COMPARISON OF THE 24-HOUR DIETARY RECALL AND THE THREE-DAY ESTIMATED WEIGHT RECORD FOR DETERMINING THE NUTRIENT INTAKE OF CHILDREN

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This Mini-dissertation is dedicated to my beloved husband and son

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ABSTRACT

Objective: This study examined the comparison of the 24-hour recall and three-day record for assessing the macro- and micronutrient intakes of school children aged 10 to 15 years in the Mmabatho location.

Design: The study formed part of the larger study of the THUSABANA, which was designed to assess the prevalence and determinants of overweight and obesity among children aged 10 to 15 years. This was a cross-sectional study of a random sample of schools selected from the list of schools in the Northwest province in South Africa.

Subjects/setting: A sub-sample of 40 school children, girls and boys residing in the Mmabatho location were included. The dietary intake was obtained using the 24-hour recall and three-day estimated weight record methods. Trained field workers interviewed the subjects with the 24-hour recall technique. Food models and picture books were used to quantify the food intake. The same subjects who completed the 24-hour recall also completed the three-day dietary record.

Statistical analysis: All data were computerised and the paired t-test was used to compare between the 24-hour recall and the three-day estimated weight record method.

Results: The findings indicated that there was no significantly difference between the 24-hour recall and three-day estimated weight record method for energy, protein, carbohydrates and 6 micronutrients. However, the overall results of this study showed that the third day of the estimated weight record had the best resemblance to the 24-hour dietary recall method. The findings further indicated that there were significantly higher reported intakes of total fat, fibre and five micronutrients and significantly lower intake of ascorbic acid, and vitamin E using the three-day estimated weight record.

Conclusions: The research question whether the 24-hour recall and the three-day estimated weight record were significantly different has been answered. The study found no significant difference between the two methods. The contribution of this mini-dissertation is that the two methods are equally important but the 24-hour recall should be widely promoted because it is suitable, user friendly, culture sensitive and cost-effective in assessing the dietary intakes of the school children in epidemiological studies.

OPSOMMING

Doelstelling: Hierdie studie het die vergelyking tussen die 24-uur-herroepmetode en drie-dag-geskatte-gewig rekordmetode vir die bepaling van die makro- en mikronutriëntinnames van 10- tot 15-jarige skoolkinders in Mmabatho-gebied bestudeer.

Ontwerp: Die studie het deel gevorm van 'n groter studie genaamd THUSABANA, wat ontwerp was om die voorkoms en determinante van oorgewig en vetsug onder kinders 10 tot 15 jaar te bepaal. Dit was 'n dwarssnitstudie van 'n ewekansige monster van skole gekies uit die lys van skole in die Noordwes Provinsie in Suid-Afrika.

Proefpersone/plek: 'n Ewekansige sub-monster bestaande uit 40 skoolkinders wat in die Mmabatho omgewing bly, is ingesluit. Die dieetinnames is verkry deur gebruik te maak van die 24-uur-herroepmetode en die drie-dag-geskatte-gewig rekordmetode. Opgeleide veldwerkers het onderhoude gevoer met die proefpersone deur die 24-uur-herroepmetode te gebruik. Voedselmodelle en fotoboeke is gebruik om voedselinname te kwantifiseer. Dieselfde proefpersone wat die 24-uur-herroepmetode voltooi het, het ook die drie-dag-geskatte-gewig rekordmetode voltooi.

Statistiese ontleding: Alle data is gerekenariseer en die gepaarde t-toets is gebruik om die 24-uur-herroepmetode en die drie-dag-geskatte-gewig rekordmetode te vergelyk.

Resultate: Die resultate het getoon dat daar geen betekenisvolle verskil tussen die 24-uur-herroepmetode en drie-dag-geskatte-gewig rekordmetode vir energie, vet, proteïen, koolhidrate en ses mikronutriënte was nie. Die oorkoepelende resultate het egter getoon dat die derde dag van die geskatte-gewig rekordmetode die beste met die 24-uur herroepmetode ooreengestem het. Die resultate het verder aangetoon dat daar

betekenisvolle hoër innames van vesel en vyf mikronutriënte en betekenisvolle laer inname van askorbiensuur en vitamien E met die drie-dag-geskatte-gewig rekord was.

Gevolgtrekkings: Die navorsingsvraag of die 24-uur-herroepmetode en die drie-dag-geskatte-gewig rekord betekenisvol verskil is beantwoord. Geen betekenisvolle verskil tussen die twee metodes is gevind vir energie en die makronutriënte nie. Die bydrae van hierdie skripsie is dat die twee metodes ewe belangrik is, maar dat die 24-uur-herroep-metode wyd bevorder behoort te word omdat dit geskik, gebruikersvriendelik, kultuursensitief en koste-effektief is in die bepaling van dieetinnames van skoolkinders in epidemiologiese studies.

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LIST OF ABBREVIATIONS

CHE	Christian Higher Education
FAO	Food and Agricultural Organisation
FFQ	Food Frequency Questionnaire
FGP	Food Guide Pyramid
IVACG	International Vitamin A Consultative Group
PSMA	Portion Size Measurement Aids
SAVACG	South African Vitamin A Consultative Group
THUSA	Transition and Health during Urbanisation of South Africans
RDA	Recommended Dietary Allowance
AI's	Adequate Intakes

CHAPTER 1

PROBLEM STATEMENT AND AIM OF THE STUDY

1.1 Introduction

Improving the nutritional status of the population should be the goal of all countries because nutritional problems continue to be the basic cause of many diseases that impede progress towards universal good health. Both illnesses resulting from chronic undernutrition in developing countries and diseases of affluence in developed countries are nutritionally related. Countries need to identify the worst food security and nutritional problems in their populations and assign priorities for solving them. The problems may be deficiencies in macronutrients, micronutrients or both (Kigutha, 1997).

Assessing the dietary intake of children is also important because many of the diet-associated chronic diseases of adulthood begin in childhood. Other reasons for assessing children's dietary intake include nutrition monitoring and assessment of the effects of nutrition education programmes. Studies often require information about children's dietary intake. However, validated methods for assessing children's diets are needed (Baxter, 2000) to ensure quality data in order to draw conclusion that are valid.

Interviewers typically use probing questions when collecting dietary information from children. However, probing children could decrease the accuracy of children's self report of diet (Baxter, 2000). Twenty-four hour recalls are commonly used to collect information about children's intake, but most published studies failed to identify the prompts used by the interviewers to assist children (Baxter, 2000).

This study formed part of the multidisciplinary project called THUSABANA in the North West Province. THUSABANA is a Tswana word meaning "help the children". The THUSABANA study was a long-term study which aimed at obtaining baseline data from 1336 children and appropriate interventions were to be implemented. Children aged 10-15 years of both genders were randomly selected.

1.2 Problem statement

Steyn *et al.* (1989) found that urban and rural black children aged 11 years had energy and macronutrient intakes far below what is available as indicated by food balance sheet data. In a review of the literature on the nutritional status of South Africans Vorster, *et al.* (1997) also found that there was high prevalence of micronutrient deficiencies across all age groups. The findings of the South African Vitamin A Consultative Group (SAVACG) study indicated that 33.3 % of South African children had a marginal vitamin A status and thus identified South Africa as having a serious public health problem of vitamin A deficiency. The most disadvantaged were the children in the 12-17 months age group, those living in informal type housing and whose mothers were poorly educated (SAVACG, 1995).

The World Health Organisation's study group on diet, nutrition and prevention of chronic disease has recommended that individual countries should develop an appropriate policy to promote good nutrition and create a basis for monitoring progress toward nutrition goals.

Dissemination of state-of-the-art dietary assessment methods is especially critical in both developed and developing countries with rising rates of various chronic diseases. This activity provides opportunities to discuss the advantages and limitations of available methods and addresses issues in specific countries and cultures (Kigutha, 1997).

Dietary intake assessment remains crucial in assessing the nutritional status of children, because it assists in the monitoring of the nutritional state of the children, and in the application of proper intervention for improving nutritional status. Children need food rich in energy and nutrients. Poor dietary intake will prevent children from achieving their full genetic potential. Severe malnutrition can cause early death, permanent disability and increased susceptibility to life-threatening illness (FAO, 2000). Therefore, there is a need to determine a suitable dietary intake method that is easy and convenient to use in children's studies.

According to Vorster *et al.* (1997), the 24-hour recall method tends to measure lower intakes than the diet history and food frequency questionnaire. However, the 24-hour recall method has several advantages. It is suitable for use in populations with low literacy levels and is relatively quick to perform. Large samples can, therefore, be assessed. It describes the average intake of a group of subjects, and was the most suitable method for the THUSABANA study.

However, it was necessary to compare the results obtained with the 24-hour recall method with nutrient intakes from diet records, which are regarded as the ideal measure of intake (MacIntyre, 1998).

1.3 Aim

The aim of this study was to compare the energy and nutrient intake as determined by a 24-hour recall method and a three-day estimated weight record method in a study of 10-15 year old children.

1.4 Hypothesis

The following hypothesis has been formulated for this study:

There is no significant difference between the total energy and nutrient intakes using the 24-hour recall method and the three-day estimated weight record method.

The paucity of data in relation to the most suitable dietary intake method to be used in children's studies was the motive for this part of the THUSABANA study.

1.5 Structure of the mini-dissertation.

This mini-dissertation will be presented according to the structure shown in Figure 1.1.

In Chapter 2, the literature review on nutritional status and dietary intake assessment methods is given. In this chapter the challenges in collecting dietary intake data, importance of number of days during collecting the dietary data and cultural influence on dietary patterns are also discussed. The chapter concludes with the need for empowering children through healthful eating habits.

In Chapter 3 the study methodology used in the empirical study to compare the energy and nutrient intake as determined by a 24-hour recall method and a three-day estimated weight record method amongst children aged 10-15 years is described.

In Chapter 4 the results and discussion of the empirical study are presented.

Chapter 5 comprises of the recommendations and conclusions of the study.

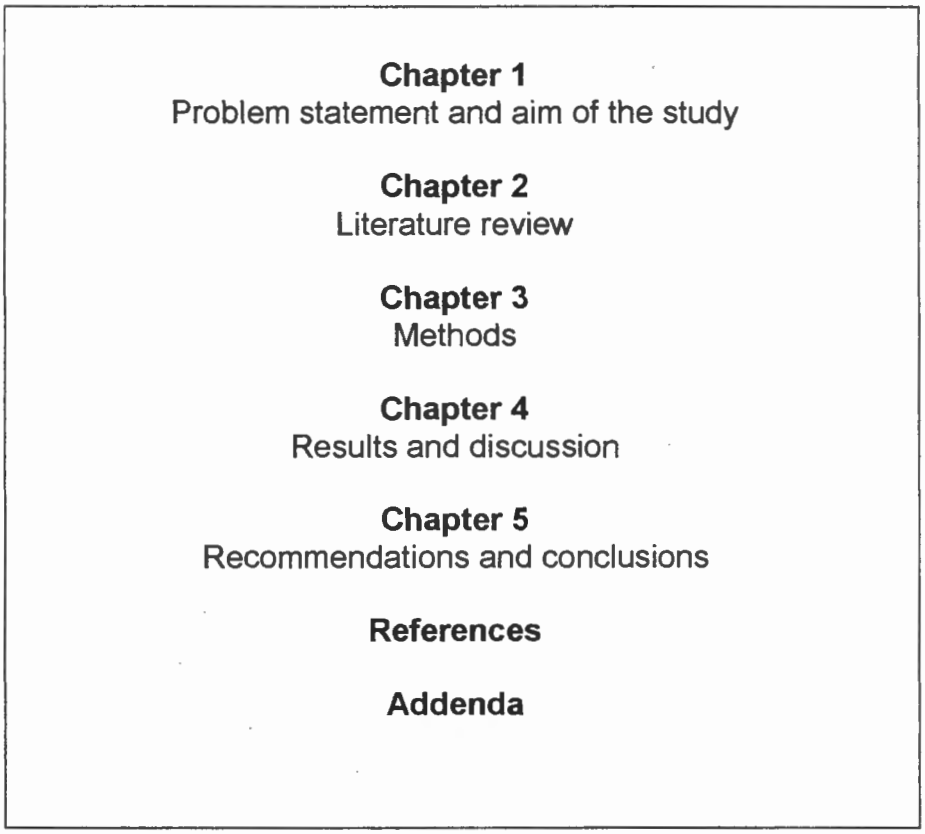

Figure 1.1 Structure of this mini-dissertation

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Dietary assessment methods have been developed due to the increase of various diet-related chronic diseases. The health status of the population can be detected through nutritional status assessment, including the dietary intake assessment method. Improving the nutritional status of the population should be a goal of all countries, because nutritional problems continue to be the basic cause of many diseases that impede progress towards universal good health (Kigutha, 1997).

The dietary intake estimation entails the collection of information on the quantity of individual portions of food eaten, and using food composition values. The dietary assessment technique relies on information supplied by the respondents themselves with the result that a certain degree of uncertainty, with regard to the accuracy of the results is introduced. The accuracy of the method is reflected by its internal validity, that is, whether the method measures what is intended to measure. The only accurate way to validate any method for determining nutrient intake would be by observation and comparison with the actual food intake (Faber *et al.*, 1999).

The accurate recording and evaluation of individual dietary intake is the most difficult and frustrating aspect of the nutritional assessment. The information obtained can be very useful, however, it is important to recognize the limitation of the data, for example the very act of recording has a tendency to influence food intake. Also many people simply cannot remember the types or amount of food they ate (Czajka-Narins, 1992). It is not always possible to use elaborate and time consuming investigation methods. A method to determine dietary intake should be practical, easily managed, economical and reasonably valid and reliable (Faber *et al.*, 1999).

Dietary study methods for adults may not be suitable for children. Studies on children need to be longitudinal because of the children's increasing nutrient needs as they grow. Interviews of young children are difficult because children fail to concentrate, therefore their dietary information must be obtained from adults who may be parents, child minders or schoolteachers. Although teenagers may respond to certain questions, they may fail to answer some of the questions (Czajka-Narins, 1992).

2.2 Definition of terms

The following definitions apply to terms used in the context of this mini-dissertation.

Assessment: – the science of determining nutritional status by analysing clinical, dietary, and social history, anthropometric data and biochemical data (Mahan & Escott-Stump, 1996).

Nutritional status: – a measurement of the extent to which the individual's physiological needs for nutrients are met (Mahan & Escott-Stump, 1996).

24 hour dietary recall: - the respondent is asked to remember and recall all foods and beverages consumed in the preceding 24 hours or in the preceding day (Buzzard, 1998).

Food record: - the respondents record all the foods and beverages and the amounts of each day consumed over a period of days (Thompson & Byers, 1994).

Estimated weight record: - can be defined as estimating the weight of food by comparing portions with pictures in a food picture photo book (Buzzard, 1998).

2.3 Assessing the nutritional status

The main objective for the assessment of nutritional status of a group or population is to determine whether some remedial action is required. Such an assessment requires some selection of appropriate indicators to identify the nature and extent of a nutritional problem.

A comprehensive assessment of nutritional status incorporates four major methods: anthropometric, clinical, biochemical and dietary investigation (Kreutler, 1980).

Nutritional assessment methods may also involve the collection of information on variables known to affect the nutritional status of a population, including relevant socio-economic and demographic data, cultural practices, food habits, food beliefs and food prices.

Information on marketing, distribution and storage of food may also be collected, as may be health and statistics (National Department of Health, 2001).

2.4 Anthropometric measurement

2.4.1 Introduction

The methods of assessing children's nutritional status by anthropometry depend on the purpose, objective, the degree of accuracy required and the resources available. Nutritionists must be well acquainted with the use of the different techniques and be able to interpret and express them in understandable terms (Jelliffe & Jelliffe, 1989).

The choice of measurements depends on:

- the general purposes and detail of the investigation which would be screening, assessment of nutritional status, monitoring and evaluation or analytical epidemiological studies;
- the problem being investigated; and
- epidemiological significance.

A number of measurements are used, of which body weight, height, or length and body composition (skinfold thickness) are the most useful (Jelliffe & Jelliffe, 1989).

2.4.2 Body weight

This is the most versatile and simplest method especially for children and is the most prominent sign of growth failure or under- and overnutrition. However, it may not be used for measuring growth, because other factors affect weight such as acute dietary inadequacy, infection and low birth weight.

Weight measurement evaluation should take into account other factors that will increase or decrease it, such as height, proportion of fat, muscle and bone, oedema, worm infestation or enlarged organs. This implies that weight assessment should be done in conjunction with other anthropometric measurements such as height, muscle and subcutaneous fat and clinical examination (Jelliffe & *Jelliffe.*, 1989).

Weight-for-age is a simple and a direct assessment of growth. If the weight of the child being assessed is lower than the reference, discrepancies can result which can mask malnutrition. If age is incorrectly assessed, where parents do not know the child's age, this index can give a distorted view of the child's nutritional status (Gorstein, 1989).

A low weight-for-height reflects wasting, as a result of acute nutritional stress and severe food shortage or serious illness. Wasting of 5-9 % in a population is regarded as a moderate prevalence and more than 10% as a severe problem, which will need immediate nutritional support (Vorster *et al.,* 1997). The weight in this index must correlate with that of a group in the same height, therefore it is age independent.

These need to be accompanied by height-for-age to obtain information on present and past nutritional status (Jelliffe & Jelliffe., 1989).

2.4.3 Height

The measurements of height, especially for young children, are reliable indicators of normal growth and development, and imply adequate nutritional status. Height measurement also indicates abnormal growth that may be due to dietary deficiency (Kreutler, 1980). Height measures the skeleton and is the most basic measurement for children. It is measured by a vertical flat wall or rod, which can be attached to a weighing scale. The technique involves standing the subject as erect as possible on a flat floor or board or scale without shoes on, with the feet together, heels, buttocks, shoulders, and back of head touching the upright or wall.

The legs must be straight, shoulders relaxed, head looking forward in the Frankfort plane and the arm hanging naturally at the sides. As the headpiece is lowered gently it must compress the hair and make contact with the head (Jelliffe & Jelliffe., 1989).

Height-for-age (H-a) estimates the past and chronic malnutrition but not necessarily the present nutritional status. Low H-a is indicative of stunting, which is a result of chronic, long-term dietary inadequacy, reflecting socio-economic deprivation. The WHO (1986) regards a population to be moderately affected if 25-50 % of its children under 5 years of age are stunted, and severely affected if more than 59 % are stunted (Vorster *et al.*, 1997).

2.4.4 Other anthropometric indices

Measurement of skinfold thickness, midarm muscle circumference, chest and head circumferences, and the use of X-rays to determine wrist bone development are also helpful in identifying abnormal growth. In certain conditions they can provide significant additional data about an individual condition. Their disadvantage, in comparison with more easily and inexpensively obtained height and weight measures, is that they require specialised equipment and technicians trained in their use (Kreutler, 1980).

2.4.5 Clinical examination

The clinical examination includes a complete physical examination and a medical history. Significant findings on physical examination include temporal wasting, proximal muscle weakness, depleted muscle bulk and tongue atrophy.

The appearance of the skin should be noted for pallor, scaly dermatitis, wounds, quality of wound healing, bruising and hydration status. Special attention should be given to areas where signs of nutritional deficiencies appear: skin, hair, teeth, gums, lips, tongue, and eyes. Many signs result from a lack of several nutrients as well as from non-nutritional causes (Mahan & Escott-Stump, 1996).

A nutrition-focused physical examination is an important component of overall nutritional assessment as some nutritional deficiency may not be identified by other assessment approaches. One must keep in mind that some signs of nutritional deficiency are non-specific and must be distinguished from those with a non-nutritional etiology (Mahan & Escott-Stump, 2000).

2.4.6 Biochemical analysis

Biochemical tests are useful adjuncts to anthropometric and clinical assessment. They can confirm suspicions of existing long-term deficiencies and can also provide an early warning of clinical deficiency symptoms. Body measurements and clinical assessment reflect long-term and previous nutritional status, but biochemical analyses reflect the most recent situation.

Inadequate intakes, inefficient digestion, disturbance in metabolism, or altered excretion of nutrients show up quickly in the chemical composition of body fluids. Blood and urine in particular, provide an accessible window on current nutritional status.

A sample of blood, for instance, contains all the substances that are currently circulating to and every cell in the body. A urine sample contains wastes and by-products that indicate how from those substances have been used in the cell (Kreutler, 1980).

2.5 Dietary intake assessment methods

There are different methods of obtaining individual food intake information:

- the food record;
- 24-hour dietary recall;
- food frequency questionnaire; and
- diet history.

2.5.1 The food record (diary)

For the dietary record approach, the respondent records all the foods and beverages and the amount of each consumed over a period of days. The amount consumed may be measured with a scale or household measures (such as cups, teaspoons) or estimated using models, pictures, or particular aids. The leftovers are weighed and deducted, and also food eaten away from home must be weighed and recorded (Thompson & Byers, 1994).

The recording period should not exceed three days because the respondent becomes fatigued of the recording process. When the recording period proceed for long, the habitual eating patterns can be disrupted by the task of weighing which result in lower reported intakes. For the less burdensome estimated food records respondents are asked to describe the food and amount eaten. Description of food includes kind, preparation, brand name, and main ingredients in mixtures. It is important that all measures must be levelled, and not rounded or heaped for accurate measurement (Pao & Cypel, 1996).

Solid food may be measured with a ruler and described by shape (square, rectangle, and wedge) and dimension (length, width, height, and diameter). Counts such as small, medium or large may also be sufficient for the measurement. It is important to train the respondents in the level of detail needed to describe adequately the foods and amounts consumed.

At the end of the recording period, a trained interviewer should review the records with the respondent to clarify entries and to probe for forgotten foods. Although intake data using dietary records are typically collected in an open-ended form, closed-ended forms also have been developed. The closed-ended forms consist of listing of food groups, and then the respondent indicates whether that food group has been consumed. Portion sizes can also be asked in both closed and open forms.

In content these checklist forms resemble the food frequency questionnaires, but they are filled concurrently with the actual intake or at the end of a day for that day's intake (Thompson & Byers, 1994).

Strength of dietary records

- The major strength of the food record method is that it does not rely on memory, if subjects comply with the instructions; foods and amounts are recorded at the time they are eaten.
- The dietary record method has the potential for providing quantitative accurate information on food consumed during the recording period.
- With recording food as it is consumed, the problem of omission is lessened and food intake is described more fully.

- The period is defined.
- For elderly people, dietary records may be more accurate than the recalls.
- Food intake is quantified, so nutrient content can be calculated, and the multiple day record provides reliable information about less frequently eaten foods (Pao & Cypel, 1996).

Weaknesses of dietary records

- Dietary record keeping requires that respondents be both motivated and literate, which can potentially limit the method's use in some population groups such as low socio-economic status, recent immigrants, children and some elderly groups.
- The requirement for co-operation in keeping records can limit the generalisability of the findings, from which the study sample was drawn.
- There may be incomplete records as more days of records are kept, and the validity of the collected information decreases in the later days of a seven-day recording period, in contrast to collected information in the earlier days.
- Recording food as they are eaten can sometimes affect both the type of food chosen and quantities consumed.
- The information collected on dietary records can lead to high personnel costs (Thompson & Byers 1994).

Validity of the food records

Validity refers to whether the method measures exactly what it is supposed to measure. The validity of food records is very important because food records are often used as a reference against which other methods are compared. The validity of the food records may be decreased by the burden of having to weigh food before eating. The underestimation of reports may also decrease validity of the food records.

Underreporting on food records is probably the result of the combined effects of incomplete recording and the impact of the recording process on dietary choices (Thompson & Byers, 1994).

2.5.2 The 24-hour food recall

In the 24-hour dietary recall, the respondent is asked to remember and recall all the foods and beverages consumed in the preceding 24 hours or in the preceding day. The method is usually conducted by personal interview, either computer-assisted or using a paper pencil form (Thompson & Byers, 1994).

The family's normal routine is less disrupted, and there is less opportunity to change the food intake to impress the investigator. This makes it an attractive alternative for large-scale surveys, or for those with limited budgets, personnel, or time constraints. Well-trained interviewers are crucial in administering a 24-hour recall, because asking probing questions collect much of the dietary information.

Dieticians are the most ideal people to collect this information because of their education in food and nutrition. A non-nutritionist who has been well trained in the use of the standardized instrument can also be effective (Thompson & Byers, 1994).

The interviewers must be knowledgeable about foods available at the marketplace and about preparation practices, including prevalent regional or ethnic foods. It is often structured, so as to help the respondent to remember all foods consumed throughout the day.
The advantages of the probing questions are that the respondents are able to remember all foods consumed throughout the day (Ferguson *et al*, 1989).

Probing is necessary to provide details, such as how foods were prepared. It is also useful in recovering many items not originally reported, such as common additions to foods for example butter on toast and eating occasions not originally reported such as snacks and beverages breaks (Thompson & Byers, 1994). Dietary recall questionnaires may be administered in person, by telephone and in automated interviews. Interviews may be conducted in the home, in the clinic setting or at some other convenient site (Pao & Cypel, 1996).

Strengths of the 24-hour recall

- It is a simple and practical method to use especially with children (Thompson & Byers, 1994).
- It is easier to use with large samples and this is a relatively quick method.

- The interviewer administers the tool and records the responses; therefore literacy of the respondents is not required (Buzzard, 1998).
- The respondents are able to recall most of their dietary intake because of the immediacy of the recall period.
- About 20 minutes is the usual time required to complete a 24-hour recall.
- Dietary recalls are occurring after the food has been consumed, so there is less potential for the assessment method to interfere with dietary behaviour (Steyn *et al.*, 1989).
- The recall does not require literacy (Buzzard, 1998).

Weaknesses of the 24-hour recall

- Individuals may not report their food consumption accurately for various reasons related to memory and the interview situation.
- Because most individuals' diets vary greatly from day to day, it is not appropriate to use data from a single 24-hour recall to characterize an individual's usual diet.
- Data from single 24-hour recalls should not be used to estimate the proportion of the population that has adequate or inadequate diets (e.g. the proportion of individuals with less than 30 % of energy from fat or who are deficient in vitamin C intakes).
- The primary limitation of the method is that data on a single-day's diet, no matter how accurate, is a very poor descriptor of an individual's usual nutrient intake because of day to day variation (Lee & Nieman, 1993).

- Another major limitation of the 24-hour recall includes its reliance on memory, both for identification of food eaten and for quantification of portion sizes, and the need for a highly trained interviewer (Buzzard, 1998).

Validity of the 24-hour recall

Obtaining data on the absolute validity of the 24-hour recall for free living individuals is difficult. The amount consumed by respondents is not easily quantified unobtrusively (Ferguson *et al.*, 1989).

Validity of the 24-hour recall has been assessed in a number of studies by comparing the recalled intake with observed intake or with intake records obtained by other methods. Investigators found that recalled intake compared with weighed intakes tend to be overestimated when intakes are low and underestimated when intakes are high (Ferguson *et al.*, 1989).

Buzzard (1998) further describes the common strengths and limitations of both the 24-hour dietary recall and food record methods as follows.

- Both methods are based on actual intake and may be used to estimate absolute rather than relative intake of energy and other food components such as the macronutrients and some vitamins and minerals that are broadly distributed within the food supply.

- Both methods are completely open ended, they can accommodate any food or food combination reported by the subject, and they allow an unlimited level of specificity regarding type of food, food source, food processing method, food preparation and other details related to describing foods and amounts.
- Recalls and records are especially useful for estimating intakes in culturally diverse populations representing a wide range of foods and eating habits.
- Another strength of the recall compared with the food record it that it is unlikely to alter eating behaviour, since the information is collected after the fact.

Importance of number of days and which days for the dietary intake data

If food records or 24-hour dietary recalls are to be used as the data collection method, issues regarding the number of days and which days to include must be considered. A single food record or 24-hour recall per individual may be adequate if estimates of group means are sufficient for answering the question that the study is designed to answer. The design of the study determines the relative importance of balancing the days of the week. For example, if the purpose of the study is to determine the effectiveness of an intervention programme, it may be less important to include a balance of days as long as the same combination of days is used for data collection both before and after the intervention. However, if the purpose is to estimate changes in absolute nutrient intake, an appropriate balance of the days of the week is likely to be of greater importance (Buzzard, 1998).

If the purpose of the study requires estimating the distribution of individual intakes within the group, it is necessary to collect more than one recall or record per individual in the study population or in a random sub-sample of the population.

In the case of food records, however, it may be more cost effective to train fewer people in methods of record keeping and increase the number of days per individual. When multiple days of intake are collected to permit estimation of within person variability, the combination of days of the week for each individual should be randomly assigned and be non-consecutive (Buzzard, 1998).

2.5.3 Food frequency questionnaires (FFQs)

The food frequency questionnaire (FFQ) method is mostly suited to assess dietary intake in a large epidemiological study. Food frequency questionnaires are increasingly recognized as suitable methods for collecting data in epidemiological studies because more precise methods (e.g. food diaries or duplicate portions) are labour intensive and are therefore prone to low response rate and/or high drop out rates during the study (Hammond *et al.,* 1993).

Food frequency questionnaires allow assessment of a large number of children, improving the power of the study, and it is relatively cheap to administer. It can be used repeatedly to allow the detection of changes in dietary intake patterns with age in a single sample of children followed longitudinally or to measure trends over time in cross-sectional samples of children of the same age (Hammond *et al.,* 1993). The food frequency approach asks respondents to report their usual frequency of consumption of each food from a list of foods for a special period.

The FFQ is the most frequently used instrument for assessing dietary intake, and is a structured form that supply respondents with a list of 60-120 foods. A food line may consist of a single food item, for example white bread, or a group of foods having similar nutrient composition. These lines are grouped into food categories, for example bread, dairy products, fruits and meat. For each food line, respondents are asked to report frequency of consumption on average (usual or typical intake) or relative to a specific time period (Thompson & Byers, 1994).

Pao & Cypel (1996) indicated that the method of FFQs is often used to rank an individual by food or nutrient intake so that characteristics including disease status, of those with high and low intake may be compared. The questionnaires vary as to the food listed, the length of time covered by the reference period, the response interval for specifying frequency, the procedure for estimating portion size, the nutrient composition database, as well as the manner in which the questionnaire may be administered.

The type of food listed varies depending on whether the researcher is interested in specific nutrients or the total diet. The food lists may include only items high in a specified nutrient such as calcium, or attempted to represent the total diet. There are two methods of using the food frequency questionnaire, namely the qualitative FFQs and quantitative FFQs. Generally only the usual number of times each food is eaten during a specified period, such as the past months is obtained. The quantitative methods require subjects to report the amount of food eaten, usually with the use of measured aids (Pao & Cypel, 1996).

Strength of the FFQ

- The food frequency approach is designed to estimate the respondent's usual intake of foods.
- It can also be used to circumvent recent changes in diet (e.g. changes due to disease) by obtaining information about an individual's diet as recalled about a prior time period.
- It can be used to rank individuals according to their usual consumption of food or groups of foods, and when portion size estimates are included, to rank individuals according to nutrient intake.
- It can be designed to be self-administered and to require little time to complete.
- The cost of data collection and processing and the respondent's burden are typically much lower for food frequency methods than for multiple diet records or recalls (Thompson & Byers, 1994).

Weaknesses of the FFQ

- The major limitation of the FFQ method is that many details of dietary intake are not measured, and the quantification of intake is not as accurate as with records.
- Inaccuracies result from an incomplete listing of all possible foods, from errors in frequency estimation and from errors in estimation of usual serving sizes. Longer food frequency lists overestimate intake, whereas shorter lists underestimate intake.
- Food frequency questionnaires are much better suited for ranking subjects according to food or nutrient intake than for estimating the levels of intake.
- It is difficult for respondents to evaluate serving sizes of food consumed and this is problematic for all dietary history instruments.

- Obtaining accurate reports for foods eaten both alone and in mixtures is particularly problematic.
- Validation of the method is difficult.
- The respondent's burden is governed by the number and complexity of food listed and quantification procedure.
- Recalls of past diets may be biased by current diets (Thompson & Buyers, 1994).

Validity of the food frequency questionnaire

The definitive validity for a food frequency based estimate of usual diet would require non-instructive observation of the respondent's total diet over a long period.

Food frequency instruments have a longer list of food and nutrient intake than the methods of 24-hour recall and food records. The overestimation of intake with a very long list can produce estimates of energy intake that is unrealistic for some respondents, and is one reason why many investigators statistically adjust for total energy intake when analysing nutrient intake estimates derived from FFQs (Thompson & Byers, 1994). The validity of FFQs can be determined by encouraging the interviewer to choose participants of diverse age, education, and income level, and positions in the household.

Interviewers must be trained to collect recalls by using a kit consisting of locally available bowls, cups, cardboard and plastic food models and rulers. Plastic models of meat must also be provided to assist estimation of meat servings.

For difficult to quantify foods such as home-made bread, cookies and cakes, respondents must be asked to draw an outline indicating their size on a blank sheet of paper (Kigutha, 1997).

2.5.4 Diet history

The diet history method was developed to obtain information at regular intervals about dietary habits and the usual diet for use in longitudinal studies of human growth and development (Pao & Cypel, 1996). Thompson & Byers (1994) describe diet history as any dietary assessment that asks the respondent to report about the past diet. The method does not only collect information about the frequency of intake of various foods but also about the method of preparation of meals.

Several investigators have developed a diet history method that provides information about usual food intake patterns beyond simple food frequency data. Some of these methods characterized food in much more detail than is allowed in food frequency lists (for example, preparation methods and food eaten in combination and some of these methods ask about food consumed at every meal) (Pao & Cypel, 1996).

The method of diet history incorporates three components:

- an interview about usual eating pattern;
- a food list with amount and usual frequency of eating; and
- a food list with amounts and usual frequency of eating, and a three-day food record.

Strengths of the diet history method

- The major strength of the diet history method is its assessment of usual meal pattern and details of food intake rather than intakes for a short period of time or only frequency of food consumption.
- Details on how foods were prepared can be helpful in better characterizing nutrient intake (for example, frying versus baking, as well as exposure to other factors in foods).
- When the information is collected separately for each meal, analysis of the joint effect of food eaten is possible, for example effects on iron absorption of concurrent intake of food containing vitamin C (Thompson & Byers, 1994).

Weaknesses of the diet history method

- The method requires trained interviewers and may require considerable time and cost.
- Recalls of the diet in the past may be biased by current diets.

Validity of the diet history

It is difficult to assess the validity of the diet history because of the lack of independent knowledge of the individual's long-term intake.

2.6 Reducing error in data collection

A major source of error in collecting dietary data using the 24-hour dietary recall method is its reliance on the subject's memory. One's ability to recall food intake is associated with a number of factors including age, gender, mood, attention, and consistency of eating pattern. Memory limitation can be minimized by using well-trained interviewers who are skilled in the art of asking questions that help subjects remember what they ate. Providing a relaxed and unhurried atmosphere gives the subject a chance to carefully reflect on his or her eating behaviour. Asking about the previous day's activity and relating these activities to food intake may also help subjects to recall their food intake.

Providing a list of foods commonly forgotten can help jog the subject's memory of items inadvertently omitted, such as snack items, beverages and desserts. Extensive probing substantially increases estimates of energy intake obtained by 24-hour recall in both elderly and younger respondents (Buzzard, 1998).

In theory, memory limitation should not be a source of error for the food record method, however, subjects who keep food records sometimes delay recording their intakes for several hours or more, in which case they are relying to some extent on short-term memory.

The procedure for reducing the extent of underreporting in food records include careful training of subjects in methods of keeping accurate records, providing written as well as verbal instructions for record keeping, emphasizing the importance of the subject's contribution to the research, stressing the need for timely recording of food intake, and encouraging subjects to maintain usual eating habits during the recording period (Jonnalagada *et al.*, 2000).

Another source of error in collecting food intake data is the lack of adequate food descriptive detail. With respect to the 24-hour recall, the interviewer must remember to ask all of the appropriate probing questions to obtain all the necessary levels of specificity for meeting the study objectives. To do this well may require considerable training and practice.

Quantification of portion sizes is another source of error in collecting food intake data. This is of particular concern for the 24-hour recall method, since amount consumed must be recalled from memory. The use of photographs for estimating portion sizes compared favourably with weighed-food records. When using photographs or food models, it is preferable to present more than one portion size option so that subjects can relate their portion to a variety of sizes. Otherwise there is a tendency to report whatever amount is represented by the model (Buzzard, 1998).

Finally, lack of motivation is a potential source of error for both the subjects and interviewers. It is critical that the interviewers and/or others who introduce the study to the subjects be enthusiastic about the study and be able to convey this enthusiasm to the participants.

Taking time to explain the purpose and importance of the research and to establish a friendly and relaxed but business-like rapport with the participants creates an atmosphere of trust and motivates the participants to provide accurate information (Buzzard, 1998).

2.7 Portion sizes and children's food intake

2.7.1 Approaches to food portion estimation

The following food measurement aids may be used:

- food models: commercial or home made;
- food pictures or drawings of different portion sizes;
- photographs of foods in different portion sizes;
- abstract shapes of cupboard, wooden spoon or plastic block in various sizes;
- utensils and containers: cups, spoons, jugs, bowls, plates etc in various sizes; and
- containers and packets of bought foods, for example sweet wrappers, potatoes crisp packets, soft drink cans and bottles, yoghurt and ice cream cups and milk cartons.

2.7.2 Direct weighing and measuring of portions of actual food provided

- Respondents dish out the amount they think is their usual serving and the portion size is weighed or measured

2.7.3 Alternative approaches

- Have some foods which can represent other foods. For example, maize meal porridge may also be used to estimate portion sizes of other types of porridge, mashed potato and pasta.
- Use dry, uncooked foods to estimate quantities, for example maize meal, milk powder, samp and dried beans. Respondent estimates portion sizes by pouring the item into a plate or bowl (MacIntyre, 2001).

2.8 Factors to be kept in mind when developing or selecting portion size measurement aids

The following factors are important during the selection of portion size measurement aids:

- size of the image (pictures or photographs) or models: clearly recognisable;
- number of portion sizes to include (depend on the size of the image);
- range of portion size: from minimum to maximum;
- interval between portion sizes: if too small, respondents may not be able to distinguish between portions, if too large, may lose information;

- the order of presentation (smallest to largest, largest to smallest, random);
- background and reference objects, for example, plates, bowls, cups, spoons or other cutlery; and
- only one food should be depicted at a time (McIntyre, 2001).

2.8 Accuracy of dietary information

More accurate information can be obtained if the following are done:

- Taking time to thoroughly ask questions about dietary intake with the family and or referring to a registered dietician who has extensive background and training in dietary assessment.
- Asking the respondents to remember the activities of the days for which information is to be collected so that food intake can be associated with other events.
- Providing careful instruction to the families before asking them to keep the dietary records.
- Verifying information by asking or going through the questionnaire with the respondents (Hammond *et al.*, 1993).

Parent's reporting of children's intakes are also preferable, in obtaining the accurate dietary information of children aged 11-12 years. Most parents of children in this age and younger are still responsible for providing their child's food and ensuring their diets are adequate. Parent's accuracy of reporting is as good as, if not better than a wife reporting her husband's intake, which is a more moderately accurate method of dietary intake assessment (Hammond *et al.*, 1993).

Baxter (2000) indicated that dietary intake assessment is essential in the assessment of the nutritional status, nutrition monitoring, nutrient metabolism, and also for the effects of nutrition education programmes.

Validated methods for assessing children's diets are needed, when requiring information about children's dietary intake. Parents may assist their children in reporting their dietary intake, but they do not always know what their children ate outside the home. Baxter (2000) further stated that young children provided information about what they ate as accurately as or more accurately than their mothers. Thus, parents are not always considered good sources for the validation of children's dietary intake.

Sobo *et al.* (2000) further pointed out that most researchers believe that parents should assist children in completing recalls, because they are the ones responsible to select, prepare and serve food for children. When they do, their knowledge of the types and quantities of food consumed is likely to be accurate.

2.10 Meeting the nutrient needs

Where a good and varied supply of food is available and affordable, everyone should be able to meet their nutritional needs.

2.10.1 Young children

Young children are the most at risk of being malnourished. They have very high energy and nutrient needs for their body size in comparison to adults. Proper care and feeding is essential for their normal growth and activity. Children need to maintain their diet of energy-rich and bodybuilding foods throughout their growing years until they reach adulthood.
As eating habits are established early in life, it is important to teach children at an early age how to get the best from their food. They should be encouraged to eat enough of a variety of energy and protein rich foods and fruits and vegetables for growth and maintenance (FAO, 1997).

2.10.2 Adolescents

Adolescents grow rapidly and so have high requirements of energy and all nutrients. In addition an adequate amount of protein is needed to sustain growth and development.
Special attention should be given to adolescent girls who need to be well nourished both for their immediate development and future stresses of childbearing. Anaemia and calcium deficiency are common problems. Foods rich in calcium and iron should be encouraged (FAO, 1997).

2.11 Challenges in collecting dietary intake data

It is challenging to collect dietary intake, because people are often suspicious of strangers who are interested in what they eat. In some societies, it is frightening if a foreigner or a person in apparent authority to question what one eats, in other circumstances, questioning provokes shyness and embarrassment. Thus, it is important for the dietary researcher to know the group's attitudes towards questioning. They must also know enough about the society being studied to ask the right questions of the right people, using the appropriate languages and approaches (Kigutha, 1997).

The research team must be sensitive to the local customs, including food behaviours associated with religious, ethnics and local beliefs and practices. The field workers should be knowledgeable about the local taboos, eating mannerisms and patterns. They should be aware of the reluctance of people to report the consumption of food considered to be of low status. To avoid the spread of inaccurate assumptions about a survey, the purpose of the survey should be clearly explained to all subjects and to local leaders.

Biases in responses can easily be introduced if, for example the subjects believe that they will receive food or financial aid if they report low food intakes. Alternatively, over reporting of intakes can occur if participants wants to impress their interviewer (Kigutha, 1997).

2.12 Cultural influences on dietary pattern.

The availability and affordability of food are not the only factors, which influence the dietary pattern. Culture, tradition and religion also influence the eating pattern of many South Africans. Knowledge of these influences and specific taboos is necessary to analyse the adequacy of nutrient intake and also to ensure that dietary recommendations and food choices for specific nutritional aid programmes are culture sensitive (Vorster *et al.,* 1997).

2.12.1 White South Africans

The diet of most whites in South Africa is described as a typical western diet. The food culture, which was developed during the past 300 years, was based on the European culture with strong Dutch, German, and later, English, Irish and Scottish influences.
One of the strongest influences was that of the Malayan culture, which introduced strongly flavoured foods and dishes and a variety of spices and condiments, resulting in typical traditional dishes such as bobotie, curried fish, sosaties and blatjang.

Traditionally, the Afrikaner ate three meals. Mealtimes were important occasions. Snacking (tea or coffee with baked products) between meals was common. With time and urbanisation, meal patterns changed and broadened under the influence of British, Italian, Greek, Indian and also African cultures (Vorster *et al.*, 1997).

2.12.2 Coloured South Africans

The Malayan culture, which strongly flavoured hot and spicy foods, contributed to the rich cooking culture of the coloured people. The Muslim influence is also very strong in the lifestyle and eating patterns of many coloureds. In urban communities, a typical western diet, with a variety of foods rich in animal protein and fat with refined starchy foods and relatively large intakes of sugar, jams, and other sweet items are followed. The coloureds in the Free State eat three meals a day, although many families both in rural and urban areas ate only two meals a day. The children eat breakfast before school (Vorster *et al.*, 1997).

2.12.2 South African Indians

The Indian housewife and mother perceive her cooking of traditional Indian meals as an art, a privilege and an expression of her love for her family. Most South African Indians are either Muslims or Hindu.

The Islamic prescription regarding religion, lifestyle, eating patterns and hygiene are followed faithfully by many Muslims.

Special dishes are prepared for the many feasts. A wide variety of foods, strongly flavoured with many spices including chillies and ginger are eaten. Meat must be halal and pork is not allowed. Foods are thoroughly washed before cooking, often finely cut and cooked for long periods. An interesting feature is the belief that the stomach should be one third filled with food, one third filled with liquid and one third with air. This belief could prevent against overeating and obesity (Vorster *et al.*, 1997).

2.12.3 Black South Africans

Traditional eating patterns and taboos of the different black groups in South Africa are different. There are several taboos of individual groups and also common habits and patterns. One is that traditionally only two meals were eaten daily. Breakfast was eaten late in the morning and originally consisted only of sour milk (amasi), especially in the South Nguni's. Later thin porridge cooked from cereal (sorghum, millet or maize meal) and served with sour milk was eaten (Vorster *et al.,* 1997).

Milk was a favourite food. However, numerous taboos and rituals influenced its consumption and it was also used as sour milk. Only small children and the elderly can drink fresh milk. Milk consumption indicated kinship. Milk played a purification role and it was sprinkled around the house to purify the house (Vorster *et al.,* 1997).

2.13 The importance of parental knowledge

Children's food preferences are influenced by parental eating habits. . Once acquired in early childhood, healthful dietary habits tend to be carried out into childhood. Parental nutrition knowledge is essential for monitoring eating habits of children, identifying high–energy foods, and understanding the long-term risks of obesity (Variyan, 2001).

2.14 The empowerment of children to develop healthful eating habits

Evers (1997) indicated that by allowing children to make decisions about what and how much they eat, parents empower children to self regulate their eating. It was found that most children were capable of regulating their energy intake if they were given control of food selection. Manifesting those capabilities depend on parents effectively executing feeding tasks (Evers, 1997).

Many parents have a hard time accepting that children can control their eating. This is true for parents who worry about enough food as for those concerned with overeating. The parent's role is to offer a variety of healthful foods, oversee the planning and assembly of meals, set the schedule for meals and snacks, make eating times pleasant and for providing mystery expectations. The child's responsibility is to decide what, how much and even whether to eat (Evers, 1997). Given parent's successful execution of their tasks, children will increasingly gain capability with eating behaviour and food acceptance.

Children will also retain the ability to regulate food intake, grow in a constitutionally appropriate way, and maintain positive eating attitudes and behaviour.
For children to learn to like a variety of foods and regulate their food intake, they depend on adults to choose wholesome food and provide them with regular meals and snacks (Satter, 2000).

Satter (2000) further indicated that teaching children food rules in the hope that they will achieve nutritional goals on their own represents a crossing of the line dividing responsibility

and is an exercise in futility. It confuses and alarm children about food. He further pointed out that children can also learn about the Food Guide Pyramid (FGP) and may even be able to place food on the pyramid, they are developmentally ready to apply that learning to making value judgements about food. Rather than teaching food selection, nutrition education can reinforce support for and enhance the capabilities of food acceptance and food regulation that children have learned at home (Satter, 2000).

2.22 Summary

One may not be able to conclude which one of the dietary methods is the best or the most accurate method. Each method has its own strength and weakness, therefore it will solely depend on the type of the study to select the suitable dietary method, and it will also depend on the research question.

Diet is an important modifiable risk factor in the prevention of several causes of modifiable risk in the prevention of morbidity and mortality in the developed countries. The difficulties of dietary intake assessment are many, however, they have been documented (Hammond *et al.*, 1993).

It is not always possible to use elaborate and time consuming investigation methods. A method to determine dietary intake should be practical, easily managed, economical and reasonably valid and reliable especially when dealing with children. There is a need to determine the suitable, easily managed dietary assessment method suitable for children aged 10-15 years of age in the Northwest province.

CHAPTER 3

METHODS

3.1 Introduction

The study formed part of the multidisciplinary THUSABANA project. As explained in Chapter 1, Section 1.1, THUSA is a Tswana word, which means help. It is also an acronym for Transition and Health during Urbanisation of South Africans. BANA is a Tswana name meaning children, so in short THUSABANA means, "help the children'. The THUSA study was a multidisciplinary project in which different Schools of the Potchefstroom University for Christian Higher Education (PU for CHE) were involved. THUSABANA was a follow-up of the THUSA project, which was implemented in 1996-1998 in the Northwest province. These Schools comprised of Physiology, Nutrition and Consumer Science, the School of Biokinetics, Recreation and Sport Science and the School of Psycho-social Behaviour Science. Each school that was involved in this project provided researchers who were responsible for gathering health-related data in their specific field of expertise. Although a vast amount of data were gathered, each school was only responsible for gathering data in their specific field, and therefore the author of this study was only responsible for gathering the information on the comparison of dietary intake assessment methods suitable for children.

3.2 Design of the THUSABANA project

The THUSABANA project was designed to assess the prevalence and determinants of overweight and obesity among children aged 10-15 years in the Northwest province of South Africa. This was a cross-sectional study of a random sample of schools selected from a list of schools in the Northwest province of South Africa. The measurements were done on a random sample of children selected from class lists from the selected schools during school hours.

3.3 Sampling for the dietary method comparison study

Fifty-four school children, girls and boys aged 10-15 years, residing in Mmabatho area, were included. The dietary intake was obtained using the 24-hour recall method and three -day estimated weight record method. The 24-hour recall method aimed to determine the dietary intake for the previous 24-hours. Fieldworkers, previously trained and well experienced in dietary intakes, interviewed the participants with the 24-hour recall technique. Food models and picture books were used to quantify the food intake (Venter *et al.*, 2000). Preparation of food and beverages were described in detail. The 24-hour recall was obtained at school during the school hours.

The same participants, who completed the 24-hour-recall, completed the three-day estimated weight record. The three-day diet record required the participants to record everything consumed during the three-day period. The children were instructed about the recording of food intake by the researcher. A booklet with written instructions, an example of a food intake record, and space to record food intake was provided (See Addendum 4).

The participants were asked not to alter their usual food intake during the period of the study. They were also encouraged to record the quantities in terms of household measures, cups, spoons and dimensions, because weighing the food could influence their eating pattern and would be too cumbersome. The subjects estimated portion sizes using food models and picture books validated by Venter *et al.* (2000).

The subjects were also asked to describe the method of food preparation. The researcher checked the records on the second and third day of the record by probing especially on the description of the preparation methods, and also the in-between meal snacks as they are easily forgotten.

3.3.1 Number of subjects

The sample in this study comprised of 54 children from two schools in Mmabatho visited in 2001 only. The final number of children (n=40) represented a response rate of 74 %. Some of the children did not participate due to the following reasons:

- some parents refused to give their consent;
- some children refused to participate; and
- some did not complete their diet records for all three days.

3.3.2 Ethical consideration

The Ethics Committee of Potchefstroom University for Christian Higher Education approved this study, according to project number 00M-10. The Department of Education in the North West gave permission to do the study during school hours. Since the subjects were still minors, the parents and guardians were required to sign an informed consent form, to grant permission for the children's participation in the study (See Addendum 1).

3.4 Organisational procedures

Prior to the commencement of the study, permission to conduct a study was obtained from the Deputy Director General of the Department of Education of Northwest province. Letters were sent to all selected schools and two research assistants visited the schools. They then explained to the principal of the study school what the research entails and submitted the consent forms. The principals distributed the forms to the selected subjects' parents. The 24-hour recall questionnaire was designed based on the scientific literature (Ferguson *et al.* 1994, Buzzard, 1998, Faber *et al* 1999). It was tested on children during a pilot study to see if they could understand the questions, and so that the field workers could practise.

Having received approval from all parties involved, the researcher called all the parents of children involved in the comparison study prior to the visitation, confirming the appointment and explaining to the parents the purpose of the study.

Since the study was aimed at comparing the 24-hour recall and three-day estimated weight record, the subjects were visited for three days. On the first day of the record, the researcher had to explain in details to the subject how to record the diet, and on the second and the third day, the researcher was just monitoring the diet record and probing some questions where necessary.

3.5 Statistical analysis

All data were computerized and nutrient analysis was done with the FoodFinder software programme. The paired t-test was used to compare the 24-hour recall and three-day estimated weight record method. The paired t-test was used to compare the association between energy and nutrient intakes of the means of:

- the 24-hour recall and three-day estimated weight record intakes;
- comparing intakes of day A with the 24-hour recall;
- comparing intakes of day B with the 24-hour recall;
- comparing intakes of day C with the 24-hour recall; and
- a P-value of ≤ 0.05 was taken as being statistically significant.

3.6 Summary

The comparison of the mean energy and nutrient intakes of the 24-hour recall and three-day estimated weight records will be reported and discussed in the next chapter.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter the results of the 40 school children who completed their diet records for all three days will be presented. The descriptive statistics of demographic data and the comparison of the mean macro- and micronutrient intakes of the 24-hour recall and the three-day estimated weight records are also presented.

4.2 Demographic information

The data from the THUSABANA study (2001) in Table 4.1 presents the demographic information of school children (n=1257). These school children are grouped according to age, gender, stratum of urbanisation and ethnic groups. The frequency and percentages are also indicated in this table. The total sample was representative of the NorthWest province. Most of these children were from the urban areas (46.4 %), and a small percentage of children (17.8 %) were living in the informal settlements. Thirty-five point eight percent of the children were from the rural areas. In THUSABANA study, there was about the same number of female subjects (51.6 %) and male subjects (48.4 %). In this sub-study, 40 (27 females and 13 males) black children were included.

Data in Table 4.2 show the age distribution of the subjects.

Table 4.1 Frequency distribution of selected socio-demographic characteristics of school children in the THUSABANA study (n=1257)

Demographic variables	
Age (years)	**Frequency (percentages)**
9	6 (0.48 %)
10	202 (16.6 %)
11	223(17.7 %)
12	249 (19.8%)
13	194 (15.4 %)
14	185 (14.7 %)
15	198 (15.99 %)
Gender	
Male	608 (48.4 %)
Female	649 (51.6 %)
Strata of urbanisation	
Rural	450 (35.8 %)
Informal settlements	224 (17.8 %)
Urban	583 (46.4 %)
Ethnic group	
Black	919 (73.1 %)
White	191 (15.2 %
Coloured	69 (5.49 %)
Indian	78 (6.2 %

Table 4.2 Age distribution of the subjects in the validation study (n=40)

Age (years)	Both gender		Female		Male	
	Number	%	Number	%	Number	%
10	5	12.5	4	10	1	2.5
11	4	10	4	10	0	-
12	11	27.5	6	15	5	12.5
13	6	15	3	7.5	3	7.5
14	12	30	10	25	2	5
15	2	5	1	2.5	1	2.5
Total	**40**	**100**	**28**	**70**	**12**	**30**

4.3 The comparison between 24-hour recall and three-day estimated weight record

4.3.1 Comparison of macronutrient intakes measured using 24-hour recall and individual three- day records

Data in Table 4.3 show the differences in macronutrient intakes of the 24-hour recall compared with the individual three-day dietary records, 1, 2, and 3 respectively. The data indicate that there was significant difference in fibre (p=0.0153) intake. Data for added sugar show only significant difference in day 2 (p=0.0390). There was no significant difference for energy (p=0.2732) total protein (p=0.7444), total fat (p=0.5200), total carbohydrate (p=0.2298) and for day 1 and 3 for added sugar. The intakes of all these nutrients were higher with the record method than with the 24-hour recall, except for protein intake on day 3, which was 5.3g lower with the record method (p=0.4561) and also fat intake on day 3, which was -2.5g lower with the record method (p= 0.7408).

Table 4.3 The mean (SD) of the macronutrient intakes of the 24-hour recall in comparison with the records of three-days (n=40)

Variable	24-hour recall	Day 1minus24hour recall		Day 2minus24hour recall		Day 3minus24hour recall	
	Mean (SD)	Mean (SD)	P=value	Mean (SD)	P=value	Mean (SD)	P=value
Energy (KJ)	7887(2760)	1097.5(4261.7)	0.1114	986.8(4409)	0.1648	17.4(4926)	0.9823
Total protein (g)	64.2(27.0)	7.7(39.8)	0.2272	3.0(34.5)	0.5905	-5.3(44.3)	0.4561
Total fat (g)	59.0(31.3)	7.5 (42.2)	0.2655	6.5 (38.7)	0.2893	-2.5 (47.5)	0.7408
Total carbohydrate (g)	278(101)	42.9(160.1)	0.0981	42.2(191.1)	0.1709	8.8(195.4)	0.7772
Fibre (g)	14.3(7.2)^{a,b,c}	7.8(14.2)^{a}	0.0004	8.6(13.9)^{b}	0.0004	5.4(13.6)^{c}	0.0153
Added sugar (g)	41.8(41.2)^{b}	17.0(54.6)	0.0566	17.9(55.9)^{b}	0.0493	8.4(60.0)	0.3900

Means (SD) with the similar alphabet letter in the same row differed significantly (p=≤0.05)

4.3.2 Comparison of micronutrient intakes measured using 24-hour recall and three-day record

Data in Table 4.4 show the difference in micronutrient intakes for the 24-hour and individual three days, 1, 2, and 3 respectively. The data for vitamins A and E indicate significant difference (p=0.0139) and (p=0.0392) respectively (higher vitamin A intake and lower vitamin E intake with the record method). Data for days 1 and 2 for iron (p=0.0004 and p=0.0068), nicotinic acid (p=0.0378 and p=0.0073) and ascorbic acid (p=0.0035 and p=0.0036) respectively, were significantly different (with higher iron and nicotinic acid and lower ascorbic acid intakes recorded than recalled).

There were significant differences in day 2 for thiamin (p=0.0256), folic acid (p=0.0207) and vitamin B6 (p=0.0534) with higher intakes recorded than recalled. There was no significant difference in days 1, 2, and 3 respectively for calcium (p=0.9980), vitamin B12 (p=0.3326), zinc (p=0.8885) and riboflavin (p=0.7023). The very large standard deviation for vitamin B12 might due to the fact that some of the subjects had very low intake of meat and some did not consume meat at all. Some respondents had high intake of liver, while other subjects did not consume vegetables especially the yellow and green vegetables.

Table 4.4 The mean (SD) of the micronutrient intakes of the 24-hour recall in comparison with the records of three-days (n=40)

Variable	24-hour recall	Day 1minus24 hour recall		Day 2minus24 hour recall		Day 3minus24hour recall	
	Mean (SD)	Mean (SD)	P=value	Mean (SD)	P=value	Mean (SD)	P=value
Calcium (mg)	412(297)	41.5(354.0)	0.4627	65.3(390)	0.2963	0.2(371)	0.9980
Vitamin B12 (µg)	3.0(2.8)	-0.4(2.4)	0.3326	3.0(16.0)	0.2462	5.0(22.4)	0.1762
Iron (mg)	8.7(4.6)[a,b]	2.2(6.4)[a]	0.0004	3.4(7.4)[b]	0.0068	1.6(7.8)	0.2031
Magnesium (mg)	223(89)[a,b,c]	120.2(195.5)[a]	0.0004	94.4(168.7)[b]	0.0011	57.3(182.4)[c]	0.0539
Zinc (mg)	8.7(5.2)	1.9(6.8)	0.0868	0.9(6.7)	0.3969	0.2(7.4)	0.8885
VitaminA(µg RE)	308(309)[a,b,c]	233.9(194.9)[a]	0.0001	647.7(1715.6)[b]	0.0219	962.7(2362.7)[c]	0.0139
Thiamin (mg)	1.0(0.4)	0.1(0.8)	0.3541	0.3(0.8)	0.0256	0.0(0.8)	0.8096
Riboflavin (mg)	1.5(1.2)	-0.1(1.7)	0.5773	0.1(1.8)	0.7023	0.1(1.7)	0.6832
Nicotinic acid (mg)	13(6)[a,b]	3.3(9.7)[a]	0.0378	4.6(10.3)[b]	0.0073	2.5(10.6)	0.1517
Vitamin B6 (µg)	1.1(0.7)[b]	0.1(1.1)	0.4184	0.4(1.3)[b]	0.0534	0.2(1.0)	0.1323
Folic acid (µg)	157.9(88.1)[b]	27.3(146.6)	0.2459	71.3(187.0)[b]	0.0207	50.2(193)	0.1083
Ascorbic acid (mg)	60(88)[a,b]	-45.9(93.3)[a]	0.0035	-46.0(93.7)[b]	0.0036	-28.9(111.0)	0.1075
Vitamin E (mg)	10.2(9.8)[a,b,c]	-3.9(11.1)[a]	0.0333	-4.2(12.1)[b]	0.0317	-4.1(12.2)[c]	0.0392

Means (SD) with the similar alphabet letter in the same row differed significantly (p=≤0.05)

4.3.3 Macronutrient intakes measured using 24-hour recall and combined three-day record

Data in Table 4.5 show the macronutrient intakes of combined three-day records and 24-hour dietary recall. The data further indicate that only fibre (p=0.0153) were significantly different with differences of (7.2 %) and (33.5 %) respectively. Meanwhile, energy (p=0.9823), total protein (p=0.4561), total fat (p=0.5200) total carbohydrate (p=0.7772) and added sugar (p=0.3900) showed no significant difference.

Table 4.5 Difference in the mean (SD) intakes of macronutrient for the two methods, the 24-hour recall and three-day record (n=40)

Variable	24-hour recall	Three-day record	Absolute difference[a]	Percentage difference[b]	P-value
Energy (KJ)	7887(2760)	8541(3089)	654	7.7	0.9823
Total protein (g)	64.2(27.0)	64.3(26.4)	0.1	0.2	0.4561
Total fat (g)	59.0(31.3)	62.2(28.8)	3.8	5.4	0.5200
Total carbohydrate (g)	278(101)	310(129)	32	10.3	0.7772
Fibre (g)	14.3(7.2)[q]	21.5(11.2)[q]	7.2	33.5	0.0153
Added sugar (g)	41.8(41.2)	54.8(38.1)	13	23.7	0.3900

[a] (Three-day minus 24hour recall)

[b] (Three-day minus 24 hour recall)/ Three-day multiply 100 for group mean intakes

Means (SD) with the similar alphabet letter in the same row differed significantly (p=≤0.05)

4.3.4 Micronutrient intakes measured using 24-hour recall and combined three-day record

Data in Table 4.6 show the micronutrient intakes of the 24-hour dietary recall and combined three-day records. The data further indicate that iron (p=0.0231 folic acid (p=0.1083), ascorbic acid (p=0.1075) and vitamins E (p=0.0392) and A (p=0.0139) respectively, were significantly different. Meanwhile the data for calcium (p=0.9980), vitamin B12 (p=0.1726), zinc (p=0.8885), thiamin (p=0.8096), riboflavin (p=0.6832) and vitamin B6 (p=0.1083), magnesium (p=0.0539), nicotinic acid (p=0.1517), were not significantly different.

Table 4.6 The mean (SD) of micronutrient intakes of 24-hour recall and three-day record (n=40)

Variable	24-hour recall	Three-day record	Absolute difference[a]	Percentage difference[b]	P-value
Calcium (mg)	412(297)	420 (11)	8	1.9	0.9980
Vitamin B12 (µg)	3(2.8)	5.1(15.1)	2.1	41.1	0.1726
Iron (mg)	8.7(4.6)	10.9(4.8)	2.2	20.1	0.2031
Magnesium (mg)	223(89)[q]	307(146)[q]	84	27.3	0.0533
Zinc (mg)	8.7(5.2)	9.4(4.3)	0.7	7.4	0.8885
Vitamin A (µg RE)	308(309)[q]	615(1603)[q]	307	49.9	0.0139
Thiamin (mg)	1.0(0.4)	1.2(0.6)	0.2	16.6	0.8096
Riboflavin (mg)	1.5(1.2)	1.5(1.2)	0	0	0.6832
Nicotinic acid (mg)	13(6)	15(8)	3	13.3	0.1517
Vitamin B6 (µg)	1.1(0.70	1.3(0.9)	0.2	15.3	0.1323
Folic acid (µg)	157.9(88.1)	204.9(133.2)	47	22.9	0.1083
Ascorbic acid (mg)	60(88)	25(36)	-35	-140	0.1075
Vitamin E (mg)	10.2(9.8)[q]	8(6)[q]	-2.2	27.5	0.0392

[a](Three-day-24 minus hour recall)

[b](Three-day minus 24 hour recall)/ Three-day multiply 100 for group mean intakes

Means (SD) with the similar alphabet letter in the same row differed significantly (p=≤0.05)

Although the aim of this study was not to compare nutrient intakes of the children with the Recommended Dietary Allowances, Table 4.7 depicts the mean intakes of the children as measured with the two methods and with the Dietary Reference Intakes (mean of boys and girls aged 9-13 and 14-18 years). The data further indicate that the nutrient intake for Iron, Zinc, Thiamin, Riboflavin, Nicotinic acid, and vitamin B6 for both the 24-hour recall and three day record are adequate when compared with the Recommended Dietary Intakes and Adequate Intakes, while other nutrient intake such as calcium, magnesium, vitamin A, folic acid, and vitamin E are far below the required Recommended Dietary Intakes and Adequate Intakes for the both methods, except for vitamin B12, which is far higher than the required RDA per day for both the 24-hour recall and three-day record method. The vitamin B12 mean intake for the 24-hour recall is (3µg) and for the three-day record method is (5.1µg) while the required Recommended Dietary Intake is (2.1µg).

This suggests that both the 24-hour recall and the three-day record dietary assessment methods can be used interchangeable to determine the nutrient intakes, because both methods yielded the same results when compared with the Recommended Dietary Intakes and Adequate Intakes. The reason for the low intake of most micronutrient intake might be because most subjects did not consume the fruits and vegetables especially the green and yellow-orange fruits and vegetables.

Table 4.7 The mean intakes of the 24-hour recall and three-day record compared with the Recommended Dietary Allowances

Variable	24-hour recall	Three-day record	RDA's (9-12 years)[a]
Calcium (mg)	412	420	1300
Vitamin B12 (µg)	3	5.1	2.1
Iron (mg)	8.7	10.9	9.8
Magnesium (mg)	223	307	313
Zinc (mg)	8.7	9.4	9
Vitamin A (µg RE)	308	615	700
Thiamin (mg)	1.0	1.2	1.0
Riboflavin (mg)	1.5	1.5	1.0
Nicotinic acid (mg)	13	15	13.5
Vitamin B6 (µg)	1.1	1.3	1.1
Folic acid (µg)	157.9	204.9	350
Vitamin E (mg)	10.2	8	13

[a] RDAs values were quoted from (National Academy of Science,1997,1998,2000,2001).

4.4 Discussion of the results

There is a paucity of scientific studies done that have tried to compare the 24-hour recall and three-day estimated weight record using school children aged 10 to 15 years. Only few studies could be cited, for example, Sobo and co-workers (2000) in San Diego studied children (n=34), aged 7 to 11 years found that 24-hour dietary recall method is the best tool for quantifying children's intakes.

Faber and colleagues (1999) comparing the 24-hour dietary recall method and the seven-day estimated dietary record for determining the mean intake of a population found that 24-hour recall method gave the same mean values for nutrient intakes as the more cumbersome 7-day-estimated dietary record method for obtaining mean nutrient intakes.

The overall results of this study show that day 3 had the best resemblance with the 24-hour dietary recall. The reason could have been that the children started to clearly understand what was required in recording their dietary intakes. However, there was significantly higher mean intakes of fibre and vitamin A and significantly lower intake of vitamin E with the record method. The data further suggest that there was no significant difference between macronutrients, for example, total energy, total protein, total carbohydrate and total fat added sugar. Six micronutrients (calcium, vitamin B12, zinc, thiamin, riboflavin and vitamin B6) were also not significantly different.

On the basis of these findings, it can be argued that the three-day estimated weight record and 24-hour dietary recall yielded about equal estimates of the mean intakes of the subjects. In the present study it was found that both methods have some advantages and disadvantages. The advantage of the three-day estimated weight record method was that the subjects did not rely on memory, whereas, with the 24-hour recall method, subjects relied heavily on memory. Faber and co-workers (1999) reported similar findings. A study in Kenya by Kigutha reported on advantages and disadvantages of the two methods while assessing dietary intakes in rural communities.

The 24-hour dietary recall method has been reported to be cheaper and easier than the dietary record and has been found to yield reliable information if carefully planned and executed. Steyn and colleagues (1986) concluded that the 24-hour recall method of measuring dietary intake yields a relatively valid estimate of the mean intake of groups.

In the present study, we found underreporting and overreporting with the 24-hour recall method. This might have been due to the fact that children did not know the recipes and food preparation methods used. For example, lower intakes for ascorbic acid, vitamin E and protein were found with the 24hour recall, compared to each of the three days recorded. Meanwhile, total fat, fibre, iron, magnesium, vitamin A and niacin were underreported. The findings showed that compared to each of the three days total fat and fibre were underreported. Iron, niacin and magnesium were also underreported compared to the records of days 1 and 2. Buzzard (1998) also reported that the food record method overestimated the difference in fat intake between study groups by approximately 40 % at six months ($p=0.08$) and by 25 % at 12 months ($p=0.62$). Sobo and co-workers (2000) indicated that before the age of 12 years, children's recall skills, ability to estimate and indicate portion size, and food-related vocabularies are limited. However, the most important advantages of the 24-hour recall were that literacy of the subject was not required and that the recall required less time to complete. Thomson and Byers (1994) regarded the strength of the 24-hour recall that the interviewer administers the tool and record responses therefore, the literacy of the respondents is not required. They further indicated about 20 minutes was the usual time required to complete the 24-hour recall.

According to Buzzard (1998), both the dietary record and recalls are completely open-ended and can accommodate any food combination reported by the subjects, and allow unlimited level of specificity regarding the type of food source, food preparation and other detail-related to describing foods and amounts.

In this study, we found that the three-day estimated weight record method was cumbersome for the subjects. This was due to the fact that the method required literacy level of the subjects and some subjects could not write correctly. Also, the method required the subject to estimate their intakes whereas most of them were tired of repeated recording of the foods. Faber and co-workers (1999) also reported that dietary record method was a more tedious method than the 24-hour recall.

In this study the findings suggest that the three-day estimated weight record can be substituted by the 24-hour dietary recall and also suggest that the two dietary methods can be interchangeably used. We argue that the significant difference in nutrient intake observed between the two methods might be due to the reason that certain foods are different as sources of fat, fibre, and vitamins A and E. Another explanation can be that children tend to have special food preferences in reporting. For example, they can remember easily foods they like such as sweets and chocolates and forget foods like fruits and vegetables. Sobo *et al.* (2000) argued that children might be inattentive to aspects of food and drink that are unimportant to them. They further argued that children tend to report what was served instead of what was eaten. Children did not know how much fat was used in food preparation.

Vuckovic *et al.* (2000) investigated the factors influencing participant's decisions regarding their food choices and what to report on food record. They found that the dietary records are influenced by honestly, social acceptability and simplifying food intake data, but also that perception of portion sizes varied according to personal preferences, the role of food in the meal, the type of food, product serving size and comparison with others. Simplified food intake on record days may lead to either underreporting (when certain foods or meals are avoided to improve the ease of reporting) of energy and fat.

4.5 Summary

In summary, our findings indicate that there was no significant difference between the 24-hour recall and three-day estimated weight record methods in three macronutrients and there was significant difference in seven of the micronutrients. The significant differences in nutrient intakes were probably due to underreporting and overreporting in the 24-hour recall method.

CHAPTER 5

RECOMMENDATION AND CONCLUSIONS

5.1 Introduction

To the best of the researcher's knowledge there is limited scientific literature regarding the comparison of the 24-hour recall and three-day estimated weight record using school children, aged 10 to 15 years. However, few studies could be cited for comparison as described in the Chapter 4.

In this chapter, the practical implications of the findings and conclusions will be presented.

5.2 Aim of the study

The aim of this study was to compare the energy and nutrient intake as determined by a 24-hour recall and a three-day estimated weight record in a study of 10 to 15 year old school children.

5.3 Limitations of the study

- The major limitation of the study was that the three-day estimated weight record required the subjects' literacy level, motivation and longer time to complete the tool. Also, in comparison the latter method seem to be more expensive as compared to the 24-hour dietary recall. The researcher had to travel three times to visit one subject, approximately two months to complete all 40 subjects whereas in the 24-hour recall only two visits were made for all subjects (n=40).

- It was also found that the major limitation of the 24-hour recall was reliance on subject's memories. This probably could be a reason for over- and underreporting of the nutrient intakes in the present study.

5.4 Recommendations

On the basis of the findings from this study, the following recommendations were made according to the three different levels, namely, policy, programme and research.

5.4.1 Policy level

- Resource mobilisation, advocacy and sensitisation to the planners, decision makers, politicians and managers will be required to promote dietary intake assessments for segments of the populations. This should be the entry point for all future undertakings in government institutions, non-governmental organisations, research and tertiary institutions.

5.4.2 Programme level

- It is recommend that dietary intake assessment should be conducted prior to any nutrition intervention programmes. It is further recommend that the 24-hour recall method can be a suitable, user friendly, culturally sensitive and cost-effective method.

5.4.3 Research level

- In comparison, the three-day estimated weight record required participant's literacy level, we recommend that the 24-hour recall method should be used in school children during nutrient intake studies. However, well-trained interviewers will be required to administer the tool.

- The researcher found that with the 24-hour dietary recall method higher or lower nutrient intakes were found for same nutrients. Therefore, it is recommended that intensive training should be given to interviewers especially on probing techniques and also creating a favourable environment for the subjects to actively participate in the study. It is also recommend that, because children are inattentive in aspects of food and drink that are unimportant to them, parents and/or caregivers should assist children in completing their dietary intake records.

- The researcher found that school children did not have knowledge on food preparation methods and recipes. It is recommended that the researchers should be well skilled on probing techniques during dietary intake recalls and records. Proper orientation training for the research assistants will be a prerequisite in the future undertakings.

- Researchers should examine the factors influencing over- and underreporting by subjects and their impact on macro-and micronutrients intakes. Such information can be used to develop accuracy-enhancing guidelines for conducting recalls with school children.

5.5 Conclusions

The research question whether the 24-hour recall and three-day estimated weight record were significantly different has been answered. No significant differences between the two methods were found. The only difference found in macronutrients was in fibre and in the micronutrients in vitamin E. The implication of this finding is that 24-hour recall can be suitable, user friendly, and cost-effective to assess the dietary intakes of the school children.

Therefore, in conclusion this mini-dissertation contributes knowledge that the two methods are equally important but the 24-hour recall should be widely promoted in future dietary assessment studies across all population groups for epidemiological studies with a large sample size.

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Addendum 1: The informed consent form

THUSA BANA PROJECT: INFORMATION ON THE STUDY

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

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)_____

Addendum 2: Control form

THUSA BANA PROJECT

Subject name:_____ No:_____ Gender:____

STATION	ACTIVITY	CHECK CONTROL
STATION 1	RECRUITMENT, DEMOGRAPHIC QUESTRIONNAIRE	
STATION 2	BLOOD PRESSURE	
STATION 3	ANTHROPOMETRY	
STATION 4	ANTHROPOMETRY: CLOTHING	
STATION 5	PSYCHOLOGICAL QUESTIONNAIRE A	
STATION 6	DIETARY QUESTIONNAIRE	
STATION 7	MOTOR DEVELOPMENT A	
STATION 8	PSYCHOLOGICAL QUESTIONNAIRE B	
STATION 9	EATING HABITS	
STATION 10	FAMILY CIRCUMSTANCES + HIV TRANSMISSION	
STATION 11	PHYSICAL ACTIVITY	
STATION 12	MOTOR DEVELOPMENT B	SIGNATURE
BACK TO STATION 1		

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Addendum 3: Demographic questionnaire

Potchefstroomse Universiteit
vir Christelike Hoër Onderwys

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

Addendum 4: 24-hour dietary recall questionnaire

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:					

Addendum 5: Three-day dietary record questionnaire

1064

CONFIDENTIAL

SUBJECT NUMBER: ~~1071~~ ~~1064~~

AGE: 12

SEX: Female

THUSABANA

FOOD DIARY

E2
1:5

INSTRUCTIONS

1. Please use this booklet to write down everything you eat or drink for the following seven days :

As you will see, each day is marked into sections, beginning with the first thing in the morning and ending with bedtime. For each part of the day write down everything that you eat or drink, how much you eat or drink, and a description if necessary. If you do not eat or drink anything during that part of the day, draw a line through the section.

2. You have been provided with : a scale to weigh food,
a measuring jug to measure liquids and a set of measuring spoons to measure small amounts of foods and liquids.

3. Write down everything at the time you eat or drink it. Do not try to remember what you have eaten at the end of the day.

4. Before eating or drinking, the **prepared** food or drink must be weighed or measured and written in the record book. If you do not consume all the food or drink, what is left must also be weighed or measured and recorded in the book.

5. Please prepare foods and drinks as you always do. Also eat and drink in the same way as normal: eat the foods and drink in the amounts and at the times that you always eat and drink. Try not to change the way you eat and drink at all.

6. We need to know **ALL** the food and drink you take during these seven days. So if you eat away from home, (eg at work, with friends, at a cafe or restaurant) please take your measuring equipment with you so you can still measure your food. Also do not forget to measure food bought at take aways.

7. Please write down the recipes of homemade dishes such as stews, soups, cakes, biscuits or puddings. Also say how many people can eat from them or how many biscuits or cakes you get from the recipe.

8. On the next page is a list of popular foods and drinks. Next to each item is the sort of thing we need to know so that we can tell how it is made and how much you had. This list does not contain all foods, so if a food that you have eaten is missing, try to find a food that is similar to it. Please tell us as much about the food as you can.

9. Please tell us the amount and type of oil or fat that you use for cooking, frying or baking

10. Most packet and tinned foods, like Simba chips, Niknaks, corned meat, tinned pilchards have weights printed on them. Tins, bottles and boxes of cold drinks and alcoholic drinks also have weights printed on them. Please use these to show us how much you ate or drank. When possible, please keep the empty packets, bottles or tins.

PLEASE NOTE: we need to know the amount **YOU** eat or drink. So, if you do not eat the whole packet or tin of food, or drink the whole bottle of cold drink, please **measure** the amount you eat or drink.

11. At the end of each day there is a list of snacks and drinks that can easily be forgotten. Please write any extra items in here if you have not already written them down in some part of the day.

12. The research assistant will visit you during the record days to help you if you have any questions or problems. She will collect the equipment and record book after the seven days.

ALL THE INFORMATION YOU GIVE US IS STRICTLY CONFIDENTIAL. IT WILL ONLY BE USED FOR RESEARCH PURPOSES. ONLY YOUR SUBJECT NUMBER APPEARS ON THE RECORD BOOK. NOBODY WILL BE ABLE TO IDENTIFY YOU WITH THE RECORD BOOK.

FOOD/DRINK	DESCRIPTION AND PREPARATION	AMOUNT
Atchar	Homemade or brand name	Weight or number of measuring spoons
Beer	What sort: Tlokwe; homemade; Brand name e.g. Lion, Castle, Black Label. If homemade, please give recipe.	Number and size of bottles, cans, mugs or glasses
Biscuits	What sort; homemade. Please give recipe	Number and size
Bread spreads	Type eg margarine, peanut butter, jam, atchar	Number of measuring spoons
Bread	White, brown, whole wheat; bread or bread rolls or buns.	Weight and number of slices
Breakfast cereals	Name eg Kelloggs All Bran, Rice Crispies	Weight
Cheese	What sort: cheddar, Gouda, cottage, cream; wedges, spread	weight, number
Chicken	Boiled, fried, roasted, grilled or stewed. Part of the chicken eaten eg breast, wing Skin eaten or not	Weight - say whether with or without bone
Chocolates	Name e.g. Nestle milk chocolate, Bar-One, Tex	Number or weight on packet
Cold drinks	What sort e.g. Sweeto, SixO; Coke, Fanta; fruit juice; sweetened or diet	Volume of glass or size of bottle or tin
Dumpling	Type of flour used. Please give the recipe	Weight
Eggs	Boiled, poached, fried, scrambled. If fried or scrambled, the amount and type of fat used.	Number
Fat cakes	Size. Please give the recipe.	Weight and number
Fat	Type eg dripping, beef fat, Holsum	Weight or measuring spoons
Fresh fruit	What sort, with or without skin	Size and number or weight
Fried fish	Bought or home-made; with or without coating	Weight
Homemade dishes	Please say what the dish is called and give the recipe or ingredients	Weight
Mabella	Fine or course. Name of mabella used. Stiff or soft. Salt added or not. Please keep a sample of mabella	Weight
Margarine	Name, hard, soft or medium fat	Weight or measuring spoon
Mealie-meal porridge	Name of mealie-meal used. Crumbly, very stiff, stiff, medium stiff, soft, very soft, mageu. Weigh the amount of meal and measure the amount of water used to make the porridge. Salt added or not. Please keep a sample of porridge.	Weight
Meals eaten away from home	What sort e.g. fish and chips, steak, hamburger, chicken, bread and chips, Please say what the dish is called and give ingredients if possible. Give the name of the restaurant or take away.	Weight, or table spoons
Meat	What sort, fatty or not. Fat cut off or not. How cooked eg boiled, fried, stewed. With or without bone. Cooked with or without vegetables.	Weight - say whether with or without bone

FOOD/DRINK	DESCRIPTION AND PREPARATION	AMOUNT
Milk - in tea /coffee	What sort: fresh, milk powder - give name, whitener - give name, condensed milk	Number of spoons or volume
Milk to drink or on porridge or cereals	What sort: fresh, milk powder - give name, whitener - give name, condensed milk	Number and size of cups/glasses
Oil	Name	Measuring spoons
Other porridge	Name. Salt added or not	Weight
Polony	Type	Weight or thickness of slice
Pudding	What sort and brand, e.g. jelly, tinned fruit, instant pudding, baked pudding, custard, give recipe	Weight or volume
Ready-made dishes	What sort e.g. pizzas, pies, frozen foods. Please keep the containers	Weight
Rice	Type of rice.	Weight
Salt, pepper		Measuring spoons
Samp Samp and beans	Name of samp. Type of fat added. Number of cups of samp and beans used. Type of beans used.	Weight
Sauces	Tomato sauce, worcester sauce, mustard sauce, chutney	Number of size of spoons
Snacks in packets	What sort e.g. Simba chips, cheese curls, Niknaks, peanuts	Weight of packet
Soya	Name eg Toppers, Imana, Woza	Weight
Spirits	What sort e.g. brandy, cane, gin, whisky; type of mixer e.g. coke, tonic, soda water	Number of tots or glasses
Sugar - in tea /coffee	What sort: white or brown	Number and size of measuring spoons
Sweets	What sort: e.g. toffees, hard sweets, liquorice all sorts, marshmallows	Number
Take away	What sort e.g. fish and ships, steak, hamburger, chicken. Please say what the dish is called and give ingredients if possible. Give the name of the take-away	Weight
Tea / Coffee	What sort	Size and number of cups/mugs
Ting	Mealie-meal or mealie meal and mabella Salt added or not Please keep a sample of ting	Weight
Tinned fruit	What sort. With or without custard	Weight of fruit Volume of custard
Tinned fish	Type, straight from tin or mixed with onion and/or tomato	Weight
Vegetables	What sort, how cooked eg fried, boiled, with potato and onion, with fat	Weight
Wine	White, red, sweet, dry	Number and size of glasses

EXAMPLE:

Breakfast		Office use			
Food/ Drink	**Description and Preparation**	**Amount served**	**Amount left**	**Amount eaten**	**Code**
Mealie meal porridge	*Iwiza. Soft, 1 cup meal and 3 cups water*	*300g*	-		
Milk	*Fresh, full cream Clover*	*300ml*			
Bread	*Brown*	*1x60g*			
Margarine	*Rama, soft*	*10 ml*			
Tea	*Glenn tea bags*	*1 cup*			
Milk	*Fresh full cream Clover*	*25 ml*			
Sugar	*White*	*2 heaped teaspoons*			

DAY No 1

DATE 14/08/2001 DAY OF WEEK TUESDAY

EARLY MORNING - BEFORE BREAKFAST				Office use:	
Food / Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

BREAKFAST				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Bread Toast	White Toast Bread	60g X2	—	120g ✓	
Ham		10g	—	10g	
Butter	Stork	5g	—	5g	
Tea	Five roses	220ml	—	220ml	
Sugar	White sugar	10ml x3	—	30ml	
Milk	Long life full cream	20g	—	20g	

MID MORNING - BETWEEN BREAKFAST AND LUNCH TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Pie	Steak and Kidney	60g	-	60g	
Drink	Fanta	250ml	—	250ml	
Sweets	Bigtime	5g x 4	—	20g ✓	

LUNCH TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

MID AFTERNOON - BETWEEN LUNCH AND DINNER				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

DINNER TIME				Office use:	
Food/Drink	**Description and Preparation**	**Amount served**	**Amount left**	**Amount eaten**	**Code**
~~P~~ Fish Porrige	Lucky star White star	60g 350g	— —	60g 350g	

LATE NIGHT - up to last thing at night				Office use:	
Food/Drink	**Description and Preparation**	**Amount served**	**Amount left**	**Amount eaten**	**Code**
Milk	Long life	250ml	—	250ml	

Between meals, snacks and drinks if not already written in before					
Food/Drink	**Description and Preparation**	**Amount served**	**Amount left**	**Amount eaten**	**Code**
Sweets and chocolates					
Biscuits or cakes					
Simba chips					
Peanuts					
Other snacks					
Cold drinks					
Beer					
Tlokwe					
Mageu					
Other drinks					
Tea					
Coffee					
Milk					
Anything else?					

Please write in the recipes or ingredients of any homemade dishes, take away that you have written in but not already described:

END OF DAY No 1

DAY No 2

DATE 15/08/2001 DAY OF WEEK Wednesday

EARLY MORNING - BEFORE BREAKFAST				Office use:	
Food / Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

BREAKFAST				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Fish Porrige	Lucky star White star	30 g 350g	— —	30g 350g	

MID MORNING - BETWEEN BREAKFAST AND LUNCH TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Bread Chips Mince sweets	Blue Ribbon (White) fried stew Bigtime	100g 60g 60g 79X5	— — — —	100g 60g 60g 35g	

LUNCH TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Bread	Blue Ribbon (Brown)	60g X2	—	120g	
Butter	Stork	5g	—	5g	
tea	Five roses	220ml	—	220ml	
Sugar	White sugar	10ml/x3	—	30ml	
Milk	Long life	20g	—	20g	

MID AFTERNOON - BETWEEN LUNCH AND DINNER				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

DINNER TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Rice	Tastic	125g	—	125g ✓	
~~Chiken~~ Chicken	Farm chicken fried	45g	—	45g ✓	
Cabbige		60g	—	60g ✓	
Mayonise	Nola (tangy one)	~~40g~~ 40g	—	40g ✓	
Tomato & Onion gravy		40g	—	40g ✓	

LATE NIGHT - up to last thing at night				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Bread	Blue ribbon (Brown)	60g	—	60g ✓	
Milk	Long Life	250ml	—	250ml ✓	

Between meals, snacks and drinks if not already written in before					
Food/Drink	**Description and Preparation**	**Amount served**	**Amount left**	**Amount eaten**	**Code**
Sweets and chocolates					
Biscuits or cakes					
Simba chips					
Peanuts					
Other snacks					
Cold drinks					
Beer					
Tlokwe					
Mageu					
Other drinks					
Tea					
Coffee					
Milk					
Anything else?					

Please write in the recipes or ingredients of any homemade dishes, take away that you have written in but not already described:

END OF DAY No 2

DAY No 3

DATE 16/06/2001 DAY OF WEEK Wednesday

EARLY MORNING - BEFORE BREAKFAST					Office use:
Food / Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

BREAKFAST					Office use:
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Sweets	Joystic	7g X 6	—	42g	✓

MID MORNING - BETWEEN BREAKFAST AND LUNCH TIME					Office use:
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
~~Fanta~~ Drink	Fanta	300ml	—	300ml	✓
Bread	Butter Fild (white)	30g	—	30g	✓
Chips	fried	30g	—	30g	✓

LUNCH TIME				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
~~Bibo~~					
Drink	Bibo	200ml	—	200ml	✓
Bread	White (butterfild)	60g	✓	40g	✓
Chips	Fried	60g	—	60g	✓
Sweets	Beacon	7g x 4	—	28g	✓

MID AFTERNOON - BETWEEN LUNCH AND DINNER				Office use:	
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code

DINNER TIME					Office use:
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code
Rice	Tastic rice	125 g	—	125g	✓
Meat	Beef (ribs)	90 g	—	90g	✓
Cabbige		30g	—	30g	✓
Mayonise	Nola ~~a~~ the tangy one	10g	—	10g	✓

LATE NIGHT - up to last thing at night					Office use:
Food/Drink	Description and Preparation	Amount served	Amount left	Amount eaten	Code