	16.3	13.7
7	White rice, cooked	149.7	84.5	7	Chicken with skin	58.8	26.7
8	Instant coffee	280.8	157.5	8	Savoury snack (Niknaks,Fritos)	46.6	29.1
9	Savoury snack (Niknaks,Fritos)	36.7	16.2	9	White rice, cooked	190.3	112.6
10	Rooibos tea	267.9	110.0	10	Instant coffee	281.1	126.4
11	Chicken with skin	60.3	26.5	11	Polony	31.1	26.4
12	Polony	24.3	19.2	12	Cold drink, carbonated	273.6	195.9
13	Cold drink, carbonated	327.2	175.0	13	Tea	253.8	72.3
14	Tea	257.2	90.5	14	Sunflower oil	5.4	1.4
15	Tomato and Onion, stewed	45.3	30.1	15	Potato chips, deep fried	72.9	30.6
16	Mango Atchar	45.7	23.3	16	Mango Atchar	26.0	14.1
17	Sunflower oil	6.3	2.9	17	Apple, raw	143.3	30.82
18	Potato, boiled without skin	85.1	56.4	18	Commercial cookies	33.8	20.7
19	Cheese	30.8	22.3	19	Potato, boiled without skin	134.3	764
20	Enriched maize meal	142.1	73.3	20	Cold drink, squash, diluted	274.3	216.0
21	Potato chips, deep fried	100.1	47.8	21	Egg, fried	86.7	26.9
22	Cold drink, squash, diluted	246.4	215.4	22	Boerewors	80.0	31.0
23	Vetkoek homemade	216.4	146.9	23	Enriched maize meal	168.3	54.3
24	Apple, raw	171.4	72.0	24	Orange juice, canned/sweetened	205.0	23.5
25	Marmelade/jam	15.2	21.6	25	Orange juice, 100%	208.3	49.2
36	Orange juice, 100%	274.7	124.3	26	Tomato and Onion, stewed	60.0	21.9
40	Orange juice, canned/sweetened	253.1	102.3	27	Cheese	30.0	18.7

SD: Standard Deviation

The first six foods on the list were the same for both groups, namely white sugar, whole milk, maize meal, white bread, brown bread and margarine. The overweight girls reported chicken as the first protein source on number seven, while the normal weight girls had white

rice on number seven. The first protein food for normal weight girls was chicken, but on number 11. Whole milk was number 2 on both these lists. The mean milk portion size for normal weight girls was greater (187.0 ± 152.76g) than for overweight girls (152.2 ± 149.5g). There was no significant correlation between calcium intake and BMI in the girls.

The first vegetable mentioned by both overweight and normal weight girls was tomato and onion stew on number 26 and 15, respectively. The first fruit for both overweight and normal weight girls was an apple on number 17 and on number 24, respectively.

For the normal weight girls, the savoury snack (Fritos, Niknaks-type) was on number nine, with a mean portion size of 36.7g (SD ±16.2). In the overweight female group, savoury snack (Fritos, Niknaks-type) was on number eight, with a bigger mean portion size than normal weight girls (46.6g, SD ±29.1).

Carbonated beverages were on number 12 and 13 respectively for overweight and normal weight girls. Mean portion sizes for the overweight girls were 273.6g (SD ± 195.9) and slightly bigger for the normal weight girls (327.2g, SD ±175.0). The overweight girls reported the intake of diluted squash on number 20, with a bigger portion size than normal weight girls. For the normal weight girls, diluted squash was on number 22.

When comparing overweight boys to normal weight boys, the frequency of foods consumed was as follows (Table 3.11):

Table 3.11. The food frequency of normal weight boys and overweight boys for 10 – 15 year old children in the THUS BANA study.

Normal weight **boys** (n=570)				Overweight **boys** (n=34)			
	Food	Mean portion size	SD		Food	Mean portion size	SD
1	White sugar	25.2	17.1	1	White sugar	15.0	7.9
2	Whole milk	203.6	174.9	2	Whole milk	163.0	141.3
3	White maize meal	203.4	130.8	3	White bread/rolls	170.4	104.3
4	White bread/rolls	161.1	109.2	4	Hard margarine	15.0	12.7
5	Brown bread/rolls	157.2	103.3	5	Coffee	255.6	155.8
6	Hard margarine	15.9	12.0	6	White rice, cooked	156.9	120.7
7	White rice, cooked	159.8	90.3	7	Brown bread/rolls	106.5	75.9
8	Instant coffee	299.9	203.6	8	Cold drink, carbonated	435.4	232.1
9	Rooibos tea	298.4	130.5	9	White maize meal	149.2	65.2
10	Cold drink, carbonated	392.1	250.7	10	Cheese	48.6	36.3
11	Polony	28.8	23.9	11	Chicken with skin	46.4	25.8
12	Tea	290.0	133.7	12	Polony	21.7	11.3
13	Chicken with the skin	56.6	22.3	13	Apple, raw	185.0	84.3
14	Savoury snack (Niknaks,Fritos)	45.3	35.7	14	Tomato, raw	29.2	12.0
15	Potato chips, deep fried	129.8	93.0	15	Marmelade	10.3	2.6
16	Sunflower oil	6.2	2.6	16	Savoury snack (Niknaks,Fritos)	48.0	30.9
17	Mango Atchar	51.1	30.6	17	Peanut butter	11.0	10.8
18	Tomato and Onion stewed	39.4	27.2	18	Tea	264.0	87.6
19	Peanut butter	20.0	17.6	19	Steak , fried with fat	110.0	61.6
20	Potato boiled without skin	86.6	65.2	20	Minced beef	38.8	17.5
21	Enriched maize meal	156.3	98.0	21	Mango Atchar	31.3	21.0
22	Marmelade/ jam	14.8	14.3	22	Orange juice, 100%	356.3	139.0
23	Cold drink, squash, diluted	238.6	204.8	23	Pumpkin, squash	83.8	65.0
24	Cheese	33.5	21.1	24	Potato boiled without skin	51.3	23.2
25	Vetkoek, homemade	206.7	103.7	25	Tomato sauce	27.5	28.4
29	Apple raw	170.9	71.6	31	Snack, savoury, potato crisps	45.0	18.03
40	Orange juice, 100%	241.4	94.1	39	Cold drink, squash, diluted	140.0	90.4

SD: Standard Deviation

The first two foods remained the same for both groups, namely white sugar and whole milk. The overweight boys reported cheese as the first protein source on number 10, while the normal weight boys reported polony as the first protein source on number 11. Whole milk was number 2 on both these lists, the mean portion size for normal weight boys was 203.6g (SD 174.9) and for overweight boys 163.0g (SD 141.3). There was no significant correlation between calcium intake and BMI in the boys.

The first vegetable consumed by overweight boys was tomato on number 14, followed by mango atchar on number 21. The first vegetables for the boys of normal weight was potato

chips. The first fruit for both overweight and normal weight boys was an apple, on number 13 and only on number 29, respectively.

For the normal weight boys, the savoury snack (Fritos, Niknaks-type) was on number 14, while in the overweight boys it was on number 10, with a bigger portion than the normal weight group.

Carbonated beverages were on number 8 and 10 respectively for overweight and normal weight boys. Mean portion size for the overweight boys was bigger than for the normal weight boys (435.4g vs 392.1g respectively). The normal weight boys reported the intake of diluted squash on number 23, portion size 238.6g (SD ±204.8). For the overweight boys, diluted squash was only on number 39, with a smaller mean portion size 140.0g (SD ±90.4).

When comparing the intakes of the subjects in the three different strata of urbanisation, the frequency of foods consumed is as follows (Table 3.12):

The first five foods of the rural area and the informal settlements compared well, namely white sugar, maize meal, whole milk, white bread and brown bread. The only difference is that brown bread is eaten more often than white bread in the informal settlements. For urban areas, white sugar is followed by milk, white bread, maize meal and margarine. The first protein food is boiled chicken on number 9 for rural areas, number 7 for informal settlements and polony on number 12 for urban areas. Whole milk was second on the list for urban areas, portion size 212.4g (SD±155.5). Milk was third on the list for both the informal settlements (portion size 182.5±176.3) and rural areas (portion size 212±167g).

Table 3.12 The most frequently consumed foods per stratum for 10-15 year old children.

Rural area (n=449)				INFORMAL SETTLEMENT (N=224)				URBAN AREA (N=583)			
	Food	Mean portion size	SD		Food	Mean portion size	SD		Food	Mean portion size	SD
1	White sugar	19.7	13.4	1	White sugar	23.1	15.7	1	White sugar	25.9	17.8
2	White maize meal	172.3	103.6	2	White maize meal	219.5	145.7	2	Whole milk	182.0	155.5
3	Whole milk	212.4	166.9	3	Whole milk	182.5	176.3	3	White bread/rolls	155.0	105.2
4	White bread/rolls	141.5	95.8	4	Brown bread/rolls	149.1	90.1	4	White maize meal	168.0	98.3
5	Brown bread/rolls	144.5	97.4	5	White bread/rolls	173.1	115.2	5	Hard margarine	14.8	11.1
6	Hard margarine	1.1	11.6	6	Hard margarine	16.6	13.8	6	Brown bread/rolls	140.2	89.0
7	Coffee	263.4	115.5	7	Chicken with skin	56.1	24.1	7	White rice, cooked	156.3	89.5
8	White rice	142.3	72.85	8	Tea	248.8	89.9	8	Rooibos tea	291.7	133.6
9	Chicken with skin	57.1	24.54	9	Rooibos tea	452.1	1251.6	9	Cold drink, carbonated	385.4	235.5
10	Tea	283.4	116.9	10	Savoury snack (Niknaks, Fritos)	39.1	13.0	10	Coffee	305.7	172.8
11	Polony	19.0	12.8	11	White rice, cooked	197.7	121.4	11	Savoury snack (Niknaks, Fritos)	44.8	35.3
12	Sunflower oil	6.1	2.2	12	Coffee	302.0	306.9	12	Polony	32.7	25.9
13	Savoury snack (Niknaks, Fritos)	37.0	17.5	13	Polony	27.6	20.9	13	Cheese	33.7	21.3
14	Mango Atchar	38.3	18.3	14	Enriched maize meal	167.4	89.1	14	Potato boiled without skin	95.3	63.4
15	Cold drink, carbonated	323.2	188.8	15	Mango atchar	42.9	26.8	15	Potato chips, deep fried	126.8	70.9
16	Potato chips, deep fried	96.9	83.5	16	Sunflower oil	5.7	2.7	16	Cold drink, squash,	239.1	229.5
17	Rooibos tea	272.7	107.6	17	Tomato and onion, stewed	44.3	37.0	17	Tomato and Onion stewed	39.2	20.8
18	Tomato and Onion, stewed	49.5	31.5	18	Marmelade/jam	17.4	19.2	18	Corn Flakes cereal	52.6	25.5
19	Potato boiled without skin	82.3	61.8	19	Vetkoek, homemade	228.3	132.1	19	Chicken with skin	62.5	25.6
20	Enriched maize meal	133.6	57.9	20	Commercial cookies	53	29.9	20	Fudge/toffees	25.7	21.1
21	Vetkoek, homemade	188.9	86.5	21	Potato chips, deep fried	105.2	65.9	21	Tea	282.0	128.3
22	Cheese	31.4	27.5	22	Beef, chuck, braised	90.7	27.0	22	Apple, raw	169.9	67.9
23	Egg, fried	105.3	38.4	23	Cold drink, carbonated	253.2	98.1	23	Marmelade/jam	14.0	19.6
24	Maltabella	450.0	243.8	24	Beef stew with vegetables	72.2	29.2	24	Mango Atchar	59.4	31.6
25	Mashed potato	72.0	34.8	25	Peanut Butter	20.8	20.3	25	Peanut Butter	17.6	16.7
27*	Orange, raw	193.6	60.7	26*	Apple, raw	182.2	99.3	26*	Sausage, 'Boerewors'	85.2	34.8
29*	Cold drink, squash	277.1	162.5	40*	Cold drink, squash	155.0	111.7	27*	Chicken, roasted	75.8	49.0

SD: Standard Deviation *Items added to show position on the list of most frequently consumed foods

The first vegetable for the rural areas was mango atchar, followed by deep fried potato chips. The first vegetable for the stratum informal settlements was also mango atchar, on number 15 and stewed tomato and onion on number 17. The first vegetable for the urban area was boiled potatoes, followed by deep fried potato chips. The first fruit for the rural area was number 27, an orange. For the informal settlement, the first fruit was on number 26, an apple and in the urban area, the first fruit, an apple, was on number 22.

For subjects from rural areas, the savoury snack was number 13 and for the group from informal settlements, savoury snack was number 10, with similar portion sizes. Subjects from the urban area reported the savoury snack on number 11, with the biggest portion size (44.8 g) of the three strata. Other snack foods consumed by the subjects from the informal settlements (under the top 25 foods) were commercial cookies, number 20. Other snack foods consumed by the subjects from the urban areas were fudge-type sweets, number 20.

Carbonated beverages were number 15 for subjects from rural areas with a mean portion size of 323.2g. Informal settlement children reported carbonated beverages only as number 23 with a smaller mean portion size (253.2g). The intake of carbonated beverages amongst urban subjects was on number 9 (portion size 385.4g), the biggest portion size of the strata. Amongst the subjects from rural areas, diluted squash was on number 29, the largest portion for the three strata with a mean portion size of 277.1g. Diluted squash was number 40 on the list for subjects from informal settlements, with a portion size of 155.0g, and number 16 for subjects from urban areas with a portion size of 239.1g.

When comparing the intake of the different ethnic groups, the frequency of foods consumed is as follows (Tables 3.13 – Table 3.16):

Table 3.13 The frequency of food intake per ethnic group: Black children

Black children (n=919)			
	Food	Mean portion size	SD
1	White sugar	24.8	16.9
2	White maize meal	195.8	104.4
3	Whole milk	184.7	169.3
4	Rooibos tea	340.8	653.3
5	Brown bead/rolls	143.1	82.4
6	White bread/rolls	164.5	100.0
7	Hard margarine	13.1	10.8
8	White rice, cooked	187.8	95.5
9	Coffee	287.3	245.6
10	Polony	26.7	21.2
11	Savoury snack (Niknaks, Fritos)	33.0	20.7
12	Tomato and Onion, stewed	35.4	17.2
13	Mango atchar	66.4	25.4
14	Cold drink, carbonated	257.7	182.9
15	Chicken with skin	65.4	31.1
16	Potato chips, deep fried	107.1	47.3
17	Cold drink, squash, diluted	145.2	112.9
18	Chicken, roasted, with skin	63.7	29.2
19	Marmelade/ jam	9.9	5.5
20	Enriched maize meal	172.8	91.4
21	Vetkoek, homemade	263.8	136.7
22	Apple, raw	178.9	73.9
23	Mashed potato	69.6	36.7
24	Chicken, with batter, fried (Kentucky)	61.6	26.1
25	Peanut Butter,	9.6	15.1

SD: Standard Deviation

The first protein mentioned by black children was polony on number 10. Whole milk was third on the list for black children with a mean portion size of 184.7g (SD 169.3). The first vegetables for this ethnic group were stewed tomato and onion and mango atchar on numbers 12 and 13. The first fruit for all children was an apple (Tables 3.13 – 3.16).

The only snack food under the top 25 foods was savoury snack (Fritos, Niknaks-type) Cold drinks included carbonated beverages on number 14 (mean portion size 257.7 ±182.9g) and diluted squash on number 17, (portion size 145.2 ±112.9).

Table 3.14 The frequency of food intake per ethnic group: White children

White children (n=191)			
	Food	Mean portion size	SD
1	White sugar	24.4	20.0
2	Whole milk	233.9	170.7
3	White bread/rolls	115.2	105.2
4	Coffee	323.5	208.9
5	Hard margarine	19.9	15.1
6	White rice, cooked	115.7	69.8
7	Cold drink, carbonated	405.7	216.7
8	Brown bead/rolls	114.4	84.0
9	Cheese	40.1	26.1
10	Cold drink, squash, diluted	316.5	261.9
11	Savoury snack (Niknaks, Fritos)	44.7	24.5
12	Peanut Butter	18.7	16.8
13	Salad, mixed, no dressing	61.2	39.1
14	Golden syrup	18.7	15.5
15	Chicken, roasted with skin	81.8	41.8
16	Boerewors	81.8	33.3
17	White maize meal	103.6	75.5
18	Apple, raw	165.7	55.6
19	Marmelade/jam	13.2	7.7
20	Potato, boiled without skin	128.3	75.9
21	Potato chips, deep fried	160.0	115.4
22	Tomato, raw	27.3	20.0
23	Fudge/toffees	65.2	22.8
24	Cereal, Corn Flakes	61.4	26.9
25	Cereal, Weetbix	44.3	20.1

SD: Standard Deviation

The first protein mentioned by white children was cheese on number 9,. Whole milk was second on the list for white children, portion size 233.9g (SD ±170.7). The first vegetables were mixed salad and boiled potato, numbers 13 and 20 respectively.

The savoury snack (Fritos, Niknaks-type) was on number 11 and fudge-type sweets were at number 23. Carbonated beverages were on number 7 with a mean portion size of 405.7g (SD ±216.7) and diluted squash was on number 10, portion size 316.5g (SD ±261.9).

Table 3.15: The frequency of food intake per ethnic group: Coloured children

Coloured children (n=69)			
	Food	**Mean portion size**	**SD**
1	White sugar	28.9	17.7
2	White bread/rolls	209.6	150.5
3	Whole milk	194.7	147.2
4	White rice, cooked	204.9	134.4
5	Cold drink, carbonated	366.7	217.3
6	Coffee	289.6	146.3
7	Polony	35.0	30.1
8	White maize meal	168.4	95.8
9	Hard margarine	18.1	10.5
10	Beef mince	76.5	61.2
11	Margarine, polyunsaturated	23.5	15.8
12	Brown bead/rolls	166.9	114.2
13	Rooibos tea	288.3	137.2
14	Cheese	38.4	24.4
15	Savory snack (Niknaks, Fritos)	64.5	47.4
16	Potato boiled without skin	114.3	74.6
17	Tea	256.8	110.1
18	Beef steak, fried	95.8	31.5
19	Regular butter	28.3	21.5
20	Peanut Butter	27.1	20.4
21	Cereal, Corn Flakes	44.4	12.7
22	Apple, raw	160.0	35.2
23	Sweets, hard boiled	24.5	18.6
24	Vetkoek, homemade	220.0	226.3
25	Fudge	28.9	18.8

SD: Standard Deviation

The first protein mentioned by coloured children was polony on number 7. Whole milk was third on the list, portion size 194.7g (SD ±147.23). The first vegetable for coloured children was boiled potato.

The savoury snack (Fritos, Niknaks-type) was on number 15, mean portion size of 64.5g (SD 47.4). Hard-boiled sweets or soft jelly type sweets were number 23 and fudge-type sweets were at number 25, portion size 28.9g (SD 18.8). Carbonated beverages were on number 5 with a mean portion size of 366.7g (SD 217.3). The intake of diluted squash was not under the top 25 foods consumed.

Table 3.16: The frequency of food intake per ethnic group: Indian children

Indian children (n=78)			
	Food	Mean portion size	SD
1	Whole milk	142.4	148.5
2	White sugar	26.1	19.6
3	White bread/rolls	165.6	83.9
4	Cold drink, carbonated	476.0	236.4
5	Rooibos tea	271.7	119.7
6	White rice, cooked	138.5	75.4
7	Potato, boiled without skin	94.7	54.9
8	Hard margarine	11.6	8.3
9	Orange juice, 100%	253.2	84.4
10	Savoury snack (Niknaks, Fritos)	68.4	51.9
11	Potato chips, deep fried	112.6	59.1
12	Cheese	34.1	18.3
13	Fudge	31.7	27.4
14	Polony	58.7	24.8
15	Tomato paste	16.3	18.9
16	Coffee	293.3	125.5
17	Vienna sausages	67.5	42.7
18	Mutton stew/curry	153.3	114.1
19	Cereal, Corn Flakes	49.8	13.3
20	Roti made with sunflower oil	70.0	78.9
21	Chocolate, dark	60.1	88.1
22	Milk, flavoured, low fat	224.1	24.6
23	Chicken stew with skin	147.3	119.8
24	Tomato and Onion, stewed	37.5	26.2
25	Regular butter	11.1	8.6
69*	Apple, raw	160	0.00

SD: Standard Deviation

*Added to show position in the list

The first protein mentioned by Indian children was cheese on number 12. Whole milk was the first food on the list with a portion size of 142.4g (SD ±148.5). Flavoured low fat milk was 22nd on the list, with a mean portion size of 224.1g (SD±24.6). The first vegetables were stewed tomato and onion and raw tomato on numbers 24 and 33 respectively. The first fruit for Indian children, an apple, was only number 69.

The savoury snack (Fritos, Niknaks-type) was on number 10, with a mean portion size of 68.4g (SD±51.9). Fudge-type sweets were at number 13 and chocolate was at number 21. Indian children had the highest intake of carbonated beverages, on number 4, with a mean portion size of 476.0g (SD236.4). Orange juice was at number 9, with a mean portion size of 253.2g (SD±84.4).

3.4.4 Snack foods

The nutritional value of the snacks consumed by 10 to 15 year olds was calculated to assess whether it is just empty calories or does it contribute to micronutrient intake. Table 3.17 describes the nutritional value of the snacks, using an apple, the most frequently consumed fruit, as a control.

Figure 3.2 shows the portion sizes of the snacks consumed for overweight and normal weight boys and girls.

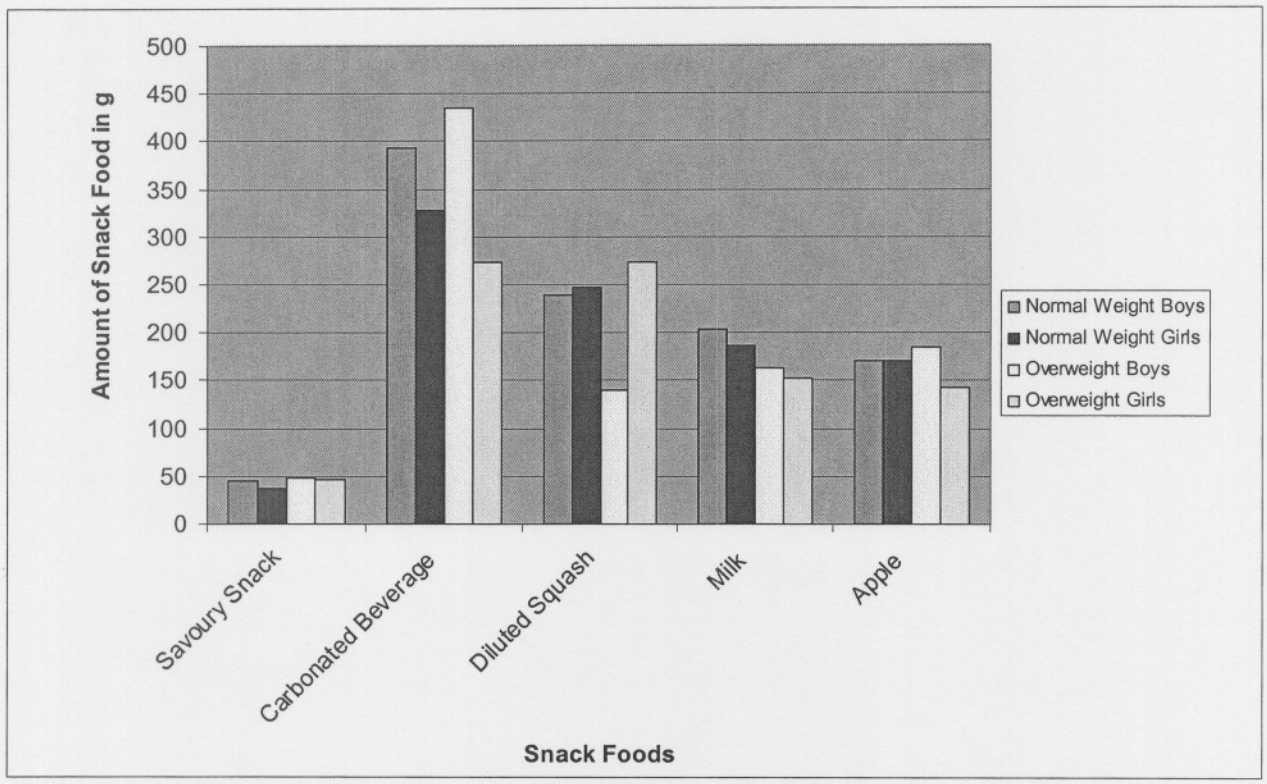

Figure 3.2: The comparison between the snack food sizes in normal and overweight boys and normal and overweight girls.

Table 3.17. The nutritional value of the snacks consumed.

	RDA/AI (10 – 13 years)	Savoury snack, Niknaks		Fudge/Toffee/ Caramel sweets		Commercial plain cookies		Hard boiled sweets		Savoury snack, potato crisps		Apple	
Mean portion size (g)		41.4	%RDA/AI	23.3	%RDA/AI	34.3	% RDA/AI	26.5	% RDA/AI	33.6	% RDA/AI	169.5	% RDA/AI
Energy (kJ)		940.4		399.1		623.7		409.4		772.8		415.3	
Total protein (g)		2.98		0.70		2.54		0		2.29		0.34	
Total Fat (g)		14.40		3.03		4.60		0.21		12.10		0.68	
Total CHO (g)		22.07		17.28		26.0		24.51		15.79		22.20	
Fiber (g)	26*	0.70	2.69	0	0	0.38	1.46	0	0	1.34	5.15	3.73	14.35
Added sugar (g)		0		17.05		9.02		24.40		0		0	
Calcium (mg)	1300*	33.54	2.58	30.99	2.38	41.17	3.17	3.86	0.30	5.71	0.44	11.86	0.91
Vitamin B12 (µg)	1.5#	0	0	0	0	0	0	0	0	0	0	0	0
Iron (mg)	5.9#	0.54	9.15	0.28	4.75	0.72	12.20	0.294	4.98	0.67	11.36	0.34	5.76
Magnesium (mg)	200#	19.05	9.53	5.82	2.91	5.83	2.92	0.53	0.27	28.23	14.12	8.47	4.24
Zinc (mg)	7.0#	0.30	4.29	0	0	0.21	3.00	0	0	0.24	3.43	0.07	1
Copper		0.02		0.09		0.03		0.02		0.10		0.07	
Vitamin A (µg)	445#	12.01	2.70	0.23	0.05	0	0	0	0	0	0	8.47	1.90
Thiamin (mg)	0.7#	0.09	12.86	0.01	1.43	0.05	7.14	0	0	0.12	17.14	0.03	4.29
Riboflavin (mg)	0.9#	2.61	296.67	0.02	2.22	0.03	3.33	0	0	0	0	0.02	2.22
Nicotinic acid (mg)	9.0#	0.50	5.56	0.02	0.22	0.52	5.78	0	0	0.84	9.33	0.17	1.89
Vitamin B6 (mg)	0.8#	0.42	52.5	0	0	0.02	2.50	0	0	0.91	113.75	0.08	10
Folate (µg)	250#	0	0	0	0	4.46	1.78	0	0	0.34	0.14	5.08	2.03
Vitamin C mg	45#	0.83	1.84	0	0	0	0	0	0	15.46	34.36	10.17	22.6
Vitamin E (mg)	9.0#	1.18	13.11	0	0	0.48	5.33	0	0	1.43	15.88	0.34	3.78
Pantothenic acid (mg)	4.0*	0	0	0	0	0	0	0	0	0.13	3.25	0.10	2.5
Biotin (µg)	20*	0	0	0	0	0	0	0	0	0	0	0.5	2.5

RDA: Recommended Daily Allowance; AI: Adequate Intake, # Recommended daily allowance, * Adequate Intake
µg, microgram, mg, milligram, g, gram, kJ, kilojoules

The overweight boys and girls (Figure 3.2) had slightly greater mean intakes of savoury snacks when compared to normal weight subjects. The carbonated beverage intake was higher for overweight boys, but not for overweight girls when compared to normal weight subjects. Milk intake was lower for the overweight subjects than for the normal weight subjects. None of these differences were statistically significant. Milk portions were smaller than carbonated beverage portions for all groups.

3.5 Discussion

The main findings were that the micronutrient intakes did not meet the RDA/AI for children 10-15 years of age. More girls than boys skipped breakfast and the skipping of breakfast was associated with lower nutrient intakes. The reason given by most children for skipping breakfast was not being hungry in the morning. When investigating the food consumption patterns, the low intake of fruit and vegetables is prominent. Large portions of cold drink and the frequent consumption of snacks is noted amongst all groups studied. Milk portions were small. The snacks consumed were not nutrient dense and were consumed frequently in large portions.

3.5.1 Macro and micronutrient intake

3.5.1.1 Energy

The four groups (boys and girls aged 10-13 and 14-15 years) consumed between 7072 to 7864.3 kJ per day, which is lower than the RDA (ranging between 8400 and 10500kJ per day). The lower intake is consistent with the results of the South African National Food Consumption Survey (SANFCS) done on children 1-9 years of age, where it was found that all the children consumed less than the RDA for their age groups. Children tend to underreport food intake, which may also explain the lower intakes. The study results show energy intakes lower than overseas studies in Switzerland, United States of America, Germany and Belgium

(Clavien *et al.*, 1996,; Cavadini *et al.*, 2000,; Kersting *et al.* 2001,; Matthys *et al.*, 2002).

3.5.1.2 Protein, fat and carbohydrates

The median protein intake and carbohydrate intake were above the AI for the boys and girls in the study, which is consistent with the results of the SA NFCS, children aged 1-9 years (Steyn & Labadarios, 1999:261-262). The median fat intake in our study was between 47 – 56 g per day (Table 3.1-3.2). No RDA is established for fat intake, but it is higher than the fat intake in the SA NFCS, which found 25 g per day for children 7-9 years of age (Steyn & Labadarios, 1999:264). This could be due to the age difference of the subjects. The subjects in this study had a much lower fat intake than the results from the USDA national survey where 83 g per day was reported for children of the same age group (Cavadini *et al.*, 2000).

3.5.1.3 Fibre

The results in this study showed a fibre intake below the AI for fibre for all groups, which is consistent with the results of Butriss *et al.* (2000:212) who found a daily fibre intake of 11.2 g for boys and 9.7 g for girls in the United States of America. The intakes reported in this study are similar to the intakes in the SA NFCS (Steyn & Labadarios, 1999:265), suggesting that the fibre intake does not increase with age in South African children. A higher fibre intake has been associated with a decrease in Coronary Heart Disease (CHD) risk and an increase in gastro-intestinal health (Trumbo *et al.*, 2002:1628). Therefore, a low fibre intake may increase the risk for coronary heart disease in these children later in life.

3.5.1.4 Vitamins

3.5.1.4.1 Vitamin A

The median intake in this study was below 67% of the RDA for vitamin A. According to the SAVACG report (Labadarios & Van Middelkoop, 1995), one out of three South African 1-6 year olds had marginal vitamin A status and the SA NFCS reported that over half of these children had a vitamin A intake of less than 50% of the RDA (Steyn & Labadarios, 1999:267). Older children's diets in the NWP are not meeting the RDA for vitamin A. The low intake is of concern as vitamin A deficiency can lead to xerophthalmia, night blindness and blindness (Combs, 2000:72). Foods high in vitamin A include liver, fat from milk, carrots and yellow pumpkins (Combs, 2000:71).

3.5.1.4.2 Vitamin E

The low median vitamin E intake for all the age groups is consistent with the results from the SA NFCS, which found that 25 - 82% of the children had intakes below 67% of the RDA for vitamin E (Steyn & Labadarios, 1999:269). The low vitamin E intake persisted into adolescence. Good food sources of vitamin E include sunflower oil and margarine (Combs, 2000:81).

3.5.1.4.3 Vitamin C

The median intake of vitamin C was lower than two-thirds of the RDA for all the groups. The SA NFCS (Steyn & Labadarios, 1999:234) also found intakes below two thirds in children 1-9 years of age. What is of concern is that Steyn & Labadarios (1999:234) found a median intake of 15 mg/d for 7-9 year olds, higher than the intakes in this study. Low intakes of vitamin C may lead to scurvy (Combs, 2000:103). Vitamin C intakes were not higher in adolescents than in younger children. Food sources of vitamin C include fresh fruit and vegetables, especially, citrus fruit and tomatoes (Combs, 2000:102).

3.5.1.4.4 Folate

In this study, the median intake is less than 67% of the RDA for all the children. The intakes are similar to those found in the SA NFCS (130 mg/d) (Steyn & Labadarios, 1999:276), showing folate intakes were not higher in adolescents than in younger children. Low folate intakes may lead to reduced cell division, affecting growth and megaloblastic aneamia (Combs, 2000:94-95). The USDA 1994-1996 survey as well as the National Health and Nutrition Survey (NHANES) (1999-2000) studies found higher intakes of folate among American children (Cavadini *et al.,* 2000; Briefel & Johnson 2004). Green leafy vegetables are good sources of folate (Combs, 2000:94). Since October 2004, all bread and maize have been fortified with folate (South Africa, Department of Health, 2004) and higher intakes of folate can now be expected in all children.

3.5.1.4.5 Pantothenic acid

The median intakes of pantothenic acid were below two thirds of the AI for all the children in the THUSA BANA study. Neither the SA NFCS nor the SAVACG study investigated panthotenic acid intake of children in South Africa. The low intake of pantothenic acid is of concern as it may lead to weakness, fatigue and insomnia. According to Combs (2000:98), dietary deficiencies of pantothenic acid are very rare because of its abundance in a large number of foods, suggesting that the diets of the children in this study were very limited in variety. An AI for pantothenic acid was only established in 1998 (Combs, 2000:97) for the first time and databases may be limited for pantothenic acid.

3.5.1.4.6 Biotin

Very few studies investigated the biotin quantity in children's diets. The results of this study show that the median intake was below 67% of the AI. This is of

concern as it may lead to dermatitis and glossitis. Milk and liver are food sources of biotin (Combs, 2000:100). The databases for biotin may be incomplete.

3.5.1.4.7 Other B vitamins

The children in the THUSA BANA study had median intakes above 67% of the RDA for vitamin B_{12}, thiamin, riboflavin, nicotinic acid and vitamin B_6. These results are consistent with the SA NFCS for vitamin B_{12} and thiamin (Steyn & Labadarios, 1999:242). In contrast with the results from this study, the SA NFCS found intakes below two thirds of the RDA for riboflavin, nicotinic acid and vitamin B_6. Intakes of these vitamins will be higher after October 2004, when fortification of bread and maize meal has been implemented (South Africa, Department of Health, 2004)

3.5.1.5 Minerals

3.5.1.5.1 Calcium

The median intake for all the children was below the 67% of AI for calcium. This is of concern as low calcium intakes have been linked to the development of osteoporosis later in life (Tucker, 2003:10-11). The SA NFCS found that 81 – 94% of 1-9 year old South African children had an intake of less than 50% of the RDA for calcium (Steyn & Labadarios, 1999:236). It seems that the low calcium intake of South African children during childhood continues into adolescence. When compared to overseas studies, the children in this study consumed about half or less than half of the calcium children consume overseas. Kersting *et al.* (2001:609) found intakes of 791 mg, 894 mg, 727 mg and 561 mg per day for boys aged 10-11, 13-14 years and girls 10-11 and 13-14 years of age respectively in a study in Germany. The NHANES data for 1999-2000 show intakes of 1058 mg for boys 12-18 years and 806mg for girls 12-18 years of age in the USA (Briefel & Johnson, 2004:413).

3.5.1.5.2 Iron

The iron intake was below 67% of the RDA for girls 14-15 years of age. The other children consumed amounts of iron above two thirds of the RDA. The low intake in this age group is of concern as it may lead to anaemia, especially because this is the time most girls start the menarche. According to the SAVACG report on 1-6 year old South Africans, 20% of children were anaemic (Labadarios & van Middelkoop, 1995). The SA NFCS reported more than 50% of 1-9 year old children consumed less than 67% of the RDA for iron. The children in this study had slightly higher iron intake, but it was still below the results of Kersting *et al.* (2001), who found iron intakes of 11.9-13 mg for boys 10-14 years of age and 10.2-10.5 for girls 10-14 years of age in Germany. Bread and maize meal are also now fortified with iron and higher intakes of iron can be expected (South Africa, Department of Health, 2004).

3.5.1.5.3 Magnesium

The 10 -13 year old children had intakes above 67 % of the RDA for magnesium, but the 14-15 years olds had intakes below two thirds of the RDA. The SA NFCS found adequate intakes for 1-9 year olds. It seems that in South African children, the intake of magnesium may decrease with increase in age. This is of concern as low magnesium intakes may lead to tremor and muscle spasms (Anderson, 2000:122). Good food sources of magnesium includes nuts, legumes and wholegrain cereals (Anderson, 2000:121).

3.5.1.5.4 Zinc

A median zinc intake lower than 67% of the RDA was only found in boys 14-15 years of age. The SA NFCS survey found an intake less than 67% of the RDA for zinc. A low intake of zinc may lead to delayed wound healing, alopecia and growth retardation (Anderson, 2000:134-135). Good food sources include wheat germ and meat products (Anderson, 2000:133) and all bread and maize meal are now fortified with zinc (South Africa, Department of Health, 2004).

3.5.1.5.5 Copper

The RDA for copper is 1.5 mg/d for adolescents. The intakes for all the groups were less than two thirds of the RDA. This increases the risk of these children for developing osteoporosis and soft tissue calcification (Anderson, 2000:138). Copper is found widely in foods, especially animal products excepting for milk (Anderson, 2000:137), therefore, copper deficiency will not likely be found in children.

3.5.2 Breakfast consumption

Skipping meals adversely affect dietary quality and breakfast is a commonly missed meal among teenagers (DeBate *et al.,* 2001:819). In a study in Maryland, Baltimore, Gross *et al.* (2004:424) found that urban children were more likely to skip breakfast than suburban and rural children. In this study, more children from informal settlements skipped breakfast, followed by urban children. A possible explanation is that the parents in informal settlements have less time to prepare food for breakfast as they are far from work and have to leave early, or the children are far from school and have to leave early. Another reason may be that the parents do not have the utensils to prepare breakfast or the children have not enough time to eat before leaving for school. Children from informal settlements are usually from a lower socio-economic background. O'Dea and Caputi (2001:521) found that children from a lower socio-economic background tend to skip breakfast more often. The reason most children gave is that they were not hungry in the morning, followed by no time to eat. There was also no food available in the morning in some households, probably in households with the lowest income.

In this study, slightly more girls than boys skipped breakfast (17.6% *versus* 16%). This is consistent with the results of Nicklas *et al.* (2000:314), who found that more girls than boys skipped breakfast in Louisiana. In this study it was found that older children tend to skip breakfast more often, which is consistent with the findings of Burghardt (1995:182S).

The total group of children who had breakfast had significantly lower BMI than those who skipped breakfast. Also, the breakfast eaters had lower MUAC and sum of skin folds than the children who skipped breakfast, although the differences were not significant. These results are consistent with the results of the CATCH Main Trial, which showed that overweight students (eighth graders) were more likely to omit breakfast and eat two rather than more meals a day than those who were not overweight (Dwyer *et al.*, 2001:801). Eating a nutritious breakfast may help to control body weight (Ortega *et al.*, 1996:65) due to reduced dietary fat intake and minimized impulsive snacking (Schlundt *et al.*, 1992:645).

For the boys 10-15 years of age, the MUAC and the BMI was similar for the group skipping and eating breakfast. The mean sum of skin folds for boys 10-13 years of age was not significantly bigger for the group skipping breakfast, but surprisingly not significantly smaller for the boys 14-15 years of age skipping breakfast. This could be due to the fact that children skipping breakfast often came from a low socio-economic group and had a low quality diet overall.

The girls 14-15 years of age who skipped breakfast had a lower BMI and MUAC than the girls having breakfast. This could be due to the fact that children skipping breakfast came from a lower socio-economic background and have a lower quality diet. The mean sum of skinfolds was bigger for children skipping breakfast, but the differences were not significant. The BMI and sum of skinfolds tended to be greater for the breakfast skipping group. The mean MUAC was also bigger, but the difference was not significant.

Most children skipped breakfast because they were not hungry in the morning or they had no time to eat. These reasons are consistent with other research results (Shaw, 1998:851; Reddan *et al.*, 2002:47). Skipping breakfast is associated with increased snacking and increased consumption of high fat snacks (Schlundt *et al.*, 1992:645), which may increase the incidence of overweight. This was probably not the case in this study. Almost a quarter of coloured and a quarter of black children (18% of the total group) gave the reason for not eating

breakfast as having no food available in the morning (almost a fifth of the total group). This could lead to poor nutritional status and explain the lack of difference in BMI, MUAC and sum of skinfolds between children who skipped and ate breakfast.

About five percent of subjects gave wanting to lose weight as the reason for not eating breakfast. Shaw (1998:851) reported that teenagers wanting to lose weight often skip breakfast to do so. The consumption of breakfast was, however, associated with 30% lower odds of being overweight or obese (Boutelle *et al.* 2002:531).

Children from households where the parents were professionals, working in the informal sector or where the parents were businessmen or women skipped breakfast the least. It is possible that the households with parents who are businessmen and women and professionals are households from a higher income, which means food is available. Professionals and businessmen and women usually have a good education, know the benefits of having breakfast and enforce this in their households. The children that skipped breakfast from these two groups probably did so because of a lack of time to eat before leaving for school. Children from parents in the informal sector probably had breakfast more often because the parents had time to prepare breakfast in the morning.

Children from households where the parents were doing domestic work, office workers and unknown jobs were skipping breakfast most often. Children from households where the parents are domestic workers are usually from a low socio-economic area and lack of food to eat and parents and children that have to leave early may influence breakfast consumption. Children of office workers may skip breakfast more often because of lack of time to eat.

In this study, the fat intake as well as the total protein and carbohydrate intake for the subjects skipping breakfast was lower than the subjects eating breakfast. This could be explained by some of the breakfast eaters coming from a low socio-economic background and having a poor diet quality.

In this study, the total group of children skipping breakfast, when compared to children who had breakfast, had significantly lower intakes of the following nutrients: energy, protein, fat, carbohydrate, fibre, vitamin B_6, folate, calcium, magnesium, iron, zinc, copper, thiamin, nicotinic acid and vitamin C ($p<0.05$). This is consistent with the results of Sampson *et al.* (1995:195) and Nicklas *et al.* (1993), who found significantly lower intakes of vitamin A, E, B_6, folate and calcium in children who skipped breakfast. Sampson *et al.* (1995:195) also found significantly lower intakes of iron and Nicklas *et al.* (1993) also found significantly lower intakes of magnesium, riboflavin and vitamin B_{12}. The results in this study show lower intakes for vitamin A, E, B_{12}, biotin and riboflavin in children who skipped breakfast, but these differences were not significant.

Breakfast is considered the most important meal of the day. It improves concentration, learning and school performance and prevents dietary *inadequacies (Nicklas et al., 2000:314). By eating breakfast, children will have* higher intakes of energy, fibre, vitamin C, calcium, iron, magnesium, zinc, copper, thiamin, nicotinic acid and vitamin B6. The higher intakes will lead to better nutritional status and prevent deficiencies. Eating breakfast will improve school performance and improve learning in children.

3.5.3 Frequency of foods consumed

When the frequency of food consumed by boys and girls is compared (Table 3.8), not much difference in the first six foods eaten are found. The frequency of food items consumed compares well with the results of the SA NFCS, which found maize, sugar, tea, whole milk and brown bread as the first five foods, whereas this study found sugar, whole milk, maize, white bread and brown bread as the first five foods (Steyn & Labadarios, 1999:285).

3.5.3.1 Staple foods

Maize meal is consumed more often than bread by girls and boys in the NWP, which is consistent with the results of the SA NFCS (Steyn & Labadarios, 1999:285). White rice for both boys and girls was on number 7, also a staple that is consumed frequently by the children. Enriched maize meal, however, is found on number 21 for girls and 22 for boys. Most families were not using enriched maize meal for their meals. At the time of the present study only riboflavin and niacin has been used in maize meal fortification. All maize meal in South Africa has been fortified with various vitamins and minerals since October 2004 to improve the micronutrient intake of the children. Vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc are now added to maize meal according to the Foodstuffs, Cosmetics and Disinfectants Act 54 of 1972 (South Africa, Department of Health, 2004) The fortification will improve the intakes of especially vitamin A, folic acid, iron and zinc, which were very low amongst the children in this study.

3.5.3.2 Protein foods

The first protein food was on number 9 for girls (chicken) and 11 for boys (polony). In the SA NFCS, the first protein was number 11, chicken with a similar portion size as the girls in our study (Steyn & Labadarios, 1999:285). Milk consumption is of concern as all the age groups have a median calcium intake below two thirds of the recommended calcium intake. Boys and girls had a mean milk intake of 200.9g and 183.4g respectively, while the recommendation for a growing child is to consume 500 to 750 ml milk per day (Whitney & Rolfes, 2002:39). Children from white households drank more milk than other ethnic groups. A possible reason may be that a large percentage of blacks are lactose intolerant (Segal *et al.*, 1983:901; Wittenberg & Moosa, 1990:470) and the parents of black children then consume less milk. White children may see their parents drinking milk and follow their example. Fisher *et al.* (2000:249) found that mothers' own milk intake may serve as a protective factor for adequate calcium intake in their daughters by

increasing opportunities to consume milk. The children from informal settlements consumed the smallest portions of milk. This is probably because of accessibility to milk or lack of refrigerators to keep milk fresh. Urban areas are close to the shops and milk is accessible, while in rural areas, many of the people have cows to milk and provide fresh milk.

3.5.3.3 Savoury snacks

Savoury snacks were reported frequently and the portion sizes were bigger than in the SA NFCS (Steyn & Labadarios, 1999:285). This suggests that as children get older, they tend to snack more frequently and the snack portions sizes become bigger. This can be due to pressure from their peers. The increased size and frequency of snacks may lead to obesity. Nicklas *et al.* (2003:9) found that the total gram amount of food/beverage consumed, particularly from snacks, and total gram consumption of low-quality foods were positively associated with overweight status in ten year olds. Savoury snacks are not nutrient dense, which may contribute to decreased micronutrient intake. Furthermore, savoury snacks are reported more frequently than any vegetables or fruit. It seems that children would rather choose to snack on savoury snacks than fruit, which contributes to lower intake of micronutrients.

3.5.3.4 Cold drink

Cold drink was consumed frequently. Diluted squash is found on number 23 for boys and 22 for girls, with mean portion sizes of 233.2g and 249.5g respectively. The SA NFCS found squash on number 14, but with a smaller portion size 195g (Steyn & Labadarios, 1999:285). Carbonated cold drink was consumed more often than squash, number 10, portion size of 396g and number 13, portion size of 321g respectively for boys and girls. No carbonated cold drink was reported under the first 25 foods in the SA NFCS. It seems as if carbonated cold drink intake increases when children enter adolescence. The portion size of carbonated cold drink is of concern, as it is double the portion size of milk consumed in a day. This is consistent with the results of Rajeshwari *et al.*

(2005:211) who found soft drink quantity 2.5 times the quantity of milk. Herbold and Frates (2000:306) reported that adolescents often replace milk with soft drinks because of accessibility. This seemed to be the case in the THUSA BANA study as well.

Milk intake decreased and carbonated cold drink intake increased in all groups. This leads to lower intakes of calcium, as milk is a good source of calcium. Black *et al.* (2002:675) reported that children with low calcium intakes are shorter, with smaller skeletons and have lower total body mineral content and lower bone density than children with a high calcium intake. Kalkwarf *et al.* (2003:263) found that milk intake in childhood and adolescence is associated with increased bone mass and density in adulthood and this effect was independent of current milk intake or calcium intake. Milk provides a variety of nutrients (for example. protein, phosphorus, vitamin D, zinc and magnesium) in addition to calcium, that may have positive effects on bone growth and mineralization. Their results support promotion of a diet containing one or more servings of milk per day for girls during childhood and adolescence to increase bone mass and density in adulthood and reduce the risk of osteoporotic fracture (Kalkwarf *et al.*, 2003:263).

3.5.3.5 Fruit and vegetable consumption

The first vegetable was on number 15 for both girls (tomato and onion stew) and boys (potatoes), and compares well to the results from the SA NFCS (Steyn & Labadarios, 1999:285) which found the first vegetable was reported on number 10 (potatoes). The low intake of vitamin A and folate is explained by not having an orange or green leafy vegetable under the top 25 foods. Most children reported potatoes, a starchy vegetable, which increases the starch intake and not vitamin A or folate. Not having vitamin A rich or green leafy vegetables may lead to low vitamin A and folate intake. There is only a small variety of vegetables under the top 25 foods, which compromises micronutrient intake.

As mentioned in the results section, if it is assumed that each of the subjects only consumed one fruit portion daily, exclusive of fruit juice, 20% of the boys and 25% of the girls consumed one fruit portion the previous day. If fruit juice was included and the same criteria used, 33% of the girls and boys consumed one fruit the previous day. This is lower than the results from Janssen *et al.* (2004:363-364), who found in a study in Canada that 36.3% of the boys and 41.7% of girls consumed fruit daily. Other researchers, including the SA NFCS, found a daily mean intake of about 1.5 fruits per day (Jiminez-Cruz *et al.*, 2002:76; Cavadini *et al.*, 2000; Steyn & Labadarios, 1999:285). The results of this study are in line with a study in Baja, California, which found that 79% of adolescents did not consume fruit daily (Third report on Nutrition Monitoring in the United States, as summarized by Jimenez-Cruz *et al.*, 2002:77), and with the results of the NHANES in 1999-2000, (Briefel & Johnson, 2004:401), who found that about half of the population did not consume fruit over the three day study period. When gender is compared, our findings correlate with Nyström *et al.* (2005), who found that girls consume more fruit than boys. When fruit intake is compared in the frequency of food intake for boys and girls (Table 3.7), fruit is reported to be less frequently eaten than savoury snacks, carbonated cold drink and diluted squash, which leads to the conclusion that children rather snack on savoury snacks and cold drink than fruit. The low intake of fruit may also explain the low intake of vitamin C and fibre in the study group.

3.5.4 The frequency of food consumed by overweight, normal and underweight subjects

The role of diet in the development of obesity is poorly understood. Limitations of dietary methodology make it difficult to show an association between dietary composition and the prevalence of obesity (Nicklas *et al.*, 2001:602). The normal and underweight children in this study also came mostly from a low-socio-economic background with a lower quality diet than the overweight children, who came from a higher socio-economic background with a higher diet quality (Kruger *et al.*, 2005).

3.5.4.1 Sugar

Although sugar was the food most frequently consumed, the portion size was small at 24.6g and 21.9 g for boys and girls respectively. This intake is similar to the SA NFCS, where the mean intake was 21g (Steyn & Labadarios, 1999:285). Overweight girls consumed slightly more sugar than normal weight girls, although the mean portion size for the overweight boys was lower than for the normal weight boys. According to the Food and Nutrition Board's report on Dietary Reference Intakes on Macronutrients, there is no clear and consistent association between increased intake of added sugars and BMI. A maximal intake of 25% or less of energy from added sugars is suggested, based on the decreased intake of some micronutrients in diets exceeding this level (Food and Drug Administration: 1996).

3.5.4.2 Margarine/oil

The overweight boys and total overweight group reported margarine and oil slightly more frequently, but with similar portion sizes. Similar portion sizes and frequency were also reported for oil intake for the girls and the total group. The portion sizes for oil and margarine intake were small for all groups. According to Kruger (2003:187), there was a weak correlation between dietary fat intake and BMI in children in the THUSA BANA study.

3.5.4.3 Protein

The overweight groups reported protein foods more often in the top 25 most frequently consumed foods when compared to the normal weight groups. This is consistent with the results of Nicklas *et al.* (2003:13), who reported that meat intake was positively associated with overweight status. The overweight girls reported protein foods with a higher fat content like fried eggs and boerewors and the boys reported steak fried with fat and minced beef. The overweight group

also reported bigger portion sizes of polony, cheese and chicken with skin than their normal weight peers.

3.5.4.4 Milk

The overweight subjects reported lower intakes of milk in comparison to the normal weight subjects. Milk is a major source of calcium. Zemel *et al.* (2000:1137) found that a low calcium diet favours increased adipose tissue energy storage. Rautenbach (2004:37) found that a higher calcium intake is associated with a lower BMI in adults. This same association is suggested for adolescents according to the results of this study, although there was no significant correlation between calcium intake and BMI or sum of skinfolds in this study. A possible explanation is that children do not report dietary intake as accurately as adults.

3.5.4.5 Fruit

Overweight girls and overweight boys reported fruit higher up on the list than the normal and underweight group. Increased fruit intake has been linked to lower BMI by various researchers (Nicklas *et al.*, 2003:13, Janssen *et al.*, 2004:363). In this population the overweight children may have had a better quality diet than the normal and underweight subjects, probably including more fruit than the latter. The normal and underweight subjects came from lower socio-economic circumstances.

3.5.4.6 Vegetables

The first vegetable was only reported on number 14 for overweight boys, while the other groups only reported the first vegetable on number 15. The overweight boys reported more types of vegetables than their normal and underweight peers. *The portion sizes of the vegetables are relatively small for all the groups. All the* normal weight groups as well as the overweight girls reported potato and deep

fried potato chips under the top 25 foods. The overweight boys were the only group to report a vitamin A rich vegetable under the top 25 foods. None of the groups had green leafy vegetables under the top 25 foods consumed. Low intake of vitamin A rich and green leafy vegetables is of serious concern, as the children in this study had low intakes of vitamin A and folate.

3.5.4.7 Savoury snacks

Snacking is associated with increased caloric intake and many snack foods have little nutritional value (Gahagan, 2004:13). In this study, overweight girls reported consumption of savoury snacks more frequently while overweight boys reported savoury snacks less frequently. All the overweight groups reported slightly bigger portions than their normal weight peers. This is consistent with the results of Nicklas *et al.* (2003:9) who found that the gram amount of snacks consumed was positively associated with overweight status in ten year olds. Baur and O'Connor (2004:339) found that frequent snacking was related to established obesity. Savoury snacks were reported more frequently than fruit and vegetables in all the groups except the overweight boys, suggesting that overweight and normal weight children rather chose savoury snacks than fruit and vegetables as snacks. A possible reason is that fruit and snack intake was not reported accurately.

3.5.4.8 Sweets

Sweets were not reported under the top 25 most frequently consumed foods for overweight or normal weight subjects, though Nicklas *et al.* (2003:14) found that intake of sweets was positively associated with overweight status.

3.5.4.9 Cold drink

Overweight girls and overweight boys reported carbonated cold drink more frequently than normal weight boys and girls. Overweight boys reported bigger portions than normal weight boys and overweight girls reported smaller portions

than normal weight girls. Squash intake was reported more frequently and in bigger portion sizes by the overweight girls, while the overweight boys reported it less frequently. Orange juice was under the top 25 foods for overweight girls and boys, while it was not under the top 25 foods in the normal weight group. It seems that overweight boys drank more carbonated cold drink than normal weight boys and overweight girls drank more squash than normal weight girls. More types of cold drink were reported under the top 25 foods for overweight children than for normal weight children. Several researchers (Harnack *et al.,* 1999:436; Nicklas *et al.,* 2003:13; Boumtje *et al.,* 2005:11) found that consumption of soft drinks was positively associated with overweight.

It remains difficult to see a pattern in the diet of overweight adolescents in comparison to normal weight subjects, because of the various factors influencing overweight in adolescents (Nicklas *et al.,* 2003:15).

3.5.5 The frequency of foods consumed according to strata of urbanisation

There was little difference between the first six foods reported on the list according to strata (Table 3.12). No protein food was found under the top 10 foods consumed for urban children, while chicken was found under the top 10 foods for rural and informal settlement children. For the rural areas, less processed foods are found under the top 25 foods. This is expected due to accessibility.

The first 10 reported foods differ from a study done in 1993 on Pedi children in a rural area (Steyn *et al.,* 1993:7). For the Pedi children, sugar was not found under the top 10 foods, three vegetables were under the top 10 foods and no margarine was under the top 10 foods. One protein food and one fruit were also found under the top 10 foods for Pedi children. The Pedi children consumed more vegetables than the boys and girls in this study, and it seems that in rural areas in the NWP,

vegetable intake is low among children. This could be due to accessibility, rural people being far from shops and not planting vegetables in their gardens.

3.5.5.1 Staple foods

The results show that children from rural and informal settlement areas ate maize meal as the most common starch. This is consistent with a study on children 61 months to 11 years of age in Tshikundamalema, (Venda) and Atteridgeville, that showed that maize meal was eaten frequently by rural and urban children, The urban children consumed white bread more often than maize meal, probably because of better availability of bread in urban areas. Odendaal *et al.* (1988:22) found that children in urban areas were eating a larger variety of starches. In the THUSA BANA study, the urban children reported more kinds of starches under the top 10 foods consumed when compared to rural and informal settlement areas. This is probably because of a higher availability of these foods in urban areas and a lower income in the rural areas.

3.5.5.2 Sugar

The portion sizes for sugar was higher for urban children than for informal settlement and rural children, probably due to distance from the shops and better availability in urban areas. The children in urban areas probably come from a higher income group, therefore having more money to buy sugar.

3.5.5.3 Meat and protein foods

Rural children and children from informal settlements reported more types of protein under the top 25 foods than children from urban areas, but the portion sizes were smaller. The smaller portion sizes could be due to parents buying the protein foods and making them last until they go to the shops again, while protein foods and shops are accessible to urban families. Children from informal settlements and rural areas are probably from families with a lower income, this could lead to the parents buying meat and meat products, but in small quantities

leading to smaller portions for these children. The smaller variety under the top 25 foods for urban children is in contrast with the results of Odendaal *et al.* (1988:22) who found urban Venda children consumed a larger variety of protein foods than rural children.

3.5.5.4 Milk

Slightly more urban children reported drinking milk than children from rural areas and informal settlements. In urban areas, milk is more accessible than informal settlements. Children in rural areas reported larger portion sizes than the other two strata. This is in contrast with the study on Pedi children. The Pedi children did not report milk under the top 10 foods and the portion sizes of this study were more than 7 times those of the Pedi children (Steyn *et al.,* 1993:7). Milk may be accessible in rural areas if the people have cows to milk, which may explain the larger portion sizes. Steyn *et al.* (1990:24) found that urban adolescents in the Western Cape consumed milk more often than rural children in the Western Cape.

3.5.5.5 Sunflower oil/ margarine

Sunflower oil was reported by more rural children than children in the informal settlements, but with similar small portion sizes (6.1 g and 5.7 g respectively). The intake of margarine was similar for all three strata with similar portion sizes. There was no major difference in fat intake between the three groups.

3.5.5.6 Fruit and vegetables

Fruit was only reported under the top 25 foods by urban children. This is of concern as fruit is a major source of fibre, vitamins and minerals. In the study on Pedi children in rural areas, fruit was on number 10 for 11-14 year old children (Steyn *et al.,* 1993:7). The low intake of fruit in rural and informal settlement children may be due to availability of fruit. Only one vegetable was found under the top 25 foods for each of the three strata and none of the vegetables were

vitamin A rich or green leafy vegetables. The portion sizes were also very small, which is of concern as it was found that the median intake of all the age groups was beneath 67% of the RDA for vitamin A and vitamin C (Tables 3.1-3.2).

3.5.5.7 Cold drink intake

All the groups reported carbonated cold drink very frequently with the biggest portion sizes in the urban area, followed by the rural areas. Children from rural areas reported carbonated cold drink on number 15, showing although they are living in rural areas, these items are still consumed regularly. Squash was found under the top 25 foods only in the urban group, which suggests carbonated cold drink is a more popular choice than squash. High carbonated cold drink intake may be due to the vendors selling these items, pressure from their peers to buy these items or television advertisements. It is assumed that peer influence and group conformity are important determinants in food acceptability and selection (Story *et al.*, 2002:s45). In America, the food marketing system is the second largest food advertisers and an adolescent would see about 105 min of commercial advertising in a typical week (Story *et al.*, 2002:S48). Odendaal *et al.* (1988:22) found rural Venda children did not consume carbonated cold drinks while urban Venda children consumed them daily. It seems as if carbonated cold drink are now more accessible, especially in rural areas and intake in rural areas has increased since 1988.

3.5.5.8 Savoury snacks

All three groups reported intake of savoury snacks frequently. The portion sizes were the largest for urban children, second largest for informal settlement and smallest for rural areas. The high intake in urban areas could be due to availability and for other areas due to vendors selling savoury snacks at schools. Snack food sizes are of concern as Nicklas *et al.* (2003:9) found weight gain to be positively associated with the grams of snack food consumed and may add to the obesity problem in rural, informal settlement and urban areas. Savoury snacks

are consumed by more children than fruit and vegetables, which is of concern as the total group of children had low median intakes of fibre and micronutrients (Table 3.1-3.2).

3.5.6 The frequency of foods consumed according to ethnic group

Nicklas *et al.* (2003:14) found a lack of consistency between the African American and European American groups when studied for an association between overweight and ethnicity. Their data suggests that eating patterns associated with obesity may vary by ethnicity and gender.

3.5.6.1 Staple foods

Walker *et al.* (1993:18) noted that the carbohydrates in Indian adolescents' diets are mainly rice, white bread, potatoes and sugar. The Indian children in this study reported similar intakes for starches under the top 25 foods. The black children reported the most different kinds of starches under the top 10 foods. Coloured children and Indian children reported only white, refined starches under the top 10 foods, while the black and white children mentioned brown bread on number 5 and 8 respectively. Refined starches have low fibre content and the high intake is of concern as the children had low overall fibre intakes. A high fibre intake has been associated with a decrease in CHD risk and an increase in gastro-intestinal health (Trumbo *et al.*, 2002:1628). Therefore, a low fibre intake may increase the risk for coronary heart disease or gastro-intestinal problems in these children later in life.

3.5.6.2 Sugar intake

In a study done by Steyn *et al.* (1990:24) on adolescents in the Western Cape, sugar was the food most frequently consumed by white, black and coloured children, which is consistent with the findings in this study, although the mean daily intake was quite small.

3.5.6.3 Margarine and fat intake

All the groups reported using margarine. The mean daily intake differed between 11.1 g (Indian children) and 19.9 g (white children). The coloured children reported using margarine, butter and sunflower oil in the top 25 foods, while the other three groups only reported margarine. According to Walker *et al.* (1993:18), the proportion of fat in the Indian diet is mostly from ghee and to a lesser extent from vegetable oil and margarine.

3.5.6.4 Milk intake

As discussed in 3.5.3.2 and 3.5.3.4., milk portion size is of concern in all children. Whole milk intake was third on the list for black and coloured children and second on the list for white children. Indian children reported whole milk in position one and low fat flavoured milk on position 22, combined giving a portion size of 366.5 g. For Indian children, whole milk was first on the list with a small portion size. The combined portion size of milk was bigger than for the other groups. The portion sizes for carbonated cold drink was at least 1.5 times that of milk, except for low fat flavoured milk in Indian children. All ethnic groups should be informed about the importance of milk in the diet to prevent osteoporosis and increase peak bone mass in children (Kalkwarf *et al.*, 2003:263).

3.5.6.5 Meat intake

The Indian children reported the largest variety of meat under the top 25 foods consumed, while the white children reported only two meat products under the top 25 foods. There was not much difference between portion sizes of the three

ethnic groups. Nicklas *et al.* (2003:13) found meat intake positively associated with overweight status, putting Indian children at a higher risk for being overweight.

3.5.6.6 Fruit and vegetables

Fruit and vegetable intake is of great concern in all four ethnic groups. More white children were eating fruit, followed by black and coloured children. Indian children reported fruit only on number 69, but reported fruit juice on number 9. The nutrient intake of all the children showed median fibre intake below 67% of the AI, and fruit is a major source of fibre and micronutrients. All the groups except coloured children reported four vegetables under the top 25 foods. The Coloured children reported potatoes on number 16. The only green leafy vegetable reported was mixed salad, consumed by white children, putting the children at risk for folate and other vitamin and mineral deficiencies. None of the groups reported a vitamin A rich vegetable amongst the top 25 foods, which is of concern as median vitamin A intake was below 67% for all the children.

3.5.6.7 Snacks

Savoury snacks were reported most frequently by Indian children (number 10), followed by black and white children (number 11) and then coloured children (number 15). Portion sizes for the Indian and coloured children were double those of black children and one and a half times that of white children, which may increase their risk for becoming overweight.

Diets high in added sugar have been associated with dislypidemia, dental caries, obesity, bone loss and poor diet quality (Johnson & Frary, 2001:2766S). It is of particular concern as Indian children and coloured children reported the highest sugar intake and the most frequent carbonated cold drink intake, as well as big portion sizes. Sweets also appear twice amongst the top 25 foods for these groups. Black and white children reported sugar as their most frequently

consumed food, with smaller daily intakes. Carbonated cold drink was reported less frequently than their coloured and Indian peers, but in large portion sizes. Squash also contains large amounts of sugar and adds to sugar consumption in white and black children. White children reported drinking squash more frequently and more than twice the amount of black children.

3.5.7 Snack foods

High energy dense snack foods may be of concern as they are not nutrient dense (Phillips *et al.,* 2004:470). Frequent consumption of low-nutrient dense foods was associated with higher energy intake and with lower intake of vitamin A, vitamin B_6, folate, calcium, magnesium, iron and zinc (Briefel & Johnson, 2004:421). Therefore, high nutrient dense foods may play an important role in improving the dietary quality of the children, increasing the daily micro-nutrient intake. According to Briefel and Johnson (2004:423), snacks provided about one sixth of the nutrients and one fifth of the total energy of American diets each day. This emphasizes the importance of high nutrient snacks in the diets of children and adolescents.

3.5.7.1 Energy

The hard boiled sweets, toffee sweets and the apple had similar energy content per portion, while the 'NikNaks' type savoury snack, potato crisps and commercial cookies contained almost double or more energy per portion than an apple. This high energy content may contribute to overweight in chidren.

3.5.7.2 Carbohydrate, fat and fibre

The carbohydrate content of the snacks varied between 17.28 g and 26 g per portion, comparing well with the apple, containing 22.2 g, although almost all the

carbohydrates in fudge-type sweets and hard boiled sweets were from added sugars.

The fat content of the Niknaks-type snacks and the potato crisps was 14.4 g and 12.1 g respectively, while an apple contains about 0.68 g. Boumtje *et al.* (2005:11) state that increased fat intake has the highest probability to change a school age child's weight status from normal weight to at risk of becoming overweight.

The amount of fibre in an apple is about three times that of the cookies, potato crisps and 'Niknaks'-type snacks. The sweets contain no fibre. The fibre intake in the THUSA BANA study was low. This could be because children choose chips and sweets above fruit. Fibre may reduce the risk for CHD and play a role in gastro-intestinal health (Trumbo *et al.,* 2002:1628). By choosing low-fibre snacks, children lack the benefit of fibre in their lives.

3.5.7.3 Vitamins and minerals

The snacks do not contain a variety of vitamins and minerals and contain very low quantities of the vitamins and minerals. While an apple contains low amounts of vitamins and minerals, it contains a little of all the vitamins and minerals except zinc and vitamin B_{12}. Also none of the snacks contain biotin or pantothenic acid, while these are present in an apple. The high snack intake of the children contributes to the low intake of vitamins and minerals in the children.

The normal weight boys consumed smaller portions of carbonated cold drinks than overweight boys and the same pattern was seen with squash consumption amongst the girls. Overweight girls consumed less apples than normal weight girls and the reverse was true for the boys. Overweight girls and boys consumed less milk than their normal weight peers. Rautenbach (2004:32) found that in white adult women in South Africa, a higher calcium intake was associated with a lower BMI. There was no correlation between calcium intake and overweight in this study. Overweight children consumed bigger portions of savoury snacks than

normal weight children. This is consistent with the results of Nicklas *et al.* (2003:9) who found gram amount of snacks consumed was positively associated with overweight status in ten year olds.

The relationship between snacking and overweight is not clearly understood. Nicklas *et al.* (2003) found that the consumption of sugar-sweetened beverages and sweets were associated with being overweight, while Field *et al.* (2004:1210) found that snack food did not predict weight change among children and adolescents. Whether snack foods affect the risk of being overweight or not, it is important to note the snack foods consumed in this study are low in micronutrients and contain a limited variety of vitamins and minerals. A fruit, which will contain a wide variety of micronutrients and macronutrients will be a better choice as a snack.

3.5.8 Limitations of the study

Limitations of the study include possible underreporting by the children and the use of the 24-h recall method. According to Vuckovic *et al.* (2000), dietary records are influenced by honesty, social acceptability and simplifying food intake data, perceptions of portion sizes varies according to personal preference, the role of food in the meal, the type of food, product serving size and comparison to others. Blundell and Cooling (2000:S34) reported that obese individuals also tend to underreport high fat foods selectively. Baxter *et al.* (2002:392) specifically examined the accuracy of children in a 24-h recall questionnaire. They found that the accuracy was inconsistent from one recall to another and the results compared poorly with observation of meals. Underreporting may also have occured due to a combination of forgetfulness and lack of compliance among adolescents, as they are quickly bored or irritated by food intake assessment methods (Livingstone & Robson, 2000:289).

The benefit of the 24-h recall method is the speed and ease with which it can be administrated and that literacy of the respondent is not required (Nelson &

Bingham, 1997). It is well known that subjects with lower observed intakes tend to over-report and subjects with higher intakes tend to underreport their past dietary intake (Madden *et al.*, 1976). Therefore, in cases where data on the variation in dietary intake within and between individuals are required, the 24-h recall needs to be repeated, preferably on non-consecutive days (Thompson & Byers, 1994). In the THUSA BANA study, only one 24-h recall was done, which is a limitation. Two separate steps were taken to control the reliability or reproducibility and validity of the dietary intake data. a) A duplicate 24-h recall was done on 289 of the children already taken up in the sample and reported in a separate study (Ngwenya, 2002). b) Statistically significant correlations were found between the mean energy and nutrient intake of 15 nutrients by the children on the two occasions that measurements were taken. Only two nutrients, vitamin B_{12} and folate, significant correlations between the measurements on two occasions were not found (Kruger, 2003:145-146).

3.5.9 Summary

Nutrient intake

Overall the diets of children 10-15 years of age were deficient in various micronutrients. The RDA/AI's were not met for vitamin A, C, E, folate, pantothenic acid, biotin, calcium, magnesium, zinc and copper. The intake of fibre is low for these children.

Breakfast consumption

Girls and children from informal settlements skipped breakfast more often than those from other strata. When investigating all the children, a significantly lower BMI was found for the children having breakfast when compared to those who were skipping breakfast. No significant differences for the different age groups and BMI, MUAC and sum of skin folds were found. The reason given the most for skipping breakfast was not being hungry in the morning, but when the nutritional status and the socio-economic background of these children were investigated, food availability may also have played a role. The skipping of breakfast was associated with a lower diet quality.

Different foods consumed

When investigating the different foods eaten by the subjects in the survey, the low intake of fruit and vegetables and high intake of snacks are apparent, which may partly explain the low fibre intake and low micronutrient intake. Snacks were reported more frequently than any fruit or vegetables in the study. Small milk portions were consumed by the children and big portions of cold drink were reported frequently. This suggests that cold drink is replacing milk in the diets of 10-15 year old children in the NWP. The overweight children consumed smaller portions of milk, although we found no correlation between calcium intake and BMI in this study. The overweight boys consumed more carbonated cold drink and the overweight girls consumed more squash than their leaner peers, showing that cold drink intake may be positively related to overweight in this study. It remains difficult to see a consistent pattern for overweight and normal weight children, possible due to inaccurate reporting of dietary intakes.

Snack foods

The snacks consumed by the children were not nutrient dense and can be classified as empty calories. The snacks were also consumed regularly. The high intake of snacks plays a role in the low micronutrient intake and fibre intake. The importance of high nutrient dense snacks needs to be emphasized in both the children and their parents.

3.6 Conclusion

The diets of 10-15 year old children in the NWP do not meet the RDA/AI for their age. Low fruit, vegetables and milk intakes and high intakes of cold drink and snacks are of particular concern in the children in the NWP.

3.7 Recommendations

The following recommendations can be made:

- The importance of a balanced diet and consumption of a variety of foods to improve micronutrient intake should be emphasized to both parents and children.
- Nutrition education for both parents and children with the emphasis on high fibre foods is important to prevent gastro-intestinal disease.
- Fruit and vegetable consumption should increase. Emphasis should be on the consumption of green leafy vegetables and orange or red vegetables every day and the consumption of fruit instead of other snacks between meals.
- Dairy consumption should be encouraged to improve calcium intake. Low fat or fat free dairy products should be used if no energy increase is wanted.
- Cold drink consumption should be discouraged and used only in small quantities.
- Snacks should be nutrient dense and low nutrient dense snacks like crisps and biscuits should be discouraged or used in small quantities.

Chapter 4

4.1 Summary

Current national nutrition surveillance data suggest that the diets of teenagers in the United States (US) is putting them at risk for cardiovascular disease, cancer and osteoporosis, based on their intakes of saturated fat, total fat, fruits, vegetables, fibre, sodium, calcium-containing foods and soft drinks (Lytle, 2002:S8). In the Birth to Ten Study, it was found that the nutrient intake of children appeared to deteriorate from 1995 to 2000 in South African children (MacKeown *et al.*, 2003:185). Overall, the diets of children 10-15 years of age were deficient in various micronutrients. The RDA/AI's are not met for vitamin A, C, E, folate, pantothenic acid, biotin, calcium, magnesium, zinc and copper. This puts them at increased risk for developing deficiencies of these micronutrients or osteoporosis later in life (Tucker, 2003). The intake of fibre was low for these children, increasing their risk for cardiovascular disease (CVD) (Trumbo *et al.*, 2002).

International studies on breakfast consumption showed that individuals who consumed breakfast had more adequate micronutrient intakes and better diet quality than those who did not (Sampson *et al.*, 1995; Nicklas *et al.*, 1998). Overseas studies also found that eating a nutritious breakfast may help control body weight (Ortega *et al.*, 1996) due to a reduced dietary fat intake and minimized impulsive snacking (Schlundt *et al.*, 1992). In this study it was found that girls skipped breakfast more often and children from informal settlements skipped breakfast more often than those from other strata. When looking at all the children, a significantly lower BMI was found for the children having breakfast when compared to those who were skipping breakfast. No significant differences for the different age groups and BMI, MUAC and sum of skin folds were found. The reason given the most for skipping breakfast was not being hungry in the morning, but when looking at the nutritional status and the socio-economic background for these children, food availability may have played a role. The

skipping of breakfast was associated with a lower diet quality, as was found in the literature.

In overseas studies, Morton and Guthrie (1999) reported that the amount of fat from snacks in US children's diets increased, as well as soft drink intake, together with a decrease in milk intake. Wolfe and Campbell (1993) found that 70% of 2-19 year olds did not meet the recommendations for fruits, grains, meats and dairy products, while 64% did not meet the requirements for vegetables. When looking at the different foods eaten by the subjects in this study, the low intake of fruit and vegetables and high intake of snacks are apparent, which may partly explain the low fibre intake and low micronutrient intake. Snacks were reported more frequently than any fruit or vegetables in the study. Small milk portions are consumed by the children and big portions of cold drink are reported frequently. This suggests that cold drink is replacing milk in the diets of 10-15 year old children in the NWP. The overweight children consumed smaller portions of milk, although no correlation between calcium intake and BMI was found in this study. The overweight boys consumed more carbonated cold drink and the overweight girls consumed more squash than their leaner peers, showing that cold drink intake may be positively related to overweight in this study. It remains difficult to see a consistent pattern for overweight and normal weight children, possibly due to inaccurate reporting of dietary intakes.

The low diet quality and low intake of various micro-nutrients is of major concern. Cross *et al.* (1994) found that up to 75% of children in the US consumed snacks daily. Snack intake can play a major role in adding micro-nutrients and fibre to the diet. The snacks consumed by the children in this study were not nutrient dense and can be classified as empty calories. The snacks were consumed regularly. The high intake of snacks may play a role in the low micronutrient intake and fibre intake found in the study. The importance of high nutrient dense snacks needs to be emphasized to both the children and their parents.

4.2 Conclusion

In conclusion, the hypothesis for this research is accepted, as the eating habits of the children in the North West Province (NWP) were not adequate to provide in their nutritional needs.

The secondary goals of the study were to:

1. Compare the intake of nutrients from food by children in the NWP with their nutritional needs.

   The diets of the 10-15 year olds in the NWP are overall inadequate with regards to fibre and several vitamins and minerals. The low intakes are of concern as these nutrients are needed for the growth spurt and low intakes may lead to deficiencies or chronic diseases later in their lives. Calcium intake is of special concern.

2. Investigate the breakfast patterns of the children in the NWP, and determine the reasons for breakfast skipping and how it influences nutritional status and nutrient intake.

   Most children in the NWP ate breakfast in the morning and only a small proportion of children (16.8%) skipped breakfast in the morning. The reason given most for skipping breakfast is not being hungry or not having time to eat. The importance of breakfast must be emphasized to all children and households. Children who skipped breakfast had lower intakes of fibre, vitamin E, vitamin B6, folate, calcium, vitamin C and biotin. The whole group had low intakes of these nutrients, which emphasizes the importance of breakfast to increase the intakes of these nutrients.

3. Determine types of food most frequently eaten.

When looking at the food choices of the children, it is of concern that most children reported savoury snacks more often then having fruit and vegetables. This leads to lower intakes of fibre and various vitamins and minerals. The use of enriched maize meal should also be encouraged to increase micronutrient intake. Most children consumed milk, but the portion sizes were much smaller than portion sizes for cold drinks. The importance of milk and calcium intake must be emphasized to the children and their parents.

4. Assess the difference between the foods eaten by normal weight and overweight children.

There are no clear differences between the food choices of the overweight and normal weight children in the NWP. The overweight boys and girls had slightly smaller milk portions, but the weight difference did not correlate with calcium intake. Overweight boys consumed carbonated cold drink more regularly with bigger portion sizes than normal weight boys and the same was true for overweight girls and squash consumption. Cold drink intake may influence weight status, but more research is necessary in this area.

5. Assess the influence of transition on the food intake of children.

Urban subjects reported more kinds of starches, confirming a more varied diet than rural and informal settlement children. Surprisingly the children from rural areas and informal settlements reported more different kinds of proteins, but in smaller portions than urban children. Urban children consumed more milk and were eating fruit more regularly than children from informal settlements and rural areas. Cold drinks and savoury snacks were consumed regularly, independent of being from rural, urban or informal settlement area.

6. Compare the eating habits of children from different races.

Coloured and Indian children reported more refined starches than white and black children. White children were drinking more milk, probably because of availability and coloured and black children were drinking the least milk. White children also were eating more fruit than the other races and Indian children consumed very little fruit. Also there was no folate-rich or Vitamin A rich vegetable amongst the top 25 foods in any of the races. Indian and coloured children consumed bigger portions of sugar, but black and white children consumed bigger portions of cold drink, increasing their sugar intake. Cold drink and big portions of savoury snacks were consumed in all the groups.

7. Assess snack intake and the influence of snacks on micronutrient intake and nutritional status.

The snack foods that the children consumed were not nutrients dense and can be regarded as empty calories. It seems as if snacks are consumed in the place of fruit and vegetables and do not contribute to micronutrient intake as fruit and vegetables would have. The high snack intake on low nutrient density snacks like savoury snacks, decreases the micronutrient intake of the children and increases the risk for these children to develop micronutrient deficiencies. Snacks like fruit and vegetables and milk or yogurt should be promoted.

4.3 Recommendations

1. The importance of a healthy diet and consuming a variety of foods to ensure adequate micronutrient intakes must be emphasised to the children and their parents by health workers and teachers.
2. Nutrition education for both parents and children with the emphasis on high fibre foods is important to prevent gastrointestinal disease.
3. The importance of breakfast must be conveyed to children and their parents. Quick breakfasts like a ready to eat cereal or brown bread with peanut butter is a quick way of having breakfast and should be promoted.

Ready to eat cereals are usually fortified with vitamins and minerals, which will increase the micronutrient intake. In low socio-economic areas, where the availability of food to eat in the morning is a problem, schools can consider providing breakfast for the children.

4. Fruit and vegetable intake must be promoted. Fruits can be sold as snacks at school tuck-shops or by the vendors in order to increase availability to the children. Parents should be educated on the importance of fruit and vegetables and micronutrients in order to provide their children with fruit and vegetables. Vegetable gardens are a good way of increasing the availability of vegetables in rural and informal settlement areas.
5. Milk consumption should be encouraged. Vendors and school tuck shops can sell milk and yogurt or other milk products instead of carbonated cold drinks to increase availability to the children. Children should be educated about the importance of milk consumption and encouraged to consume 2-3 portions every day. Low fat or fat free dairy products should be used if no energy increase is wanted.
6. The snacks consumed by children should be nutrient dense to improve the micro-nutrient intake of children. Low nutrient dense snacks like crisps and biscuits should be discouraged or used in small quantities and children should be encouraged to rather snack on fruit, vegetables, milk, yoghurt or ready to eat cereals.
7. More research is necessary in the area of overweight and eating habits with different methods of collecting dietary intake data that will give a more accurate reflection of the eating habits and activity levels of children.

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Addenda

Addendum A: Informed Consent Form

Addendum B: Demographic Questionnaire

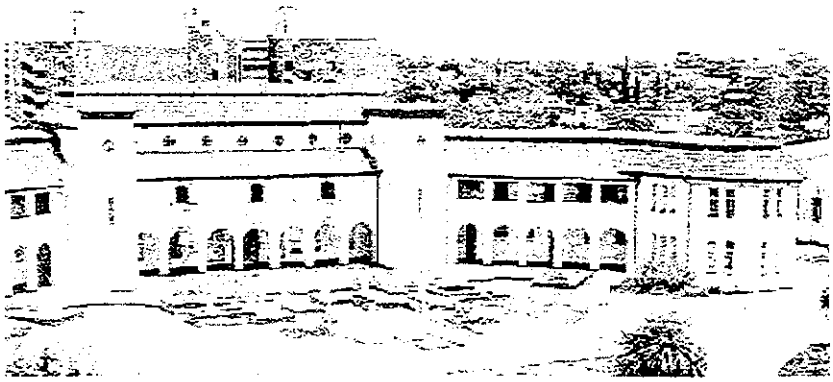
Addendum C: 24-h Recall

Addendum D: Eating Habits Questionnaire

Addendum E: BMI Charts

THUSA BANA PROJECT

INFORMATION



PU FOR CHE

[1]SCHOOL OF PHYSIOLOGY, NUTRITION AND FAMILY ECOLOGY
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PROF. HH VORSTER (DIRECTOR)[1]
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Potchefstroomse Universiteit
vir Christelike Hoër Onderwys

THUSA BANA PROJECT: INFORMATION ON THE STUDY

THE PRPOJECT HAS BEEN APPROVED BY THE ETHICS COMMITTEE OF THE PU FOR CHE. ETHICS COMMITTEE NUMBER (00M10)

I CONFIRM THAT:

It has been explained to me, that:

1. The purpose of the research study is to collect information on the problem of overweight and obesity among schoolchildren aged 10-15 years in the North West Province of South Africa.
2. I have been told that the researchers will obtain anthropometric variables of a random sample of children aged 10-15 years
3. The participant will be weighed and his/her height as well as circumferences and skinfolds of his/her arm will be measured without causing any pain to the child. For those measurements boys and girls in separate groups will be asked to undress in privacy of a class-room, because some measurements must be taken with the children dressed in underwear only. The different age groups will be measured separately. The researchers and fieldworkers will work in a professional way, not to embarrass the children.
4. Appropriate methodology to classify overweight and obesity in these age groups will be developed
5. The prevalence of obesity in children in the North West Province will be determined
6. The anthropometry of the different ethnic groups will be compared
7. The relationship between body mass index and adiposity in stunted children (low-height-for-age) will be determined
8. The role of dietary practices in the development of overweight and obesity will be determined
9. The role of physical activity levels and patterns in the development of obesity
10. Influences of ethnicity and urbanisation on the causative factors of overweight and obesity will be determined
11. Perceptions regarding overweight and obesity in these age groups will be measured
12. The general health status of obese children with controls, regarding absence from school due to illness will be compared
13. Guidelines for appropriate, culture sensitive, practical and sustainable intervention programmes for these age groups will be developed
14. I have also been told that this research is being done for the benefit of the children, and that 1200 children will take part in this study
15. It was also explained to me that the information I will give shall be kept confidential, but that it will be used anonymously for making known the findings to other scientist
16. It was also clearly explained to me that I can refuse to participate in this research study or I can stop answering the questions at any time during the interview

The information in this consent form was explained to me by_____(name of interviewer) in_____(language) and I confirm that I have a good command in this language and understood the explanations, OR it was translated to me by_____(Name of translator) in my language_____. I was also given the opportunity to ask questions on things I did not understand clearly.

I the participant (child) hereby agree voluntarily to take part in this research survey.

Signed/confirmed at_____on_____2000

Witness_____

Participant's/representative of participant (parent)_____

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1 Subject number			
2 Date	D	M	Y
3 Place and region			
Interviewer			
Home address			

4 Stratum of urbanisation:	Rural *	1
	Informal town	2
(Classify stratum of urbanisation)	Urban	3

*Rural = tribal land, farm schools; informal town = corrugated iron house; urban = formal town/city

5 Gender	Male	1
	Female	2
6 Age		
Date of birth (for control purposes, do not code)	D M Y	
7 First Language	Setswana	1
	Afrikaans	2
	English	3
	Xhosa	4
	Zulu	5
	Other:	6
8 Second Language	Setswana	1
	Afrikaans	2
	English	3
	Xhosa	4
	Zulu	5
	Other:	6
9 Do you receive treatment for any chronic disease?	Yes	1
	No	2
10 If yes - what disease?		
11 Girls only: Have you started menstruating (seeing periods) yet?	Yes 1	No 2
If yes, at what age (year)?		

12 Do you take snuff?	Yes	1
	No	2
13 Do you smoke?	Yes	1
	No	2
14 If no – have you smoked regularly before?	Yes	1
	No	2
15 If yes – what do you smoke?	Cigarettes	1
	Tobacco/pipe	2
	Other:	3

If other – describe

16 How much do you smoke?	per day	
	per week	
17 For how long have you been smoking (years)		
18 Calculate pack years		

19 In which grade are you this year?	Grade 1-3	1
	Grade 4	2
	Grade 5	3
	Grade 6	4
	Grade 7	5
	Grade 8	6
	Grade 9	7

20 Does any member of your household have the Right to use any property (house/flat/room) as his/her own?	Yes	1
	No	2

21 What type of property?	

22 Please name the members of your household

Member	Age	Education (grade passed)	Present job

23 Who is the breadwinner in your home?		
24 Does he/she have a job at the moment?	Yes	1
	No	2

25 If yes – what kind of job?	Doctor/nurse/teacher/professional	1
	Business/taxi/self employed formal	2
	Typist/assistant/office work	3
	Domestic worker/garden/contract	4
	Hawker/car washer/informal sector	5

26 On which days of the week does he/she work?	Irregular (piece work)	1
	Part time (1-4 days/week)	2
	Full time (5-6 days/week)	3

27 Does someone in your household receive any additional pensions?	Yes	1
	No	2

28 What type of house do you live in?	Traditional hut	1
	Mokuku	2
	Brick house	3
	Other	4
Specify other		

29 Do you share a toilet with other households?	Yes	1
	No	2

30 What type of toilet do you have?	None	1
	Communal	2
	Bucket system	3
	Outside pit toilet	4
	Outside chemical	5
	Outside water flush	6
	Inside water flush	7

31 Where do you get your drinking water from?	Fountain, river	1
	Communal tap	2
	Tap on premises	3
	Tap in house	4
	Other	5
If other specify		

32 Do you have access to electricity inside your house?	Yes	1
	No	2

33 What type of stove do you have?	None	1
	Coal/wood	2
	Gas or parrafin	3
	Electric	4

34 What type of fridge do you have?	None	1
	Parraffin	2
	Gas	3
	Electric	4

35 Do you watch television every week?	Yes	1
	No	2

36 Do you listen to the radio every week?	Yes	1
	No	2

37 Do you have a computer in your home?	Yes	1
	No	2
38 If yes, do you play/work on the computer on most days?	Yes	1
	No	2
39 If yes, how many hours do you play/work on the computer on most days?	.....hour	

40 Does your school week include a physical activity/training period ?	Yes	1
	No	2

24-HOUR RECALL

Subject number: _____ Interviewer: _____

School: _____ Date: ___/ ____/ 200___

Tick what the day was yesterday:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

I want to find out about everything you ate or drank yesterday, including water or food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method	Amount	Amount in g (office use only)	Code (office use only)
From waking up to going to school, or starting day's activities					
During the morning at school or at home					

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method	Amount	Amount in g (office use only)	Code (office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					
After dinner, before going to sleep					
Do you take any vitamins (tablets or syrup)?			Yes	1	No 2
Give the brand name and dose of the vitamin/tonic:					

EATING HABITS OF 10-15 YEAR OLD SCHOOL CHILDREN IN THE NORTH WEST PROVINCE

1	Subject number										1-4
2	Date										5-10
3	How many meals (sitting down at a table) do you eat on most days?										11
4	Do you eat before you go to school?						Always		1		
							Most days		2		
							Weekdays		3		
							Seldom		4		
							Never		5		12
5	If you do not eat breakfast, why?	5.1	Do not have time to eat								13
		5.2	Mother does not have time to cook								14
		5.3	No food available								15
		5.4	I want to lose weight								16
		5.5	I feel stressed/ in a hurry								17
		5.6	Other								18
				7d	4-6d	1-3d		Never			
				3	2	1		0			
6	If yes, what do you eat?	6.1	Ready-to-eat cereal								19
		6.2	Cooked porridge								20
		6.3	Milk with cereal/porr.								21
		6.4	Sugar with cereal/por								22
		6.5	White bread/toast								23
		6.6	Brown bread/toast								24
		6.7	Egg/ protein food								25
		6.8	Fruit/fruit juice								26
		6.9	Other:								27
											28
											29
											30
7	Is there a school feeding scheme at your school?					Y	1	N	2		31
8	If yes, which food items do you receive?			5d	4d	3d		1-2d		0	
				5	4	3		2		1	
			8.1 Cool drink								32
			8.2 Peanut-butter bread								33
			8.3 Vitamin biscuit								34
			8.4 Porridge (Morvite)								35
			8.5 Soup								36
			8.6 Other:								37
9	Do you take a lunch-box to school?					Y	1	N	2		38
10	If yes, which foods do you take?		10.1 Brown bread sandwiches								39
			10.2 White bread sandwiches								40
			10.3 Fresh fruit/juice								41
			10.4 Cold drink/squash								42
			10.5 Sweets								43
			10.6 Crisps								44
			10.7 Porridge								45
			10.8 Other								46
10	Do you buy food at/after school? (tuck shop or hawkers)					Y	1	N	2		47

11	If yes, what do you buy?	11.1 Crisps	Y	1	N	2	48
		11.2 Sweets					49
		11.3 Cold drink					50
		11.4 Ice lollies					51
		11.5 Ice cream					52
		11.6 Meat pie					53
		11.7 Bread/sandwich					54
		11.8 Vetkoek					55
		11.0 Other					56
12	Do you sit down to a meal after school (lunch)?		Y	1	N	2	57
13	Do you eat between meals in the afternoon?		Y	1	N	2	58
14	If yes, what do you eat as a snack?	14.1 Crisps					59
		14.2 Sweets					60
		14.3 Cold drink					61
		14.4 Ice lollies					62
		14.5 Ice cream					63
		14.6 Tea/coffee					64
		14.7 Bread/sandwiches					65
		14.8 Milk					66
		14.9 Fresh or dried fruit					67
		14.10 Other					68
15	Do you sit down to a meal in the evening?		Y	1	N	2	69
16	Do you eat a late night snack?		Y	1	N	2	70
17	Do you eat/drink while watching TV?		Y	1	N	2	71
18	Name your most favourite food item	18.1 pizza					
		18.2 ice-cream					78
		18.3 hamburgers					79
		18.4 crisps					80
		18.5 chocolate					81
		18.6 french fries					82
		18.7 other					83
19	Name the food item that you dislike most?	20.1 pumpkin					84
		20.2 peas					85
		20.3 milk					86
		20.4 grean beans					87
		20.5 pasta					88
		20.6 broccoli					89
		20.7 cabbage					90
		20.8 other					91
20	Do you follow a special diet for health reasons?	Y	1	N	2		92
21	If yes, what kind of diet?	21.1 allergies					93
		12.2 diabetes					94
		12.3 other					95
22	Do you follow a special diet for cultural reasons?	Y	1	N	2		96
23	If yes, what kind of diet?	24.1 Moslem diet					97
		24.2 Hindu diet					98
		24.3 other					99
24	Do you follow a diet to lose weight?	Y	1	N	2		100

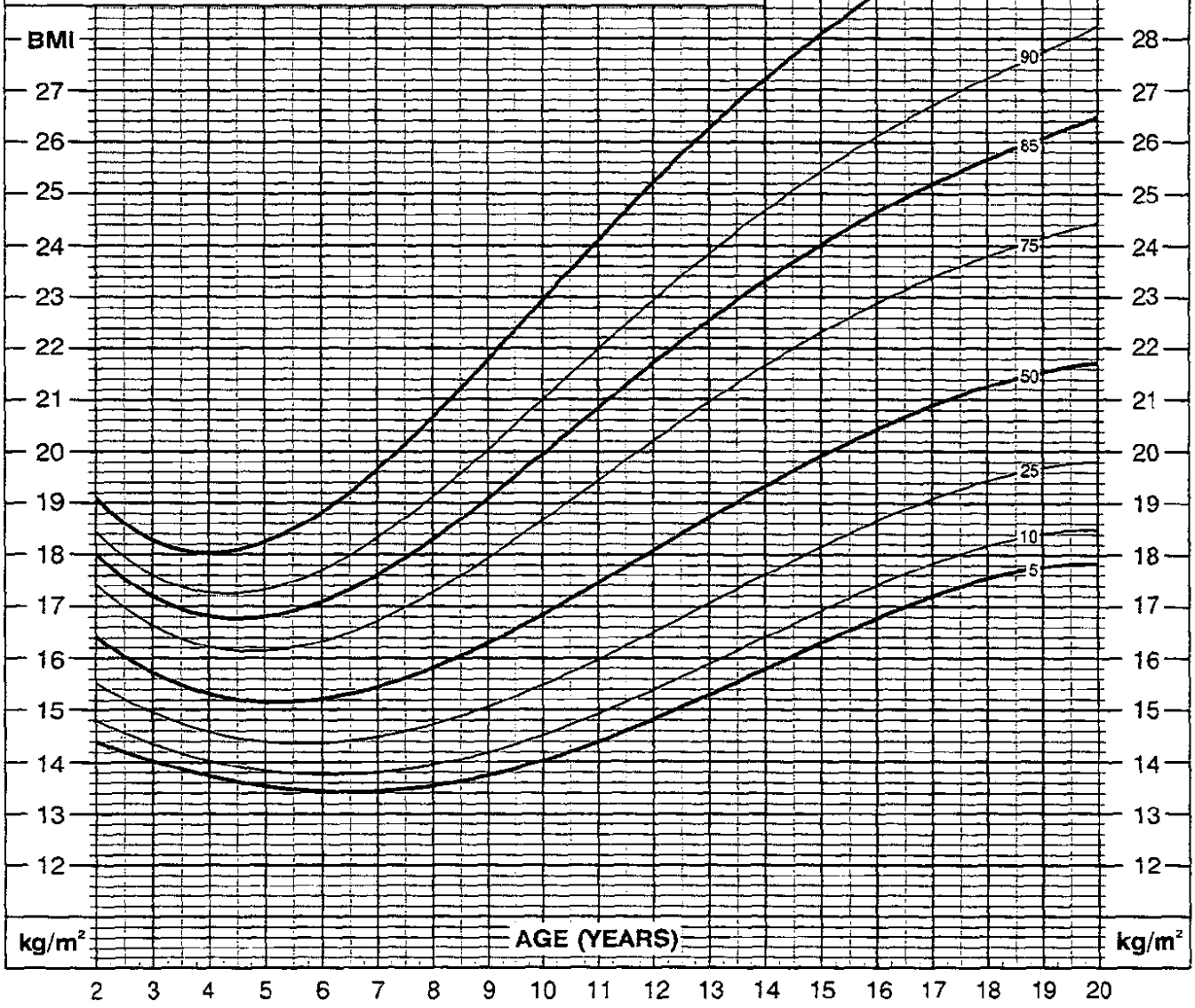
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



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SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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