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**Title**

Evaluation of the food service for adolescent boys in Mogale Child and Youth Care Centre in Gauteng, South Africa, 2012.

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# Title

# EVALUATION OF THE FOOD SERVICE FOR ADOLESCENT BOYS IN MOGALE CHILD AND YOUTH CARE CENTRE IN GAUTENG, SOUTH AFRICA, 2012

By

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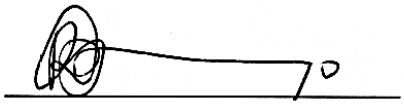
A dissertation submitted to the Faculty of Health Sciences at the School of Health Systems and Public Health, University of Pretoria in fulfilment of the requirements for the Degree of Magister Scientiae; MSc (Community Health).

18th October 2013

# Declaration

I, ROSELIDAH ANYANGO ALUHA declare that this dissertation is my own, unaided work. It is being submitted in fulfilment for the Degree of Master of Science in Community Health at the Faculty of Health Sciences at the School of Health Systems and Public Health, University of Pretoria. It has not been submitted for any other degree or examination in any other University.



Signature

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Date

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**Dedication**

To my uncles,

Mr. Peter O. Wayodi,

and

Mr. Kevin O. Wayodi,

who laid a strong foundation in my life, educationally and socially.

❁ ❁ ❁

To my children,

Glenn, Daniel and Ruth

for inspiration to achieve their highest degree of academic excellence.

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## Acronyms and Abbreviations

| | |
|---|---|
| BMI | Body Mass Index |
| DRI | Daily Recommended Intake |
| DYC | Dyambu Youth Centre |
| EER | Estimated Energy Requirement |
| FAO | Food and Agriculture Organization |
| HACCP | Hazard Analysis and Critical Control unit Point |
| IFSS | Integrated Food Security Strategy |
| MCYCC | Mogale Child and Youth Care Centre |
| MRC | Medical Research Council |
| PAL | Physical Activity Level |
| RDA | Recommended Daily Allowances |
| RDP | Reconstruction Development Programmes |
| SSB | Sugar Sweetened Beverage |
| UN | United Nations |
| UNHR | United Nations Human Rights |
| WHO | World Health Organisation |

## Abstract

The study was carried out at the Mogale Child and Youth Care Centre (MCYCC) a privately run institution by Bosasa Operations in partnership with the Gauteng Provincial Departments of Social Development and Health and Social Welfare Department. The facility caters for boys in conflict with law aged 14–18 years, who have been legally placed in the facility as a place of safety by court order. It is expected that the findings and recommendations from this study will be useful in improving the food service standards for such institutions. At the time of this study there were 200 adolescents, 137 were awaiting trial, 55 on the diversion programmes and 8 were serving court sentence at the centre.

The cross sectional study evaluated the food service offered at the MCYCC to establish the nutritional adequacy of the food served. Both qualitative and quantitative research methods were used to collect and analyse data. Out of the 200, 144 answered the customer satisfaction questionnaire and 167 took the BMI test. Observations were done in the kitchen to determine the compliance level to the food and safety regulations.

The analytical results of the responses from the self-administered questionnaire on the customer service satisfaction generated by the SAS software revealed reliable results. The probability, (p-value) from the Chi-square ($\chi^2$) test showed that there was a significant difference in response the parameters tested including the overall satisfaction. Body Mass Index (BMI) calculations established different anthropometric patterns of which 1.3% adolescents were found to be obese, 28.2% were overweight, 57% had normal weight while 13.5% were found to be underweight. The Foodfinder 3 software used to evaluate the nutrient composition in a 2-week cycle menu revealed that in most cases both the macronutrients and micronutrients in the menus exceeded the recommended daily allowance (RDA) for the adolescent boys. Food safety and hygiene standards results showed that the unit is compliant with the required standards as it scored 86%; it was colour coded Silver and rated as very good.

All the parameters evaluated scored above average percentage rating the customer satisfaction level for the services offered at the MCYCC are as good. Both underweight and overweight adolescents exist among the adolescents at the centre. The weights from the sample food plates exceeded the RDA of the adolescent boys. The centre's compliance to health and safety regulations was rated as very good. The authorities in the Gauteng Provincial Departments of Social Development and Health and Social Welfare and Bosasa operation management should make use of this evident information to further improve the food service standards for other such institutions.

# CHAPTER 1: INTRODUCTION

## 1. OUTLINE

This research involves an evaluation of the food service for adolescent boys in Mogale Child and Youth Care Centre in Gauteng, South Africa. Chapter one has covered the aspects of: Background information on the facility, the relevance and motivation of study, the problem statement, the aim and objectives of the study and the study setting.

## 1.1 Background

Food service units have an important role to play in the public health sector by providing proper nutrition to enhance good health. It is mandatory that they keenly observe the stipulated rules and regulations set for such institutions, in order to provide excellent service to their clients and meet the objectives of their existence in the communities. It has been recorded that the failure by the food service providers to comply with set rules and regulations results into numerous health risks which are costly, placing a burden on the public health sector, or in unfortunate cases, loss of lives (1).

The foundations of excellent service in a food service unit generally depend on adequate knowledge in food and nutrition, planning and preparing nutritious meals and adhering to the food and safety principles. This in return ensures customer satisfaction and good health of the consumers. On the contrary, inadequate knowledge in food and nutrition, poor planning and preparation of meals especially for the adolescents, result into inferior diets leading to customer dissatisfaction, riots in cases of institutions and poor nutrition which leads to malnutrition. Malnutrition which refers to both over and under nutrition and lack of food safety practices in the food service units result into risky health situations that place a heavy burden on the health care systems all over the world. Subsequently, poor food safety and unhygienic practices by food handlers may lead to cross contamination during food preparations. This may eventually result into food poisoning, which is also costly to the health sector worldwide (1).

Poor quality and insufficient quantity of food have been identified as the major causes of malnutrition among adolescent boys in schools and other institutions of learning including child and youth care centres. Together with poor food safety and unhygienic conditions in food service units, malnutrition amongst adolescent boys has become a public health concern (1). Adolescent boys in conflict with the law are vulnerable due to the conditions they find themselves in and therefore the set rules and regulations governing their welfare in terms of adequate and safe nutritious food need to be adhered to. This should be done in order to help support their rapid growth and development at this stage; maintain their good health as well as help to ease the stigma placed on them because of their circumstances.

Any factors that may contribute to poor customer service need to be dealt with in order to eliminate customer dissatisfaction. In addition, careless approaches and lack of diligence when handling food leading to food contamination and general food poisoning need to be monitored in order to avoid foodborne diseases that are now a serious public health problem worldwide. The threats of foodborne diseases are numerous and varied with symptoms ranging from relatively mild discomforts to very serious life threatening illness that food handlers need to be aware of and avoid (2).

### 1.2 Relevance and Motivation of Study

Not much of what goes on in the food service unit in MCYCC is known since no research has been carried out and documented in this area. The resident adolescents who are in conflict with the law have a great need for growth and development as well fair treatment like any other free human being. The tendency is to neglect them because of their situation, but by law they are also entitled to safe nutritious meals served on time by friendly and courteous staff. Since the adolescents do not get food from anywhere else, their growth and development dependents solely on what is provided to them by the food service unit. Therefore it is paramount that the food service unit plays its role prudently to be able to meet the needs of these vulnerable young adults.

Nutritional deficiencies at this stage manifest in anthropometric patterns like underweight, overweight, obese, stunted growth which are easily evident among the individuals' whose diets are not well planned and implemented. The nutrient requirements for an individual depends on their state of heath, gender, age, body size and the level of activity (3).

Therefore the evaluation of the food service at MCYCC was crucial as it sought to establish the quality of the service provided to this vulnerable group of adolescents who do not have the freedom to choose the type, quality and quantity of food or meal times.

Consumer satisfaction to any service provided is important for the coexistence of the consumer and the service provider. Therefore a service acceptability investigation was done in order to define the level of satisfaction rendered by the food service unit at the MCYCC.

An institution's compliance to the regulations of the national food service management policies and guidelines are important to all stakeholders ranging from the consumer, the facility management and the health sector. The food safety and high hygiene standards in food service units in institutions are important as they help to reduce microbial counts in food and in the cooking facility in general. This in turn helps to reduce the risks of food poisoning and other foodborne illnesses (4).

Food safety and hygiene practices are grounded on the '4Cs' for food safety [cleaning, cooking, cross contamination and chilling], which if keenly followed may safeguard the safety of the served and consumed food. All food handlers need to practice the 4Cs during food preparation procedures, cooking, serving as well storage processes to ensure food safety which is a priority in the food service units. These practices also help to meet the customers' expectations of food safety, hygiene, and quality, motivating them to willingly pay for the asked price in the case of public food outlets. The implementation of procedures to meet the total consumer's nutritional needs is dependent on the management of the facility which forms part of the food service unit (4, 5).

### 1.3 Problem Statement

The nutritional adequacy, service acceptability and sufficiency of the food served to the resident adolescents at MCYCC were not known. Likewise, the food safety and hygiene status of the food service unit was also not known.

## 1.4 Aim and Objectives of the Study

### 1.4.1 The aims of the study

The aims of this study was to investigate the nutritional adequacy and sufficiency of the food served at MCYCC, the quality of the food offered as well as and customer service satisfaction and food safety and hygiene in the food service unit.

To achieve these aims, the study was guided by four research questions:

1. Is the food served nutritionally adequate for the adolescents?
2. Is the food served to the adolescents sufficient?
3. Is the food and service offered acceptable to the clients?
4. Do the food service procedures comply with the recommended food safety and hygiene standards for institutions?

### 1.4.2 The objectives of the study

1. To investigate the acceptability of the food and customer satisfaction of the service offered to the adolescents by conducting a customer satisfaction survey.
2. To establish the anthropometric patterns of the current resident adolescents at the MCYCC by BMI calculations.
3. To analyse the planned menus using the Foodfinder 3 and determine their nutritional adequacy in comparison to the Recommended Daily Allowances (RDAs) for adolescents.
4. To determine the sufficiency of the provided food portions by weighing the actual food portions served and compare them to the recommended food portions in the menu.
5. To assess the compliance of the unit to the set food safety and hygiene regulations by conducting a document audit and observations by the researcher of food preparation procedures, personal hygiene of the employees and the general cleanliness of the facility.
6. Make recommendations.

## 1.5 The Study Setting

### 1.5.1 MCYCC – A place of safety: Background information

A study by Makoko provides the background information of the MCYCC. Formerly known as Dyambu Youth Centre (DYC), the MCYCC is a residential, secure care facility for male children of ages 14–18 years, who are in conflict with the law. It is situated in Mogale City in Krugersdorp on the West Rand of Gauteng province and it is the biggest centre of its nature in South Africa. The centre is divided into two separate sections: Mogale, which caters for youths above 16 years old and Leseding for children between 14 and 16 years old. The separation was essential to try and manage the arrival of younger boys and help them settle down. This could also help reduce the negative influence of some of the older boys on the younger ones (6).

The centre is run by a privately owned South African company Bosasa Operations (Pty) Ltd., which was previously known as Dyambu Operations (Pty) Ltd. This is done in partnership with the Gauteng's Provincial Departments of Social Development, Health and Social Welfare. The main aim of the facility is to provide a safe and secure place for children in conflict with the law.

Bosasa Operation's role in running the centre involves providing safe and secure accommodation, provide nutritious meals and run rehabilitation programmes for the children in conflict with the law. The other legal aspects of the children in conflict with the law are handled by the Departments of Social Development, Health and social Welfare in collaboration with the South African police. All the processes are executed in accordance to the UN convention on the rights of the child of 1989 in article 3.3, which requires State parties to ensure that the institutions, services and facilities responsible for the care of or protection of children should conform to the standards established by competent authorities. Such standards must cover areas of safety and health, in addition to the number and suitability of their staff, as well as competent supervision as stipulated by the 1989 UN Convention on the Rights of the Child (7).

In adherence to the Article 24 of the UN Convention on the rights of a child which states that the child has the right to the best health care possible, safe drinking water, nutritious food, a clean and safe environment, and information to help them stay well, all food

service units especially for vulnerable groups like the adolescent boys in conflict with the law should strictly comply in order to these support good health, growth and development for the adolescent boys.

1.5.2 The origin of privately-run youth centres in South Africa

The privately run youth centres resulted from the new South African Government's invitation to the private sector to partner with them in the reconstruction and development of the country in accordance to Article 2.13.4.4 of the Government regulations to introduce Reconstruction and Development Programmes (RDP) (8).

The introduction of the RDP in the new South Africa after the first democratic election in 1994 set the wheels in motion for change in all departments throughout the country. The government encouraged the participation of the private sector to help rebuild the nation.

The uncoordinated release of children awaiting trial from detention, following the declaration of the amendment of section 29 of the Correctional Services Act and the high rates of delinquent behaviour among the youths, resulted into a need for suitable safe and secure alternative accommodation to prisons and police cells (9).

Juvenile delinquency refers to behaviour that is contrary to the needs and rights of others and thereby violating the society's setting through illegal acts committed by individuals who are under the age of 18 years. With the escalating rates of juvenile delinquency in the society there was a need to get secure places where the youngsters would be held separately. Their conduct did not conform to the norms set by institutions such as the family, school or community in which they live therefore alternatives institutions had to be sought for to accommodate them safely.

While detained in these centres they would either serve sentences for the crimes they committed, put on diversion programmes for corrective measures or await trial by the juvenile courts. Decisions made at any of the above process need to be made in accordance with the UN Human Rights rules and regulations (10). An example of these rules as given in "The Beijing Rules" states that juveniles should only be deprived of their liberty in agreement with the principles and procedures set forth in the United Nations Standard Minimum Rules for the Administration of Juvenile Justice (11). The rule further states that those who are detained or are awaiting trial ("untried"), are presumed innocent

and shall be treated as such. It further states that detention before trial shall be avoided to the extent possible and limited to exceptional circumstances.

Therefore, more efforts should be made to apply alternative measures to contain the youths in conflict with the law. When preventive detention is used, juvenile courts and investigative bodies are required to give the highest priority to the most efficient processing of such cases to ensure the shortest possible detention duration.

Other rules include the separation of the untried detainees from the convicted juveniles (10). This explains why the MCYCC is divided into two sections: Mogale and Leseding. Mogale is for the convicted while the Leseding is for those awaiting trial and those on diversion programmes. Shaw and Tschiwula have also heighted that the most effective responses to youth crime and violence, revolves around prevention and inclusion (especially for youths in government care centres) rather than exclusion, punishment and incarceration. They highlight the key role for local governments in developing effective local responses that draw in and support all key local actors (parents, schools, police and businesses), in regard to the plight of children in conflict with the law (12).

### 1.5.3 The facilities available at the MCYCC

*Does MCYCC meet the standards of United Nations Human Rights (UNHR)?*

Every youth care facility in South Africa needs to meet some operational standards to be able to appropriately care for the youths in their custody. The standards are set and monitored by the Department of Social Development, Health and Social Welfare and should be in accordance to the United Nations Human Rights (UNHR) rules and regulations as indicated in the UNHR Articles. The basics include facility being secure, available accommodation, appropriate staff, food service unit, health care and creation facilities.

*Accommodation*

The MCYCC offers accommodation for children on diversion programmes, those awaiting trial and those serving their sentence for the crimes committed. The facility is safe, secure and operates within the new children's Act No.75 of 2008 which stipulates that children awaiting trial and those on diversion programmes should not be held in prisons. Instead

they should be held in secure child and youth care facilities if they cannot be released into the care of their parents (9, 13).

*Food facility*

MCYCC has a kitchen equipped with industrial cooking equipment making it possible to effectively produce food for big numbers. There is a protected serving area to limit contact of the youth with the kitchen staff. Each group has its own dining hall where they sit and take their meals and the serving is done separately for each group. They use a two menu cycle which is clearly displayed on the kitchen wall, serving area and the dining halls.

*Registration facility*

There is a registration area equipped with a biometric system that captures and records the children's details upon arrival at the centre. The registration includes a health examination, which is conducted in the clinic to establish their health status as soon as they arrive. This also entails taking their weight and height measurements on arrival and departure.

*Health facility*

The clinic has three nurses who work on shift rotation and one doctor who comes in once a week or whenever there is a need. The youths are also referred to any other nearby hospitals in case of an emergency or complications that cannot be handled at the clinic.

*Sports facility*

The playgrounds are equipped for various sporting activities like soccer, swimming, obstacles course, volley ball and cricket. Facilities for indoor games like weight-lifting, pool, boxing, and darts are also available. With the help of a timetable drawn by the sports committee indicating what time which group of youths need to be on different playgrounds and under the supervision of the social workers, they are able to engage in different physical activities daily.

# CHAPTER 2: LITERATURE REVIEW

## 2. OUTLINE

This section covers a literature review on the growth and development stages at adolescence, nutrition at the adolescence, nutrition of adolescents in youth care centres, menu planning and food preparation in institutions, body mass index, food and food service acceptability, food safety and hygiene.

## 2.1 Growth and Development at Adolescence

### 2.1.1 Eating habits and health risks

Research shows that there is a relationship between eating habits and the development of several non-communicable diseases. It also reveals that adolescents have developed poor eating habits in the recent decades making it necessary to probe the underlying factors for such behaviour in order to develop and implement strategies to correct the patterns. The research findings by de Moraes *et al*. assert that a healthy eating pattern and physical activity in adolescents can help prevent the incidences of such diseases both at this stage and later on in adulthood. They further state that proper growth and development in adolescents largely depends on a balanced intake of nutrients and physical activities that help reduce the risks of metabolic diseases (14).

### 2.1.2 Rapid growth and development

The adolescence stage is characterised by rapid growth in an individual's life, which is only second to the first year of life when growth rate is at its highest. The stage can be divided into three categories namely; early adolescence (11–14), middle stage (15–17) and late adolescent stage (18–21). According to Mahan and Esccott-Stump, identification of the different adolescence stages can be helpful when providing nutritional counselling and designing educational programs. These authors emphasize that early adolescence (11–14 years) is characterised by the onset of puberty and increased cognitive and emotional

development. Nutritionally at this stage, they are willing to do or try anything that makes them look better or improve their body image (15).

The middle stage is 15–17 years and is characterised by increased independence and experimentation. There is a tendency to be influenced by peers, mistrust of adults and overreliance on their independence. This may result into temporary rejection of the family dietary patterns. This stage is characterised by excessive caloric intake, sedentary behaviour patterns, inadequate physical activity and lack of exercise. It is at this stage that health care practitioners need to use counselling and advocacy strategies that promote physical activity and reduce sedentary time in children and adolescents (15).

A study by Lipnowski and LeBlanc revealed that late adolescent stage 18–21 years is a time for making important personal and occupational decisions. At this stage, the adolescents think about the future and are interested in improving their overall health. They may want to make their own decisions but are open to information provided by health care providers. The researchers advised that nutritional counsellors offering services at this stage should not only present the current recommendations but should also explain the rationale behind them to make the concepts easily understandable (16).

The rapid growth rate at any of these stages demand for an increased supply of energy and nutrients to sustain it. According to Zia-ud-Din and Paracha, poor nutrition during any of these stages may lead to malnourished adolescents. Subsequently, the inadequate supply of nutrients leads to underdevelopment whereas excess supply may lead to overdevelopment resulting in obesity. Adequate nutrition produces dramatic increase in physical growth and development thereby putting the body under great pressure to demand for more supply of nutrients (17). Research findings by Spear have indicated that sufficient nutrition levels may cause the adolescents to experience a weight gain equivalent to 65% of their weight or 40% of their final weight, and a height gain equivalent to 15% of their adult height if they receive sufficient nutrients. This increment in growth at puberty is also mediated by growth hormones that are controlled to a great extent by nutritional factors (18).

In their research findings Kimani-Murage *et al.* underscore the importance of understanding the prevalence and patterns of under-nutrition and the emergence of overweight and obesity in children and adolescents. Understanding these patterns are of great significance in the formation and implementation of public health policies that deal with the related risks of metabolic diseases. Under-nutrition leads to underdevelopment

and stunted growth whereas over-nutrition and lack of physical activity lead to overweight and obesity (19).

Recent epidemiological studies by Makama *et al*. indicated that the coexistence of both underweight and obesity is a major problem in both developed and developing countries. In Sub- Saharan Africa, the presence of overweight and obese children and adolescents are reported to vary between 5–17% and 1–5% respectively (20). Another study in the Potchefstroom area of the North West Province in South Africa reported 8.6% obesity level for the 12–18 year old adolescents involved in the study. It is therefore important to understand the trends of overweight or obesity and underweight in adolescents because they are associated with adverse effects on health and social repercussion in both adolescence and adulthood. As such early identification of the adolescents at risk is essential for prevention of adulthood obesity (21).

### 2.1.3 Consequences of obesity

Obesity, according to Krebs *et al*. could be defined as a condition characterised by excessive body fat although the exact meaning of excess has not been defined. Therefore, it is regarded as the excess percentage of body weight that is fat. Excessive body fat in adolescents is significantly associated with current levels and changes in blood pressure, blood lipids and lipoproteins, plasma and other factors known to be risks for obesity-related disease in adults (22). Research findings by Himes and Dietz further reveal that overweight and fatness and the increases thereof during adolescence may cause higher health risks and increased adult mortality (23).

Highlighting adolescent growth and development, Spear further articulates that consequences of obesity, which include subsequent development of chronic non-communicable diseases, psychological dysfunction and excess adiposity in adulthood are rampant and very costly as they extend into adulthood (18). Likewise, research carried out by McMormick and Stone revealed that there is a significant healthcare cost associated with treating obesity and its direct consequences. These include higher social care costs, higher levels of sickness and absence from work among the obese population, which reduces productivity in any work place and imposes costs on businesses. Premature mortality is a consequence of obesity which also reduces the national output relative to the level it would be in the absence of obesity (24).

Toriola *et al*. have observed that obesity is a growing health concern globally among all age groups. A study carried out in 2010 revealed 43 million children (35 million in developing countries) were overweight or obese, and 92 million were at risk of becoming overweight. Worldwide, the prevalence of childhood overweight and obesity increased from 4.2% in 1990, to 6.7% in 2010. It is projected that this trend would reach 9.1% or approximately 60 million in 2020. The research further reveals that increasing rates of overweight and obesity of 17.1%-22.8% among the South African children is expected. The World Health Organization (WHO) has always emphasised the importance of monitoring its prevalence in different populations. In their study Toriola *et al.* reveal that overweight and obesity among children increase with age peaking at age 12 years (25). This makes adolescence a critical period for the onset of obesity and for obesity-associated morbidity in later life. Therefore, the factors that contribute to obesity and overweight in adolescents such as decreased physical activity, sedentary lifestyles and poor eating patterns need to be monitored at this stage. Increased intakes of dietary fat foods also need to be discouraged in order to prevent the escalation of these patterns in children and adolescents.

### 2.1.4 Consequences of underweight

Research by Bonti-Ankomah revealed that trends like stunting and underweight-for-age due to insufficient food supplies and other factors, are a major source of ill health and is rampant among populations of lower social economic status worldwide (26). In addition, a study carried out by Puckree *et al*. in a rural black South African primary school revealed that the majority of the South African population like any other developing country experience poor economic status and grapple with the problems of underweight and malnutrition. This however has often been overshadowed by other epidemics such as overweight and obesity (27).

## 2.2 Nutrition at Adolescence stage

According to Rogol *et al*., nutrition may be considered as the intake of food in relation to the body's dietary needs and is a major determinant of growth. Since adolescents are growing and developing physically, they need more nutritious food in proportion to their

size than adults do. Good nutrition, which refers to an adequate, well balanced diet combined with regular physical activity, is the cornerstone of good health. Under-nutrition is considered the single most significant cause of growth retardation worldwide. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity (28). Additionally, Rogol *et al*. in another study revealed that nutritional deficits result from self-induced restrictions of energy intake, a single factor that impacts on both the linear body growth and energy expenditure for sports training and competition (29).

Adolescence being a midway period between childhood and adulthood covers the ages between 11–19 years and requires appropriate nutrition to support its rapid growth and development. The sudden growth spurt is associated with hormonal, cognitive and emotional changes that make adolescence a vulnerable period of life. Research by Schenkel *et al*. revealed that it is also at this stage that food choices can be influenced by several factors including growing independence, increased involvement in social life, need for peer acceptance, dissatisfaction with body image and influence from the media (30). Similarly greater tendencies to skip meals, increased consumption of meals outside the home, greater reliance on ready-to-eat foods, increased snacking and greater interest in dieting are experienced during this phase of life. There is need for proper nutrition to be emphasised at this stage in order to have well developed adolescents without health challenges in adulthood (28, 30).

### 2.2.1 Common nutritional challenges at adolescence

*High nutrient demand*

Most adolescents have a desire to feed correctly but their desire is never realised due to the challenges they meet on the way. Adolescents are a vulnerable group in any population and need the intervention of the public health principles regarding better nutrition to enable them to have good health. The lack of balance between the great demand for calories and nutrients due to the intense increase in physical, physiological, behavioural and social changes and the adequate intake of nutrients makes adolescence a susceptible stage of poor health especially where well balanced meals are not frequently provided. Besides being characterised by compound body changes, it is a phase of changing lifestyles, food habits and search for independence. These factors crucially affect

the dietary intake at this stage and may jeopardise the intake of nutrients required to support growth and development to achieve a healthy adult body (17).

*Dietary excesses and deficiencies*

Malnutrition refers to both overnutrition and undernutrition and is one of the challenges at the adolescence stage. Undernutrition occurs when people at all ages do not eat or absorb enough nutrients to cover their needs for energy and growth, or to maintain a healthy immune system. This may cause micronutrient deficiencies which usually affect growth and immunity leading to clinical conditions such as anaemia (iron deficiency), hypothyroidism (iodine deficiency) or xerophthalmia (vitamin A deficiency) (31).

Causes of undernutrition which can be immediate, underlying and basic have also been reported in the Food and Agriculture Organization (FAO) Africa's report of 2004 as important underlying causes of illness and death in Africa. This is largely due to poor diets which are low in quantity, nutrient density or variety or eaten infrequently. Family food insecurity, unhygienic living conditions, inadequate health care services and inadequate care of vulnerable members of the society, have also been highlighted as the underlying causes while poverty and lack of nutritional knowledge are some of the basic causes of undernutrition (32).

Research further reveals that adolescents of both genders and in all income and racial/ethnic groups are at risk for dietary excesses and deficiencies. Such poor eating habits result into unhealthy individuals who become a burden to the health sector of the community. Dietary excesses of total fat, saturated fat, cholesterol, sodium and sugar commonly occur in this age group. Subsequently, most of them do not meet dietary recommendations for fruits, vegetables and calcium-rich foods due to their feeding lifestyles as shown by Krešić *et al*. (33). It is therefore the responsibility of the health sector to try and come up with interventions that can help reduce instances of dietary excesses and deficiencies among the adolescents.

*Lifestyle*

Lifestyles and own adapted dietary intake habits that do not support their high energy nutrient requirements is another major challenge for adolescents. Most of the adolescents' diet is composed of easily available, low-cost, high-fat and/or high-sugar, low-nutrient

foods such as French fries, candies, chips or soda. This kind of diet is deficient of specific nutrients which are necessary for supporting proper growth and development. This may result in lower energy stores, reduced muscle mass, compromised height and contribute to disorders such as anaemia and immune dysfunction.

*Social environment*

Research further shows that most adolescents develop poor dietary intake habits as a result of peer-pressure influence, advertisements and the changes in their social environment. Social environment if not monitored in regard to providing proper nutrition can further lead to insufficient intake of nutrients, posing a risk of nutritional deficiencies and other emotional, behavioural and peer-controlled influences. This may put the adolescents at risk of poor health as well as being in conflict with the law (34).

### 2.2.2 Consequences of poor eating habits at adolescence

Research carried among the Canadian youths revealed that obesity has escalated due to the sedentary lifestyles and poor or inappropriate dietary habits which increase the risks or incidences of chronic diseases among adolescents. Of great concern is the increasing rate of obesity and obesity-related health risks such as diabetes and cardiovascular diseases. The prevalence of type 2 diabetes among the adolescents has increased and is closely linked to overweight and obesity, which stretches into adulthood (35).

The consumption of sugar-sweetened beverages (SSBs), for example, soda, vitamin water, sports-drinks and energy drinks, has dramatically risen among the adolescents and continues to replace milk and water. This has become a health concern as SSBs contain excess sugar and caloric intake, which contribute to overweight, obesity and dental carries. Many adolescents quickly reach out for sports-drinks since they are convinced of instant energy replacement. On the contrary, the Committee on Nutrition and the Council on Sports Medicine and Fitness led by Schneider and Benjamin have indicated that children and adolescents do not need to replace their electrolyte needs by consuming sports-drinks, but should eat healthily to attain a physically fit body (36).

In their research, Vignerová *et al*. found that some of the factors that highly contribute to children and adolescents exceeding their needs for dietary energy include a significant increase in the consumption of high-energy and low-nutrient dense foods, an increase in

portion sizes and a decrease in physical activity. This increasingly causes overweight and obesity among the adolescents resulting into higher risks of being overweight or obese in adulthood (37).

Adolescent boys require enough of both the macronutrients and micronutrients to help them be in good health. Therefore it should be the goal of every food service provider to ensure that the daily nutritional needs for energy, macronutrients and micronutrients are at least achieved with the three meals served to the adolescent boys. In their findings, Story and Stang further reveal that adolescents who consume at least two meals (with or without snacks) on a consistent basis have an adequate intake of calories and a more nutrient dense diets with respect to calcium, iron, vitamin E, and fibre compared to those with other meal patterns, which was confirmed by Jenkins *et al*. (38, 39).

While most adolescents find themselves feeding on junk food, which they presume would give them the calories they require, research by Siega-Riz has shown that most junk foods provide a platform for increased risk of heart disease, risks of becoming obese now or later in life, some cancers related to excess fat and sugar intake, greater chance of diabetes later in life and increased tendency toward hypertension (40).

Adolescents need to be encouraged to include more fruit and vegetables in their diets since a diet rich in fruits and vegetables as well as low in fat is recommended by health practitioners and has been shown to be related to improved health as asserted by Zabinski *et al*. Fruits and vegetables are important sources of fibre and are low in total fat, saturated fats and sodium although research shows that generally the adolescents' intake of these foods do not meet the recommended guidelines (41).

### 2.2.3 Nutrient needs at adolescence

*Energy needs*

The energy of an individual or group of persons is the amount of dietary energy needed to maintain health, growth and an appropriate level of physical activity as discussed by Torun (42). Likewise the recommended dietary energy requirements in adolescents are intended to maintain health, promote optimal growth and maturation, and support a desirable level of physical activity. The adolescents who limit their energy intake or have food security issues and do not meet their energy intake requirements and may hinder their ultimate

adult growth (15). Dietary energy recommendations should be accompanied by strong involvement in physical activity, which is compatible with good health, prevention of obesity, and adequate social and psychological development.

Carbohydrates, proteins and fat provide energy in the form of kilojoules. Carbohydrates and protein each contain 16.7 kilojoules (kJ) while fat contains 37.7 kJ per gram. Of the total kilojoules required, about 60% is needed for the body's basic energy needs, also known as basal metabolism. Basal metabolism includes tissue growth and repair as well as heart and lung function. Research shows that adolescent males require about 7 531 to 13 389 kJ compared to their female counterparts that require 6 694 to 10 042 kJ per day (38, 43, 44).

*Carbohydrates needs*

Carbohydrate is the body's primary source of dietary energy for active children and adolescents. However, daily carbohydrate intake must be balanced with the adequate intake of protein, fat, and other nutrients (36). Simple carbohydrates like sugary snacks, juices and soft drinks provide quick bursts of energy which the body quickly breaks down and uses instantly. Complex carbohydrates from starches and fibres take time to break down and yield more and consistent form of energy. Carbohydrate-rich foods, such as fruits, vegetables, whole grains, and legumes are also the main source of dietary fibre as eluded by Story and Stang (38).

Sweeteners and added sugars provide approximately 20% of total calories to the diets of adolescents. The mean intake of added sugars ranges from 23 teaspoons/day (nearly 1/2 cup) for females ages 9-18 to 36 teaspoons/day (3/4 cup) for males ages 14 to 18. Soft drinks are a major source of added sweeteners in the adolescents' diets, accounting for over 12% of all carbohydrates consumed. Soft drink consumption has steadily increased over the years among adolescents raising concerns over the intake of other nutritious beverages like milk and water as highlighted by Kassem *et al*. (45).

Therefore, menus for adolescent boys should be planned to include food sources of whole-grain foods, rice, bread, pasta, fruits and vegetables which are rich in carbohydrates while the whole grain sources will provide the fibres.

*Protein needs*

Protein needs of adolescents are influenced by the amount of proteins required for the maintenance of existing lean body mass and accumulation of additional lean body mass during the adolescent growth spurt (15). Protein requirements per unit of height are highest for females in the range of 11–14 years of age and for males in the range of 15–18 years of age, which corresponds to the usual timing of peak height velocity. Research carried out in the United States (U.S.) revealed that the average intakes in protein are well above the RDA for all age groups. In comparison, the protein intake of adolescents from the U.S is much higher than the intake of proteins of adolescents from other countries. The risk is that excessive intake of protein can interfere with calcium metabolism and increase fluid needs. This becomes a danger for adolescent athletes who may experience high rates of dehydration (15).

Generally, insufficient protein intakes are uncommon in the adolescent population. However, if energy intake is inadequate for any reason (e.g., food security issues, chronic illness, and attempts to lose weight) dietary protein may be used to meet energy needs. This will result into proteins being unavailable for synthesis of new tissues or for tissue repairs. When protein intakes are consistently inadequate, reductions in linear growth, delays in sexual maturation and reduced accumulation of lean body mass may be apparent (38).

Protein is abundant in meat, fish and poultry and is an essential element of a healthy diet, allowing both growth and maintenance of the 2500 protein encoded within the human body as well as other nitrogenous compounds which together form the body's dynamic system of structural and functional elements. A male adolescent requires at least 52–57 g of protein at every mealtime daily as this contributes 30% of the calories that the body uses. This is to aid in the many physiological functions like building muscles and bones as detailed by Cho *et al*. in their research on dietary patterns associated with BMI in a Korean Population (46).

*Calcium needs*

According to Krešić *et al*. calcium needs are greater during adolescence than they are in either adulthood or childhood because of the adolescents' dramatic muscular, skeletal and endocrine development. Adolescence is a critical stage for bone mass accumulation and adequate intake of milk and dairy products, which are excellent sources of protein,

calcium, phosphorus, magnesium, riboflavin and vitamin B12, should be encouraged to avoid nutritional deficiencies which contribute to long term health problems like osteoporosis and delayed sexual maturation (33). Since 45% of peak bone mass is attained during adolescence, adequate calcium intake is important for the development of dense bone mass and the reduction of the lifetime risk of fractures and osteoporosis as discussed by Greer and Krebs (47).

Story and Stang further explain that by age 17, adolescents have attained the approximately 90% of their adult bone mass. Therefore, adolescence represents a “window of opportunity” for optimal bone development and future health. The daily recommended intake (DRI) for calcium is 1300 mg for all adolescents. A well rounded diet including low-fat dairy products, fruits, and vegetables and appropriate physical activity are important for achieving good bone health. It is advisable that the practices of consuming adequate calcium intakes be established during childhood so that they can be followed throughout the life span in order to reduce calcium deficiency diseases (38).

Milk provides the greatest amount of calcium in the diet of adolescents followed by cheese, ice-cream and frozen yoghurt. Calcium-fortified foods are widely available in orange juice, breakfast bars, bread, cereals and can also be excellent sources of calcium (15, 38, 46).

The increased consumption of cola beverages or other soft drinks by adolescents is becoming a public health concern as they may displace the consumption of more nutrient-dense beverages, such as milk and juices leading to less intakes calcium, magnesium, riboflavin, vitamin A and ascorbic acid. Insufficient intake of calcium paves a way for a likelihood of bone fractures. Research has further revealed that cola drinks contain phosphoric acid, which affects calcium metabolism leading to increased bone loss from skeleton and contribute to low bone mass, thereby increasing the risk of bone fractures (45). It is therefore essential to identify and target behaviour that impacts bone health, particularly those associated with attaining peak bone mass in the adolescent years. Water should be their beverage of choice; however non-fat or low-fat milk can also be consumed after exercise.

## 2.3 Nutrition of Adolescents in Youth Care Centres

Youth care facilities are secure residence places for the youths in need due to various reasons like being in conflict with the law or being orphaned and not having a place to stay. These make youths in these facilities a vulnerable group of individuals who require well-established organisational structures to be implemented in order to meet their needs. Adolescents in youth care facilities, just like any other youths, have a right to eat healthily and live in an acceptable environment despite the fact that they are in conflict with the law and under arrest. According to the United Nation's Universal Declaration Article 25.1 on Human Rights, it is stated that: "Everyone has the right to a standard of living adequate for health and well-being for himself and his family, including, food, clothing, housing, medical care, the necessary social services and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control" (48). This forms a guideline on how the youth in these facilities ought to be treated regardless of their status.

Most countries have legislations in place to help manage the different sectors of the government and sufficiently serve its citizens including the adolescents in conflict with law. According to section 27 Constitutional Bill of Rights in South Africa, food security is a constitutional right whereby every citizen has the right to have access to sufficient food and water. It is therefore a constitutional right for the adolescents in youth care facilities to have sufficient food regardless of their status. The South Africa's government has designed a national Integrated Food Security Strategy (IFSS) to ensure that there is an adequate nutrition for all. The principles in the strategy have been successfully used in schools to provide adequate nutrition and can similarly be implemented in youth care facilities since they provide, relatively stable environment for health promotion to help influence better nutrition and health patterns in the youth in the country (49).

Adolescents in youth care facilities just like any other free adolescents should be served with sufficient food, prepared in a hygienic environment to promote growth and development as well as healthy lifestyles now and thereafter. This should also be done to support the World Health Organisation's (WHO's) definition of health as the state of complete physical, mental and social wellbeing and not just the absence of disease or infirmity (50).

Although adolescents in youth care centres are not free to do what they want or choose what to eat, it is the duty of the food service providers to ensure that they receive sufficient nutrients to promote good health that is characterised by progressive physical growth, proper body organ development, proper social wellbeing and freedom from nutritional deficiencies and infections. The South Africa Consumer Protection Act (Act 68 of 2008) outlines key consumer rights which include the satisfaction of basic needs. Highlighted in this Act are the consumer's rights to basic goods and services for survival, such as food, water, education and sanitation to which every service provider should observe in order to enhance good health for the consumer (51).

## 2.4 Menu planning and food preparation in institutions

Menus designed for adolescents should meet their energy requirements and strengthen their immune system. This will help to prevent frequent infections and sickness and provide nutrients for growth and body-building. Such menus should also be planned support rapid growth and development and help prevent poor anthropometric patterns. Well planned menus consisting of carbohydrates, proteins, vitamins and mineral salts if served in correct portions for the age group can help alleviate diet related problems while providing variety and helping avoid monotony that causes many not to enjoy meal times. It has been documented that an increased consumption of fruits and vegetables help reduce the risks of coronary heart diseases and provide vitamin C, which guard against infections. Menus planners should ensure that meals contain sufficient fruits and vegetables (52, 53).

In addition to satisfying the physical and social needs, food can also satisfy emotional needs, which include a sense of security, love and attention. Mudambi and Rajagopal state that "Familiar foods make us feel secure and sharing of food is a token of friendship and acceptance. In a friendly gathering we try unfamiliar foods and thus enlarge our food experiences but it must be noted that even a nutritionally balanced meal may not be satisfying to the individual, if the foods included are unfamiliar or distasteful to him/her" (54). Therefore menus for adolescents in the youth care facilities should be planned carefully with these individuals needs in mind. For example familiar foods served occasionally may help them feel at home though away from home.

Furthermore, well prepared food, served at the right temperatures and time may promote the overall food satisfaction and acceptability. There should also be room for variation when planning meals to avoid monotony and foods in season should be included on the menus to help reduce high food costs. Correct food preparation methods assist in preserving the nutrients in the food especially vitamins. This helps in meeting the recommended nutrient content levels in the food served. Research shows that higher temperatures used to cook vegetables for too long durations contribute to the loss of nutrients. Exposure to water, sunlight and agitation during cooking may also lead to the loss of vitamin C. Food handlers need to be careful when preparing fruits and cooking vegetable in order to preserve nutrients (52).

## 2.5 Body Mass Index (BMI)

### 2.5.1 Definition

Body Mass Index (BMI) is an anthropometric index of weight and height (stature) that is defined as body weight in kilograms divided by height in metres squared **(kg/m²).** It has become a reliable standard rate as indicator of overweight and obesity and is now the commonly accepted index for classifying adiposity in adults and its use is recommended for children and adolescents (22).

Research by Jinabhai *et al*. revealed that although the International Obesity Task Force (IOTF) has developed a new global database for defining overweight and obesity among children and youths, based on the adult BMI, but it lacks overweight prevalence rates from youths in Africa (55). He stated that this inclusion would have been of great advantage for public health interventions on the continent. A study carried out in Korea indicated that dietary patterns are associated with BMI and that what an individual eats contributes greatly to the growth and development in height and weight, which are then used to calculate their BMI (46).

### 2.5.2 BMI-for-age

Research by both Cho *et al*. (46) and Flegal *et al*. (56) revealed that BMI-for-age has been recommended as a screening test for excess adiposity in children and adolescents. Often considered as an indicator of body fatness, it is a substitute measure of body fat because it

measures excess weight rather than excess fat and correlates with direct measures of body fat, making it a reliable indicator of body mass for most children and teenagers. Health care providers should integrate other factors into health assessments like the evaluation of diets, physical activities, family history and other appropriate health screenings to be able to give a full diagnosis of an individual health status.

These research findings further explain that the children and adolescents' BMI definitions are based on BMI-for-age from a reference population. The research further states that the underlying assumption for using BMI to assess adiposity is that, at a given height, higher weight is associated with increased fatness. However, BMI is an imperfect measure of body fatness since it cannot discriminate between lean mass and fat mass (56).

### 2.5.3 Advantages of the BMI approach

According to Nicholas *et al*. BMI as a screening tool has several advantages as listed below, although its effectiveness as a screening tool depends on the willingness of the health workers to use it (57).

(i) BMI is a simple, inexpensive, and non-invasive substitute measure of body fat. In contrast to other methods, BMI relies solely on height and weight and with access to the proper equipment. Individuals are able to have their BMI routinely measured and calculated with reasonable accuracy as indicated by Himes (58).

(ii) It is an appropriate measure for screening for obesity and its health risks. Various studies have shown that BMI levels correlate with body fat and with future health risks as indicated by Freedman *et al*. High BMI predicts future morbidity and death which can be controlled if identified early in life (59).

(iii) The contribution of BMI is effective at the population level and its use has resulted in an increased availability of published population data. This allows public health professionals to make comparisons across time, regions and population subgroups if well used since it is an extensive and longstanding application (58).

(iv) The sex-specific BMI-for-age growth charts are available and easy to use. The BMI values are plotted on the BMI-for-age growth charts for boys or girls to obtain a percentile ranking that highlights anthropometric patterns of underweight, optimal weight, overweight and obese status.

2.5.4 BMI percentiles as BMI status indicators

According to Himes is a good indicator of excess body fat among the obese children whose BMI-for-age is greater than or equal to the 95$^{th}$ percentile. However among the overweight children with BMI-for-age between the 85$^{th}$ and 94$^{th}$ percentiles, elevated BMI levels can be the result of increased levels of either fat or fat free mass. Similarly, among relatively thin children, the differences in BMI are often due to differences in fat-free mass (58). The other levels are shown in the table below;

| **Percentile range** | **Explanation** |
|---|---|
| <5$^{th}$ percentile | Underweight |
| 5$^{th}$ to <85$^{th}$ percentile | Normal weight |
| 85$^{th}$ to <95$^{th}$ | Overweight |
| ≥95$^{th}$ Percentile | Obesity |

Individuals in the equal to or greater than 95$^{th}$ percentile (≥95$^{th}$) should be considered to be at risk of overweight and should be referred to a second-level screening. Screening at this level includes family history, blood pressure, total cholesterol, large prior increment in BMI and concerns about weight. If the youths are positive for any of the items on the second level screen, they should be referred for further medical assessments including diet evaluation, physical activity and family history (23).

## 2.6 Food and Food Service Acceptability

2.6.1 Definition of customer satisfaction

According to Naik *et al*. customer satisfaction has been defined as the “customer’s fulfilment response”, which is an assessment and an emotion-based reaction to a service provider. It can also be defined as the customer’s overall evaluation of the performance when a service is given. The customer measures whether the product, performance, or the perceived service matches a buyer’s expectation. Satisfaction is only achieved when performance matches the buyer’s expectations (60). Sahari *et al*. further explain that if performance exceeds the expectations, then the customer is highly satisfied or delighted as highlighted in the research findings (61).

2.6.2 Consumer protection Act

Most governments have legislations to protect the consumers from the unreliable acts of some service providers. For example the South African government has various powerful legislations in place to protect the consumer and to promote a fair, accessible and sustainable marketplace for consumer products and services. One such example is the Consumer Protection Act, (Act 68 of 2008). This Act outlines key consumers' rights including satisfaction of basic needs. The consumers have the right to reliable basic goods and services for survival, such as food, water, education and sanitation. It also states that the consumer has the right to physical environment that will enhance good quality of life (51). Customer food service acceptance is multi-dimensional in nature as consumers' responses depend on several factors such as food quality, interpersonal service quality, pricing and the cleanliness of the environment and brand image among others (62). It is in this breath that this study sought to find out the quality of service offered by the food service unit at the MCYCC. The food service unit ought to provide adequate nutrition and acceptable service to the adolescent boys in their care in support of their growth and development and their overall being.

2.6.3 Food security

Sufficient food supply is as a result of food security in a country and largely contributes to customer-satisfaction in the food service industry. Research shows that South Africa is food secure (63). It produces its main staple foods, exports its surplus food, and imports what it needs to meet its food requirements (49). This sufficiency trickles down to household, schools and other public and private institutions. This is so because as mentioned earlier the South African government has made food security to be part of the section 27 Constitutional Bill of rights of South Africans. This section of the constitution Bill of rights states that every citizen which includes the children in the conflict with law who are residents in the youth centres have the right to have access to sufficient food and water. It is in this regard that the MCYCC, other youth centres and public institutions are obligated to provide sufficient food to citizens in their care

Another reason to this success is that the RDP in 1994 identified food security as a priority policy objective. As a result the government reprioritised public spending to focus on improving the food security conditions of historically disadvantaged people. The policy resulted into increased spending in social programmes of which the Social Provincial

Departments are able to partner with private companies like Bosasa operations and provide service to children in conflict with the law. Other programmes include school feeding schemes, and child support grants, free health services, pension funds for the elderly and many more (49).

The Integrated Food Security Strategy (IFSS) of South Africa was formulated to streamline, harmonise and integrate the diverse food security programmes. Its vision is to 'attain universal physical, social and economic access to sufficient, safe and nutritious food by all South African at all times to meet their dietary and food preferences for an active and healthy life'. This vision agrees with the Food and Agricultural Organisation's (FAO) goal to eradicate hunger, malnutrition and food insecurity over 2015. Among its many objectives is to improve nutrition and food safety for all, including the adolescents in conflict with law held up in youth care facilities (49).

### 2.6.4 Principle drivers of customer satisfaction

Different principles influence customer satisfaction depending on the setting being studied. Food quality emerges to be a common factor to determine customer satisfaction in the food service industry. The research carried out in Malaysia to determine the principle drivers of customer satisfaction put the aspects in the following hierarchical order of food quality, the presentation of food, meal portion and then food pricing (61). The research also reveals that all these factors have a significant impact on the satisfaction of the customers and their loyalty to the restaurants. The same research looking at student food service revealed that the factors of highest impact in customer satisfaction are food variety, price fairness and convenience (in that order). In his study on the food service satisfaction for work sector meals, Wen-Hwa Ko concludes that quality is the major factor that affects customer satisfaction (64).

### 2.6.5 Service excellence

Service excellence and quality products have been highlighted by Abdullah and Rozarion as determinants of organization's business success and customers' satisfaction (65). This simply means that inferior services and products lead to both business failure and dissatisfied customers. Food service providers need to offer excellent service to their customers not only to satisfy them but also grow their business. Donkoh *et al*. in their

research affirm this by stating that customers' perceptions about food and service attributes are considered very crucial in influencing the satisfaction and behavioural intentions of the customers in the food and service industry (66).

## 2.7 Food Safety and Hygiene

### 2.7.1 Food safety concerns and regulations

The 1996 World Food Summit Plan of Action recognized the importance of food safety, as it defined food security as: "…when all people … (have) access to sufficient, safe and nutritious food..." (67). This meant the food consumed would not cause harm to the consumer when it is eaten according to its intended use. This also meant that it was the duty of every food handler to ensure that food was safely prepared before presentation to the consumer. Even though most government globally have set rules on food safety that need to be observed by food handlers, research indicates that there have been many food poisoning incidences that may have resulted from food not being handled safely. Due to such increasing number of food safety concerns around the world, food safety has become an increasingly important public health issue and one of the most important measure that customers use to determine their satisfaction with the service offered and the quality of food served (68).

Food prepared in unhygienic conditions becomes a health risk due to food poisoning which leads to food borne illnesses. This can be fatal especially when food is prepared in bulk and consumed by many people. Research findings reveal that food-borne illnesses caused by food poisoning contribute largely to human suffering in the African continent, especially to vulnerable groups like the children. The findings further reveal that there are high incidences of diarrheal diseases among African children, estimated as 3.3 to 4.1 episodes per child per year. It is estimated that 800,000 children in Africa die each year from diarrhoea and dehydration. While the very young, the elderly and people with weakened immune systems are at great risk of serious consequences, most of the food poisoning organisms are still a threat to all food consumers (68).

Most governments have guidelines and regulations that govern and provide guidance to food service units on safe and hygienic procedures of handling food. This is to ensure that food safety principles are adhered to in totality and at all times in an effort towards

reducing food poisoning (69). For example, South Africa is guided by the Health Act of 1977, sections 35 and 40, Act No. 63 of 1977 thereby referred to as the Regulation Governing General Hygiene Requirements for Food Premises and Transportation of Food. This document stipulates in detail what needs to be done at all stages of handling food including the hygiene of the premises and the procedures the food handlers ought to follow in order to make food safe for consumption (70).

The United Kingdom (UK) is governed by regulations established by the European Union. It is recommended that food handlers adhere to the hygiene principles and procedures laid down in food legislations to protect the public from food poisoning especially when handling some high-risk foods such as raw eggs, raw milk, and undercooked ground beef, that are particularly liable to support the growth of food poisoning bacteria (71).

### 2.7.2 Food handlers' responsibility

The food handlers' knowledge of personal hygiene and practices can help reduce cross contamination and improve the customer acceptability of food served and services provided. It is the duty of every food handler to practice personal hygiene while in the kitchen and strictly adhere to the set laws and regulations. The law in South Africa and other countries requires that every food service facility should have a hand washing facility with both hot and cold water (70). The food handlers need to use this facility whenever they change from one task to another while in the kitchen and help reduce cross contamination. The use protective clothes and the general practice of personal hygiene are also core factors in enhancing food safety. The consistent cleaning and disinfecting the kitchen surfaces and other kitchen equipment with warm soapy water and use of sanitizers can help prevent cross contamination in the kitchen. In so doing there is a reduction of the presence of germs and bacteria that contaminate food. If these practices are adhered to, they could help increase food safety which leads to customer safety and result to good health and customer satisfaction (72).

### 2.7.3 Foodborne illnesses

Foodborne illnesses are diseases that are either infectious or toxic in nature and are caused by agents that enter the body through the ingestion of contaminated food or water.

Their magnitude is widespread and has now become a public health problem both in developing and developed countries.

Most of the foodborne diseases are sporadic and often not reported yet they are outbreaks that affect large populations in most cases. For example in 1994, an outbreak of salmonellosis due to contaminated ice cream occurred in the United Stated of America affecting an estimated 244,00 people. In 1988, an outbreak of hepatitis A, resulting from the consumption of contaminated clams, affected 300,000 people in China (69).

Global statistics show that in 2005 alone 1.8 million people died from diarrheal diseases. A great percentage of this can be attributed to contamination of food and water. In the USA around 76 million cases of foodborne diseases resulting in 325,000 hospitalizations and 5,000 deaths are estimated to occur every year. This mostly occurs during summer when temperatures are high and food may not be kept cold enough to prevent bacteria from growing (69).

### 2.7.4 Food poisoning

The victims of food poisoning caused by various microbes may experience symptoms of severe abdominal pain, nausea and diarrhoea, which may be felt after 4–36 hours of consuming the contaminated food. If accompanied by vomiting and diarrhoea then the victim may get dehydrated leading to confusion, dizziness, headaches and general weakness. Severe and untreated dehydration could lead to shock causing a decrease in blood-flow to the brain and other important organs that could lead to death.

Hazard Analysis and Critical Control unit Point (HACCP), which is a preventive system designed to ensure food safety in food service units can also be used to minimise food poisoning in the foods service unit. An effective HACCP system can result into good food hygiene practices which can prevent food consumers from becoming infected with food-borne diseases (73). Research carried out by Oranusi *et al*. on a systematic evaluation of food safety in boarding schools in Zaria Nigeria using the HACCP system revealed that the cooking methods, manipulation of food after cooking and holding of cooked foods are the critical points when food contamination takes place. This study concluded that the improvement of personal hygiene of the food handlers and the environment using the HACCP system could help in ensuring that safe food is served in institutions (74).

Oranusi *et al*. further recommends that efforts must be made to adhere strictly to the hygiene measures by following good food hygiene practices and stringently implementing quality controls along the whole food chain. The HACCP strategy identifies hazards associated with different stages of food preparation and handling, assesses the relative risk, and identifies points where control measures would be effective in order to ensure that the final product is safe for the consumers (74).

## 2.8 Conclusion

Adolescence being a midway period between childhood and adulthood covers the ages between 11–19 years and requires appropriate nutrition to support its rapid growth and development. The sudden growth spurt is associated with hormonal, cognitive and emotional changes that make adolescence a vulnerable period of life and if not well managed can result into obesity or underweight.

The prevalence of underweight in children which results into underweight adolescents has received attention from international health agencies, but this attention seems to be overshadowed by the epidemic status accorded to overweight and obesity. Both over and underweight are linked to morbidity and mortality in children worldwide which denies them the opportunity to reach adolescence or adulthood. The various anthropometric patterns need to be identified and dealt with timeously to avoid their spread in the communities. This can be done through campaigns on balanced nutrient intake in both the children and adolescents, in order to maintain healthy status of individuals at age groups and minimise both underweight and overweight.

The adolescents need to be taught and adhere to the principles of proper eating habits that reduce both the dietary excesses and deficiencies and other nutritional challenges at this stage. Well balanced meals including both the macro and micro nutrients are a requirement for every adolescent in order to support the rapid growth and development. In addition every adolescent should be advised to consume more water and calcium rich foods, since their adequate intake during adolescence is essential for peak bone mass formation.

The consumer needs of adolescents in the youth care facilities just like any other consumer are governed by the law and regulations of their country of origin. Most laws and

regulations stipulate that they have a right to receive quality nutrition and services equivalent to their needs from the food service units to enhance quality of their life. Care should therefore be taken when planning menus, preparing and cooking food for this age group in order to guard against the loss of nutrients which are required for proper health.

The use of BMI as a measure to track weight status in populations and as a screening tool to identify potential weight problems in individuals is recommended as it helps identify to the anthropometric patterns. The identification of the anthropometric patterns of adolescents or any other population group can help provide the required interventions to improve the health of the individuals concerned. For example research reveals that childhood obesity just as underweight has now become a worldwide health problem and the public health institutions and medical communities are trying to implement screening strategies among children and adolescents to try and curb it.

Good customer service is a key performance indicator in the food service unit and its major components are food quality and good personality of the server. The two need to be enhanced continuously in order to maintain high standards of customer satisfaction in the food service units in any public institution. This in return will increase proper health for the individuals and uplift the name of the institution. It will also maintain the organisation's position in the market. Most governments have also put legislations in place to protect the consumer needs. If effectively implemented they can help most countries become food secure and give the food service managers and all the food handlers a chance to offer proper services to the customers, thereby leading to customers satisfaction.

Almost all countries have laws and regulations governing the food safety and hygiene in the food service industry. This is to help minimise the food safety concerns raised by the consumers which can become fatal if not contained. It is important to note that food safety and hygiene is important for several reasons including good food hygiene which helps to prevent food consumers from becoming infected with various food borne diseases. Correct food hygiene design and practices can protect both a food service facility and individual food handlers from possible prosecution. Finally food safety and hygiene is of critical importance to the human race as it impacts on all other human activities like health, food security, trade and even politics. Practices aimed at improving food safety need to be adhered to by all food service providers in order to safe guard good health for the consumers.

# CHAPTER 3: RESEARCH METHODOLOGY

## 3 OUTLINE

This section highlights the study design used, the data collection procedures, data analysis and ethical and legal consideration observed.

## 3.1 Study design

This was a cross-sectional descriptive study evaluating the food service and BMI status of the resident adolescent population at one point in time. The study applied both quantitative and qualitative methods that involved collecting and analysing data (75, 76).

## 3.2 Data collection procedures

### 3.2.1 Customer satisfaction questionnaires

Out of the 200 adolescents at the centre by the time of the study, 144 adolescents were willing to answer a self-administered customer satisfaction questionnaire with both closed and open ended questions, a sample of which is given in Appendix 1. This was done to determine the adolescents' satisfaction with the food served and food service provided. Following their approval to participate in the survey by signing the informed consent and assent form in Appendix 2, a self-administered questionnaire on customer satisfaction was handed to them.

Pencils were issued out for use and the questions read to the participants one by one in four different languages (English, Afrikaans, Isizulu and Tswana) to assist in understanding the questions before answering. The questionnaires in English were used in the actual answering of the questions. Time was allowed for them to answer each question before moving to the next question. This procedure was followed until the last question was answered.

### 3.2.2 Taking BMI measurements

*Sampling*

A sample is a unit that is drawn from the study population to be considered for the actual inclusion in the study. For the purpose of establishing the anthropometric patterns amongst the boys aged 14–18 years, a total of 158 out of the 200 adolescents at the centre at the time participated in the study (77).

*Recruitment and consent procedure*

The study and its objectives were explained to the adolescent boys before participation. Those willing to participate were given the informed consent form in Appendix 2. Every step of the informed consent form was explained in different languages and the participants requested to sign the information consent form before being weighed.

*Taking measurements*

The nurses on duty in the health facility assisted in taking the height and weight measurements, as the researcher did the recording on the measurement record form in Appendix 3.

*Height measuring process*

A wall height metre mounted on the wall was used to take the measurements in centimetres (cm) and recorded on the measurement record form in Appendix 3. The measurements were later converted into square metres ($m^2$) as required by the formula in BMI calculations. The adolescents were asked to remove shoes, bulky clothing and ornaments during the measuring process. Causation was taken to ensure that the boys stood correctly on the scale and their hairstyle did not interfere with the measurements. The measurements were taken and the readings recorded.

*Weight measuring process*

Tanita digital scale HD 380 was used to obtain the weight measurements of the participants. The scale was placed on a firm floor and the participant requested to remove shoes and heavy clothing before stepping on the scale. Standing with both feet in the

centre of the scale and hands on the side, the weight was read and recorded to the nearest decimal number in kilograms (Kg) on the measurement record form.

*Calculating the BMI*

Both the measurements for height and weight were recorded on the measurement record form as given in Appendix 3. Each individual's weight measurement in kilograms was divided by their height measurement in metres squared as per the formula below and the BMI results recorded on the measurement record form in Appendix 3.

**Formula: BMI = weight in Kg ÷ height in $m^2$**

3.2.3 Document audit

The aim of the research was explained to the kitchen manager by the researcher and given an opportunity to ask questions before participating in the study. On accepting to participate in the study, he was requested to provide the quality control documents in Appendix 4, which included the menus, cleaning inspection reports and other documentation related to food safety and training reports of the food handlers. Copies of the cleaning schedule and the fridge temperature log sheets are shown in Appendices 5 and 6. The original documents were given back to the kitchen manager.

3.2.4 Menu analysis

The copies of menus obtained from the kitchen manager were evaluated by the researcher using the Foodfinder 3 software obtained from the Medical Research Council (MRC Foodfinder 3). This was done to establish whether the meal constituents in the planned menus were balanced and provided adequate daily dietary intake levels, sufficient to meet the nutrient requirements for this specific age and gender group. The analysis also revealed how much of the both the macro and micro nutrients were present in the meals served. The findings were compared to the ones on the recommended dietary allowance for adolescents who are 14–18 years old on Appendix 7.

Further menu evaluation was done using the food safety and hygiene evaluation tool adapted from the National food ration scales for food service units in hospital and health institutions – volume 3. This was done to establish the use and availability of the ration

scale, the implementation of the cycle menus and find out whether the basic principles of menu planning were being followed at the youth centre. The menus were evaluated and scored against the recommendations in the tool as shown in Appendix 8 under heading 1, “Menus” to include aspects in 1.1 to 1.5.

### 3.2.5 Meal portion verification

Meal portion verification included weighing different food items on the served plates selected randomly at breakfast, lunch and dinner times. The days on which the weighing took place were unannounced. The weighing process was done six (6) times in a period of two weeks. This was done on three different days of each week.

The researcher arrived and observed the serving process and randomly requested for a plate that had been served for one of the adolescents, weighed its content and recorded on the meal verification record form on Appendix 9.

### 3.2.6 Observation of food safety and hygiene in the kitchen

Observations were done in the food stores to establish whether the food safety and hygiene rules were being followed when storing the different food products. The observation included the storage conditions of the stores, the temperatures at which the different food products were being stored and served and the cleanliness of the trolleys used to transport food from the kitchen to the serving areas. The general food safety and hygiene evaluation process included observing how the different foods are handled in the kitchen during preparation, cooking and holding time and temperature of food before being served. Cleaning, sanitizing and personal hygiene and appearance of the food handlers were also observed. The scores were then recorded by the researcher, on the food safety and hygiene evaluation tool adapted from the national food ration scales for food service units in hospitals and health institutions - volume 3, in Appendix 8 under the second, third and fourth headings of storage, meal serving and food safety and hygiene respectively.

## 3.3 Data Analysis

### 3.3.1 Questionnaire data analysis

A 2007 Excel spread sheet was developed to capture quantitative data collected from the answered questionnaires. The quantitative answers were categorised and frequencies found for the levels of excellence, good, fair and poor. A fifth level of rejected responses was created to cater for the unanswered responses. The answers from the open-ended questions were categorised to establish the satisfaction level of the clients towards the food and service provided.

### 3.3.2 BMI data analysis

The BMI results for every individual shown in Appendix 10 were plotted in accordance with the WHO percentile charts for BMI-for-age for boys as shown in Appendix 11 to help determine the anthropometric patterns of the adolescents. The patterns obtained were compared to the WHO recommended standards.

The expected patterns included obese, overweight, normal or underweight and the percentiles where they can be found on the chart as shown below.

BMI 1$^{st}$ to 4$^{th}$ percentile indicates one is underweight.

BMI 5$^{th}$ to 84$^{th}$ percentile indicates one has a healthy weight.

BMI 85$^{th}$ to 94$^{th}$ percentile indicates one is overweight.

BMI 95$^{th}$ to 100$^{th}$ percentile indicates one is obese.

All the adolescents in either above the 85$^{th}$ percentile or below the 5$^{th}$ percentile have health risks due to their overweight or underweight respectively.

### 3.3.3 Menu analysis

Food items shown on the menu were entered in the Foodfinder 3 software specifically developed for South African food items to analyse food intake of individuals or for groups of individuals. This helped to determine whether the food being served to the adolescents was sufficient. The results obtained were compared to the RDAs for adolescents. Any percentages that were above 50% to 80% were deemed sufficient while below 50% were deemed inadequate. 80% and above were deemed excessive.

3.3.4 Meal portion verification

Food portions from the served plate samples were recorded in a meal portion verification form. These were later compared to the weights indicated on the menus provided. The researcher also checked whether the menus were followed in terms of what should be served on a particular day.

3.3.5 Analysis of food storage, safety and hygiene process

The compliance scores on the food safety regulations obtained during each observation were rated on summary scoring criteria card for compliance in Table 1 shown below. This was done to establish the compliance level of the food service unit.

*Table 1: The Scoring Criteria for Compliance*

| Percentage | Colour | Rating |
|---|---|---|
| 90 – 100 | Gold | Excellent |
| 75 – 89 | Silver | Very good |
| 60 – 74 | Bronze | Good |
| 50 – 59 | Red | Unacceptable |
| 49 - 00 | Black | High risk |

## 3.4 Ethical and Legal Considerations

3.4.1 Permission to carry out the study

The study protocol was submitted to the Faculty of Health Research Ethics Committee, of the University of Pretoria and approval granted in form of a letter, shown in Appendix 12.

A letter for permission to conduct the study at the MCYCC was obtained from the Bosasa Group of Companies, and is shown Appendix 13. This also served as a permission letter to allow the adolescents to participate in the study as they were under the guardianship of

the management of the MCYCC operated by Bosasa Group of Companies in collaboration with the Department of Social Services in Gauteng.

### 3.4.2 Informed consent and confidentiality

The objectives of the study and the possible benefits and risks were clearly explained to the participants. Written informed consent was obtained from the participants by requesting them to sign the information leaflet Appendix 14 before being included in the study. The study participants were assured of confidentiality and anonymity and the information obtained would only be used for the purposes of this study. Their names were replaced with unique identifying numbers.

### 3.4.3 Dissemination of results

The results from this research will be compiled in a comprehensive report and shared with the management of MCYCC and Bosasa Operations. The results and recommendations will be explained with an emphasis on how to improve the food service standards for the adolescent boys in the facility. The main focus of the discussion will be how to incorporate the recommendations in order to attain full customer satisfaction, maintain healthy BMIs for the adolescents, how to sustain safe and hygienic conditions in the food facility and how to efficiently run the food service unit in the centre.

The researcher will then seek permission to publish the results in a scientific journal.

# CHAPTER 4: RESULTS AND DISCUSSION

## 4 OVERVIEW OF RESULTS AND DISCUSSION

The results obtained from this study have been presented under the subheadings of: introduction of methods used to carry out the research, questionnaire responses, reliability of results, the BMI results, menu analysis, meal portion verification, food safety and hygiene, and quality control document audit.

### 4.1 Introduction

The study used various methods to evaluate the food service unit at MCYCC to attain its different objectives laid out at the beginning of the study.

- Answers from the customer satisfaction questionnaire were used to rate the overall satisfaction of the service offered to the adolescents.
- A document audit was done to establish whether the correct procedures were being carried out to help operate the kitchen efficiently.
- BMI measurements were calculated to establish the anthropometric patterns of the current resident adolescents at the centre.
- The Foodfinder 3 was used to analyse the planned menus and establish the nutrient constituents of the meals being served. This was done with aim of finding out whether the meals provided met the RDAs of the adolescents in relation to their great demand of nutrients to support the rapid body growth during this stage.
- Food from the served sample plates were weighed to compare the portions of the real meals served to the indicated portions of the planned meals on the menus. This was done to establish the sufficiency of the portions served and verify whether they were similar to what was stated on the menu.
- Finally observations were done to establish whether the unit is compliant with the food safety and hygiene regulations.

## 4.2 Achieved Outcomes

### 4.2.1 Demography of the respondents

Out of the 200 adolescents at the centre, 144 answered the customer satisfaction questionnaire. All the questionnaires were answered on the same day but at different times while the respondents were in their classes.

### 4.2.2 Statistical analysis of responses

The data obtained from the responses was discrete and not continuous therefore a hypothesis was developed to determine if there was a significant difference in the responses. The Chi-square ($\chi^2$) test which is designed for one-way frequencies data where the normal distribution curve is absent was used to determine the significance different rate of the responses. Using the Chi-square ($\chi^2$) method the probability of a respondent choosing any of the options provided was determined. The Chi-square test of equal proportions was used to test the null hypothesis that an equal proportion of individuals chose each possible answer to each question. The statistical analyses of responses using the Chi-square values generated by the SAS software in each evaluated area also known as parameter, have been used to test the reliability of the results.

### 4.2.3 Cleanliness of the Food Service Unit

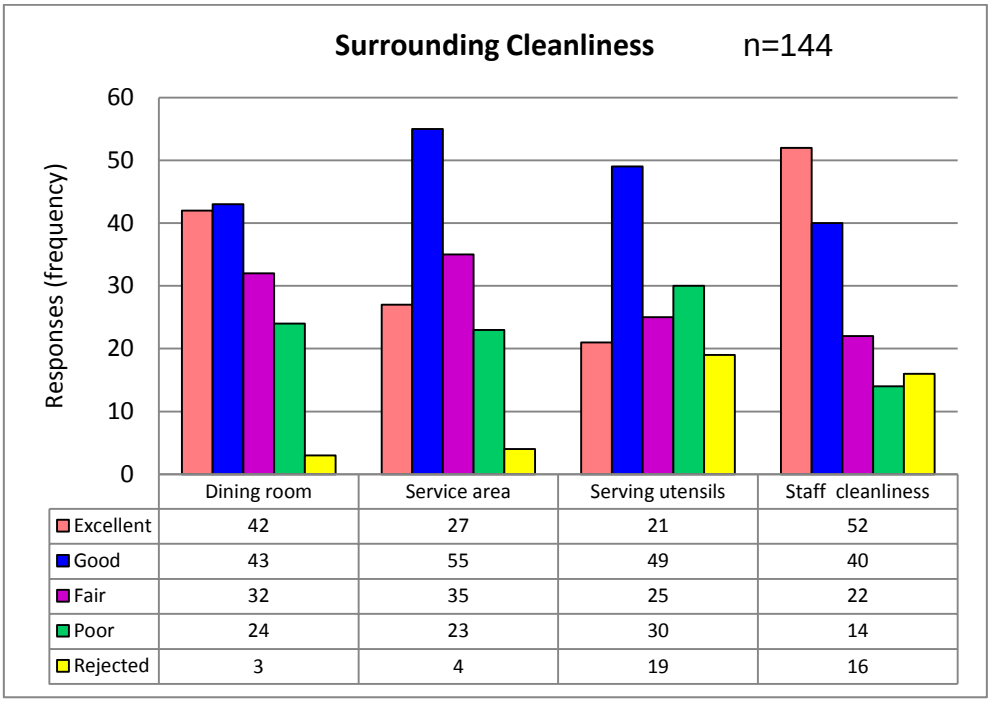
On the dining room, out of the 144 respondents, 42, which represents 29% said the cleanliness was excellent, 43 of the respondents (30%) said it was good, 32 of the them (22%) said it was fair while 24 (17 %) said it was poor; 3 responses, that is, 2% of the results were rejected.

On the service area, 19% said it was excellent, 38% said it was good, 24% said it was fair, while 16% said it was poor, 3% of the results were rejected.

On the serving utensils, 15% said it was excellent, 34% said it was good, 17% said it was fair, 21 % said it was poor while 13% of the results were rejected.

On the staff cleanliness 36% said they were excellent, 28% said good, 15% said fair while 10% said poor. 11% were rejected.

The results of the general cleanliness of the facility are summarised in Figure 1 which includes the frequency of the responses.




| | Dining room | Service area | Serving utensils | Staff cleanliness |
|---|---|---|---|---|
| Excellent | 42 | 27 | 21 | 52 |
| Good | 43 | 55 | 49 | 40 |
| Fair | 32 | 35 | 25 | 22 |
| Poor | 24 | 23 | 30 | 14 |
| Rejected | 3 | 4 | 19 | 16 |

*Figure 1: Responses on cleanliness.*

4.2.4 Service provided

The responses from the quality of service section scored 28% for friendly staff and were rated excellent. The same percentage was recorded for good. 17% of the respondents said the employees were fairly friendly while 20% said they were poor and 6% of the results were rejected. On the service area, 19% said it was excellent. 38% said it was good, 24% said it was fair, while 16% said it was poor, 3% of the results were rejected.

Considering the manager availability 20% said excellent, 31% said good, 19% said fair while 20% said poor and 10% of the results were rejected.

Quality of the service was evaluated and 20% said the quality of the service provided was excellent, 34% indicated that it was good, 19% said it was fair while 17% stated that it was poor and the 10% of the results were rejected.

Serving time recorded the highest percentage in this category with 37% of the respondents stating excellent. 20% stated the serving time was good, 10% said it was fair while 24%

said it was poor and 9% of the results were rejected. These results are summarised in Figure 2 that indicates frequencies, while Table 2 shows the responses by percentages.

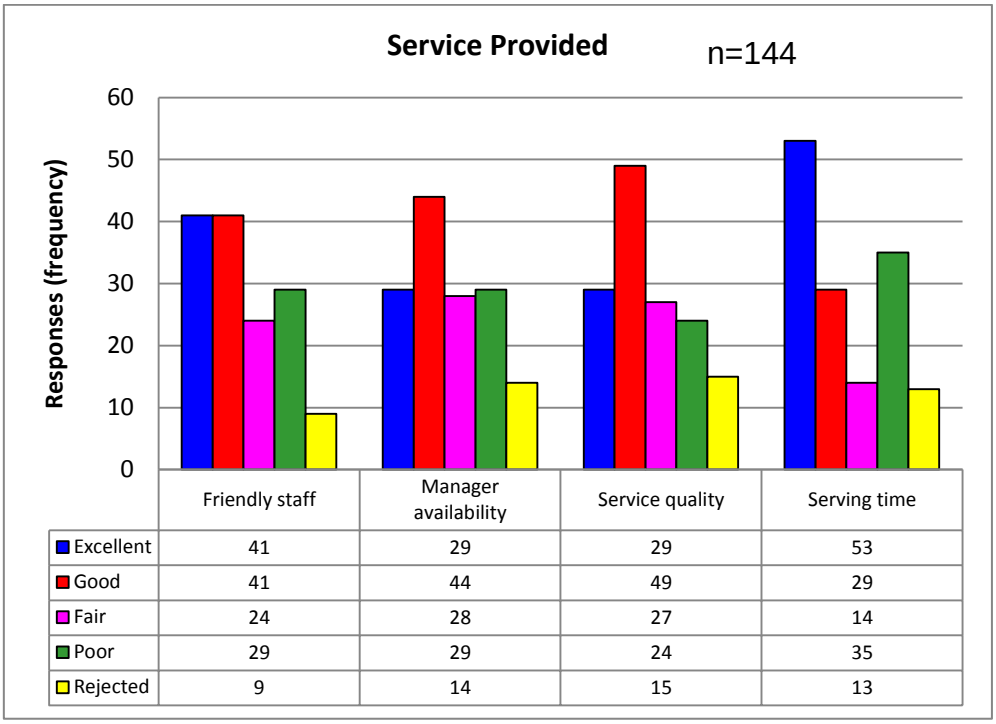



*Figure 2: Responses on quality of service.*

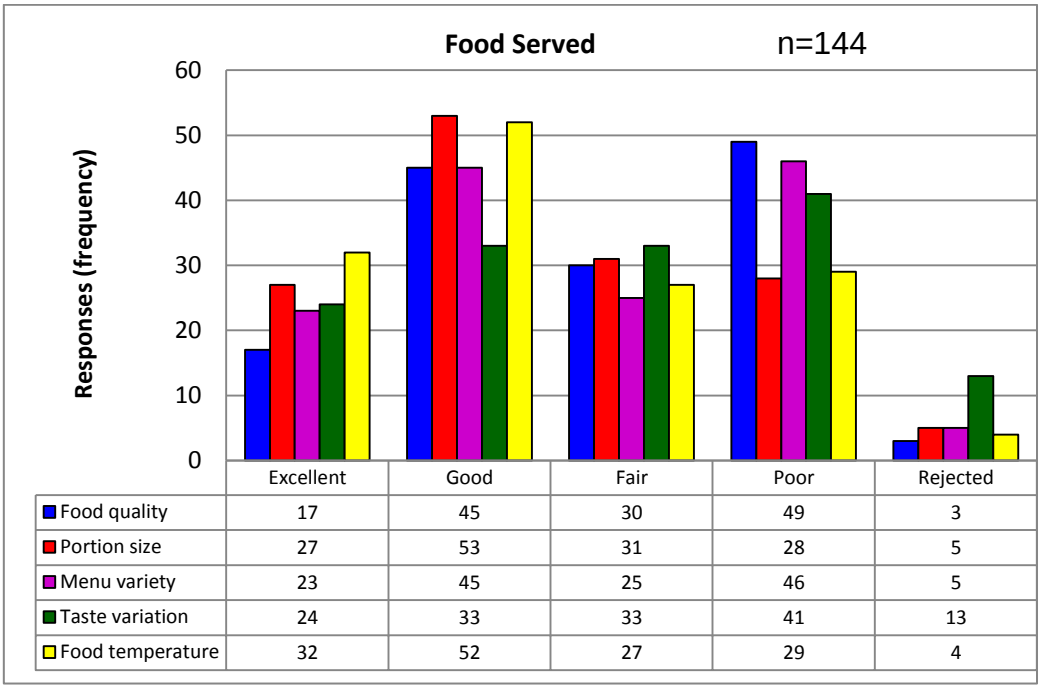
*Table 2: Responses (in %) on the service provided.*

| | Friendly staff | Manager availability | Service quality | Serving time |
|---|---|---|---|---|
| **Excellent** | 28 | 20 | 20 | 37 |
| **Good** | 28 | 31 | 34 | 20 |
| **Fair** | 17 | 19 | 19 | 10 |
| **Poor** | 20 | 20 | 17 | 24 |
| **Rejected** | 6 | 10 | 10 | 9 |
| **Total** | 100 | 100 | 100 | 100 |

4.2.5 Food served

The general quality of the food served in the facility was evaluated and the following results observed. Figure 3 indicates responses by the numbers, while the results summarised in Table 3 show the responses by percentages. 12% of the respondents

stated that the quality of the food was excellent, 31% said it was good, 21% said it was fair, while 34% said it was poor. 2% of the results were rejected.




| | Excellent | Good | Fair | Poor | Rejected |
|---|---|---|---|---|---|
| Food quality | 17 | 45 | 30 | 49 | 3 |
| Portion size | 27 | 53 | 31 | 28 | 5 |
| Menu variety | 23 | 45 | 25 | 46 | 5 |
| Taste variation | 24 | 33 | 33 | 41 | 13 |
| Food temperature | 32 | 52 | 27 | 29 | 4 |

*Figure 3: Responses on quality of food served.*

*Table 3: Responses (in %) towards the food served.*

| | Excellent | Good | Fair | Poor | Rejected |
|---|---|---|---|---|---|
| **Food quality** | 12 | 31 | 21 | 34 | 2 |
| **Portion size** | 19 | 37 | 22 | 19 | 3 |
| **Menu variety** | 16 | 31 | 17 | 32 | 3 |
| **Taste variation** | 17 | 23 | 23 | 28 | 9 |
| **Food temperature** | 22 | 36 | 19 | 20 | 3 |

Considering the portion size of the food served, 19% said it was excellent, 37% found the portion sizes good, 22% said they were fair while 19% said the portions were poor and 3% of the results were rejected.

Responses from the menu variety section showed that 16% said excellent, 31% said the variation was good, 17% said it was fair while 32% said it was poor and 3% of the results were rejected.

Considering the taste variation,17% said it was excellent, 23% said it was good, another 23% said it was fair while 28% said it poor and 9% of the results were rejected.

Responses from the food temperature section revealed that 22% of the respondents said it was excellent, 36% said it was good, 19% said it was fair and 20% said it was poor. 3% of the results were rejected.

### 4.2.6 Overall satisfaction

Considering the overall satisfaction of the food service unit the 13% of the respondents rated it as excellent, 33% said it was good, 26% said it was fair, while 25% of the respondents said it was poor and 3% of the results were rejected. The results are summarised in Figure 4 below.

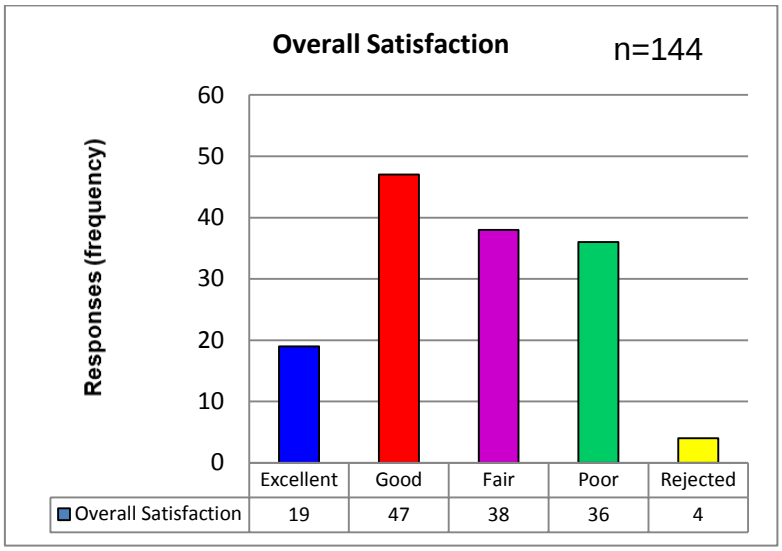



*Figure 4: Overall satisfaction of the food service unit.*

### 4.2.7 Open-ended responses

From the open-ended questions, most of the respondents expressed their dissatisfaction with the fact that the same type of breakfast was served to them daily. Statements like *'always we eat oats, sometimes they must make Kellogg and marmite', 'we don't like the oats and we need sugar in the tea', 'they have to change the menu for breakfast'* were common concerning the breakfast provided.

## 4.3 Reliability of results

### 4.3.1 Parameter: Cleanliness of surrounding

The Chi-square test was used to determine the reliability of the results in each parameter evaluated. The Chi-square value for the cleanliness of the surroundings were over 20 and the p-values less than $10^{-4}$ (or 0.0001) implying that the responses were significantly different from each other and hence the results were reliable as given in Table 4.

*Table 4: Chi-square analysis on cleanliness.*

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Dining-room

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 42 | 29.17 | 42 | 29.17 | Chi-Square | 37.3194 |
| Fair | 32 | 22.22 | 74 | 51.39 | Degrees of Freedom, (n-1) | 4 |
| Good | 43 | 29.86 | 117 | 81.25 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 24 | 16.67 | 141 | 97.92 | Exact Prob. >= Chi-Sq | $2.72 \times 10^{-7}$ |
| Rejected | 3 | 2.08 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Serving-area

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 27 | 18.75 | 27 | 18.75 | Chi-Square | 47.8056 |
| Fair | 35 | 24.31 | 62 | 43.06 | Degrees of Freedom, (n-1) | 4 |
| Good | 55 | 38.19 | 117 | 81.25 | Asymptotic Prob. > ChiSq | <.0001 |
| Poor | 23 | 15.97 | 140 | 97.22 | Exact Prob. >= Chi-Sq | $3.401 \times 10^{-9}$ |
| Rejected | 4 | 2.78 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Utensils

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 21 | 14.58 | 21 | 14.58 | Chi-Square | 20.1667 |
| Fair | 25 | 17.36 | 46 | 31.94 | Degrees of Freedom, (n-1) | 4 |
| Good | 49 | 34.03 | 95 | 65.97 | Asymptotic Prob. > ChiSq | 0.0005 |
| Poor | 30 | 20.83 | 125 | 86.81 | Exact Prob. >= Chi-Sq | $4.746 \times 10^{-4}$ |
| Rejected | 19 | 13.19 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Staff-cleanliness

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 52 | 36.11 | 52 | 36.11 | Chi-Square | 37.9444 |
| Fair | 22 | 15.28 | 74 | 51.39 | Degrees of Freedom, (n-1) | 4 |
| Good | 40 | 27.78 | 114 | 79.17 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 14 | 9.72 | 128 | 88.89 | Exact Prob. >= Chi-Sq | $2.054 \times 10^{-7}$ |
| Rejected | 16 | 11.11 | 144 | 100 | Sample Size | 144 |

### 4.3.2 Parameter: Service provided

The Chi-square probability values on the responses on the parameter of service provided in Table 5 show extremely small values, which imply that the responses are significantly different, therefore the results are reliable.

*Table 5: Chi-square outcomes for the service provided.*

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Friendly-staff

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 41 | 28.47 | 41 | 28.47 | Chi-Square | 24.75 |
| Fair | 24 | 16.67 | 65 | 45.14 | Degrees of Freedom, (n-1) | 4 |
| Good | 41 | 28.47 | 106 | 73.61 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 29 | 20.14 | 135 | 93.75 | Exact Prob. >= Chi-Sq | $6.162 \times 10^{-5}$ |
| Rejected | 9 | 6.25 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Manager-presence

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 29 | 20.14 | 29 | 20.14 | Chi-Square | 15.6528 |
| Fair | 28 | 19.44 | 57 | 39.58 | Degrees of Freedom, (n-1) | 4 |
| Good | 44 | 30.56 | 101 | 70.14 | Asymptotic Prob. > ChiSq | 0.0035 |
| Poor | 29 | 20.14 | 130 | 90.28 | Exact Prob. >= Chi-Sq | 0.0035 |
| Rejected | 14 | 9.72 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Service-quality

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 29 | 20.14 | 29 | 20.14 | Chi-Square | 21.6944 |
| Fair | 27 | 18.75 | 56 | 38.89 | Degrees of Freedom, (n-1) | 4 |
| Good | 49 | 34.03 | 105 | 72.92 | Asymptotic Prob. > ChiSq | 0.0002 |
| Poor | 24 | 16.67 | 129 | 89.58 | Exact Prob. >= Chi-Sq | $2.426 \times 10^{-4}$ |
| Rejected | 15 | 10.42 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Serving-time

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 53 | 36.81 | 53 | 36.81 | Chi-Square | 37.9444 |
| Fair | 14 | 9.72 | 67 | 46.53 | Degrees of Freedom, (n-1) | 4 |
| Good | 29 | 20.14 | 96 | 66.67 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 35 | 24.31 | 131 | 90.97 | Exact Prob. >= Chi-Sq | $2.054 \times 10^{-7}$ |
| Rejected | 13 | 9.03 | 144 | 100 | Sample Size | 144 |

### 4.3.3 Parameter: Food served

The outcomes of the Chi-square for the service provided in Table 6 below indicate that the various probabilities for the responses are extremely small, which implies that the responses are significantly different from each other, making the results reliable.

*Table 6: Chi-square analysis for the food served*

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Menu-variation

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 23 | 15.97 | 23 | 15.97 | Chi-Square | 40.7222 |
| Fair | 25 | 17.36 | 48 | 33.33 | Degrees of Freedom, (n-1) | 4 |
| Good | 45 | 31.25 | 93 | 64.58 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 46 | 31.94 | 139 | 96.53 | Exact Prob. >= Chi-Sq | $6.33 \times 10^{-8}$ |
| Rejected | 5 | 3.47 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Taste-variation

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 24 | 16.67 | 24 | 16.67 | Chi-Square | 15.8611 |
| Fair | 33 | 22.92 | 57 | 39.58 | Degrees of Freedom, (n-1) | 4 |
| Good | 33 | 22.92 | 90 | 62.5 | Asymptotic Prob. > ChiSq | 0.0032 |
| Poor | 41 | 28.47 | 131 | 90.97 | Exact Prob. >= Chi-Sq | 0.0032 |
| Rejected | 13 | 9.03 | 144 | 100 | Sample Size | 144 |

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Food-temperature

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 32 | 22.22 | 32 | 22.22 | Chi-Square | 40.5139 |
| Fair | 27 | 18.75 | 59 | 40.97 | Degrees of Freedom, (n-1) | 4 |
| Good | 52 | 36.11 | 111 | 77.08 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 29 | 20.14 | 140 | 97.22 | Exact Prob. >= Chi-Sq | $7.0 \times 10^{-8}$ |
| Rejected | 4 | 2.78 | 144 | 100 | Sample Size | 144 |

### 4.3.4 Parameter: Overall satisfaction

The Chi-square value for overall satisfaction was 40.9306 and the probability (p-value) was $5.8 \times 10^{-8}$ (or 0.000000058). This implies that the responses were significantly different from each other and hence the results were reliable.

*Table 7: Chi-square outcomes for the overall satisfaction.*

One-Way Frequencies: **Results**
The FREQ Procedure
Parameter=Overall-satisfaction

| Response | Frequency | Percent | Cumulative Frequency | Cumulative Percent | Chi-Square Test for Equal Proportions | |
|---|---|---|---|---|---|---|
| Excellent | 19 | 13.19 | 19 | 13.19 | Chi-Square | 40.9306 |
| Fair | 38 | 26.39 | 57 | 39.58 | Degrees of Freedom, (n-1) | 4 |
| Good | 47 | 32.64 | 104 | 72.22 | Asymptotic Prob. > ChiSq | <0.0001 |
| Poor | 36 | 25 | 140 | 97.22 | Exact Prob. >= Chi-Sq | $5.813 \times 10^{-8}$ |
| Rejected | 4 | 2.78 | 144 | 100 | Sample Size | 144 |

## 4.4 BMI Results

On BMI distribution by age as shown in Figure 5, it was observed that 13.5% of the respondents were underweight as they were below the 5$^{th}$ percentile, 57% were between the 5$^{th}$ and the 85$^{th}$ percentile hence had normal weight. 28.2% were above the 85$^{th}$ and below the 95$^{th}$ percentiles and were considered as overweight, while 1.3% of the respondents were above the 95$^{th}$ percentile and hence found to be obese.

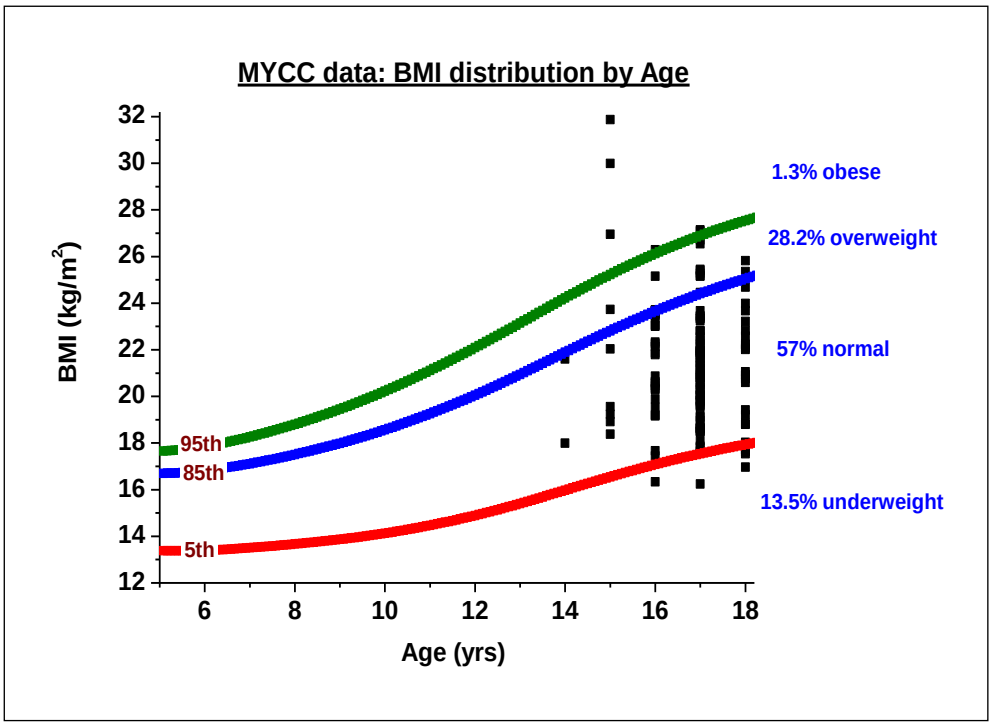



*Figure 5: BMI distribution by age*

## 4.5 Menu Analysis

All the food items consumed at the food service unit for breakfast, the morning snack, lunch, supper and late night snack in the two week cycle food menus were logged into the Foodfinder 3 software and meal constituents were generated to determine whether the food consumed by the adolescents met the recommended daily allowances. The menu used for cycle 1 is shown in Appendix 15 while the meal analysis generated by Foodfinder is provided in Appendix 16. The menu in cycle 2 is given in Appendix 17 while the nutrient analysis results are shown in Appendix 18. This research focused on the major macronutrients, macro vitamins and macro-minerals.

### 4.5.1 Macronutrient analysis results

Energy requirements

The RDA for a male adolescent is 12 134 kJ on average per day. The dietary analysis of the two cycle menu revealed that the adolescents received 12 165 kJ in week 1 as shown in Table 8 and 20 106 kJ in week 2. The same information is reflected in Figures 6 and 7 for week 1 and 2 respectively. In both cases the energy requirements were in excess by 0.26% and 66% respectively.

Table 8: Macronutrients analysis results for week 1 & 2

## MRC FOODFINDER 3

### Meal Analysis - Standard RDA

**Name: MCYCC Wk 1 Monday**
**Name: MCYCC Wk 1 Tuesday**
**Name: MCYCC Wk 1 Wednesday**
**Name: MCYCC Wk 1 Thursday**
**Name: MCYCC Wk 1 Friday**
**Name: MCYCC Wk 1 Saturday**
**Name: MCYCC Wk 1 Sunday**

**Macronutrients**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Moisture (g) | 1578.7 | | |
| Energy (kJ) | 12165 | 12133.71 | 100.26% |
| Nitrogen (g) | 11.08 | | |
| Total protein (g) | 122.9 | 56.71 | 216.70% |
| Plant protein (g) | 51.8 | | |
| Animal protein (g) | 71.0 | | |
| Total fat (g) | 113.8 | | |
| Carbohydrate, avail. (g) | 307.0 | | |
| Starch (g) | 13.5 | | |
| Glucose (g) | 9.6 | | |
| Fructose (g) | 11.6 | | |
| Galactose (g) | 0.0 | | |
| Sucrose (g) | 11.6 | | |
| Maltose (g) | 0.2 | | |
| Lactose (g) | 13.0 | | |
| Total sugars (g) | 47.4 | | |
| Added sugar (g) | 32.3 | | |
| Total dietary fibre (g) | 38.0 | | |
| Insoluble dietary fibre (g) | 6.5 | | |
| Soluble dietary fibre (g) | 5.0 | | |
| Ash (g) | 15.4 | | |
| Non-starch polysaccharides (g) | 10.6 | | |
| Insoluble NSP (g) | 5.7 | | |
| Soluble NSP (g) | 5.0 | | |
| Lignin (g) | 0.9 | | |

## MRC FOODFINDER 3

### Meal Analysis - Standard RDA

**Name: MCYCC Wk 2 Monday**
**Name: MCYCC Wk 2 Tuesday**
**Name: MCYCC Wk 2 Wednesday**
**Name: MCYCC Wk 2 Thursday**
**Name: MCYCC Wk 2 Friday**
**Name: MCYCC Wk 2 Saturday**
**Name: MCYCC Wk 2 Sunday**

**Macronutrients**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Moisture (g) | 3179.6 | | |
| Energy (kJ) | 20106 | 12133.71 | 165.70% |
| Nitrogen (g) | 12.66 | | |
| Total protein (g) | 169.4 | 56.71 | 298.69% |
| Plant protein (g) | 94.9 | | |
| Animal protein (g) | 74.5 | | |
| Total fat (g) | 113.2 | | |
| Carbohydrate, avail. (g) | 710.5 | | |
| Starch (g) | 16.3 | | |
| Glucose (g) | 9.0 | | |
| Fructose (g) | 10.7 | | |
| Galactose (g) | 0.0 | | |
| Sucrose (g) | 13.7 | | |
| Maltose (g) | 0.3 | | |
| Lactose (g) | 11.2 | | |
| Total sugars (g) | 45.8 | | |
| Added sugar (g) | 27.6 | | |
| Total dietary fibre (g) | 56.0 | | |
| Insoluble dietary fibre (g) | 6.9 | | |
| Soluble dietary fibre (g) | 5.3 | | |
| Ash (g) | 14.5 | | |
| Non-starch polysaccharides (g) | 11.2 | | |
| Insoluble NSP (g) | 6.0 | | |
| Soluble NSP (g) | 5.3 | | |
| Lignin (g) | 0.9 | | |

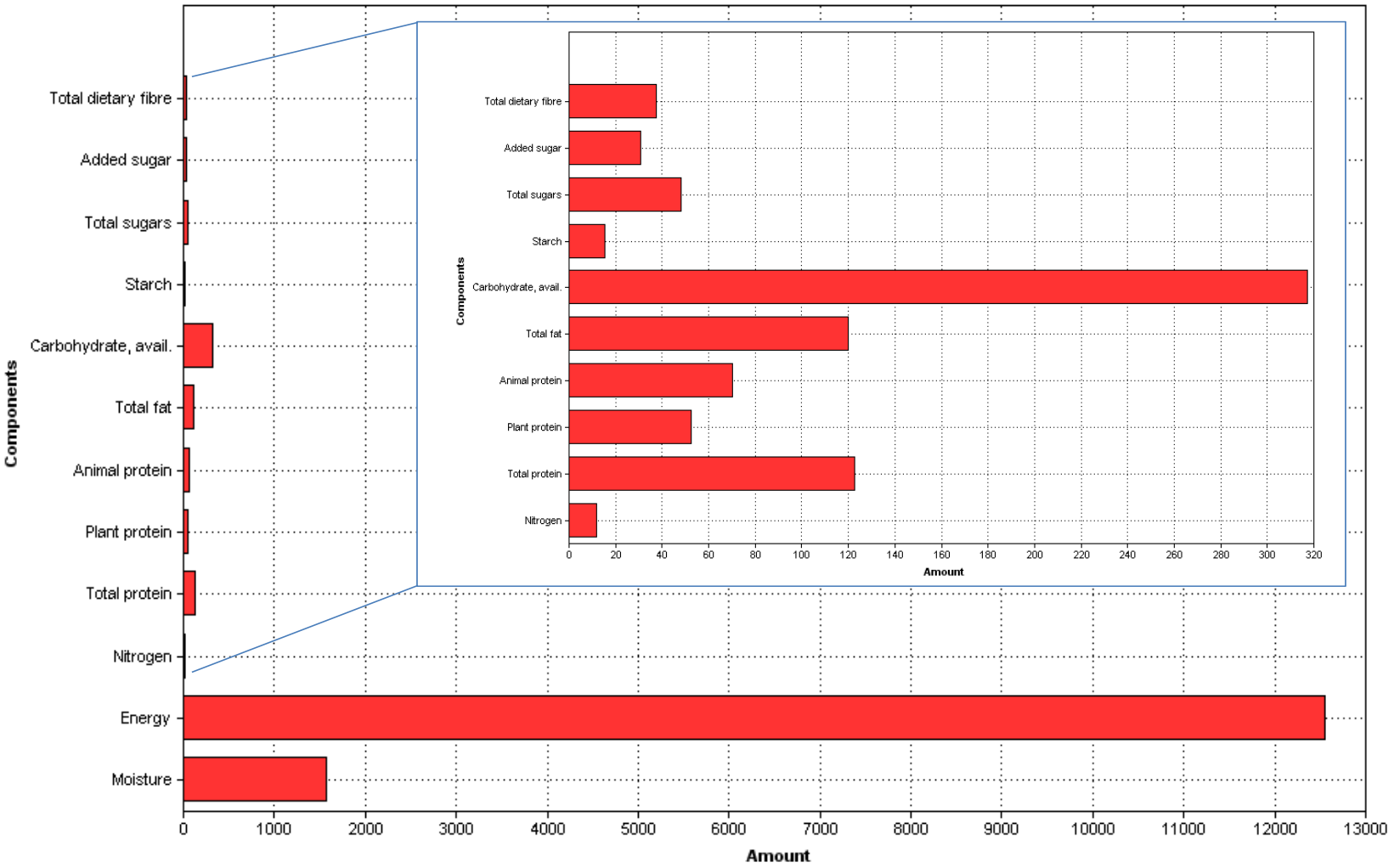



*Figure 6: Plots for the macronutrients in week 1.*

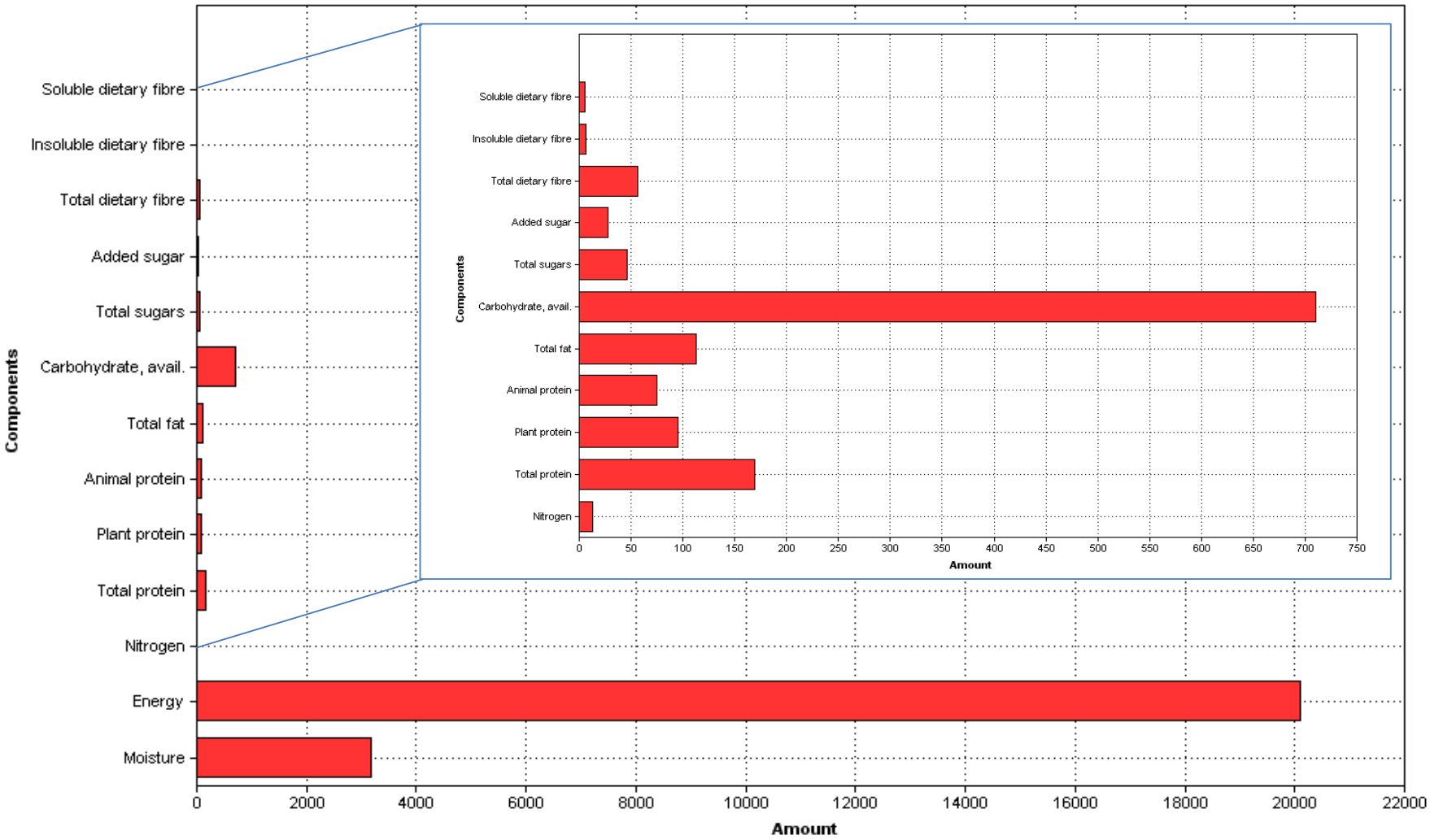



*Figure 7: Plots for the macronutrients in week 2.*

*Protein requirements*

The analysis of the two week menu cycle revealed that 123 g in week one and 169 g in week two were consumed compared to the 57 g, which is the RDA. In both cases the requirements were in excess by 117% and 199% respectively.

Figure 8 below show high levels of cholesterol in the diet. This could be as result of excess intake of the animal proteins. The human body needs fat in the diet but in moderation for provision of energy and help to transport some of the essential micronutrients such as the fat soluble vitamins (Vitamin A, D, E, and K).

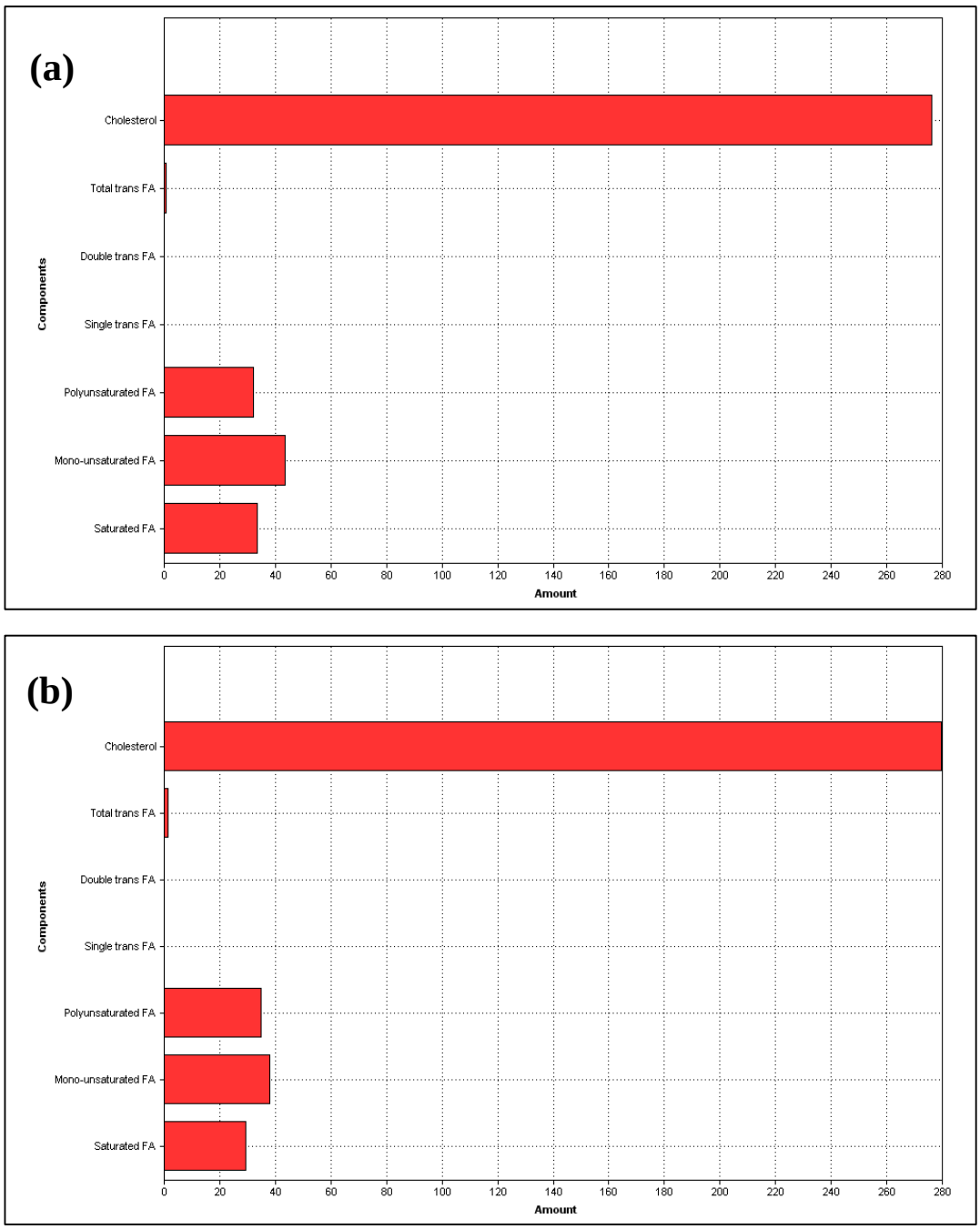



*Figure 8: Cholesterol values for (a) week 1 and (b) week 2.*

### 4.5.2 Minerals analysis

Findings from this researched shown in Figure 9 and Table 9 below reveal that the menu used at the MCYCC did not meet the RDA of the some of the macro minerals like calcium in both the menu cycle. 776 mg and 750 mg were obtained for Week 1 and 2 respectively compared to the RDA of 1 200 mg.

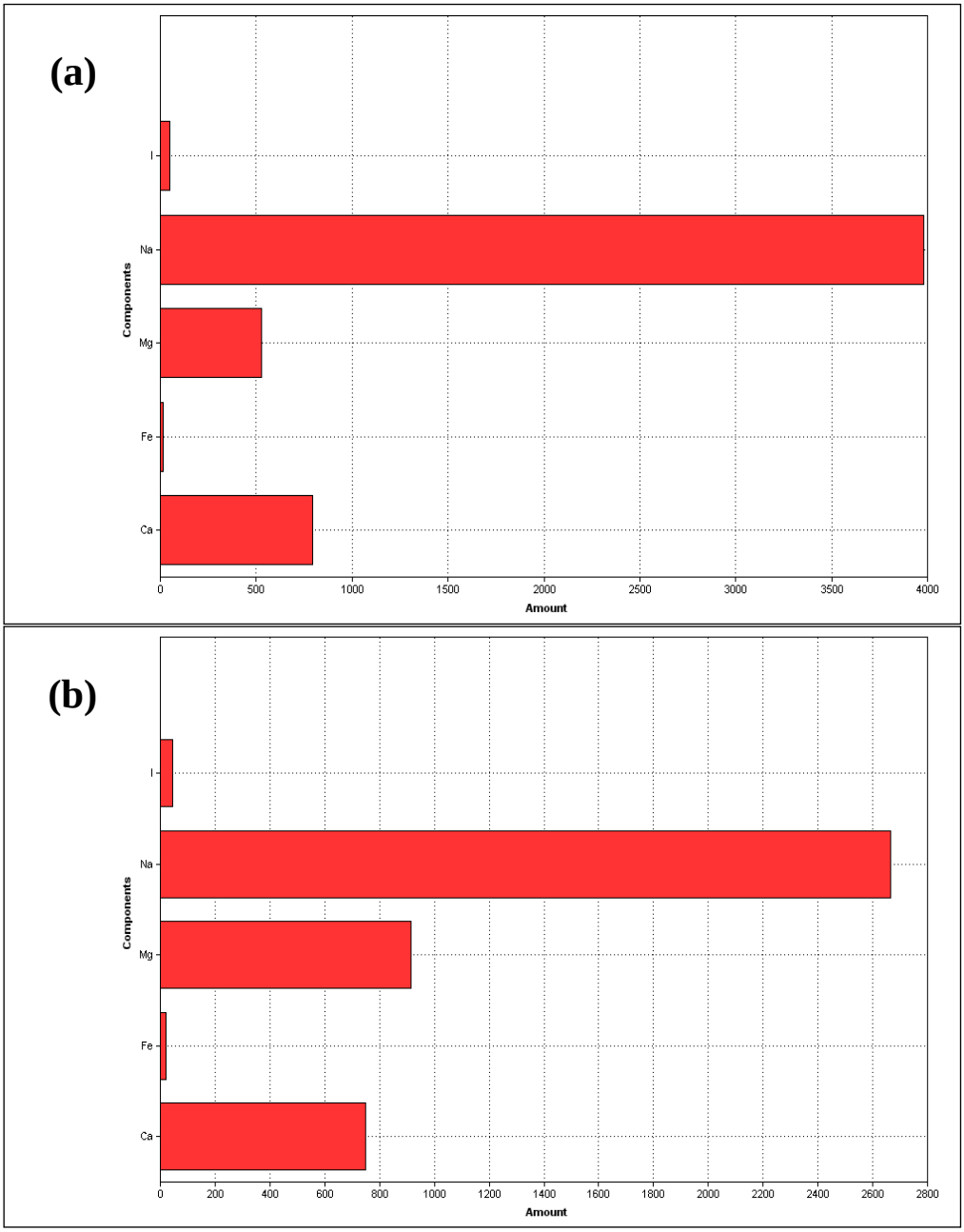



*Figure 9: Minerals content for (a) week 1 and (b) week 2.*

Table 9: Meal analysis for minerals in the diet for week 1 & 2

## MRC FOODFINDER 3

### Meal Analysis - Standard RDA

**Name: MCYCC Wk 1 Monday**
**Name: MCYCC Wk 1 Tuesday**
**Name: MCYCC Wk 1 Wednesday**
**Name: MCYCC Wk 1 Thursday**
**Name: MCYCC Wk 1 Friday**
**Name: MCYCC Wk 1 Saturday**
**Name: MCYCC Wk 1 Sunday**

**Minerals**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Ca (mg) | 776 | 1200.00 | 64.67% |
| Fe (mg) | 14.9 | 11.43 | 130.38% |
| Haem iron (mg) | 1.0 | | |
| Non-haem iron (mg) | 5.2 | | |
| Mg (mg) | 529 | 367.14 | 144.09% |
| P (mg) | 1762 | 1200.00 | 146.83% |
| K (mg) | 3627 | | |
| Na (mg) | 3206 | | |
| Cl (mg) | 1682 | | |
| Zn (mg) | 17.76 | 15.00 | 118.40% |
| Cu (mg) | 1.91 | 2.07 | 92.21% |
| Cr (mcg) | 50.3 | 125.00 | 40.24% |
| Se (mcg) | 44.5 | 54.29 | 81.97% |
| Mn (mcg) | 7356 | 3500.00 | 210.17% |
| I (mcg) | 50 | 150.00 | 33.33% |
| B (mcg) | 1847 | | |
| F (mcg) | 192 | | |
| Si (mcg) | 3259 | | |

## MRC FOODFINDER 3

### Meal Analysis - Standard RDA

**Name: MCYCC Wk 2 Monday**
**Name: MCYCC Wk 2 Tuesday**
**Name: MCYCC Wk 2 Wednesday**
**Name: MCYCC Wk 2 Thursday**
**Name: MCYCC Wk 2 Friday**
**Name: MCYCC Wk 2 Saturday**
**Name: MCYCC Wk 2 Sunday**

**Minerals**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Ca (mg) | 750 | 1200.00 | 62.50% |
| Fe (mg) | 19.7 | 11.43 | 172.38% |
| Haem iron (mg) | 1.2 | | |
| Non-haem iron (mg) | 5.7 | | |
| Mg (mg) | 914 | 367.14 | 248.95% |
| P (mg) | 2812 | 1200.00 | 234.33% |
| K (mg) | 4858 | | |
| Na (mg) | 2665 | | |
| Cl (mg) | 1184 | | |
| Zn (mg) | 24.04 | 15.00 | 160.27% |
| Cu (mg) | 2.37 | 2.07 | 114.41% |
| Cr (mcg) | 57.5 | 125.00 | 46.00% |
| Se (mcg) | 43.7 | 54.29 | 80.50% |
| Mn (mcg) | 9316 | 3500.00 | 266.17% |
| I (mcg) | 46 | 150.00 | 30.67% |
| B (mcg) | 3542 | | |
| F (mcg) | 188 | | |
| Si (mcg) | 3393 | | |

### 4.5.3 Vitamins analysis

The research findings shown in Figure 10 and Table 10 revealed excess supplies of most of the vitamins in the menu used at MCYCC. For example only 59 mg of vitamin C is needed by the body daily but this menu provided 226 mg per day and 290 mg per day for week 1 and 2 respectively. Vitamin A were supplied in excess for week 1, (1 071 mg) and under supplied for week 2, (987 mg) compared to the 1 000 mg that is required.

Total carotenoids supplies were high in week 1 and 2 menu cycles, 4.538 mg and 4.156 mg respectively.

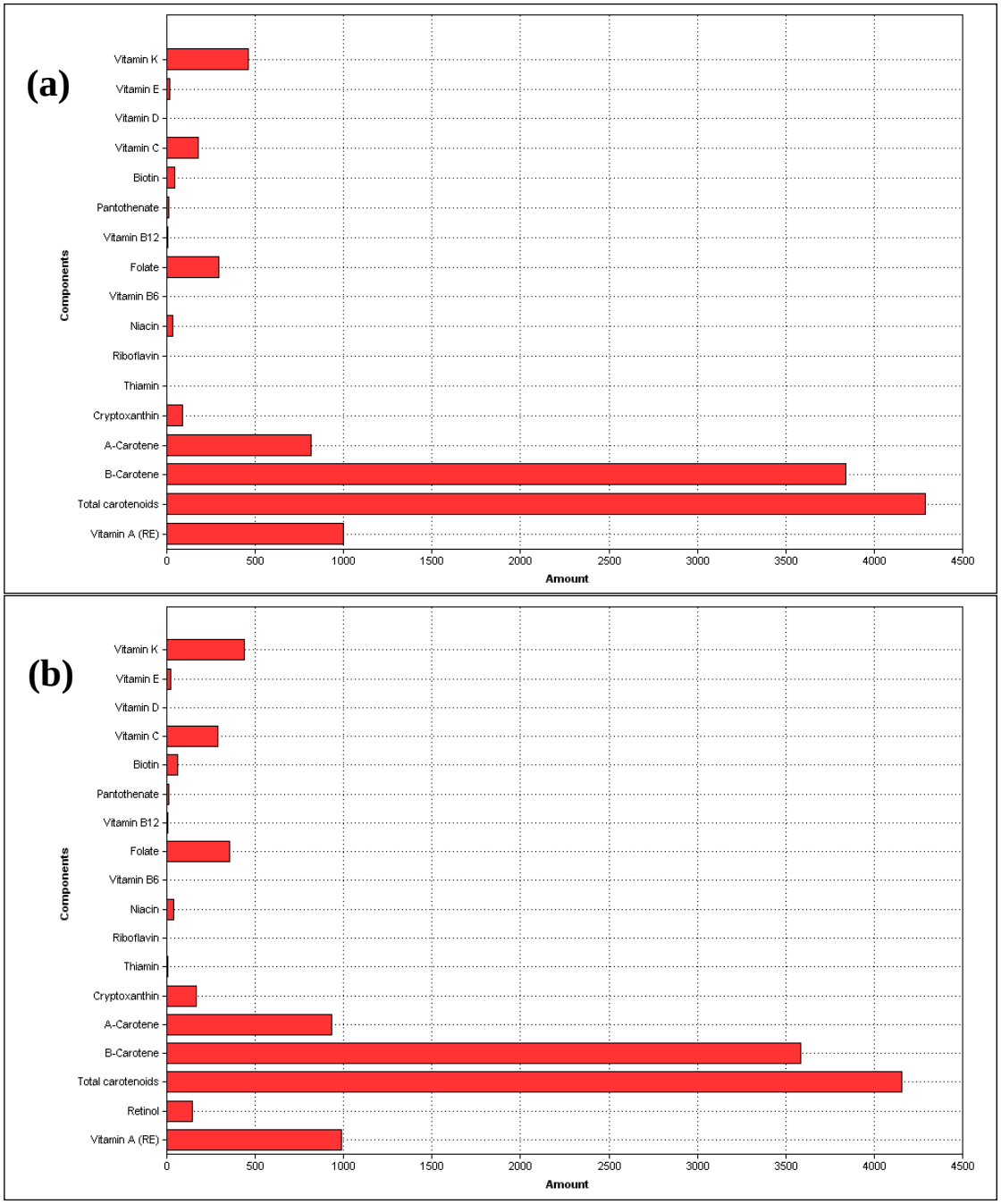



*Figure 10: Vitamin content in food for (a) week 1 and (b) week 2.*

*Table 10: Meal analysis for vitamins in the diet for week 1 & 2*

**MRC FOODFINDER 3**

**Meal Analysis - Standard RDA**

**Name: MCYCC Wk 1 Monday**
**Name: MCYCC Wk 1 Tuesday**
**Name: MCYCC Wk 1 Wednesday**
**Name: MCYCC Wk 1 Thursday**
**Name: MCYCC Wk 1 Friday**
**Name: MCYCC Wk 1 Saturday**
**Name: MCYCC Wk 1 Sunday**

**Vitamins**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Vitamin A (RE) (mcg) | 1071 | 1000.00 | 107.10% |
| Retinol (mcg) | 149 | | |
| Total carotenoids (mcg) | 4538 | | |
| B-Carotene (mcg) | 4031 | | |
| A-Carotene (mcg) | 946 | | |
| Cryptoxanthin (mcg) | 68 | | |
| Thiamin (mg) | 1.59 | 1.47 | 108.06% |
| Riboflavin (mg) | 1.36 | 1.73 | 78.68% |
| Niacin (mg) | 34.9 | 19.29 | 180.96% |
| Vitamin B6 (mg) | 1.865 | 1.96 | 95.29% |
| Folate (mcg) | 302 | 192.86 | 156.59% |
| Vitamin B12 (mcg) | 5.5 | 2.00 | 275.00% |
| Pantothenate (mg) | 10.03 | 5.50 | 182.36% |
| Biotin (mcg) | 46.4 | 65.00 | 71.38% |
| Vitamin C (mg) | 226 | 58.57 | 385.85% |
| Vitamin D (mcg) | 2.39 | 10.00 | 23.90% |
| Vitamin E (mg) | 16.35 | 10.00 | 163.50% |
| A-Tocopherol (mg) | 8.72 | | |
| B-Tocopherol (mg) | 0.34 | | |
| D-Tocopherol (mg) | 0.02 | | |
| G-Tocopherol (mg) | 0.39 | | |
| A-Tocotrienol (mg) | 0.09 | | |
| B-Tocotrienol (mg) | 0.02 | | |
| D-Tocotrienol (mg) | 0.00 | | |
| G-Tocotrienol (mg) | 0.09 | | |
| Lycopene (mcg) | 662 | | |
| Lutein (mcg) | 3222 | | |
| Vitamin K (mcg) | 501.05 | 63.57 | 788.17% |

**MRC FOODFINDER 3**

**Meal Analysis - Standard RDA**

**Name: MCYCC Wk 2 Monday**
**Name: MCYCC Wk 2 Tuesday**
**Name: MCYCC Wk 2 Wednesday**
**Name: MCYCC Wk 2 Thursday**
**Name: MCYCC Wk 2 Friday**
**Name: MCYCC Wk 2 Saturday**
**Name: MCYCC Wk 2 Sunday**

**Vitamins**

| Description | Amount | RDA | RDA % |
|---|---|---|---|
| Vitamin A (RE) (mcg) | 987 | 1000.00 | 98.70% |
| Retinol (mcg) | 146 | | |
| Total carotenoids (mcg) | 4156 | | |
| B-Carotene (mcg) | 3584 | | |
| A-Carotene (mcg) | 930 | | |
| Cryptoxanthin (mcg) | 168 | | |
| Thiamin (mg) | 3.14 | 1.47 | 213.40% |
| Riboflavin (mg) | 1.75 | 1.73 | 101.24% |
| Niacin (mg) | 37.6 | 19.29 | 194.96% |
| Vitamin B6 (mg) | 2.069 | 1.96 | 105.72% |
| Folate (mcg) | 357 | 192.86 | 185.11% |
| Vitamin B12 (mcg) | 4.3 | 2.00 | 215.00% |
| Pantothenate (mg) | 11.98 | 5.50 | 217.82% |
| Biotin (mcg) | 62.8 | 65.00 | 96.62% |
| Vitamin C (mg) | 290 | 58.57 | 495.12% |
| Vitamin D (mcg) | 2.42 | 10.00 | 24.20% |
| Vitamin E (mg) | 23.61 | 10.00 | 236.10% |
| A-Tocopherol (mg) | 9.15 | | |
| B-Tocopherol (mg) | 0.36 | | |
| D-Tocopherol (mg) | 0.02 | | |
| G-Tocopherol (mg) | 0.39 | | |
| A-Tocotrienol (mg) | 0.08 | | |
| B-Tocotrienol (mg) | 0.03 | | |
| D-Tocotrienol (mg) | 0.00 | | |
| G-Tocotrienol (mg) | 0.06 | | |
| Lycopene (mcg) | 423 | | |
| Lutein (mcg) | 3025 | | |
| Vitamin K (mcg) | 440.19 | 63.57 | 692.43% |

### 4.6 Meal portion verification

Food from served plate samples was weighed at different times when the researcher visited the food service unit and results recorded in Table 11. The quantities found were then compared to what was expected as stated on the menu in Appendices 15 and 17. Pictures of sample plates are displayed in Figure 11 for (a) Monday breakfast (b) Friday lunch (c) Saturday dinner and (d) the serving process.

The results show that the menus were correctly followed, though sometimes the portions differed from those indicated on the menus. It was also observed that some of the boys requested for double portion of what was being served especially during breakfast.

*Table 11: Food items served at different meal times.*

| Meal | Week 1 | | | Week 2 | | |
|---|---|---|---|---|---|---|
| | **Monday** | **Wednesday** | **Friday** | **Tuesday** | **Thursday** | **Saturday** |
| **Breakfast** | 250ml milk<br>45ml Oats<br>2 slices brown bread<br>20g Jam | | | | 250ml tea<br>35.4ml Oats<br>2 slices brown bread<br>14g Bread spread | |
| **Lunch** | | | 100g rice<br>100ml brown sauce<br>136 boerwors<br>74g Cabbage<br>100g butternut | 150g Beef patties<br>4 slices brown bread<br>100g Coleslaw salad<br>100g mixed vegetables | | |
| **Dinner** | | 100g pap<br>100ml brown gravy<br>140g boerwors<br>100g mixed vegetables | | | | 100g rice<br>100g mash potatoes<br>250g roast chicken<br>100ml sauce |

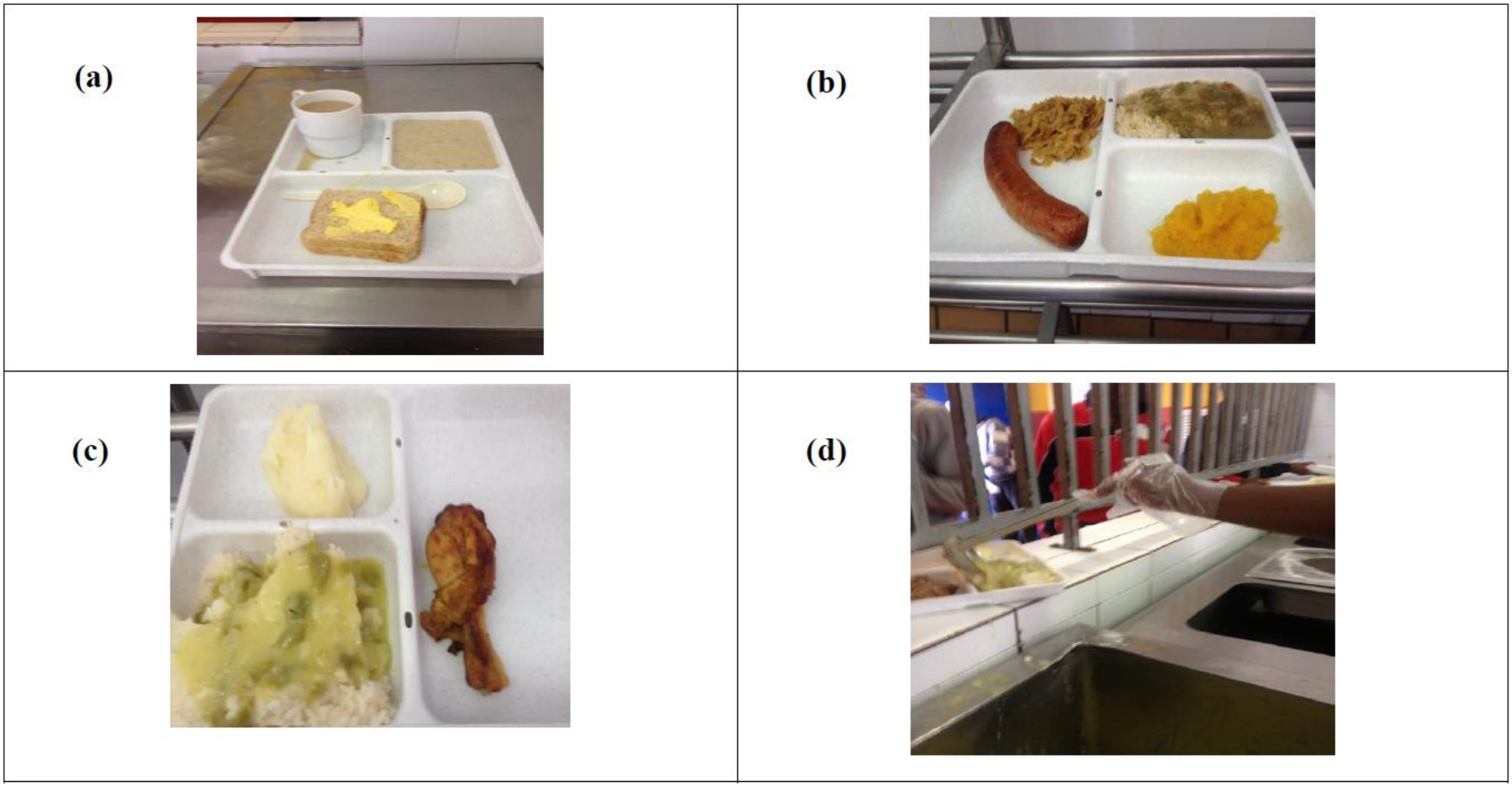



*Figure 11: Sample pictures for (a) breakfast (b) lunch (c) dinner (d) the serving process.*

### 4.7 Food Safety and Hygiene

Observations were done in the food service unit in the different areas and percentage scores were recorded. Each percentage score was colour coded and rating given according to the scoring criteria in Table 12 below. A score of between 90–100% is colour coded Gold and rated Excellent. A score of between 75–89% is colour coded Silver and rated Very good, 60–74% is colour coded Bronze and rated Good, 50–59% was colour coded Red and rated Unacceptable, while a score of less than 49% was colour coded Black and rated as High risk.

*Table 12: Food safety and hygiene compliance score-card.*

| Percentage | Colour | Rating |
|---|---|---|
| 90 – 100 | Gold | Excellent |
| 75 – 89 | Silver | Very good |
| 60 – 74 | Bronze | Good |
| 50 – 59 | Red | Unacceptable |
| 49 - 00 | Black | High risk |

The summarised results are shown in Table 13 while the comprehensive reports of the observation are recorded on the food safety and hygiene evaluation tool in Appendix 8.

*Table 13: Food safety and hygiene compliance results.*

| | Items evaluated | Score (%) | Colour Code | Rating |
|---|---|---|---|---|
| 1 | Menus | 89 | Silver | Very good |
| 2 | Storage facilities | 83 | Silver | Very good |
| 3 | Meal serving procedure | 90 | Gold | Excellent |
| 4 | Food safety and hygiene | 84 | Silver | Very good |
| 5 | Overall rating | 86 | Silver | Very good |

A score of 89% was obtained in the menu section, it was colour coded Silver and rated as Very good. The storage facilities scored 83%, colour coded Silver and rated Very good as well. The meal serving procedure scored 90%, colour coded Gold and was rated as Excellent. Food safety and hygiene scored 84%, was colour coded Silver and rated as Very good. The overall rating of the food service unit scored 86%, was colour coded Silver and rated as 'Very good'.

### 4.8 Quality Control Audit: Documentation

The results of an audit of the quality control documents shown in Table 14 revealed that the facility had normal diet menus displayed on the walls of the kitchen and serving areas as required by the law. Temperature charts with the recorded temperatures for the storage facilities were available in the file. The cleaning schedule was well displayed on the noticeboard. However the facility did not have some of the vital documents that are recommended by the government like the national food service management policy hand-outs, the national guidelines for food service units in institutions, national specifications for perishable and non-perishable foods-volume 4, the ration scale guidelines, therapeutic diet menus and there is no dietician allocated to the site. This could jeopardise their compliance to the required standards of a food service unit. The facility also lacked the training records for the food handlers.

*Table 14: Table showing required quality control documents.*

| | Item | Availability |
|---|---|---|
| 1 | National food service management policy | ✗ |
| 2 | National guidelines for food service units in institutions | ✗ |
| 3 | National specifications for perishable and non-perishable foods – volume 4 | ✗ |
| 4 | Ration scale guidelines | ✗ |
| 5 | Normal diet menus | ✓ |
| 6 | Name of the dietician in the facility | ✗ |
| 7 | Therapeutic diet menus | ✗ |
| 8 | Temperature chart with temperature recorded | ✓ |
| 9 | Cleaning schedule | ✓ |
| 10 | Records on staff training on basic hygiene and food safety* | ✗ |

*Reports and attendance registers

## 4.9 Discussion of Results

### 4.9.1 Questionnaire responses

All the areas evaluated for cleanliness which included the dining area, service area, the utensils used for serving food and the staff cleanliness scored above average percentages. This revealed that the food facility is kept clean and the members of staff maintain personal hygiene. The general cleanliness of a food service unit is important in maintaining food safety and hygiene standards which are crucial in enhancing public health. A clean environment helps to eliminate bacteria that are likely to cause food poisoning resulting into foodborne illnesses. These results also imply that the management is keen in following the food safety and hygiene standards governing the food service industry. It was reported that they have frequent audits from recognised firms like Q-pro, which help them to frequently monitor the food safety and hygiene processes.

In the parameter of service provision the aspects of friendly staff, manager availability, quality of service offered and the serving time were evaluated. All the aspects scored above average percentages. The staff members were rated as friendly and helpful and the manager was availability on site. Friendliness is an important value especially for the adolescents who are in conflict with law and away from their homes. The acts of kindness can make them feel still wanted in the society and encourage them to change their behaviour for the better (78). This may also contribute positively towards the rehabilitation programmes and accelerate this process to the benefit of both the adolescents in conflict with the law and the community. The presence of the manager on site is important as he is required to oversee the activities of the day, supervise the running of the kitchen and sort out any emergencies that might arise (79).

The two aspects of quality of service offered and the serving time were also rated above average. Serving food on time or on schedule is a sign of high quality of service being offered and good kitchen management and helps to boost the customer satisfaction. Keeping time on serving cooked food reduces the standing time ensuring that fresh food is served to the consumers. This also helps avoid overcooking the food through the food warmers which may destroy the nutrients, especially vitamin C (52). Every food facility should aim at reducing the standing time of the cooked food. This enables the food to be served at the right temperatures and reduce the activities of the microorganisms that start

growing when cooked food temperatures drop lower than the required temperatures of 60°C (5).

The parameter of food served was also highly rated in four aspects of portion size, food temperature, ability to follow menu and taste variety. The quality of food was least rated at 12%. This could be because the expectations of the adolescents were not met. Though the research findings show that the food on the planned menus and food served was of good quality, nutritious and exceed the RDA, but it did not meet the expectations of the adolescents. Considering the overall satisfaction of the service offered, 46% of the respondents rated the service as excellent and good, 26% rated it as fair, 25% as poor while the 3% of the results were rejected. This again could be due to personal preferences and expectations.

### 4.9.2 Reliability of questionnaire responses

In conclusion, the p-value (probability) returned by the test (asymptotic pr > chi sq.) on all the evaluated parameters was less than 0.05. Therefore the null hypothesis was rejected for all the questions meaning that the observed difference in proportion of responses can be interpreted and the results are reliable.

### 4.9.3 BMI Results

The BMI results revealed four different anthropometric patterns whereby 13.5% of the adolescents were found to be underweight, 57% were normal weight, 28.2 were overweight while 1.3 % was found to be obese. The identification of anthropometric patterns is important in assisting the public health sector to develop interventions that can help to compact the high risk trends like obesity and underweight amongst the youths. Subsequently the identification of the physical activities that the adolescent engage in while at the centre is crucial in order to determine their metabolic levels, and thereby be able to plan meals portions equivalent to their needs. Both underweight and obese are health risks that result from malnutrition caused by either underfeeding or overfeeding respectively. The increasing rates of obesity and obesity-related health risks such as diabetes and cardiovascular diseases have become common among overweight adolescents (25). Similarly the prevalence of type 2 diabetes among the adolescents has increased and is also closely linked to overweight and obesity, which stretches into

adulthood (19). Regular BMI screenings can quickly assist in the identification of the anthropometric patterns and appropriate steps can be taken to keep individuals healthy.

### 4.9.4 Menu analysis

Research reveals that the adolescents need adequate nutrition to be able to support the rapid growth and development that they experience at this stage (38). Adequate nutrition starts with properly planned menus that ensure that meals are balanced daily. The menu used at the MCYCC was analysed to identify the different food constituents and establish whether they meet the RDA for the adolescents. The analysis revealed that high energy levels were provided by the macronutrients foods consumed in both the weeks. The body gets energy mainly from carbohydrates and to some extent dietary fats and proteins. Energy is needed to accomplish the body tissue synthesis and maintenance, muscle activities and heat production in order to maintain the body temperature. The risk of such a diet which is high in kilojoules is that the excess is stored as fat, thereby contributing to risks of developing chronic conditions like obesity, cardiovascular diseases and type 2 diabetes (19).

To avoid excess intakes of fat in the diet, there has to be a balance between plant and animal food sources rich in protein. This research revealed that the main sources of proteins shown on the menu included eggs, chicken, fish, beef and boerewors which are all of animal origin and lacked any plant protein sources. This may have provided a lot of fat intake thereby contributing to the 1.3% rate of obesity among the adolescents in this study. Animal proteins are high in fat and excess intake especially for less active individuals result into fat storage thus increasing cholesterol levels whose consequences are detrimental (41). Consumption of excess protein greater than what the body needs may also compromise the body's ability to perform its physiological activities to its maximum capacity.

Fats have high concentrates of energy compared to the proteins and carbohydrates. Each gram of fat releases approximately 37.8 kJ of energy as compared to 16.7 kJ one gram of carbohydrates and proteins. Though fats make the meals to be palatable and produce satiety feeling after a meal, their excessive intake contributes toward excess energy intakes, which result into increased weight gain and morbidity. Other consequences may include high levels of cholesterol which may contribute to premature mortality rates due to

exposed risk of type 2 diabetes, hypertension, heart diseases, stroke, gall bladder diseases and osteoarthritis (41).

This research revealed high levels of cholesterol in the diet as shown in Figure 7, which could also be attributed to the frequent intake of animal protein provided in the diet. This can be managed if some the animal proteins were substituted by the plant proteins like soya beans and lentils which could be served with rice.

The results revealed inadequate intake of minerals, especially calcium. Calcium is important at this stage due to its demand for the dramatic muscular and skeletal development at this stage. It is also at this stage that they develop dense bone mass that could reduce risks of fractures and osteoporosis later in life. Therefore low supply of macro minerals like calcium and iron in the diet at this stage can impact negatively on their bone mass development resulting into osteoporosis later in life (53).

Results also show high intakes of sodium compared to the other minerals. Sodium helps to regulate the flow of fluids in the body and regulate the nervous system. Other functions include the regulating the functions of the muscles including the heart and nutrient absorption in the cells. These functions could be jeopardized if sodium intakes are higher than what is expected and can put the body at risk. Sodium works together with chloride and potassium to regulate the flow of fluids in the body and help regulate the nervous system. Sodium and chloride are found in table salt while potassium is found in milk, meats, green leafy vegetable and citrus fruits.

Vitamins are essential compounds that are important for life and maintaining healthy bodies by protecting the body from infections and diseases. Many reactions in the body depend on vitamins and lack or excess of one may interfere with the functioning of the other. The body absorbs the vitamins from the food consumed as it cannot manufacture sufficient amounts on its own. The research findings from this study revealed excess supplies of the vitamins. Vitamins should not be consumed in excess as they cannot be stored by the body. They body only uses what it requires and the rest is flashed out of the system (52).

### 4.9.5 Meal portion analysis

The results for meal portion analysis were found to be in the range of the RDAs for adolescents as shown in Table 11. This could be due to several factors for examples

having competent staff who know and care about the nutritional needs of the adolescents regardless of their status. It could also be due to the fact that the facility's management are keen on following the set rules governing the food service units. These adolescents though in conflict with law, know their rights and will always demand for the best. The management could also be under pressure since this is a vulnerable group due to their stage in life, staying together and being in conflict with the law creates favourable conditions for them to easily want to react negatively to situations even if minor, which could lead to a lot of damage. Therefore there is a need for the set rules and regulations to be observed keenly by the food service providers to ensure peace and tranquillity in the centre. The researcher learnt that occasionally the adolescents are given questionnaires to answer to try and find out what their views are on the services offered to them. They are also allowed to report any matters of concerns to the care and social workers that are part of the management team.

### 4.9.6 Food safety and hygiene and document audit

Both the document audit carried out and the observation done at the facility revealed that most of the documents and procedures pertaining to cleanliness were being applied. The evaluation of the storage area using the food safety and hygiene evaluation tool in Appendix 8 revealed that correct procedures of storing different foods at different temperatures were being followed keenly. The storage section in Appendix 8 had a high score of 83%. Referring to the fridge temperature log sheet in Appendix 6 both the temperatures of the walk-in freezer and walk-in fridge are daily monitored and recorded in the morning and afternoon. The recommended temperatures for walk-in freezer are between -12°C to -22°C while those of the walk-in fridge are 1°C to 4°C (69). The records show that the temperatures were within the recommended ranges. It is important to maintain the correct temperatures in the fridges and freezers to maintain the freshness of the stored food. Low temperatures prevent the growth of bacteria that cause food spoilage helping the food to remain fresh for a longer period (80).

The food safety and hygiene section on the food safety and hygiene evaluation tool in Appendix 8 scored 84%. In this section the food handling techniques of the food handlers were evaluated and results indicate that most of the areas scored full marks. For example meat or chicken is thoroughly defrosted in the fridge before preparation. This is advisable as defrosting in the fridge enables the food to thaw while the temperatures are low enough

to not to allow the bacteria to grow. Defrosting the meat outside the fridge exposes the meat to warm temperatures that can easily cause food spoilage even before preparation and cooking starts. It was also observed that samples of cooked food are labelled, dated and kept in the fridge for 72 hours. This is important as they can be tested in the laboratories and help to establish the cause and source of contamination in case there are any complaints from the consumers. Identifying the causes of contamination is the first step in offering the correct treatment to the affected individuals (81).

The observation done on the cleanliness and sanitation processes of the facility revealed that the floors and surfaces were clean. The cleaning and sanitising schedule in Appendix 5 has several areas highlighted for cleaning and the cleaning frequencies of daily, weekly or monthly. It also shows the person responsible for the task, the detergents to be used for cleaning and the specific cleaning method for different tasks. Having a specific person assigned for a specific task develops accountability at the work place and improves efficiency. The daily cleaning procedure is specifically important as this helps to maintain the daily cleanliness of the highlighted areas. However there was no mop disinfection schedule displayed and no mop disinfection was observed. Disinfection helps to destroy the germs that water and soap or other cleaning detergents cannot kill (82).

The observation done on the personal hygiene section revealed that the employees wore clean protective wear and the facility has hand washing areas with both hot and cold running water. Protective gear like safety shoes helps reduce accidents in the kitchens especially if the floors are wet and slippery and the aprons help protect the food handler's clothes from food spillages. Hand washing areas with both hot and cold water and liquid soap encourage that habit of washing hands before handling food and in between different activities. Regular hand washing assists in reducing cross contamination. Other aspects of personal hygiene in the kitchen like short, unpolished clean fingernails, covered hair and wearing of jewellery were also observed and regarded good (83).

### 4.9.7 Quality control audit: documentation

There were no records on staff training on food safety and hygiene. Staff training and development is important in refreshing their skills and improving performance. It is important that food handlers are continuously given refresher courses in their field of operation to be able to keep up with the current requirements of the food service industry and thereby be able to perform their duties better. For example, refresher courses in food

safety and hygiene are highly recommended for food handlers time after time to remind them of the steps to follow to avoid poisoning in food service units.

### 4.10 Recommendations and future work

It was observed that a therapeutic diet menu was not available at MCYCC, which means that children in need of therapeutic diets be not being catered for. In addition, the facility lacked a qualified dietician, whose services may prove valuable for prescribing therapeutic diets on site; therefore future research should look into the role of dietician on site.

I also would wish to recommend a comparative study of the food services offered in private youth centres like MCYCC with other public youth centres in South Africa.

Further research could also evaluate the role of the sports facility in the centre and their contribution to the health of the residential adolescents. This could focus on how frequent and well the facilities are being used and establish whether their impact could contribute to the wellbeing of the youths at the centre.

# CHAPTER 5: CONCLUSION

Good health is founded in expert knowledge in food and nutrition, meal planning and preparation of nutritious meals. Inadequate knowledge on planning meals especially for the adolescents results in poor diets, likely to cause malnutrition. In addition, poor practices in food safety and hygiene by food handlers may lead to food poisoning, thereby leading to customer dissatisfaction. This study therefore evaluated the food services offered to the adolescents at the Mogale Child and Youth Care Centre (MCYCC) to establish the degree of customer satisfaction in relation to their great nutrient demand for rapid body growth.

It was observed that the food served was nutritionally adequate for the adolescents. Generally, the children found the food acceptable, and the level of customer service offered satisfactory. The analysis of the planned menus in a two-week cycle, indicated that the meals met the recommended daily allowances for adolescents and the actual food portions served compare well with the recommended food portion intakes for adolescents. The anthropometric patterns of the current resident adolescents at the MCYCC revealed that, 58% had a normal BMI, 13% were underweight, and 26.6% were overweight while only 2.4% were obese.

The procedures applied in the food service unit were found to comply with the set and recommended food, safety and hygiene standards for institutions in South Africa, despite the lack of a qualified dietician on site. In assessing the compliance of the food service unit by performing a document audit, the unit met only three out of the required ten quality control measures. There is need for the management to look into other aspects of compliance especially training of the food handlers as this enhance their skills and help them perform better.

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# APPENDICES

## Appendix 1: Customer Satisfaction Questionnaire.

**1. Hygiene, service and food quality (Please tick the most appropriate to you)**

| | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| **Surroundings** | | | | |
| Dining room cleanliness | | | | |
| Serving area cleanliness | | | | |
| Serving utensil cleanliness | | | | |
| The staff are clean, neat & smart | | | | |
| **Service** | | | | |
| The staff are friendly and helpful | | | | |
| Manager is available and helpful | | | | |
| The general service is good | | | | |
| Food is served on time | | | | |
| **Food** | | | | |
| Quality of food served | | | | |
| The portions sizes are about right | | | | |
| Variety of food on the menu | | | | |
| Variety in taste of food | | | | |
| Food temperatures | | | | |

**General**

Are there any comments you would like to make:

About the breakfast service?

_____

About the lunch service?

_____

What food items would you like to see more often on the menu

_____

What is your overall satisfaction of the food service?

| Excellent | Good | Fair | Poor |
|---|---|---|---|

## Appendix 2: Informed consent and assent.

### CONSENT TO PARTICIPATE IN THIS STUDY

I confirm that the person asking my consent to take part in this study has told me about the nature, processes, risks, discomforts and benefits of the study. I have also received, read and understood the above written information (Information Leaflet and Informed Consent) regarding the study. I am aware that the results of the study, including personal details, will be anonymously processed into research reports. I am participating willingly. I have had time to ask questions and have no objection to participate in the study. I understand that there is no penalty should I wish to discontinue with the study and my withdrawal will not affect me in any way.

I have received a signed copy of this informed consent agreement.

Participant's name:

……..... (Please print)

Participant's signature: .....……

Date.....

Investigator's name:

.....…….... (Please print)

Investigator's signature.....……

Date.….....

Witness's Name .....……..... (Please print)

Witness's signature.....

Date.….....

## Appendix 3: BMI measurement record form.

| | Sample No. | Age (yrs.) | Height (m) | Weight (Kg) | BMI ($Kg/m^2$) | Remarks |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

## Appendix 4: Required quality control documents.

| | Item | Availability |
|---|---|---|
| 1 | National food service management policy | |
| 2 | National guidelines for food service units in institutions | |
| 3 | National specifications for perishable and non-perishable foods – volume 4 | |
| 4 | Ration scale guidelines | |
| 5 | Normal diet menus | |
| 6 | Name of the dietician in the facility | |
| 7 | Therapeutic diet menus | |
| 8 | Temperature chart with temperature recorded | |
| 9 | Cleaning schedule | |
| 10 | Records on staff training on basic hygiene and food safety (reports and attendance registers) | |

## Appendix 5: The cleaning schedule.

# CLEANING / SANITISING SCHEDULE Form FF 21c Rev 1 (Page 1)

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| Management Area | Lindela | Unit | Main kitchen | Facility / Area | All areas | | |
|---|---|---|---|---|---|---|---|
| Items to be cleaned | Responsible Person | Chemicals to be used | Specific Cleaning Method | Frequency | | | |
| | | | | Daily | Weekly | Monthly | |
| Basins and zinks | Cleaners | All purpose cleaner | Wash with soap water rinse dry with cloth or paper towel | ✓ | | | |
| Cups, Spoons, Plates | Cooks | Dishwashing soap | Wash with soap water rinse dry with cloth or paper towel | ✓ | | | |
| Bread bins and lid | Cooks | Dishwashing soap | Wash with soap water rinse dry with cloth or paper towel | ✓ | | | |
| Bread Trollies | Cooks | All purpose cleaner | Wash with soap water rinse dry with cloth or paper towel | | ✓ | | |
| Defrosting meat trollies | Cooks | All purpose cleaner | Wash with soap water rinse dry with cloth or paper towel | ✓ | | | |
| Pot and capdans | Cooks | Dishwashing soap and all purpose cleaner | Heat the pot to remove dry crust of food cook or fill the pot with water to make food wet and wash with pot scourer to clean | ✓ | | | |
| Planetary mixture | Cooks | Dishwashing soap | Wash with soap water rinse sanitse dry with cloth or paper towel | ✓ | | | |
| Stainless steel racks | Cooks | All purpose cleaner and Dishwashing soap | Wash with soap water rinse sanitise dry with cloth or paper towel | | ✓ | | |
| Plastic pallets | Cooks | All purpose cleaner | Wash with soap water rinse and dry | | ✓ | | |
| Urinals | Cleaners | All purpose cleaner | Wash with soap water rinse sanitise dry with cloth or paper towel | ✓ | | | |
| Toilet bowl and seat | Cleaners | All purpose cleaner | Wash with soap water rinse sanitise dry with cloth | ✓ | | | |
| Showers | Cleaners | All purpose cleaner | Wash with soap water rinse sanitise dry with cloth | ✓ | | | |
| Tilting frying pans | Cooks | Dishwashing soap and all purpose cleaner | Wash with soap water rinse sanitise dry with cloth | ✓ | | | |
| Oven and oven trollies | Cooks | Dishwashing soap and Oven cleaner | Warm the oven for ten minutes spray with oven cleaner wash with soap water rinse with nozel and airdry | ✓ | | | |
| Windows | Cleaners | Glass cleaner | Wash with window cleaner or glass cleaner and wipe with window squeegee | | ✓ | | |
| Mobile food bins | Cleaners | All purpose cleaner | Wash with soap water rinse sanitise dry with cloth | ✓ | | | |
| | | | | | | | |

Responsible Person is to sign the Satisfactory Sheet (Page 2)

## Appendix 6: Fridge temperature log sheet.

**TEMPERATURE MONITORING LOG SHEET** Form FF 21f Rev 0

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| Management Area | Limpopo | Unit | Mooyaka Youth C |
|---|---|---|---|

| Chest Freezer -12°C to -22°C | | Walk-in Freezer -12°C to -22°C | X | Walk-in Fridge 1°C to 4°C | |
|---|---|---|---|---|---|

| Date | AM Product | | PM Product | | Corrective Action taken if out of range | Responsible Person and Signature |
|---|---|---|---|---|---|---|
| | Time | Temp | Time | Temp | | |
| 2012/11/06 | 06:28 | 19°C | 18:20 | -20° | N/A | Letsie |
| 2012/11/07 | 06:10 | -20° | 18:05 | -20° | N/A | Montsengoa |
| 2012/11/08 | 06:00 | -18° | 17:15 | -18° | N/A | Montsengoa |
| 2012/11/11 | 07:05 | -19° | 17:40 | -19° | N/A | Montsengoa |
| 2012/11/12 | 06:00 | -16° | 18:28 | -15° | N/A | Montsengoa |
| 2012/11/13 | 06:30 | -18° | 18:10 | -18° | N/A | Montsengoa |
| 2012/11/14 | 06:50 | -19° | 17:57 | -18° | N/A | Montsengoa |
| 2012-11-15 | 07:22 | -18° | 18:20 | -16° | N/A | Letsie |
| 2012/11/16 | 06:55 | -18° | 18:30 | -18° | N/A | Montsengoa |
| 2012/11/17 | 07:40 | -19° | 17:45 | -16° | N/A | Montsengoa |
| 2012/11/18 | 07:30 | -18° | 17:50 | -18° | N/A | Letsie |
| 2012/11/19 | 07:20 | -18° | 18:20 | -19° | N/A | Montsengoa |
| 2012/11/20 | 06:30 | -16° | 18:00 | -18° | N/A | Montsengoa |
| 2012/11/21 | 06:50 | -16° | 18:15 | -18° | N/A | Montsengoa |
| 2012/11/22 | 06:05 | -18° | 17:03 | -18° | N/A | Montsengoa |
| 2012/11/23 | 5:50 | -19° | 18:00 | -18° | N/A | Montsengoa |
| 2012/11/24 | 06:30 | -12° | 17:00 | -16° | N/A | Montsengoa |
| 2012-11-25 | 06:37 | -14° | 17:28 | -16° | N/A | Letsie |
| 2012-11-26 | 07:00 | -16° | | | N/A | Letsie |

## Appendix 7: RDA values for some nutrients for adolescents.

(Edited and adapted from recommended dietary allowance (revised 1989) designed for nutrition of healthy people in the USA)

| Category | Age -years | Weight (kg) | Height (cm) | Proteins (g/day) | Carbohydrates Kcal/day | Vitamin C (mg) | Calcium (mg/day) | Iron (mg/day) |
|---|---|---|---|---|---|---|---|---|
| **Males with Low *PAL** | **14-18** | **45-66** | **157-176** | **52-56** | **2000-2500** | **50-60** | **1200-1500** | **12** |

***PAL-Physical Activity Level**

# Appendix 8: Food safety and hygiene evaluation tool.

| | Adapted from the National Food ration scales for Food Service Units in Hospitals and Health institutions- Volume 3 | | Compliance | | | |
|---|---|---|---|---|---|---|
| **Item** | **Criteria** | **Standards** | **Fully (5)** | **Partial (2)** | **None (0)** | **REMARKS** |
| **1** | **Menus** | | | | | |
| 1.1 | Are ration scales available and implemented? | **Meal plans should be drawn based on the ration scale guidelines. Request to see meal plans and portion sizes.** | 5 | | | Meal plans available and displayed on wall. Shows portions of food. |
| 1.2 | Is the cycle menu for normal diets available, visible and implemented? | **8-21 days menu cycle should be displayed in the FSU (to check implementation, observe the meals prepared against the planned menu).** | 5 | | | Menus displayed on notice board |
| 1.3 | Is the cycle menu for therapeutic diets available, visible and implemented? | **8-21 days menu cycle should be displayed in the FSU (to check implementation, observe the meals prepared against the planned menu).** | | | 0 | Therapeutic menu diet unavailable |
| 1.4 | **Are basic principles of menu planning adhered to?** | | | | | |
| 1.4.1 | Is the good colour combination of food taken into account? | **The menu should have good colour combination** | 5 | | | There is variety in food colour |
| 1.4.2 | Does the menu use a variety of textures? | **The menu should have a variety of textures e.g. hard, soft, grainy and crisp** | 5 | | | Various textures used |
| 1.4.3 | Does the variety of flavours complement each other? | **Spiced, sweet, herbs, tangy** | 5 | | | Yes |
| 1.4.4 | Is a variety of cooking methods used? | **A variety of cooking techniques should be used** | 5 | | | Roasting, boiling, stewing |
| 1.4.5 | Does the menu suit the client profile? | **The menu should be culturally acceptable to consumers/adolescents** | 5 | | | The menu is suitable for the adolescents |
| 1.5 | Are all menus nutritionally analysed by the dietician? | **All menus should be nutritionally analysed by the dietician** | 5 | | | Report done by the dietician is available |
| | ***Score out of 45: 40*** | | | | | |
| | | **1S/total (89%)** | 40 | | | |

| 2 | Storage | | Compliance | | | |
|---|---|---|---|---|---|---|
| **Item** | **Criteria** | **Standards** | **Fully (5)** | **Partial (2)** | **None (0)** | **REMARKS** |
| 2.1 | Is prepared food covered and dated when stored in the fridge? | **All prepared food kept in the fridge should be covered and dated and be kept for 72 hours** | N/A | | | No cooked or prepared food is kept in fridge. All food is consumed after preparation |
| 2.2 | Is the temperature in the storage areas checked regularly? | **A temperature chart with temperatures recorded should be placed at each storage area. Temperatures should be checked twice a day.** | 5 | | | Temperatures are checked twice daily. See attached samples of temperature log sheets. |
| 2.3 | Is milk cold rooms at correct temperatures of 4° C | **Temperatures of milk cold rooms should be 4°C** | 5 | | | Cold room was at 4°c at the observation time |
| 2.4 | Are vegetables and fruits cold rooms at correct temperatures of 7°C | **Temperatures of vegetable and fruit cold rooms should be 7°C** | 5 | | | Cold room was at 5°c at the observation time |
| 2.5 | Is the grocery stores properly ventilated and away from direct sunlight | **The grocery stores should be well ventilated and away from direct sunlight** | 5 | | | Grocery store is enclosed and door has wire meshes half at the bottom for ventilation purposes. |
| 2.6 | Is the temperature of the freezer at <-18°C | **The temperature of the freezer should be at <-12°C** | 5 | | | The walk -in- freezer temperatures recorded ranged from -12 °c to - 20°c |
| | ***Score out of 30: 25*** | | | | | |
| | | **25/total (83%)** | **25** | | | |

| 3 | Meal serving | | Compliance | | | |
|---|---|---|---|---|---|---|
| **Item** | **Criteria** | **Standards** | **Fully (5)** | **Partial (2)** | **None (0)** | **REMARKS** |
| 3.1 | Is hot food served hot and cold food served cold to the consumers? | **The temperature of food should be; hot at >65°C (for hot dishes) and cold at 7°C(for cold dishes) at serving points** | 5 | | | The hot food observed was at greater than 60°C. |
| 3.2 | Are correct portion sizes served according to the recommended meal plan? | **Portion sizes of served meals should be as depicted on the meal plan (observe in the portions)** | 5 | | | The served portion size corresponds with those on the set menu though some children asked to be served double. |
| 3.3 | Are trolleys and serving surfaces clean? | **All trolleys and serving surfaces should always be clean** | 5 | | | All trolleys and serving surfaces were at time of observation clean. There are different areas designated for, clean warm and a wash bay for dirty trolleys. |
| 3.4 | Is the temperature of the bain maries at > 65 °C? | **Temperature of in bain marie should be >65 °C** | 5 | | | The bain marie temperatures were set at >65 °C at the time of observation. An electric heating element on the Bain Marie is switched on to keep the food hot at the set temperature |
| 3.5 | Is food properly covered during transportation to the dining hall | **Food should be covered during transportation to the dining hall** | 5 | | | Yes, All the trolleys are covered during transportation from the kitchen to the serving area and are only opened when serving is taking place. |
| 3.6 | Is food transported to the dining hall using correct trolleys? | **Correct trolleys i.e. heated/ insulated or cold depending on the type of meals are used to transport food to the dining hall** | | 2 | | Trolleys for hot food are rinsed with hot water before serving in food |
| | ***Score out of 30:27*** | | | | | |
| | | **3S/total (90%)** | 27 | | | |

| 4 | Food Safety and Hygiene | | Compliance | | | |
|---|---|---|---|---|---|---|
| **Item** | **Criteria** | **Standards** | **Fully (5)** | **Partial (2)** | **None (0)** | **REMARKS** |
| 4.1 | Is staff trained on basic hygiene and food safety | **Staff should be trained on basic hygiene and food safety (check training reports/attendance registers)** | | 2 | | A portion of staff were last trained last year. No training reports in the files |
| 4.2 | **Food handling** | | | | | |
| 4.2.1 | Is meat/chicken defrosted thoroughly in the fridge before preparation? | **Meat should be taken out of the freezer and be put in the fridge to defrost before preparation.** | 5 | | | The is a designated refrigerated area for defrosting meat/chicken |
| 4.2.2 | Are different chopping boards used for meat and vegetables? | **There should be different chopping boards for meat and vegetables. Observe** | | 2 | | All the meats and vegetables come from the supplier already cut and parked differently in portions ready to cook. |
| 4.2.3 | Is cooked food separated from raw to prevent cross contamination? | **Cooked and raw food should be kept separately** | 5 | | | All cooked food is served from the cooking pot into trolleys and transported to serving areas. |
| 4.2.4 | Are fresh vegetables and fruits washed before use? | **All fresh vegetables and fruits should be washed thoroughly before use.** | 5 | | | This is done in the vegetable preparation area where there is wash basin and tap. |
| 4.2.5 | Are serving spoons and disposable gloves used during serving of meals? | **Food should be served using serving spoons and disposable gloves** | 5 | | | Serving spoons and disposal gloves are used |
| 4.2.6 | Is a sample of prepared food covered and kept in the fridge for 72 hours? | **All prepared food should be covered and kept in the fridge if not served. (observation)** | 5 | | | Yes, samples were available at the time of observation |
| 4.3 | **Cleaning and sanitizing** | | | | | |
| 4.3.2 | Are floors and surfaces clean? | **All surfaces and floors should be kept clean at all times** | 5 | | | The floors and surface were clean at the time of observation |
| 4.3.3 | Is a cleaning programme in place and displayed? | **Every FSU should have a cleaning schedule** | 5 | | | The cleaning schedule is available on the notice board. Was able to obtain a copy |
| 4.3.4 | Are mops disinfected daily and stored dry? | **All mops should be disinfected daily and dried** | | 2 | | There was no disinfection schedule and no disinfection was observed |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4.4 | **Equipment and utensils:** | | | | | |
| 4.4.1 | Are utensils and equipment clean? | **Food equipment and utensils should be properly washed and rinsed before and after every use.** | | 2 | | Proper washing was done after use but no rinsing was done before use. |
| 4.5 | **Personal hygiene:** | | | | | |
| 4.5.1 | Do food handlers wear clean, suitable uniform and protective clothing? | **Food handlers should wear clean, suitable uniform and protective clothing.** | 5 | | | All food handlers were in uniform and protective clothes (aprons, gum boots and head caps at the time of observation |
| 4.5.2 | Are fingernails of food handlers short, unpolished, and clean (no artificial nails)? | **Fingernails of food handlers should always be short, unpolished, and clean (no artificial nails).Observe** | 5 | | | Short, unpolished and clean nails were observed |
| 4.5.3 | Is there hot and cold water at the hand basins? | **Hand basins should have both hot and cold water.** | 5 | | | There were several hand basins each with hot and cold water taps. |
| 4.5.4 | Is liquid soap and disposable towels available at hand basins? | **Hand basins must have liquid soap and disposable towels at all times.** | | 2 | | Liquid soap was available but the disposal paper was missing |
| 4.5.5 | Are hands washed before handling food and in between different activities? | **Hands should be washed before handling food and in between different activities (observe)** | 5 | | | Washing of hand before and after handling of food was observed |
| 4.5.6 | Are employees' restrooms operational and clean? | **Employee restrooms should always be operational and clean.** | 5 | | | Employees' rest rooms were clean and operational |
| 4.5.7 | Is hair covered when in the FSU? | **Hair should be covered when in the FSU (observe)** | 5 | | | All food handlers' hair is covered. |
| 4.5.8 | Is jewellery not worn in the FSU | **No jewellery except for wedding band should be worn in the FSU** | 5 | | | No jewellery were observed. |
| | *Score out of 95:80* | | **70** | **10** | | |
| | | **4S/total (84%)** | **80** | | | |
| | **Total scores:** | *Grand total 172 out of 200* | | | | |
| | | *Total Percentage:86* | | | | |

## Appendix 9: Meal portion record form.

| Meal | Week 1 | | | Week 2 | | |
|---|---|---|---|---|---|---|
| | Monday | Wednesday | Friday | Tuesday | Thursday | Saturday |
| Breakfast | | | | | | |
| | | | | | | |
| | | | | | | |
| Lunch | | | | | | |
| | | | | | | |
| | | | | | | |
| Dinner | | | | | | |
| | | | | | | |
| | | | | | | |

# Appendix 10: MCYCC BMI results.

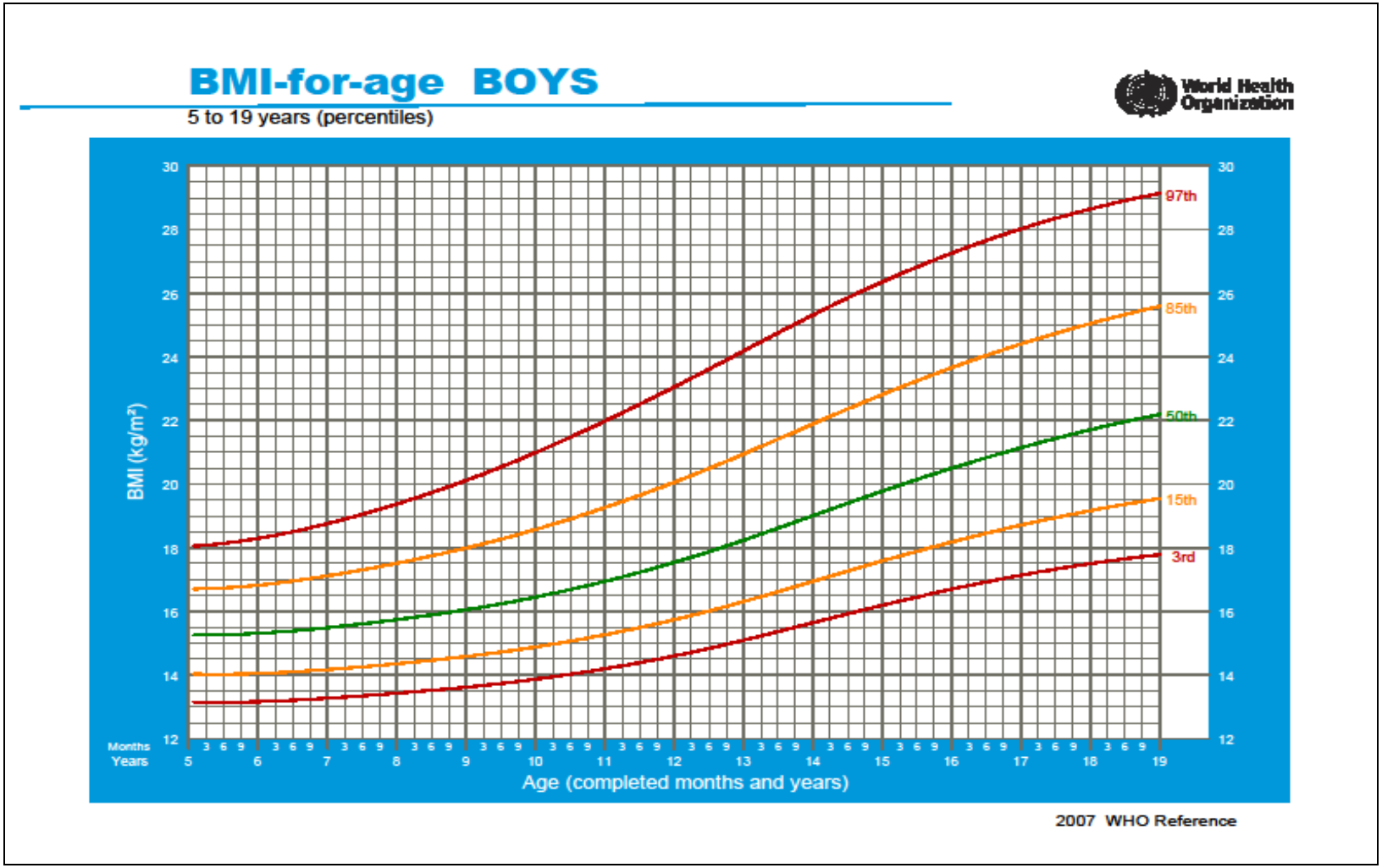
| Sample No | AGE (yrs) | HEIGHT (m) | $m^2$ | WEIGHT (Kg) | BMI ($Kg/m^2$) | |
|---|---|---|---|---|---|---|
| BB 986 | 16 | 1.84 | 3.39 | 55.3 | 16.33 | **16** |
| BB 193 | 17 | 1.76 | 3.1 | 50.3 | 16.24 | **16** |
| | 18 | 1.82 | 3.31 | 56.2 | 16.97 | **17** |
| BB 924 | 16 | 1.7 | 2.89 | 50.4 | 17.44 | **17** |
| | 18 | 1.75 | 3.06 | 53.7 | 17.53 | **18** |
| BB 826 | 17 | 1.8 | 3.24 | 56.9 | 17.56 | **18** |
| AY 408 | 18 | 1.64 | 2.69 | 47.4 | 17.62 | **18** |
| BB 778 | 17 | 1.76 | 3.1 | 54.7 | 17.66 | **18** |
| BB 870 | 16 | 1.74 | 3.03 | 53.5 | 17.67 | **18** |
| | 18 | 1.65 | 2.72 | 48.2 | 17.7 | **18** |
| | 18 | 1.54 | 2.37 | 42 | 17.71 | **18** |
| BB 891 | 18 | 1.56 | 2.43 | 43.1 | 17.71 | **18** |
| BA 138 | 17 | 1.65 | 2.72 | 48.5 | 17.81 | **18** |
| BA 155 | 17 | 1.78 | 3.17 | 56.6 | 17.86 | **18** |
| BB 006 | 14 | 1.48 | 2.19 | 39.4 | 17.99 | **18** |
| | 18 | 1.63 | 2.66 | 47.8 | 17.99 | **18** |
| | 18 | 1.71 | 2.92 | 52.7 | 18.02 | **18** |
| BB 167 | 17 | 1.63 | 2.66 | 48.1 | 18.10 | **18** |
| BB611 | 15 | 1.44 | 2.07 | 38.1 | 18.37 | **18** |
| BA 686 | 17 | 1.64 | 2.69 | 49.7 | 18.48 | **18** |
| BA 559 | 17 | 1.76 | 3.1 | 57.3 | 18.50 | **18** |
| BB 163 | 17 | 1.64 | 2.69 | 49.8 | 18.52 | **19** |
| BC 042 | 17 | 1.68 | 2.82 | 52.5 | 18.60 | **19** |
| BB 99 | 17 | 1.75 | 3.06 | 57 | 18.61 | **19** |
| BB 844 | 17 | 1.62 | 2.62 | 48.9 | 18.63 | **19** |
| BB 956 | 17 | 1.79 | 3.2 | 59.8 | 18.66 | **19** |
| | 18 | 1.74 | 3.03 | 56.9 | 18.79 | **19** |
| BA 895 | 17 | 1.69 | 2.86 | 53.7 | 18.80 | **19** |
| BB 536 | 18 | 1.74 | 3.03 | 57 | 18.83 | **19** |
| BA 828 | 15 | 1.76 | 3.1 | 58.6 | 18.92 | **19** |
| BA 177 | 17 | 1.84 | 3.39 | 64.2 | 18.96 | **19** |
| BB 846 | 17 | 1.69 | 2.86 | 54.6 | 19.12 | **19** |
| BB 678 | 16 | 1.66 | 2.76 | 52.8 | 19.16 | **19** |
| AZ 125 | 17 | 1.82 | 3.31 | 63.5 | 19.17 | **19** |
| BB 564 | 17 | 1.76 | 3.1 | 59.4 | 19.18 | **19** |
| BB 888 | 16 | 1.81 | 3.28 | 62.9 | 19.20 | **19** |
| | 18 | 1.68 | 2.82 | 54.2 | 19.20 | **19** |
| BB 838 | 15 | 1.56 | 2.43 | 46.8 | 19.23 | **19** |
| BC 056 | 18 | 1.66 | 2.76 | 53.5 | 19.42 | **19** |
| **Sample** | **AGE** | **HEIGHT** | **$m^2$** | **WEIGHT (Kg)** | **BMI ($Kg/m^2$)** | |

| No | (yrs) | (m) | | | | |
|---|---|---|---|---|---|---|
| BB 281 | 16 | 1.76 | 3.1 | 60.5 | 19.53 | **20** |
| BB 887 | 15 | 1.61 | 2.59 | 50.7 | 19.56 | **20** |
| BB 860 | 17 | 1.76 | 3.1 | 60.6 | 19.56 | **20** |
| BB 985 | 17 | 1.8 | 3.24 | 63.5 | 19.60 | **20** |
| AZ 274 | 17 | 1.83 | 3.35 | 65.8 | 19.65 | **20** |
| BA686 | 17 | 1.65 | 2.72 | 53.8 | 19.76 | **20** |
| BB 420 | 17 | 1.58 | 2.5 | 49.5 | 19.83 | **20** |
| AZ 565 | 17 | 1.57 | 2.46 | 48.9 | 19.84 | **20** |
| BC 008 | 16 | 1.6 | 2.56 | 50.9 | 19.88 | **20** |
| BB 325 | 17 | 1.77 | 3.13 | 62.7 | 20.01 | **20** |
| BB 504 | 17 | 1.76 | 3.1 | 62 | 20.02 | **20** |
| BC 056 | 17 | 1.66 | 2.76 | 55.2 | 20.03 | **20** |
| BC 044 | 17 | 1.61 | 2.59 | 52 | 20.06 | **20** |
| BB985 | 17 | 1.58 | 2.5 | 50.1 | 20.07 | **20** |
| BB 476 | 17 | 1.76 | 3.1 | 62.8 | 20.27 | **20** |
| BA 596 | 16 | 1.63 | 2.66 | 53.9 | 20.29 | **20** |
| BB 628 | 17 | 1.64 | 2.69 | 54.6 | 20.30 | **20** |
| BB 566 | 16 | 1.74 | 3.03 | 61.6 | 20.35 | **20** |
| BC 041 | 17 | 1.73 | 2.99 | 61 | 20.38 | **20** |
| BB 452 | 16 | 1.62 | 2.62 | 53.7 | 20.46 | **20** |
| BA 930 | 17 | 1.65 | 2.72 | 55.8 | 20.50 | **21** |
| BB 926 | 16 | 1.75 | 3.06 | 63 | 20.57 | **21** |
| BA 198 | 17 | 1.75 | 3.06 | 63.1 | 20.60 | **21** |
| BB 868 | 18 | 1.81 | 3.28 | 67.5 | 20.60 | **21** |
| BB 645 | 16 | 1.76 | 3.1 | 63.9 | 20.63 | **21** |
| BB 911 | 17 | 1.76 | 3.1 | 64 | 20.66 | **21** |
| | 18 | 1.53 | 2.34 | 48.6 | 20.76 | **21** |
| AZ 445 | 17 | 1.7 | 2.89 | 60.1 | 20.80 | **21** |
| BA 411 | 17 | 1.74 | 3.03 | 63 | 20.81 | **21** |
| BB 811 | 16 | 1.65 | 2.72 | 56.8 | 20.86 | **20** |
| BA 901 | 17 | 1.75 | 3.06 | 63.9 | 20.87 | **21** |
| | 18 | 1.67 | 2.79 | 58.3 | 20.90 | **21** |
| BB 875 | 17 | 1.65 | 2.72 | 57 | 20.94 | **21** |
| AX 379 | 18 | 1.55 | 2.4 | 50.3 | 20.94 | **21** |
| AZ 356 | 17 | 1.69 | 2.86 | 59.9 | 20.97 | **21** |
| AZ 720 | 17 | 1.58 | 2.5 | 52.5 | 21.03 | **21** |
| AV 667 | 17 | 1.61 | 2.59 | 54.5 | 21.03 | **21** |
| BB 600 | 18 | 1.72 | 2.96 | 62.3 | 21.06 | **21** |
| BA 177 | 17 | 1.73 | 2.99 | 63.3 | 21.15 | **21** |
| BB 868 | 17 | 1.76 | 3.1 | 65.7 | 21.21 | **21** |
| BB 984 | 17 | 1.68 | 2.82 | 60.2 | 21.33 | **21** |
| BA 20 | 17 | 1.69 | 2.86 | 61.1 | 21.39 | **21** |

| Sample No | AGE (yrs) | HEIGHT (m) | $m^2$ | WEIGHT (Kg) | BMI ($Kg/m^2$) | |
|---|---|---|---|---|---|---|
| AZ 650 | 17 | 1.61 | 2.59 | 55.6 | 21.45 | **21** |
| BB 826 | 17 | 1.68 | 2.82 | 60.8 | 21.54 | **22** |
| BA 718 | 14 | 1.65 | 2.72 | 58.8 | 21.60 | **22** |
| AZ 192 | 17 | 1.72 | 2.96 | 64 | 21.63 | **22** |
| BB 879 | 17 | 1.62 | 2.62 | 56.8 | 21.64 | **22** |
| BB 315 | 17 | 1.67 | 2.79 | 60.7 | 21.76 | **22** |
| BB 910 | 16 | 1.53 | 2.34 | 51.0 | 21.79 | **22** |
| BC 039 | 17 | 1.67 | 2.79 | 60.8 | 21.80 | **22** |
| BB 222 | 17 | 1.67 | 2.79 | 60.8 | 21.80 | **22** |
| BA 070 | 16 | 1.64 | 2.69 | 58.8 | 21.86 | **22** |
| BB 603 | 17 | 1.64 | 2.69 | 58.8 | 21.86 | **22** |
| BB 890 | 17 | 1.66 | 2.76 | 60.3 | 21.88 | **22** |
| BA 715 | 17 | 1.69 | 2.86 | 62.6 | 21.92 | **22** |
| BB 112 | 17 | 1.71 | 2.92 | 64.1 | 21.92 | **22** |
| BB 576 | 17 | 1.55 | 2.4 | 52.7 | 21.94 | **22** |
| BB 780 | 17 | 1.68 | 2.82 | 62 | 21.97 | **22** |
| BB 188 | 17 | 1.63 | 2.66 | 58.4 | 21.98 | **22** |
| | 18 | 1.83 | 3.35 | 73.7 | 22.01 | **22** |
| AZ 905 | 15 | 1.58 | 2.5 | 55 | 22.03 | **22** |
| BA 874 | 17 | 1.59 | 2.53 | 55.7 | 22.03 | **22** |
| BB 856 | 16 | 1.54 | 2.37 | 52.5 | 22.14 | **22** |
| AV 668 | 17 | 1.67 | 2.79 | 61.8 | 22.16 | **22** |
| BB 687 | 18 | 1.88 | 3.53 | 78.5 | 22.21 | **22** |
| | 18 | 1.65 | 2.72 | 60.5 | 22.22 | **22** |
| BB 930 | 16 | 1.62 | 2.62 | 58.4 | 22.25 | **22** |
| AZ 126 | 17 | 1.66 | 2.76 | 61.3 | 22.25 | **22** |
| BA 379 | 16 | 1.74 | 3.03 | 67.6 | 22.33 | **22** |
| AX 855 | 17 | 1.71 | 2.92 | 65.5 | 22.40 | **22** |
| BA 215 | 17 | 1.7 | 2.89 | 64.8 | 22.42 | **22** |
| BA 432 | 17 | 1.63 | 2.66 | 59.9 | 22.55 | **23** |
| BA A66 | 18 | 1.65 | 2.72 | 61.5 | 22.59 | **23** |
| BB 749 | 17 | 1.66 | 2.76 | 62.8 | 22.79 | **23** |
| BC 055 | 17 | 1.65 | 2.72 | 62.1 | 22.81 | **23** |
| BB 878 | 17 | 1.68 | 2.82 | 64.4 | 22.82 | **23** |
| BA 043 | 18 | 1.84 | 3.39 | 77.3 | 22.83 | **23** |
| BB 658 | 16 | 1.66 | 2.76 | 63.4 | 23.01 | **23** |
| BC 022 | 16 | 1.62 | 2.62 | 60.5 | 23.05 | **23** |
| BB 823 | 16 | 1.6 | 2.56 | 59 | 23.05 | **23** |
| | 18 | 1.65 | 2.72 | 63.2 | 23.21 | **23** |
| BC 059 | 17 | 1.58 | 2.5 | 58 | 23.23 | **23** |
| AZ 193 | 17 | 1.63 | 2.66 | 62 | 23.34 | **23** |
| BC 775 | 17 | 1.69 | 2.86 | 66.7 | 23.35 | **23** |

| Sample No | AGE (yrs) | HEIGHT (m) | $m^2$ | WEIGHT (Kg) | BMI ($Kg/m^2$) | |
|---|---|---|---|---|---|---|
| BB 535 | 17 | 1.65 | 2.72 | 63.6 | 23.36 | **23** |
| BB 876 | 16 | 1.52 | 2.31 | 54 | 23.37 | **23** |
| BA 044 | 17 | 1.72 | 2.96 | 69.3 | 23.42 | **23** |
| AZ952 | 17 | 1.72 | 2.96 | 69.4 | 23.46 | **23** |
| BB 746 | 16 | 1.4 | 1.96 | 46 | 23.47 | **23** |
| BB 188 | 16 | 1.7 | 2.89 | 68 | 23.53 | **24** |
| BB 756 | 16 | 1.62 | 2.62 | 61.8 | 23.55 | **23** |
| BB 884 | 16 | 1.62 | 2.62 | 62.1 | 23.66 | **24** |
| BB 799 | 16 | 1.69 | 2.86 | 67.6 | 23.67 | **24** |
| BB 789 | 17 | 1.63 | 2.66 | 62.9 | 23.67 | **24** |
| | 18 | 1.7 | 2.89 | 68.4 | 23.67 | **24** |
| BB 842 | 16 | 1.71 | 2.92 | 69.3 | 23.70 | **24** |
| BB 768 | 16 | 1.78 | 3.17 | 75.1 | 23.70 | **24** |
| BB454 | 15 | 1.55 | 2.4 | 57 | 23.73 | **24** |
| | 18 | 1.65 | 2.72 | 65.3 | 23.99 | **24** |
| AZ 174 | 17 | 1.54 | 2.37 | 58 | 24.46 | **24** |
| | 18 | 1.65 | 2.72 | 67.2 | 24.68 | **25** |
| BC 054 | 17 | 1.57 | 2.46 | 62 | 25.15 | **25** |
| BC 050 | 16 | 1.65 | 2.72 | 68.5 | 25.16 | **25** |
| AZ 565 | 17 | 1.76 | 3.1 | 78 | 25.18 | **25** |
| BA 792 | 17 | 1.67 | 2.79 | 70.5 | 25.28 | **25** |
| BB 560 | 18 | 1.64 | 2.69 | 68.2 | 25.36 | **25** |
| BC 039 | 17 | 1.66 | 2.76 | 70 | 25.40 | **25** |
| BB 749 | 17 | 1.63 | 2.66 | 67.6 | 25.44 | **25** |
| | 18 | 1.67 | 2.79 | 72 | 25.82 | **26** |
| BB 686 | 16 | 1.62 | 2.62 | 69 | 26.29 | **26** |
| BB 993 | 17 | 1.56 | 2.43 | 64.6 | 26.55 | **26** |
| BB 897 | 17 | 1.66 | 2.76 | 73.6 | 26.71 | **27** |
| BB 280 | 15 | 1.56 | 2.43 | 65.6 | 26.96 | **27** |
| BC 004 | 17 | 1.63 | 2.66 | 72 | 27.10 | **27** |
| AY 869 | 17 | 1.67 | 2.79 | 75.7 | 27.14 | **27** |
| BA 458 | 15 | 1.56 | 2.43 | 73 | 30.00 | **30** |
| BB 840 | 15 | 1.6 | 2.56 | 81.6 | 31.88 | **32** |

## Appendix 11: WHO Body-Mass Index graph sample.



# Appendix 12: Research Ethics Committee (UP) Letter.

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

* **FWA** 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
* **IRB** 0000 2235 IORG0001762 Approved dd 13/04/2011 and Expires 13/04/2014.

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
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Faculty of Health Sciences Research Ethics Committee
Fakulteit Gesondheidswetenskappe Navorsingsetiekkomitee

**DATE: 6/07/2012**

| | |
|---|---|
| **NUMBER** | **105/2012** |
| **TITLE OF THE PROTOCOL** | Evaluation of the food service for adolescent boys in Mogale Child and Youth Care Centre in, Gauteng, South Africa |
| **PRINCIPAL INVESTIGATOR** | Mrs Roselidah Anyango Aluha **Dept:** SHSPH, University of Pretoria. **Cell:** 0824768398 **Email:** roselidah.Anyango@vodamail.co.za / roselidah.aluha@bosasa.com |
| **SUB INVESTIGATOR** | Sydney S. Mabaso |
| **SUPERVISOR** | Dr.Kirstie Rendall-Mkosi **EMail:** Kirstie.rendallmkosi@up.ac.za |
| **STUDY DEGREE** | MSc, Community Health |
| **SPONSOR COMPANY** | Not applicable |
| **MEETING DATE** | 27/06/2012 |

The Protocol and Informed Consent Document were approved on 27/06/2012 by a properly constituted meeting of the Ethics Committee subject to the following conditions:

1. The approval is valid for 2 years period [till the end of December 2014], and
2. The approval is conditional on the receipt of 6 monthly written Progress Reports, and
3. The approval is conditional on the research being conducted as stipulated by the details of the documents submitted to and approved by the Committee. In the event that a need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

*Members of the Research Ethics Committee:*

| | |
|---|---|
| Prof M J Bester | (female)BSc (Chemistry and Biochemistry); BSc (Hons)(Biochemistry); MSc(Biochemistry); PhD (Medical Biochemistry) |
| Prof R Delport | (female)BA et Scien, B Curationis (Hons) (Intensive care Nursing), M Sc (Physiology), PhD (Medicine), M Ed Computer Assisted Education |
| Dr NK Likibi | MBB HM – Representing Gauteng Department of Health) MPH |
| Dr MP Mathebula | (female)Deputy CEO: Steve Biko Academic Hospital; MBCHB, PDM, HM |
| Prof A Nienaber | (female) BA(Hons)(Wits); LLB; LLM; LLD(UP); PhD; Dipl.Datametrics(UNISA) – Legal advisor |
| Mrs MC Nzeku | (female) BSc(NUL); MSc(Biochem)(UCL, UK) – Community representative |
| Prof L M Ntlhe | MbChB (Natal) FCS (SA) |
| Snr Sr J Phatoli | (female) BCur(Eet.A); BTec(Oncology Nursing Science) – Nursing representative |
| Dr R Reynders | MBChB (Prët), FCPaed (CMSA) MRCPCH (Lon) Cert Med. Onc (CMSA) |
| Dr T Rossouw | (female) MBChB (cum laude); M.Phil (Applied Ethics) (cum laude), MPH (Biostatistics and Epidemiology (cum laude), D.Phil |
| Dr L Schoeman | (female) B.Pharm, BA(Hons)(Psych), PhD – Chairperson: Subcommittee for students' research |
| Mr Y Sikweyiya | MPH; SARETI Fellowship in Research Ethics; SARETI ERCTP; BSc(Health Promotion)Postgraduate Dip (Health Promotion) – Community representative |
| Dr R Sommers | (female) MBChB; MMed(Int); MPharmMed – **Deputy Chairperson** |
| Prof TJP Swart | BChD, MSc (Odont), MChD (Oral Path), PGCHE – School of Dentistry representative |
| Prof C W van Staden | MBChB; MMed (Psych); MD; FCPsych; FTCL; UPLM - **Chairperson** |

**DR R SOMMERS;** MBChB; MMed(Int); MPharmMed.
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

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# Appendix 13: Permission from Bosasa to Research.

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BOSASA YOUTH DEVELOPMENT CENTRES (PTY) LTD
Reg No 2003/002608/07 Vat No 4610209985

BOSASA
Youth Development Centres

July 2011

**To:** The Secretary Ethics Committee, University of Pretoria

**REF: Permission granted for research studies**

Dear Sir/Madam,

Mogale Child and Youth Care Centre (MCYCC) is a residential facility for children between 14-17 years who are in conflict with law.

Roselidah Anyango Aluha is an employee of Bosasa Group of Companies as a Nutritionist as well as the training coordinator of DCS (Department of Correctional Services). She is currently studying MSc in Community Health at the School of Systems and Public Health at the University of Pretoria and has requested to use the boys at MCYCC as her research population on the research title **"Evaluation of the food service for adolescent boys in Mogale Child and Youth Care Centre in Gauteng, South Africa".**

We therefore grant permission for her request subject to her research protocol being accepted by the University of Pretoria Ethics Committee. This letter will also serve as consent from the parents since the boys are under our guardianship.

Yours sincerely,

JSA Leyds
Managing Director

## Appendix 14: Information Leaflet.

**TITLE OF STUDY:** Evaluation of the food service for Adolescent boys in Mogale Child and Youth Care Centre in Gauteng, South Africa, 2012.

Dear Participant,

### INTRODUCTION

We invite you to participate in a research study. This information leaflet will help you to decide if you want to participate. Before you agree to take part you should fully understand what is involved. If you have any questions that this leaflet does not fully explain, please do not hesitate to ask the investigator.

### 2) THE NATURE AND PURPOSE OF THIS STUDY

The aim of this study is to evaluate the food service offered at the Mogale Child and Youth Care Centre and find out whether it is adequate and sufficient for you as the recipient. You as residents at the centre are a very important source of information on the food services rendered at this youth centre.

### 3) EXPLANATION OF PROCEDURES TO BE FOLLOWED

This study involves taking your height and weight measurements that will be used to calculate your body mass index to help determine your body mass in comparison to your height. We will also give you a questionnaire to answer in order to assess your perception of the food services offered in relation to cleanliness of the facility; services offered to you and the food quality and quantity.

### 4) RISK AND DISCOMFORT INVOLVED

There are no risks in participating in the study however you will need to take off your shoes and thick clothing like sweaters and have your hair combed low when we weigh you and take your height measurements. This may provide some discomfort.

Some of the questions we are going to ask you may make you feel uncomfortable, but you need not answer them if you don’t want to.

Both the measuring session and answering the questionnaire will each take twenty (20) minutes of your time.

## 5) POSSIBLE BENEFITS OF THIS STUDY

Although you will not benefit directly from the study, the results of the study will help improve the food services at this institution in future.

## 6) WHAT ARE YOUR RIGHTS AS A PARTICIPANT?

Your participation in this study is entirely voluntary. You can refuse to participate or stop at any time during the study without giving any reason. Your withdrawal will not affect you in any way.

## 7) HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received written approval from the Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria and the Managing Director of the Youth Centre in Bosasa Group of Companies. Copies of the approval letters are available if you wish to have them.

## 8) INFORMATION AND CONTACT PERSON

The contact person for the study is **Roselidah Aluha.** If you have any questions about the study contact her on telephone numbers (011) 662 6483 or (082) 476 8398. Alternatively you may contact her supervisor on (012) 354 6345.

## 9) COMPENSATION

Your participation is voluntary. No compensation will be given for your participation.

## 10) CONFIDENTIALITY

All information that you give will be kept strictly confidential. Once we have analysed the information no one will be able to identify you. Research reports and articles in scientific journals will not include any information that may identify you or your centre.

## Appendix 15: MCYCC's Sample Menu: Cycle 1

# MYC / LYC MENU

Form YDC 16 ak Rev 0

| Unit | MYC/LYC | | Week | 1 | | Date | JAN 2011 |
|---|---|---|---|---|---|---|---|
| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| **Breakfast** | | | | **Time 7h00** | | | |
| 50 g | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats |
| 2 slices | Bread | Bread | Bread | Bread | Bread | Bread | Bread |
| 20g | Fruit jam | Yellow spread | Peanut butter | Yellow spread | Jam | Peanut butter | Yellow spread |
| 250ml | milk | coffee | Milk | Tea | milk | milk | Tea |
| **Snack** | | | | **Time 11h00** | | | |
| 120g | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit |
| 2 slices | Bread | Bread | Bread | Bread | Bread | Bread | Bread |
| 40g | Peanut butter | Boiled egg and Mayo | Jam | Fish fingers | Peanut butter | Sliced Polony | Jam |
| **Lunch** | | | | **Time 13h00** | | | |
| Protein | Beef stew 190g | Vienna's 90g | Chicken stew220g | Mince stew 150g | Wors 150g | Fried Fish 150g | Roast Chicken 220g |
| Starch 110g | Pap | Bread roll x 2 | Rice | Samp | Rice | Mash | Rice |
| Vegetable/ Salad 100g | Vegetable | Salad | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable |
| Seasonal Vegetable 100g | Vegetable | Seasonal Vegetable | Seasonal Vegetable | salad | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable |
| Sauce / Gravy 100ml | | | | | Sauce | Sauce | Sauce |
| Drink 200ml | Juice | Juice | Juice | Juice | Juice | Juice | Juice |
| Dessert | | | | | | | Jelly & custard |
| **Dinner** | | | | **Time 17h00** | | | |
| Protein | Fried Fish 150g | Beef stew 190g | Wors 150g | Roast Chicken 220g | Beef stew 190g | Chicken stew 220g | Mince stew 150g |
| Starch 100g | Rice | Samp | Pap | Maize Rice | Pap | Rice | Pap |
| Sauce / Gravy 100ml | Sauce | | Sauce | Sauce | | | |
| Vegetable 100g | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable |
| **Snack** | | | | **Time 19h00** | | | |
| 2 slice / 40g | 2 slice bread | Peanuts | 2 slice bread | Peanuts | 2 slice bread | Peanuts | 2 slice bread |
| 10g | Margarine | | Margarine | | Margarine | | Margarine |
| Drink | Milk | Juice | Milk | Juice | Juice | Milk | Juice |

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22/02/2010 - DH00479 - JW


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# Appendix 16: Meal Constituents in Sample Menu: Cycle 1

**MRC FOODFINDER 3**

**Meal Analysis - Standard RDA**

**Name: MCYCC Wk 1 Monday**
**Breakfast on 2012/10/08**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES heaped dessertspoon of Jam/marmalade (30.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/08**
1 PEELED 55MMX55MM DIAM little/small/thin of Orange, Raw (peeled) (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 heaped dessertspoon of Peanut Butter; Smooth Style (50.00g)

**Lunch on 2012/10/08**
4 heaped tablespoon of Stew, Beef, With Vegetables (200.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
4 heaped dessertspoon of Spinach (swiss Chard), Boiled, With Polyunsaturated Margarine (10
100 n/a g of Salad: Greek (lettuce, Tomato, Cucumber, Olive, Feta, No Dressing) (100.00g)
2 125 ml/half cup of Guava Juice, Sweetened (250.00g)

**Supper on 2012/10/08**
1 MEDIUM PIECE 100X55X30MM one unit of Fish, Medium Fat, Fried In Sun Oil (120.00g)
4 heaped tablespoon of Rice, White, Cooked (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
4 level tablespoon of Salad: Mixed Fresh Vegetables (carrot, Tomato, Lettuce, No Dressing) (1

**Late Night Snack on 2012/10/08**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 heaped teaspoon of Margarine, 50% Polyunsaturated, Floro (10.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 1 Tuesday**
**Breakfast on 2012/10/09**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 ON BREAD SLICE 93X93MM plenty/large/thick of Margarine, Polyunsaturated (20.00g)
1 MUG little/small/thin of Coffee, Brewed/ Instant (200.00g)

**In-between on 2012/10/09**
3 MASHED heaped tablespoon of Banana, Raw (peeled) (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 MEDIUM one unit of Egg, Chicken, Whole, Boiled / Poached (45.00g)

**Lunch on 2012/10/09**
180 n/a g of Vienna Sausage, Beef & Pork, Canned (180.00g)
2 125 ml/half cup of Salad: Coleslaw (mayonnaise) (100.00g)
100 n/a g of Mixed Vegetables, Frozen, Raw (carrot, Corn, Peas, Green Beans, Etc) (100.00g)
4 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (200.00g)
2 125 ml/half cup of Apricot Nectar (250.00g)

**Supper on 2012/10/09**
4 heaped tablespoon of Stew, Beef, With Vegetables (200.00g)
2 SAMP heaped tablespoon of Maize, Samp/rice, Cooked (white) (110.00g)
4 heaped dessertspoon of Cabbage, Cooked With Potato, Onion And Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/09**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
2 125 ml/half cup of Peach Nectar (250.00g)

**Name: MCYCC Wk 1 Wednesday**
**Breakfast on 2012/10/10**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
50 n/a g of Oat Bran, Cooked (50.00g)
4 level teaspoon of Peanut Butter; Smooth Style (20.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/10**
1 60MMX52MM DIAM little/small/thin of Pear, Raw (100.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES heaped tablespoon of Jam/marmalade (50.00g)

**Lunch on 2012/10/10**
6 heaped tablespoon of Stew, Chicken (with Skin), Tomato And Onion (210.00g)
6 heaped dessertspoon of Rice, White, Cooked (120.00g)
5 SHREDDED heaped dessertspoon of Cabbage, Boiled (100.00g)
4 CRS GRATED heaped tablespoon of Salad: Beetroot (100.00g)
2 125 ml/half cup of Naartjie Juice, Canned, Sweetened (250.00g)

**Supper on 2012/10/10**
5 THIN 150X16MM DIAM one unit of Sausage, Beef & Pork / Boerewors, Grilled (150.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
100 n/a g of Mixed Vegetables, Frozen, Boiled (cauliflower, Carrot,green Beans,etc) (100.00g)

**Late Night Snack on 2012/10/10**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 ON BREAD SLICE 93X93MM little/small/thin of Margarine, Polyunsaturated (10.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 1 Thursday**
**Breakfast on 2012/10/11**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
20 n/a g of Low Fat Spread, Polyunsaturated, Floro Extra Light (20.00g)
0 MUG medium of Tea, Rooibos, Brewed (0.00g)

**In-between on 2012/10/11**
120 n/a g of Apple, Golden Delicious, Raw (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 85X30X15MM CRUMBS 12G one unit of Fish Finger/stick, Fried/frozen, Crumbed, Reheated

**Lunch on 2012/10/11**
5 heaped dessertspoon of Beef, Mince (regular), Savoury (tomato, Onion) (150.00g)
2 heaped tablespoon of Samp And Beans, 1:1 (120.00g)
2 level ladle of Spinach (swiss Chard), Boiled, With Brick Margarine (100.00g)
5 heaped tablespoon of Salad: Coleslaw (mayonnaise) (100.00g)
2 125 ml/half cup of Orange Juice, Canned, Sweetened (250.00g)

**Supper on 2012/10/11**
4 DRUMSTICK 102X38X30,110X44X35 medium of Chicken, Meat And Skin, Frozen, Roasted
4 MAIZE RICE heaped tablespoon of Maize, Samp/rice, Cooked (white) (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
100 n/a g of Mixed Vegetables, Frozen, Raw (cauliflower, Carrot, Green Beans, Etc) (100.00g)

**Late Night Snack on 2012/10/11**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
250 n/a g of Mango And Orange Juice, Liquifruit (250.00g)

**Name: MCYCC Wk 1 Friday**
**Breakfast on 2012/10/12**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES heaped dessertspoon of Jam/marmalade (30.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/12**
120 n/a g of Apple, Golden Delicious, Raw (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 level tablespoon of Peanut Butter; Smooth Style (50.00g)

**Lunch on 2012/10/12**
5 THIN 150X16MM DIAM one unit of Sausage, Beef & Pork / Boerewors, Grilled (150.00g)
4 level ladle of Rice, White, Cooked (120.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Raw (baby Marrow, Carrot, Etc) (100.00g)
5 heaped tablespoon of Salad: Coleslaw (mayonnaise) (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
100 n/a g of Peach And Pear Juice Liquifruit/ceres (100.00g)

**Supper on 2012/10/12**
4 heaped tablespoon of Stew, Beef, With Vegetables (200.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
5 heaped dessertspoon of Cabbage, Sautéed In Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/12**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 ON BREAD SLICE 93X93MM plenty/large/thick of Margarine, Polyunsaturated (10.00g)
250 n/a g of Mango And Orange Juice, Liquifruit (250.00g)

**Name: MCYCC Wk 1 Saturday**
**Breakfast on 2012/10/13**
50 n/a g of Oats, Rolled Or Oatmeal, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 heaped dessertspoon of Peanut Butter; Smooth Style (25.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/13**
1 BUNCH 85MMX60MM DIAM one unit of Grape, Average, Raw (110.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
5 HOMECUT SLICE 43MM DIAMX5MM one unit of Polony / Bologna, Beef & Pork (40.00g)

**Lunch on 2012/10/13**
1 MEDIUM PIECE 100X55X30MM one unit of Fish, Medium Fat, Fried In Sun Oil (120.00g)
4 heaped dessertspoon of Potato, Mashed (whole Milk, Brick Margarine) (120.00g)
2 125 ml/half cup of Salad: Coleslaw (mayonnaise) (100.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
250 n/a g of Mango And Orange Juice, Liquifruit (250.00g)

**Supper on 2012/10/13**
6 heaped tablespoon of Stew, Chicken (with Skin), Tomato And Onion (210.00g)
4 heaped tablespoon of Rice, White, Cooked (100.00g)
5 heaped dessertspoon of Cabbage, Sautéed In Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/13**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 1 Sunday**
**Breakfast on 2012/10/14**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 heaped dessertspoon of Medium Fat Spread, Polyunsaturated, Floro Light (25.00g)
1 MUG medium of Tea, Brewed (250.00g)

**In-between on 2012/10/14**
1 PEELED 55MMX55MM DIAM little/small/thin of Orange, Raw (peeled) (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES heaped dessertspoon of Jam/marmalade (30.00g)

**Lunch on 2012/10/14**
5 DRUMSTICK 102X38X30,110X44X35 medium of Chicken, Meat Only, Frozen, Roasted (210
2 heaped ladle of Rice, White, Cooked (120.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)
4 level tablespoon of Salad: Potato (mayonnaise, Egg) (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
1 125 ml/half cup of Custard, Whole Milk (Cust Powder) (125.00g)
1 125 ml/half cup of Jelly, Dessert, Prepared With Water (110.00g)

**Supper on 2012/10/14**
3 level ladle of Beef, Mince (regular), Savoury (tomato, Onion) (150.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
2 level ladle of Spinach (swiss Chard), Boiled, With Polyunsaturated Margarine (100.00g)

**Late Night Snack on 2012/10/14**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 ON BREAD SLICE 93X93MM plenty/large/thick of Margarine, Polyunsaturated (10.00g)
1 250 ML CARTON one unit of Pineapple And Mango Juice, Liquifruit (250.00g)

**Legend**
* - There are many missing or no values for these Nutrients.
Please consult the FoodFinder3 Manual -> Reports/Analysis: Meal Analysis.
# - Estimated safe and adequate daily dietary intake (value is the mean of the range)
= - RDA = Recommended Dietary Allowance
+ - RDA % = Percentage of the Recommended Dietary Allowance

## Appendix 17: MCYCC's Sample Menu: Cycle 2

# MYC / LYC MENU

Form YDC 16 ak Rev 0

| Unit | MYC/LYC | | Week | 2 | Date | JAN 2011 | |
|---|---|---|---|---|---|---|---|
| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| | **Breakfast** | | | **Time 7h00** | | | |
| 50 g | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats | Jungle Oats |
| 2 slices | Bread | Bread | Bread | Bread | Bread | Bread | Bread |
| 20g | Fruit jam | Yellow spread | Peanut butter | Yellow spread | Jam | Peanut butter | Yellow spread |
| 250ml | Coffee | Milk | Tea | milk | Tea | milk | Coffee |
| | **Snack** | | | **Time 11h00** | | | |
| 120g | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit | Seasonal fruit |
| 2 slices | Bread | Bread | Bread | Bread | Bread | Bread | Bread |
| 40g | Cheese | Peanut butter | Jam | Peanut butter | Polony | Jam | Boiled egg and mayo |
| | **Lunch** | | | **Time 13h00** | | | |
| Protein | Mince 150g | Beef patties 70gx2 | Beef steak 150g | Chicken stew 220g | Fish 150g | Wors 150g | Roast Chicken 220g |
| Starch | Macaroni 90g | Brown Bread 4slices | Rice 110g | Pap 110g | Bread rolls x2 | Pap 110g | Rice 110g |
| Vegetable/ Salad | Seasonal Vegetable | Salad | Seasonal Vegetable | Seasonal Vegetable | Salad | Seasonal Vegetable | Salad |
| egetable/ Salad 100g | Vegetable/ Salad | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable |
| Sauce / Gravy 100ml | | | Sauce | | | Sauce | Sauce |
| Drink 200ml | Juice | Juice | Juice | Juice | Juice | Juice | Juice |
| Dessert | | | | | | | Fruit salad &ice cream |
| Protein | Chicken stew 225g | Beef steak 150g | Roast Chicken 220g | Mince stew 180g | Beef stew 150g | Chicken stew 225g | Mince 150g |
| Starch 100g | Rice | Pap | Samp | Rice | Rice | Rice | Pap |
| Vegetable 100g | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable | Seasonal Vegetable |
| | | Sauce 100ml | Sauce 100ml | | | | |
| | **Snack** | | | **Time 19h00** | | | |
| | 2 slice bread | Peanuts | 2 slice bread | Peanuts | 2 slice bread | Peanuts | 2 slice bread |
| | Jam | | Peanut butter | | Jam | | Peanut butter |
| | Milk | Juice | Milk | Juice | Juice | Milk | Juice |

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# Appendix 18: Meal Constituents in Sample Menu: Cycle 2

**MRC FOODFINDER 3**

**Meal Analysis - Standard RDA**

**Name: MCYCC Wk 2 Monday**
**Breakfast on 2012/10/22**
50 n/a g of Oat Bran, Raw (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 SMOOTH heaped dessertspoon of Jam/marmalade (30.00g)
1 MUG medium of Coffee, Brewed/ Instant (250.00g)

**In-between on 2012/10/22**
120 n/a g of Apple, Golden Delicious, Raw (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
5 SLICE 85X25X2MM one unit of Cheese, Cheddar (40.00g)

**Lunch on 2012/10/22**
3 level ladle of Beef, Mince (regular), Savoury (tomato, Onion) (150.00g)
3 MACARONI heaped tablespoon of Macaroni/spaghetti, Cooked (105.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)
4 CRS GRATED heaped tablespoon of Salad: Beetroot (100.00g)
2 125 ml/half cup of Guava Juice, Sweetened (250.00g)

**Supper on 2012/10/22**
6 heaped tablespoon of Stew, Chicken (with Skin), With Vegetables (210.00g)
4 heaped tablespoon of Rice, White, Cooked (100.00g)
5 heaped dessertspoon of Cabbage, Sautéed In Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/22**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 SMOOTH ON BREAD SLICE 93X93MM little/small/thin of Jam/marmalade (10.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 2 Tuesday**
**Breakfast on 2012/10/23**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 heaped teaspoon of Medium Fat Spread, Polyunsaturated, Floro Light (20.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/23**
120 n/a g of Apple, Golden Delicious, Raw (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 level tablespoon of Peanut Butter; Smooth Style (50.00g)

**Lunch on 2012/10/23**
2 85MM DIAMX15MM (RAW 100G) one unit of Patty, Beef, Frozen, Grilled (160.00g)
4 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (200.00g)
2 125 ml/half cup of Salad: Coleslaw (mayonnaise) (100.00g)
100 n/a g of Mixed Vegetables, Frozen, Boiled (cauliflower, Carrot,green Beans,etc) (100.00g)
1 250 ML CARTON one unit of Peach And Orange Juice, Liquifruit (250.00g)

**Supper on 2012/10/23**
150 n/a g of Beef, Thick Flank, Cooked - Moist (150.00g)
120 heaped ladle of Maize Meal, Cooked, Stiff Porridge (14400.00g)
2 level ladle of Spinach (swiss Chard), Boiled, With Polyunsaturated Margarine (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)

**Late Night Snack on 2012/10/23**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
1 200 ML CARTON one unit of Mango Juice, Ceres (200.00g)

**Name: MCYCC Wk 2 Wednesday**
**Breakfast on 2012/10/24**
0 n/a g of Oat Bran, Cooked (0.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, White (100.00g)
1 heaped dessertspoon of Peanut Butter; Smooth Style (25.00g)
1 MUG medium of Tea, Brewed (250.00g)

**In-between on 2012/10/24**
1 65MMX60MM DIAM medium of Peach, Raw (150.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES ON BREAD SLICE 93X93MM plenty/large/thick of Jam/marmalade (40.00g)

**Lunch on 2012/10/24**
150 n/a g of Beef, Thick Flank, Cooked - Moist (150.00g)
4 level ladle of Rice, White, Cooked (120.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)
4 level tablespoon of Salad: Mixed Fresh Vegetables (carrot, Tomato, Lettuce, No Dressing) (
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
2 125 ml/half cup of Naartjie Juice, Canned, Sweetened (250.00g)

**Supper on 2012/10/24**
4 DRUMSTICK 102X38X30,110X44X35 medium of Chicken, Meat And Skin, Frozen, Roasted
4 level tablespoon of Samp And Beans, 1:1 (100.00g)
5 heaped dessertspoon of Cabbage, Sautéed In Sunflower Oil (100.00g)
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)

**Late Night Snack on 2012/10/24**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 level teaspoon of Peanut Butter; Smooth Style (10.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 2 Thursday**
**Breakfast on 2012/10/25**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
4 level teaspoon of Medium Fat Spread, Polyunsaturated, Floro Light (20.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/25**
1 PEELED 55MMX55MM DIAM little/small/thin of Orange, Raw (peeled) (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 level dessertspoon of Peanut Butter; Smooth Style (30.00g)

**Lunch on 2012/10/25**
6 heaped tablespoon of Stew, Chicken (with Skin), Tomato And Onion (210.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
100 n/a g of Mixed Vegetables, Frozen, Boiled (cauliflower, Carrot,green Beans,etc) (100.00g
4 CRS GRATED heaped tablespoon of Salad: Beetroot (100.00g)
1 250 ML CARTON one unit of Pineapple And Mango Juice, Liquifruit (250.00g)

**Supper on 2012/10/25**
4 level ladle of Beef, Mince (regular), Savoury (tomato, Onion) (200.00g)
4 heaped tablespoon of Rice, White, Cooked, With Sun Oil (100.00g)
4 heaped tablespoon of Green Beans, Cooked With Potato, Onion And Sunflower Oil (100.00

**Late Night Snack on 2012/10/25**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
250 n/a g of Granadilla Juice, Liquifruit/ceres (250.00g)

**Name: MCYCC Wk 2 Friday**
**Breakfast on 2012/10/26**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 PIECES ON BREAD SLICE 93X93MM little/small/thin of Jam/marmalade (20.00g)
1 MUG medium of Tea, Brewed (250.00g)

**In-between on 2012/10/26**
120 n/a g of Apple, Granny Smith, Raw (120.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
5 HOMECUT SLICE 43MM DIAMX5MM one unit of Polony / Bologna, Beef & Pork (40.00g)

**Lunch on 2012/10/26**
1 MEDIUM PIECE 100X55X30MM one unit of Fish, Low Fat, Battered/crumbed, Fried In Sun Oi
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
4 level tablespoon of Salad: Potato (mayonnaise, Egg) (100.00g)
5 level dessertspoon of Salad: Mixed Green (lettuce, Cabbage, Cucumber, Apple, No Dressing
1 250ML CARTON one unit of Apricot Juice, Liquifruit (250.00g)

**Supper on 2012/10/26**
3 heaped tablespoon of Stew, Beef, With Vegetables (150.00g)
4 heaped tablespoon of Rice, White, Cooked (100.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/26**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 SMOOTH ON BREAD SLICE 93X93MM little/small/thin of Jam/marmalade (10.00g)
250 n/a g of Apple And Blackcurrant Juice, Liquifruit/ceres (250.00g)

**Name: MCYCC Wk 2 Saturday**
**Breakfast on 2012/10/27**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
4 5 ml/measuring teaspoon of Peanut Butter; Smooth Style (20.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**In-between on 2012/10/27**
1 BUNCH 85MMX60MM DIAM one unit of Grape, Average, Raw (110.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 PIECES ON BREAD SLICE 93X93MM little/small/thin of Jam/marmalade (40.00g)

**Lunch on 2012/10/27**
5 THIN 150X16MM DIAM one unit of Sausage, Beef & Pork / Boerewors, Grilled (150.00g)
2 level ladle of Spinach (swiss Chard), Boiled, With Polyunsaturated Margarine (100.00g)
4 heaped tablespoon of Green Beans, Cooked With Potato, Onion And Sunflower Oil (100.00g
100 n/a g of Gravy, Brown, Powder Prepared With Water (100.00g)
2 125 ml/half cup of Guava Juice, Sweetened (250.00g)

**Supper on 2012/10/27**
6 heaped tablespoon of Stew, Chicken (with Skin), With Vegetables (210.00g)
4 heaped tablespoon of Rice, White, Cooked (100.00g)
5 heaped dessertspoon of Cabbage, Sautéed In Sunflower Oil (100.00g)

**Late Night Snack on 2012/10/27**
2 heaped tablespoon of Peanuts, Roasted, Salted (50.00g)
2 125 ml/half cup of Milk, Full Fat / Whole, Fresh (250.00g)

**Name: MCYCC Wk 2 Sunday**
**Breakfast on 2012/10/28**
50 n/a g of Oat Bran, Cooked (50.00g)
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 heaped teaspoon of Medium Fat Spread, Polyunsaturated, Floro Light (20.00g)
1 MUG medium of Coffee, Brewed/ Instant (250.00g)

**In-between on 2012/10/28**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
1 MEDIUM one unit of Egg, Chicken, Whole, Boiled / Poached (45.00g)

**Lunch on 2012/10/28**
2 45MMX40MM DIAM medium of Plum, Raw (100.00g)
4 DRUMSTICK 102X38X30,110X44X35 medium of Chicken, Meat And Skin, Frozen, Roasted
4 heaped tablespoon of Rice, White, Cooked, With Sun Oil (100.00g)
2 125 ml/half cup of Salad: Coleslaw (mayonnaise) (100.00g)
100 n/a g of Mixed Vegetables, Stir-fry, Frozen, Stir-fried In Sunflower Oil (100.00g)
1 200 ML CARTON one unit of Naartjie Juice, Ceres (200.00g)

**Supper on 2012/10/28**
1 SERVING medium of Fruit Salad, Fresh, Without Sugar (pawpaw, Orange, Banana) (110.00
4 heaped dessertspoon of Ice Cream, Regular (10% Fat) (100.00g)
1 heaped ladle of Maize Meal, Cooked, Stiff Porridge (120.00g)
2 heaped tablespoon of Spinach (swiss Chard), Cooked With Potato, Onion, Sunflower Oil (10
1 200 ML CARTON one unit of Mango Juice, Ceres (200.00g)

**Late Night Snack on 2012/10/28**
2 BREAD SLICE 93X93X15MM one unit of Bread/rolls, Brown (100.00g)
2 5 ml/measuring teaspoon of Peanut Butter; Smooth Style (10.00g)

**Legend**
* - There are many missing or no values for these Nutrients.
Please consult the FoodFinder3 Manual -> Reports/Analysis: Meal Analysis.
# - Estimated safe and adequate daily dietary intake (value is the mean of the range)
= - RDA = Recommended Dietary Allowance
+ - RDA % = Percentage of the Recommended Dietary Allowance

# DRAFT PAPERS

As per the requirement of the University of Pretoria, at least one scientific article should arise from post-graduate study by research. Attached are abstracts for three draft journal articles that were derived from this work to be submitted soon for peer review and publication.

The papers are entitled:

1. Evaluation of BMI and Food Menu for Adolescent Boys in Conflict with the Law at Mogale Youth Centre, South Africa.

2. Evaluation of Food Safety and Hygiene Standards at Mogale Youth Centre, South Africa.

3. Acceptability of Food Service to Adolescent Boys in Conflict with the Law: A Case Study at Mogale Youth Centre, South Africa

# Evaluation of BMI and Food Menu for Adolescent Boys in Conflict with the Law at Mogale Youth Centre, South Africa

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## Abstract

A cross sectional study was conducted at Mogale Child and Youth Care Centre (MCYCC), which caters for confined boys in conflict with the law (14–18 years), to evaluate their food intake. This was to establish the nutritional adequacy of their meals and how it related to their Body Mass Index (BMI). Both quantitative and qualitative research methods were used to collect and analyse the data. Out of the 200 adolescents, 156 took the BMI screening and 1.3% were obese, 28.2% overweight, 57% normal, while 13.5% were underweight. BMI distribution showed positive skewness (+0.73) towards overweight. The actual food portions weighed and the menu analysis results by Foodfinder 3 software both exceeded the recommended daily allowance (RDA). This could explain for the overweight cases, although some underweight boys existed. A questionnaire was used to assess the adolescents' perception toward the food served and 56% perceived the food portions as adequate.

*Key words: BMI, menu-analysis, perception, adolescent-boys, conflict-with-the-law.*

# Evaluation of food safety and hygiene standards at Mogale Youth Centre, South Africa

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## Abstract

A cross sectional study was conducted at Mogale Child and Youth Care Centre (MCYCC), South Africa, to evaluate and establish its compliance to the standards and regulations set for food safety and hygiene. MCYCC caters for confined adolescent boys in conflict with the law, aged 14–18 years. Both quantitative and qualitative research methods were used to collect and analyse the data. Document and equipment audits on food safety and hygiene aspects were done to determine their relevance and accuracy. It was observed that cleaning schedules, fridge and freezer temperature records, Material Safety Data Sheets (MSDS) records and pest control reports were clearly displayed. The kitchen thermometer and food samples were available, but employee training reports were unavailable. A questionnaire involving 144 participants was used to evaluate the sanitation of both the food facility and the staff. On the overall cleanliness and hygiene, 25% of the boys rated it as excellent, 32% good, 20% fair, 16% poor and 7% of the responses were rejected. Observations were made on the storage conditions (temperature and ventilation); temperature and holding time of served food, equipment cleanliness, besides the personal hygiene and food safety practices of the food handlers. The scores were recorded on the food safety and hygiene evaluation tool, adapted from the South African national food ration scales for food service units in hospitals. The food service unit was then determined to be 86% compliant, was colour-coded Silver and its status viewed as very good.

*Key words: Food-safety, hygiene, compliance, cross-contamination, food-borne-illnesses.*

# Acceptability of Food Service to Adolescent Boys in Conflict with the Law: A Case Study at Mogale Youth Centre, South Africa

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## Abstract

This study investigated the level of satisfaction and acceptability of the food service offered to adolescent boys at the Mogale Child and Youth Care Centre (MCYCC). The facility caters for boys in conflict with the law aged 14–18 years, having been confined there as a place of safety by court order. At the time of this study there were 200 adolescents, 144 of whom were involved in the cross sectional study using a self-administered questionnaire adapted from the SERVQUAL approach. Under evaluation was the cleanliness of the facility and the staff, quality of service provided including attitude of the staff towards them, manager availability and the general quality of food served. The findings showed that overall, 13% of the respondents rated the services as excellent, 33% said it was good, 26% said it was fair, while 25% said it was poor and 3% of the results were rejected. Using the Chi-square ($\chi^2$) test, the results were deemed to be reliable since was there was a significant difference in their responses. It was expected that findings from this study would be beneficial to the improvement of customer satisfaction in such institutions.

Key word: *Customer-satisfaction, quality-service, food-service-unit, adolescents*