Republic of Namibia

MINISTRY OF HEALTH AND SOCIAL SERVICES

REPORT ON THE STUDY TO DETERMINE THE MAGNITUDE OF OBESITY AND PHYSICAL ACTIVITY AMONG SCHOOL CHILDREN AGED 8-11 YEARS IN WINDHOEK, KHOMAS REGION

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PREFACE

Obesity is the new “silent killer” in Africa. Rapid changes in dietary habits, lifestyle, and lack of physical activity have led to rising rates of obesity, diabetes, hypertension and high blood pressure in African countries including Namibia. Indeed, obesity is associated with several chronic diseases such as cardiovascular diseases, some types of cancer, diabetes mellitus, chronic respiratory disease, injuries and disabilities. Nowadays in Namibia, many children today are growing up in environments that encourage weight gain and obesity. Children are exposed to ultra-processed, energy-dense, nutrient-poor foods, which are cheap and readily available. Opportunities for physical activity, both in and out of school, have been reduced and more time is spent on screen based and sedentary leisure activities. The country is faced with the “double burden of malnutrition” with undernutrition coexisting with over nutrition in the population across the life course.

It is on this ground that the Ministry of Health and Social Services with support from International Atomic Energy Agency (IAEA) decided to conduct a study among school children aged 8-11 years with the aim to determine the magnitude of overweight and obesity, using the stable isotope techniques to assess body composition; and physical activity to inform the design and improvement of interventions aimed at prevention and control of obesity and related health risks among children.

This report describes the results from that obesity study among school children aged 8-11 years which took place from June-August 2014 in Windhoek, Khomas region. I would like to encourage possible readers of this report to use the results for planning purposes and come up with interventions that will prevent overweight and obesity among children, and promote healthy eating habits and physical active at schools and homes.

The Ministry acknowledges and appreciates technical support specifically by Dr. Thabisile Moleah, Dr Cornelia Loechl, Ms. Grace Munthali, Prof. John Reilly, and Dr Serge Somda and financial support from IAEA for the success of this study.

Special thanks go to Ministry of Education and Culture, sampled schools, personnel and learners for their contribution and good cooperation throughout the execution of the study. Appreciation goes to University of Namibia, Department of Biological Sciences for their support in saliva analysis to measure body composition by deuterium dilution method.

The Ministry would also like to express its appreciation to FANTA III (Mr. Fred Alumasa), ITECH, Namibia Statistical Agency (NSA), World Health Organisation (WHO), Centre for Disease Control and Prevention (CDC) and UNICEF for providing technical support.

Lastly, I wish to extend my gratitude to the team that worked tirelessly for the data collection, collating, analysis and for producing this valuable report.

DR. ANDREAS MWOOMBOLA
PERMANENT SECRETARY

PERMANENT SECRETARY
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

IAEA:	International Atomic Energy Agency
BMI:	Body Mass Index
CMD:	Cardio-metabolic disease
EPI:	Expanded Programme for Immunization
FNB:	First National Bank of Namibia
NCD:	Non - Communicable diseases
NDHS:	Namibia Demographic Health Survey
MPs:	Member of Parliament
MVPA:	Moderate to Vigorous Physical activity
FTIR:	Fourier Transform Infrared Spectrometry
WHA:	World Health Assembly
WHO:	World Health Organization
WHO-AFRO:	World Health Organization - African Region
FANTA:	Food and Nutrition Technical Assistance
I-TECH:	International Training and Educational Centre for Health
GSBHS:	Namibia Global School-Based Student Health Survey
TBW:	Total Body Water
CDC:	Centre for Disease Control
MOHSS:	Ministry of Health and Social Services

DEFINITION OF TERMS

Accelerometers	:	Movement monitors that have the ability to capture intensity of physical activity. They are devices that are typically attached to a person waist with a belt clip.
Body Mass Index	:	Body Mass Index is the indicator used to determine nutritional status. It is a measure of thinness or obesity.
Cardio-metabolic risk	:	Chances of having diabetes, heart disease or stroke
Diabetes Mellitus	:	Chronic disease associated with abnormally high level of glucose in the blood and inadequate production of insulin
Deuterium	:	Stable (non-radioactive) isotope of hydrogen, with the symbol 2H.
Fat free mass	:	Fat free mass (FFM) also known as lean body mass refers to all body components except fat. It includes body water, bones, organs and muscles.
Health Promotion	:	Process of enabling people to increases control over, and to improve health.
Healthy food	:	Food that contribute to healthy diets if consumed in appropriate amount.
Hypertension	:	Is having systolic blood pressure above 140 and diastolic blood pressure above 90 mmHg.
Obesogenic Environment	:	An environment that promotes high energy intake and sedentary behaviour.
Obesity	:	From birth to less than 5 years of age: weight-for-height more than 3 Standard Deviation (SD) above the WHO Child Growth Standards median. From age 5 to less than 19 years: BMI-for-age more than 2 SD above the WHO growth reference median.
Overweight	:	From birth to less than 5 years of age: weight-for-height more than 2 SD above WHO Child Growth Standards median. From age 5 to less than 19 years: BMI-for-age more than 1 SD above WHO growth reference median.
Prevalence	:	The proportion of individuals in a population having a disease or characteristic. It is statistical concept referring to the number of cases of disease present in a particular population at given time.
Physical activity	:	Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure. Adequate participation in energy expending activities (e.g., walking, cycling, dancing) provides a wide spectrum of health benefits including reductions in risk for a variety of diseases, improvements in functional ability, and promotes psychological well-being.
Recommended MVPA for children	:	Global physical activity guidelines recommend that children and youth, 5-17 years of age, should accumulate at least 60 min of moderate to vigorous intensity physical activity daily.
Underweight	:	Low weight for age due to acute food insecurity (temporary/transitory) and or disease

Stunting	:	Is a chronic malnutrition measured as Low height for age. Growth retardation due to chronic food insecurity and cumulative effects of inadequate food intake and/or health. Stunted growth reflects a process of failure to reach linear growth potential as a result of suboptimal health and/or nutritional conditions. On a population basis, high levels of stunting are associated with poor socioeconomic conditions and increased risk of frequent and early exposure to adverse conditions such as illness and/or inappropriate feeding practices. Similarly, a decrease in the national stunting rate is usually indicative of improvements in overall socioeconomic conditions of a country."
Sedentary behavior	:	These activities (e.g., prolonged sitting, seated screen time, motorized transportation) are characterized by sitting or reclined posture, little physical movement, and low energy expenditure (<1.5 metabolic equivalent tasks). For health benefits, children aged 5–17 years should minimize the time they spend being sedentary each day by limiting recreational screen time to no more than 2 h per day, limiting motorized transport, extended sitting, and time spent indoors throughout the day.
Stable Isotope Techniques	:	The term has a similar meaning as stable nuclide, is used when speaking of nuclides of specific element. Stable isotope refers isotope of same element.
Total body water	:	Total body water percentage is the total amount of fluid in the body expressed as percentage of the total body weight.
Thinness/ Wasting	:	Is the condition where the *Z* scores for BMI for age fall below 2 standard deviation (SD) (Z score < –2SD) of normal values as per WHO-BMI for age criteria. Low weight for height: Wasting or thinness indicates in most cases a recent and severe process of weight loss. It is usually the result of acute significant food shortage and/or disease.
Unhealthy foods	:	Foods high in saturated fats, trans-fatty acids, free sugars or salt (i.e. energy-dense, nutrient-poor foods).
Undernutrition	:	Outcome of insufficient food intake and repeated infectious diseases. It includes being underweight for one's age, too short for one's age(stunting), dangerously thin for one's height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition).
Morbidity	:	Term used to describe how often a disease occurs in specific area.
Mortality	:	The number of death in given time of place.
Waist Circumference	:	Simple assessment for excess body fat around your waist. It gives clue on high risk of type 2 diabetes, high blood pressure, high cholesterol and heart disease.

EXECUTIVE SUMMARY

Childhood obesity has physical and psychological health consequences during childhood, can contribute to behavioural and emotional difficulties, and reduces educational attainment. Importantly, obesity in childhood is a strong predictor of adult obesity with health and economic consequences for the individual and society. Obesity arises from a combination of exposure of the child to an unhealthy environment and inadequate behavioural and biological responses to that environment.

Many children today are growing up in environments that encourage weight gain and obesity. Changes in food availability and type, and a decline in physical activity for transport or play, have resulted in energy imbalance. Children are exposed to ultra-processed, energy-dense, nutrient-poor foods, which are cheap and readily available. Opportunities for physical activity, both in and out of school, have been reduced and more time is spent on screen based and sedentary leisure activities. The country is faced with double burden of malnutrition which is the coexistence of both underweight/under nutrition and overweight/ over nutrition (World Bank, 2012).

This study was conducted among 8-12 years old school children from public urban schools in Windhoek. There were four schools involved in this study whereby a school is randomly chosen from different Educational zones of Windhoek, Khomas region. At school level children who met the inclusion criteria were randomly selected from different classes and only those whose parents signed consent forms were included in the study. A total of 155 school children were involved in the study. Data collection occurred from 09th June – 31st August 2014.

A team of 12 Data Collectors/ enumerators were involved in the study. The team worked from one school to another. The team was given a room in the school where they operated and set up their points. Each child was interviewed by the interviewer using Learner Questionnaire and the child responded to the questions being asked. A questionnaire was used to collect information on demographic characteristics, knowledge, attitude and behaviours related to nutrition and dietary patterns, physical activity and sedentary lifestyle.

Anthropometric measurements which were collected included weight, height, and waist circumference. Blood pressure as an indicator of overall health and can be associated with obesity in some children. A total of 40 children were given Accelerometers to wear for at least 7 full days, which monitors their physical activity.

Children were given a dose of deuterium oxide to drink and then three samples of saliva (one before dose, one sample after 3 hours and the other after 4 hours) were taken to assess body composition.

There was a questionnaire regarding school environment and educational curriculum whereby the Principal of school or Head of Department were respondents. Data analysis was done using a Statistical Package for the Social Science (SPSS). Saliva samples were analysed using the Fourier Transform Infrared Spectrometry (FTIR) machine to assess body composition by Total body water (TBW). Data to measure physical activity which were captured by Accelerometer were downloaded using ActiLife 6 Data Analysis software.

Key Findings

The descriptive data show that 155 children in 4 schools were interviewed and 68 (43.9%) were boys while 87(56.1%) were girls. In all the schools, slightly more girls were interviewed with an exception of one school.

Nutritional Status: The prevalence of obesity in the study school children 8 to 12 years in Windhoek was 17.4% while prevalence of overweight was 14.8%. Prevalence of stunting was 4.5% while that of wasting was 5.8%. The prevalence of overweight in girls and boys was 18.4% and 10.3% respectively; while the prevalence of obesity in girls and boys was 18.4% and 16.2% respectively. This shows that more girls are overweight and obese than boys.

At risk of Cardio-metabolic factors: Waist circumference data shows that more girls (67.6%) were at risk of CMD compared to boys (32.4%). In each age more girls were found to be at risk of developing CMD compared to boys, based on waist mean circumference measurements. Chi-square test indicates a significant difference of the gender association with CMD risk (OR = 3.25 (CI: 1.66-6.37), p = 0.0004).

Body Fat percentage by Deuterium dilution: Overall, equal number of children (50%) had normal and high body fat percentage. More girls 67.1% (n=51) than boys 32.9% (n=25) had high body fat percentage. This study shows that 76 individuals have high body fat percentage, an extremely high prevalence of 76/151 of overfatness (50%); this compares to a prevalence of overweight and obesity combined of 32% by BMI-for-age z-score, and a prevalence of obesity of 27/155 of 17%- this means that the prevalence of overfatness was nearly three times higher than the prevalence of WHO BMI classification of obesity.

All the overweight and obese children had high body fat whereas the wasted children had none. Twenty seven percentage (27%) of children with BMI for age in the healthy range as per (WHO BMI for age categories) were actually had high body fat percentage by deuterium. Hypertension: The prevalence of hypertension in children 8 – 12 years in this sample was 0.6%, while that of pre-hypertension was 13.5%.

Physical activity:

Physical activity (PA) by accelerometers revealed that more boys than girls (42.9% vs. 27.8%) met the Moderate to Vigorous Physical Activity (MVPA) level recommendation of at least 60 minutes/day, (p=0.07). Boys spent more step per day than girls (10071.50 ±2908.64 VS 8934.55 ±2320.67), (p= 0.191). The subjective level measurements of PA indicate that the majority of the respondents did not comply with at least the minimum standards of healthy PA levels. The study school children did not accumulate at least 60 min of moderate to vigorous intensity physical activity levels daily. It seems the majority of respondents are involved in sports at least 1-3 times a week. Therefore this momentum of doing few sport activities needs to be increased so that the children can do more physical activity.

Healthy and unhealthy habits: The results showed that 66.5% of the children reported eating with other family members which is a healthy habit and 61.3% ate food while watching television which is an unhealthy habit. Notably 16.1% went to school on an empty stomach.

Forty-one percent of children reported to eat fast foods and 34.9% had drunk sweetened beverages. It's worthy to note that 19.4% of the children slept on an empty stomach because of lack of food at home.

Sleeping hours during school and non- school days: Only 40% of children slept for the minimum recommended 10 hours per night during school nights while 65% achieved this during non-school nights. It seems that the majority of the children go to bed late during school days and this contributes to not getting enough sleep. It is a fact that inadequate sleep may lead to poor concentration in class.

School Environment: The results show that there is high crime rate during day and night which makes it unsafe to engage in brisk walking. In the schools neighbourhood there are is high traffic in the street with no sidewalk, thus making it dangerous and impossible to walk or cycle. Most learners travel to school by either using private or public transport. Three out of four schools reported presence of fast food restaurants or vendors that sell low quality food including foods high in fat and sugar in the school proximity

Availability of amenities/ facilities: All 4 schools reported having electricity and running tap water for drinking. Three schools reported having teachers supervising learners during break times.

Two schools have an indoor hall for physical activity and education in case of bad weather. Two schools also had visible posters or messages concerning healthy eating and physical activity. The survey reported that all schools had between 3 to 8 playgrounds.

School feeding and nutrition policies: All the schools apart from NA03 offered subsidized feeding schemes at school. None of the schools had policies in respect to buying and selling of nutritious quality foods in school canteen or by vendors within and/or adjacent to the school.

All the schools reported having a school canteen or tuck shop that was stocked and sold a variety of unhealthy food and snacks such as sweets, crisps, fizzy cool drinks, white bread sandwich and hamburgers/hotdogs. However, it is worth noting that school NA03 was also selling healthy food/snacks. None of the schools reported having a vegetable garden at school.

Health problem experienced by learners and teachers: Unhealthy diet was mentioned as the top health problem among learners and teachers. Chronic lifestyle diseases such as Hypertension, Diabetes were also indicated as a health problem among teachers.

Barriers to health promotion programmes: The study results show the following factors were mentioned as the top barriers to health promotion i.e.: too little time in the school timetable; too many competing priorities; and lack of interest from outside organizations.

Recommendations:

- Nutrition and physical education to be integrated into the curriculum and be implemented in all the schools.
- More physical activity sessions to be included in school activities.
- Have a policy on provision of nutritious food available in schools' canteen and food to be packed in the lunch box, including any food vendors near the school premises.
- Educate Vendors near schools to sell healthy foods to children.

- Training for teachers, other school staff and parents on importance of healthy food and physical activity.
- Regulate advertising of unhealthy food to children at schools and in the community.
- Inform parents and children on physical activity guidelines and encourage a reduction in TV viewing time every day by both parents and their children.
- The recommended are: at least 60 minutes of moderate intensity physical activity every day for children and at least 30 minutes of moderate intensity physical activity on 5 days a week or 150 minutes a week for adults.
- All relevant Stakeholders (Namibia Breweries, Food outlets which sell junk food, Ministry of Information and Technology, Ministry of Education and Culture, Ministry of Youth and Sport, Ministry of Agriculture, Water and Forestry, Ministry of Local Government and Housing, NGOs and Private Practitioners) should be involved in the prevention and control of obesity, promotion of healthy lifestyle such as physical activity and healthy diet.

CHAPTER 1: INTRODUCTION

1.1 Background

The past two decades have seen a dramatic increase in obesity in Africa. The Ugandan Heart Institute predicts that obesity-related heart disease will be the leading cause of death in sub-Saharan Africa by 2020 (Brewis, 2011). In South Africa alone, 59% of black women and 49% of white women are overweight or obese (Niekerk, 2014). Furthermore, there appears to be an increase in the prevalence of overweight or obesity in children and adolescents in South Africa with higher prevalence of overweight or obesity among girls than boys (Rossouw, Grant, & Viljoen, 2012). Obesity has also become a major public health problem in the North African countries. For example, in Morocco, the prevalence of overweight and obesity has been increasing. In children, it has tripled from 3.1% in 1987 to 9.2% in 1997 and in adults, overweight increased from 26% in 1984 to 28.6% in 2004. (Hassan and Rguibi, 2012).

In 1996, Egypt had the highest average BMI in the world at 26.3% (Martorell, et al., 2000). A study conducted found that 45% of urban Egyptian women and 20% of rural Egyptians women were obese (Galal, 2002). Moreover, levels of obesity were 14.4% in Tunisia and are significantly higher among women than among men and prevalence among women has tripled over the past 20 year (Mokhtar, et al., 2001).

In contrast, in countries like Senegal, Uganda and Kenya, obesity is on the rise, although undernutrition continues to pose the biggest problem (Kirunda, et al, 2015). The prevalence of overweight and obesity varies highly among countries for example in Kenya the prevalence of overweight in 2008 was 17.9% and obesity was 7.5%, However, in Senegal in 2010-11 the prevalence of overweight was 13.3% and obesity was 5.1% (Neupane, et al, 2016). Additionally, in Kenya 18% of children between the ages of 3 and 5 years are overweight and 4% are obese (Gewa, 2010).

Findings from the Namibian Global School-Based Student Health Survey conducted in 2004 indicated that 41% of school students were physically inactive, 31% lead sedentary life while 41% did not do any physical exercise.

In 2005, the NCD survey in Namibia was conducted to determine the prevalence of hypertension, overweight, obesity and underweight in order to provide the country with the relevant baseline information. The findings showed that women had significantly higher BMI compared to men (25.4 kg/m2 and 22.3 kg/m2 respectively). The mean BMI among women fell in overweight category while that of men fell within the normal range.

The Namibia Demographic Health Survey (NDHS) 2013 reveals that 18.3% of mothers were overweight (BMI: 25-29), and 13.2% of mothers obese (BMI over 30) this means that total overweight/obesity rate among women is 30%. This survey also shows that over 3% of children were overweight or obese. This situation was worse in wealthier households. Higher risk of obesity was also found in urban settings (18% vs. 7.6% in rural areas), with higher levels of education and higher income bracket. According to the Namibian Healthy Lifestyle report of 2011, there were more women than men who had a waist circumference above normal: Male: 64 (5.5%) and Female: 314 (27.1%)

According to the article in the Namibian New Era Newspaper of November 2012, it was reported that First National Bank of Namibia (FNB) carried a wellness screening at the

National Assembly for parliamentarians and parliamentary staff. The screening revealed that 18.8% of Members of Parliaments (MPs) and 37.5 percent of parliamentary staff were overweight or obese or extremely obese. The results indicated that 43.8% of MPs and 39.1% of parliamentary staff had challenges related to hypertension, while 31.3 percent of MPs and 40.6% of staff had borderline to high-risk blood cholesterol levels. Close to 19% of MPs and 15.6% of staff had high blood glucose levels, which could be associated with diabetes.

The increase in non-communicable diseases in Namibia shows the beginning of a tsunami that will hit Namibia in 10 to 20 years and is unimaginable, unless we invest now in prevention and health promotion.

Therefore, obesity is an emerging problem particularly among women and children and an accurate situation analysis is required to guide the design of adequate strategies to combat the problem.

Childhood obesity is a serious public health challenge as overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age (World Health Organization, 2016). Prevention of childhood obesity therefore needs high priority.

1.2 Literature review

Obesity is defined as having excess body fat (Krebs, et al., 2007). Overweight and obesity are the result of “caloric imbalance”—too few calories expended for the amount of calories consumed—and are affected by various genetic, behavioural, and environmental factors. The prevalence of overweight and obesity in adolescents is defined according to the WHO growth reference for school-aged children and adolescents as: overweight = >1SD (one standard deviation) body mass index for age and sex, and obese =>2SD (two standard deviation) body mass index for age and sex.

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low- and middle-income countries, particularly in urban settings. The prevalence has increased at an alarming rate. Globally, in 2014, the number of overweight children under the age of 5 years is estimated to be over 42 million. Close to 31 million of these are living in developing countries (WHO, 2016). Overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age (Manu & Kumar, 2010). Overweight and obesity, as well as their related diseases, are largely preventable.

The WHO Member States in the 66th World Health Assembly have agreed on a voluntary global NCD target to halt the rise in diabetes and obesity. Namibia as a WHO member State needs also to put in place interventions to combat obesity among children, adolescents and adults.

Williams et al (1992) conducted a study among children and adolescents aged 5-18 years old with the aim to develop cardiovascular health-related percent body fat standards that may be applied to epidemiologic investigations of the prevalence and incidence of obesity in children and adolescents. Their findings conclude that fatness levels at or above 25% in males and 30% in females are indicative of increased risk for elevated BP and lipoprotein

ratios in White and Black children and adolescents. Their findings also support the concept of body fatness standards as significant predictors of CMD factors in children and youth.

According to a systemic review on physical activity in school-aged children and youth in sub-Saharan Africa, urbanization was associated with a developing trend towards decreasing physical activity, increasing sedentary behaviours, and decreasing fitness measures (particularly aerobic fitness) over time. The review found increasing proportions of overweight and obesity in school-aged children, as well as a persistent problem of underweight. According to Namibia Demographic and Health Survey (NDHS) 2013, Namibia has 3.4% overweight children under the age of five.

Causes of Childhood Obesity

Obesity results from an imbalance between energy intake and expenditure, with an increase in positive energy balance being closely associated with the lifestyle adopted and the dietary intake preferences (Anderson & Butcher, 2006). However, there is increasing evidence indicating that an individual's genetic background is important in determining obesity risk. Research has made important contributions to our understanding of the factors associated with obesity. The ecological model, as described by (Davison & Birch, 2001) suggests that child risk factors for obesity include dietary intake, physical activity, and sedentary behaviour. The impact of such risk factors is moderated by factors such as age, gender. Family characteristics, parenting style and parents' lifestyles also play a role. Environmental factors such as school policies, demographics, and parents' work-related demands further influence eating and activity behaviours.

Dietary factors have also been studied extensively for its possible contributions to the rising rates of obesity. The dietary factors that have been examined include fast food consumption, sugary beverages, snack foods, and portion sizes. Fast food Consumption: Increased fast food consumption has been linked with obesity in the recent years. Foods served at fast food restaurants tend to contain a high number of calories with low nutritional values (Niehoff, 2009).

1.3 Rationale of the study

This study was a multi-country, involving 11 countries in Africa, using a set of standardized questionnaires as well as country specific questions. The data will give a broader picture of the situation in these African countries. This study is also in line with the Ministry of Health and Social Services directives on Non-Communicable Diseases which was done in February 2012.

Preventing weight gain from an early age, i.e. in childhood, is therefore recognized as a strategy that will reap health benefits in the long run (WHO). It has been shown that school-based programmes can contribute to successful obesity prevention and behaviour change during childhood (Luttikhuis et al, 2009). Schools provides a favourable environment for policy and behavioural changes made early in life, tend to be carried on into adulthood. Also, childhood obesity affects both the physical and psychosocial health of children and may put them at risk of ill health as adults. It has been established that adult interventions are usually treatment while those that target children are preventive. Furthermore, there is a need for more data on overweight and obesity in school children using more subjective techniques to generate a Namibian data base which would be tailored for local and regional interest and specific interventions. It is also important to validate simpler field techniques to assess body composition and physical activity levels that can be used in larger surveys.

1.4 Objectives of the study

1.4.1 General Objective

To use stable isotope techniques to assess body fat and physical activity to inform the design and improvement of interventions aimed at prevention and control of obesity and related health risks among children between age 8- 11 years in Namibia.

1.4.2 Specific Objectives

1. To determine the magnitude of obesity and physical activity levels among school children to design school-based interventions.
2. To use stable isotopes field techniques to assess body composition and physical activity that can be used in large situation assessments.
3. To identify factors contributing to the development of obesity and related health risks in school children.
4. To collaborate with stakeholders (schools, communities and development partners) in the design of interventions to address obesity and related health risks.
5. To provide recommendations based on the study.

CHAPTER 2: METHODOLOGY

2.1 Study Design

A cross-sectional observational study design was used for this study. It consisted of quantitative and qualitative methods.

2.2 Inclusion and Exclusion criteria

Inclusion Criteria: Young, healthy school children boys and girls, aged between 8-11 years. Exclusion criteria: Any complications associated with large shifts in body water (water retention or dehydration); and any other condition that might impair the subject's ability to participate in the study.

2.3 Protocol deviation

The main type of protocol deviation which occurred is related to the inclusion criteria and mainly children age. Children aged 8-11 were the target group, but in this study there are 10 children aged 12 years who were included. This occurs because the team could only involve the children whom their parents give consent forms and after age verification with date of birth.

The total number of 153 children gave the saliva samples to be tested whereas two children did not give saliva. Out those 153 whose saliva samples analysed, saliva of two children were disqualified hence there are 151 children whose Body Fat percentage reported in this study.

2.4 Sampling

There are four schools involved in this study whereby a school is randomly chosen from different Educational zones of Windhoek, Khomas region. At school level children who met criteria were randomly selected from different classes and only those their parents signed consent forms have been included in the study.

2.5 Data Collection Techniques and Tools

Questionnaire regarding socioeconomic status, puberty stage, physical activity and knowledge on food and healthy habits was administered to the child by the interviewer and the child responded to the questions being asked. Anthropometric measurements which were done are: weight, height, waist circumference and blood pressure. To monitor physical activity objectively, 40 children were given Accelerometers to wear for at least 7 full days. There was a questionnaire regarding school environment and educational curriculum whereby the Head of school was a respondent.

The stable isotope was given orally as deuterium oxide (2H2O), and after mixing with body water, it is eliminated from the body in urine, saliva, sweat and human milk. Deuterium oxide is handled in the body in the same way as water, and is dispersed through the body within a matter of hours. Stable isotope techniques have been used in studies of human nutrition for over 50 years and it has no adverse effects. Total Body Water (TBW), is a measurement of body fatness used in this study as a reference method for measurement of body fatness in children and adolescents, with high accuracy. TBW was assessed by deuterium dilution

technique- a standard method which is described in detail elsewhere (International Atomic Energy Agency, 2010). The dilution of deuterium in the body provides an accurate measure of total body water, which in turn is a very accurate measure of total body fat.

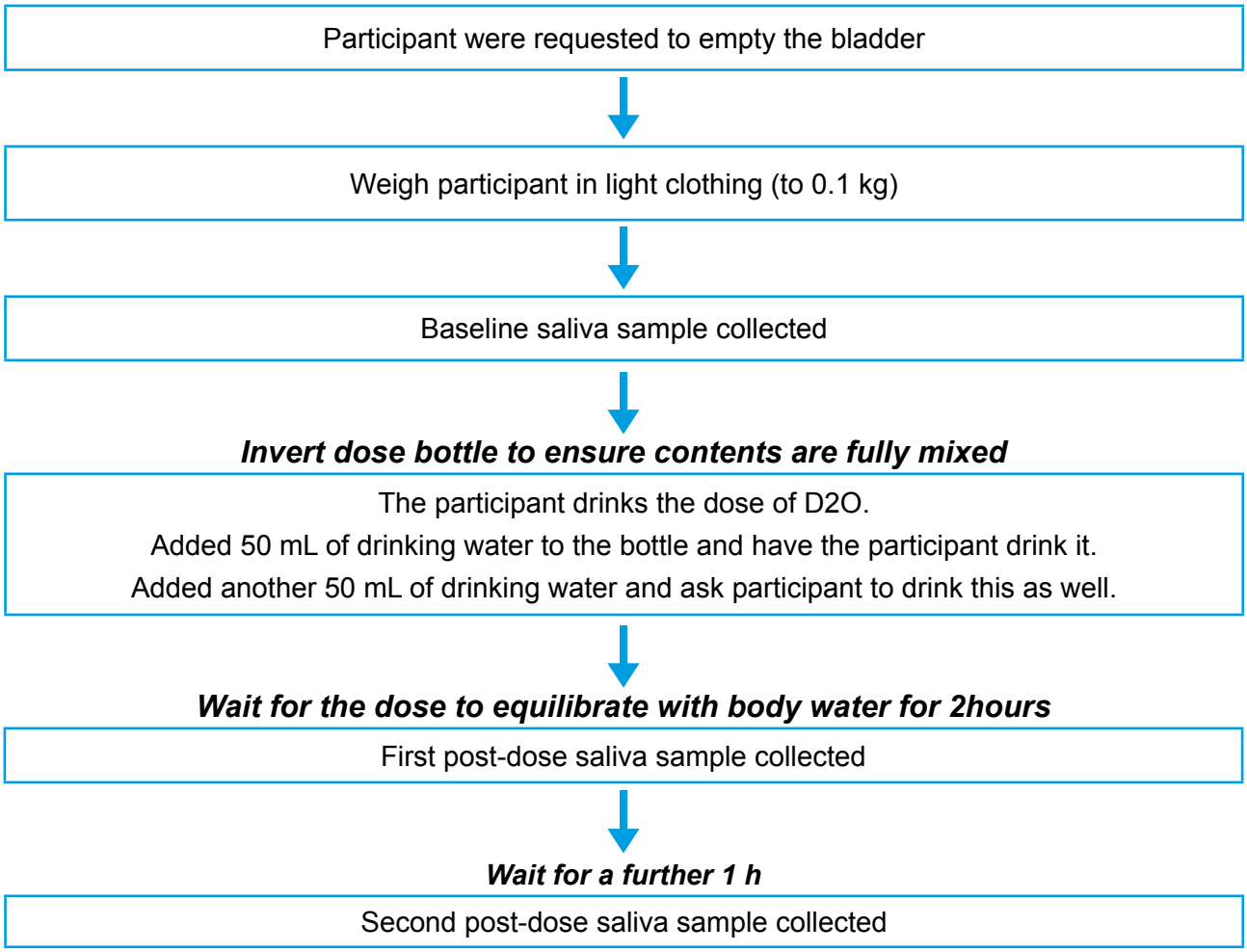
2.6 Data Collection

2.6.1 Data Collection Procedure

A total of 12 data collectors were involved in the study. Anthropometric measurements of weight, height, blood pressure and waist circumference were taken. Body composition was assessed using Deuterium dilution technique with analysis of saliva samples by FTIR. A team worked from one school to another. The team was given a room in the school where they operated and set up their points. Each child was interviewed and went through different points where all the procedures were conducted. Children were given the lunch pack after the last saliva sample was taken. A total of 40 (10 children per school) were given accelerometers to wear for 7 full days.

Children were asked to take the accelerometer off only when showering and other times that the Accelerometer would be in contact with water. We requested 7 days and requiring at least 4 valid days (i.e. at least 10 hours of wear), including at least one weekend day for analyses. At the end only 38 children wear the Accelerometers whereby one boy did not wear it and the other boy lost it.

Flow chart describing the procedure for saliva sample collection:



2.6.2 Training of the Data collectors and Field work

Training of the data collectors was conducted over a 2-day period from 19th – 20th May 2014. Thereafter the data collection tools were piloted for 8 days in one school in Windhoek.

The training was facilitated by the Project Coordinator with technical assistance from FANTA and I-TECH. Data collection in the field took place between 09th June and 31st August 2014.

2.7 Data Processing and Analysis Procedure

Data entry commenced after immediately after data collection. An EPI DATA was used for the entry of the learner and school questionnaires data. The validation module of the software was used to ensure the quality of data entry. Data analysis was done using SPSS ver 19. Saliva samples were analysed using the FTIR machine to assess body composition by Total Body Water (TBW).

Analysis for accelerometer was done using the ActiLife 6 Data Analysis software using categorical cut points for MVPA of Evenson (2008) and Puyau (2002) was used. The EV ActiGraph cut points estimate time spent in sedentary, light-, moderate-, and vigorous-intensity activity in the respondents. A single MVPA cut point of around 575 counts per 15 s (2300 counts per minute) was used for youth between the ages of 6 and 15 years. Respondents were categorized in sedentary, light, moderate, and vigorous levels of physical activity.

2.8 Data interpretation

WHO z-scores reference (2006) tables were used to calculate BMI-for-age and height-for-age. WHO reference tables (2006) were used to categorize obesity (BMI-for-age >+2SD), overweight (BMI-for-age >+1SD), undernutrition / wasting (BMI-for-age <-2SD) and stunting (height-for-age < -2SD). Waist circumference cut off points for boys and girls who are considered at risk of CMD are indicated in Table 1 below.

Table 1: Waist circumference table cut off points of schoolchildren for the identification of CMD factors.

Age (years)	Boys (cm)	Girls (cm)
7	63.85	58.25
8	64.00	59.65
9	66.45	61.10
10	66.75	65.85
11	72.65	70.50
12	75.77	71.75

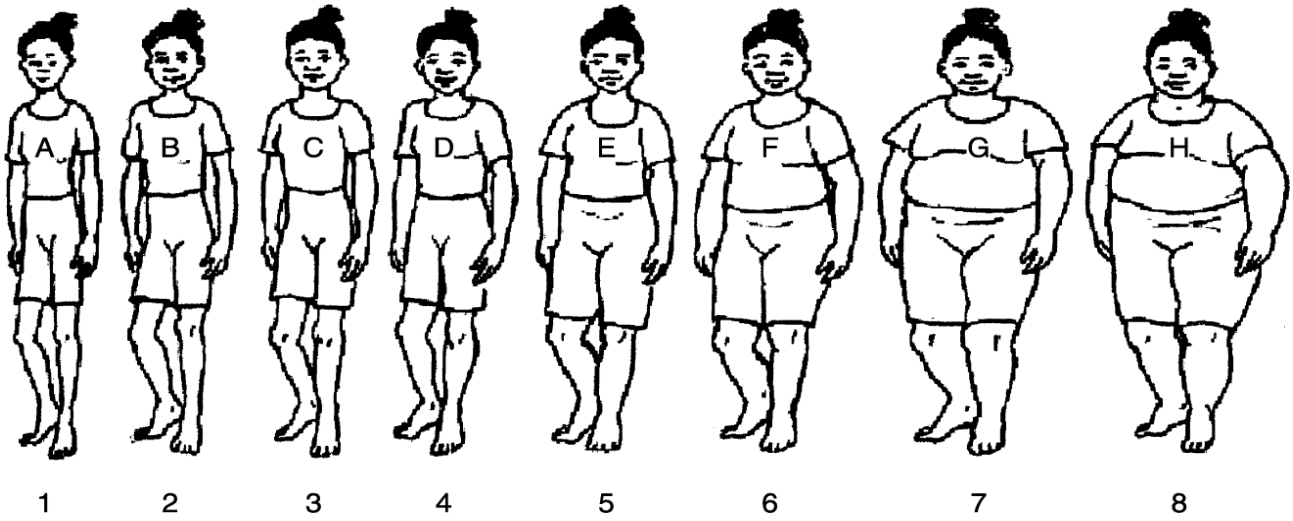
Source: Gabriel et al, 2010

The waist for height ratio cut off points was also used to indicate central obesity which is a risk factor for CMD, therefore Central obesity is Waist-height ratio: ≥ 0.5 (Mokha et al, 2010). Using body fat percentage, boys with percentage above 25% and girls with percentage >30% were considered at risk of CMD (Williams et al, 1991).

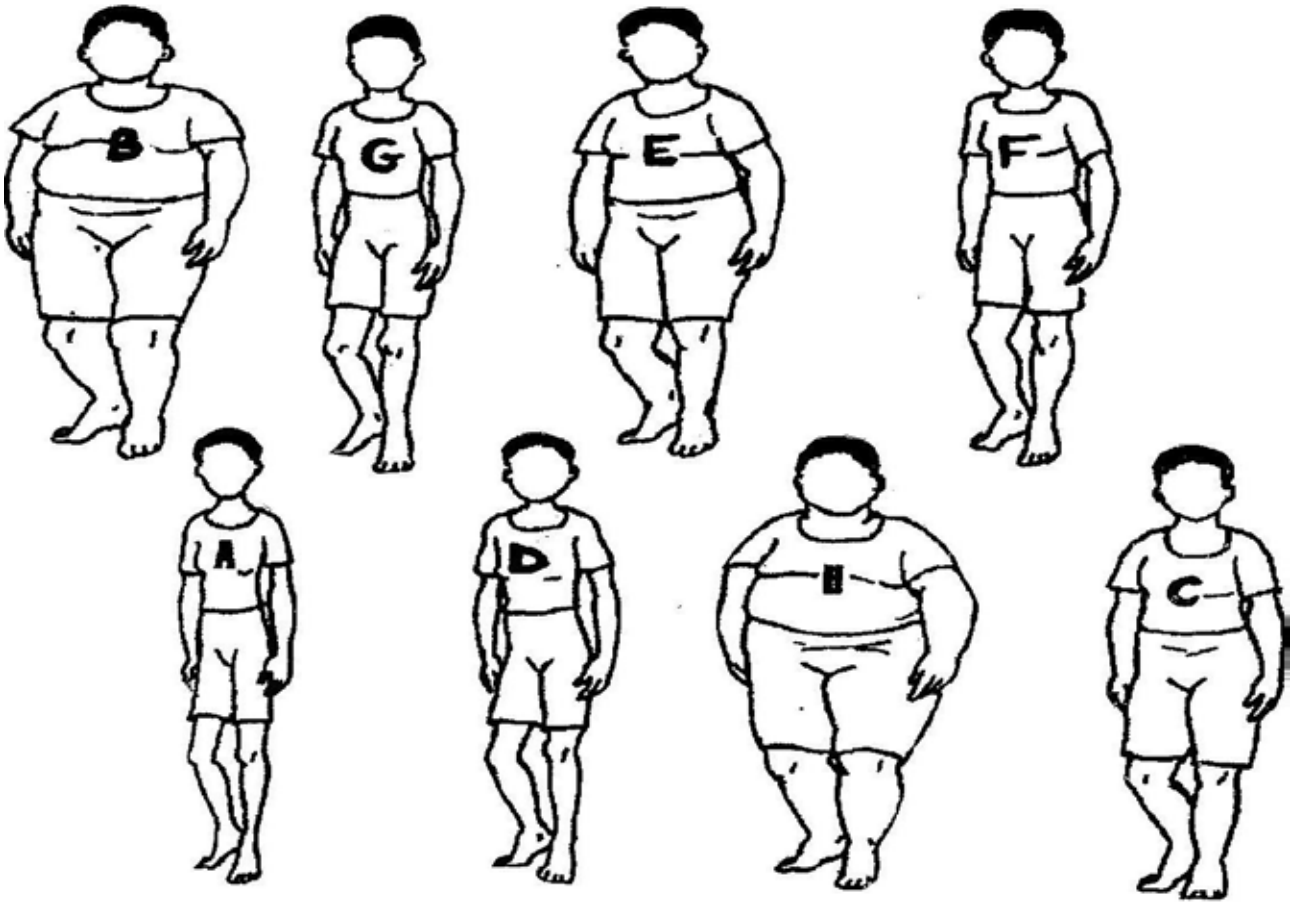
The Systolic (SBP) and the Diastolic blood pressure (DBP) was evaluated and analyzed according to the different outcomes. The Blood Pressure cut off for classifying the children as pre-hypertension was ≥120/80 mmHg and Hypertension was categorized as systolic blood pressure ≥140mmHg classified according to ages and/or diastolic blood pressure of ≥90mmHg using cut-off of National High Blood Pressure Education Programme (Robinson et al. 2004).

Figure 1: Pictures on personal physical resemblance

(a) Girls (Number 5= E was considered as the ideal figure)



(b) Boys (Number 5=C was considered as the ideal figure)



A=1, D=2, G=3, F=4, C=5, E=6, B=7, H=8

2.9 Ethical Considerations

The study protocol was reviewed and approved by the MOHSS Research Committee to ensure that all sensitive local realities have been taken into account. No personal identification data was collected throughout the study, and all interviewees and other participants were treated anonymous. All parents of study participants were required to give informed consent and those who did not wish to participate were free to opt out without any negative consequences. All data collected were handled with strict confidentiality and access to the data was limited to MOHSS staff and those involved in the study.

2.10 Pretesting

Pretesting of the data collection tools was conducted from 21-30 May 2014 at Pioneers park Primary School. A total of 14 children (7 boys and 7 girls) from grades 3, 4, 5 and 6 were selected.

The data collected from the pretest was however not included in the analysis for this report. At the end of the pretesting, many identified issues such as wording and rephrasing of some questions were discussed and agreed for clarity and easier understanding by the respondents. This also ensured easy administration of the tools in the field.

CHAPTER 3: FINDINGS

3.1 Socio-demographic characteristics

The result presented in Table 2 show that 155 children in 4 schools were interviewed. 68 (43.9%) were boys while 87 (56.1%) were girls. In all the schools, slightly more girls than boys were interviewed apart from one school.

Table 2: Sex of the respondents per school

School Code	Boys n (%)	Girls n (%)
NA01	17 (44.7%)	21 (55.3%)
NA02	19 (47.5%)	21 (52.5%)
NA03	12 (31.6%)	26 (68.4%)
NA04	20 (51.3%)	19 (48.7%)

Table 3 indicates that 73% of the respondents reported that both their parents/guardians were employed in various sectors either private or public. A significant number of children (43.9%) live in households with 6-10 people. While more than half of the respondents (52.3%) came from households that had 2-5 people. The household size and the employability of parents' influence food access, availability and intra household food distribution which affects the nutrition status of the children. Evidence from other studies have indicated that priority to food is given to family head and mature people and children suffer as results especially in large family sizes. Parents who are employed have steady income and this improves access to food at household level.

Majority of the children (61%) reported living in 4-6 roomed households. All respondents had access to tap water and flush toilets. About 81% the respondents had indoor taps while 84.5% had the flush toilet inside the house. None of the respondents used any other water source. Similarly, none of the respondents used pit latrines, bucket or the bush as toilets.

Table 3: Demographic and personal characteristics

Variable		n (%)
Parents'/guardian employment	Both parents/guardians working	113 (72.9)
	One parent/guardian working	38 (24.5)
	Parents/guardians not working	4 (2.6)
Household size	1-5 People	81 (52.3%)
	6-10 people	68 (43.9%)
	> 10 people	6 (3.8%)
Number of rooms	1-3 rooms	38 (24.5%)
	4-6 rooms	94 (60.6%)
	> 7 rooms	23 (14.9%)

Main source of water	Indoor tap water	125 (80.6)
	Outside tap water	30 (19.4%)
Type of toilet	Flush toilet inside the house	131 (84.5%)
	Flush toilet outside the house	24 15.5%)

3.2 Socio-economic status

Overall, 70 % both of parents were employed but school NA01 had a lower percentage (66%) of employment. In all the four schools indoor tap water was the main source of water with NA01 school having the highest percentage of outside tap water (47%). In addition all the schools mostly use outside toilets with NA03 at the highest (97.40%), followed by NA02 (92.5%), NA04 (84.6%) and NA01 (60.5%).

The socio-economic status showed that in all the schools, most of both guardians are employed with NA03 leading the other 3 schools. . However, students from NA01 and NA04 had two parents unemployed.

The household size was at >60% for learners in schools NA02, NA01, and NA03where the average number of people residing in the home ranged from 2 to5 persons. Households of NA04 had at least 50% of the number of persons living in that house ranging from 6-10 members.

The main source water was indoor tap, in all the learners from the schools but, NA01 had 47% of outside taps.. In all the schools, the highest type of toilet was outside flush toilet and NA03 school at the highest 97.4% level.

Figure 2: Employment status

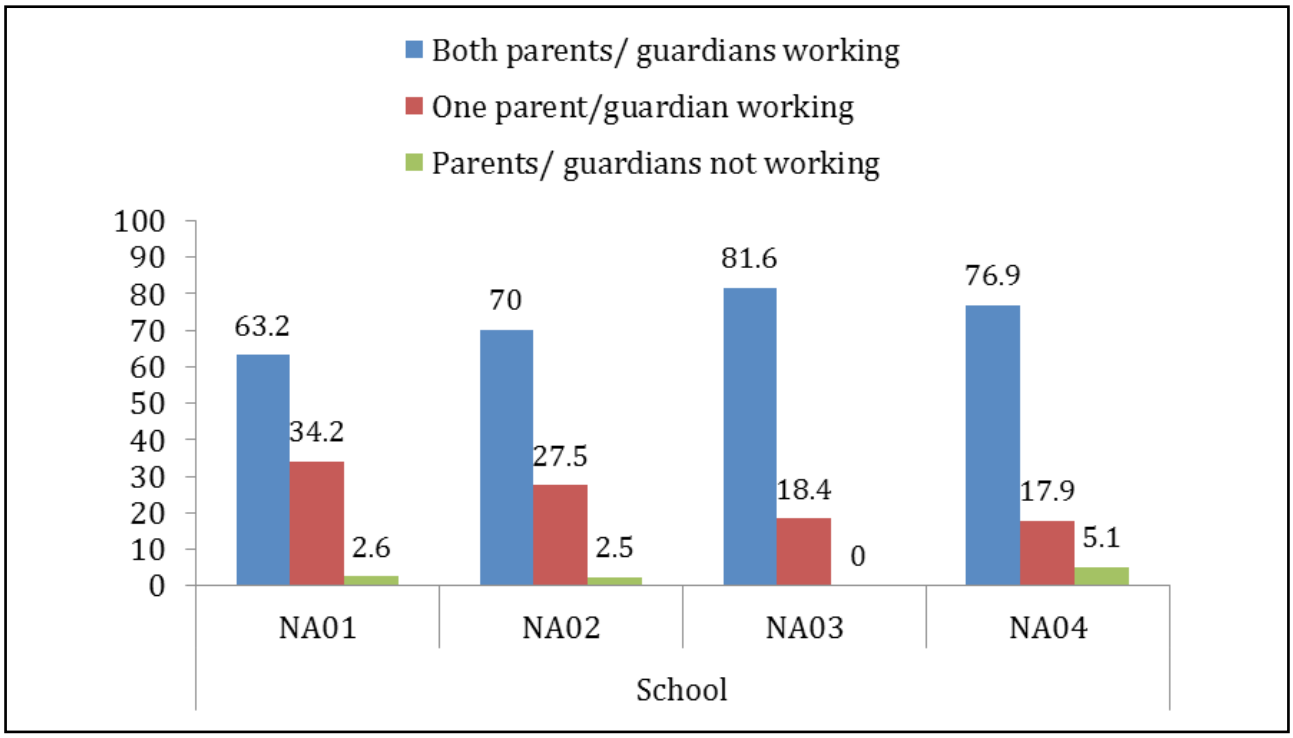


Figure 3: Number of household members by school

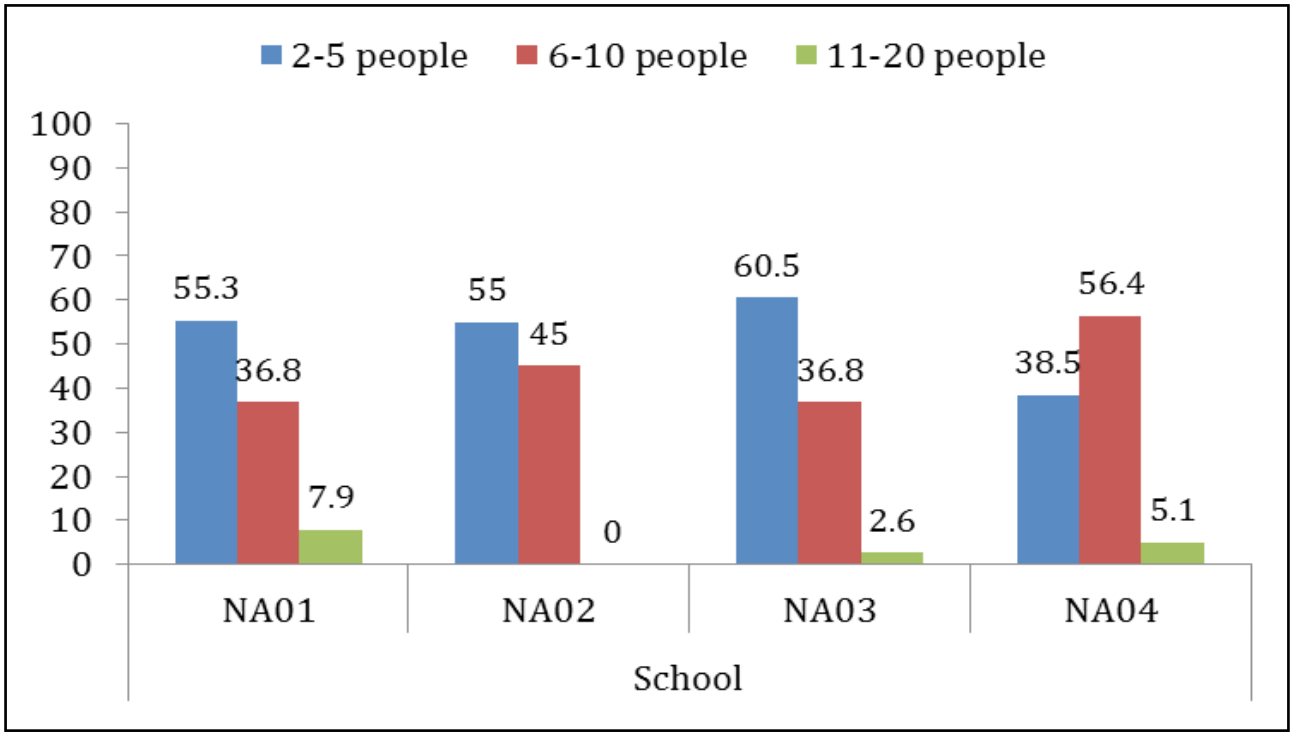


Figure 4: Number of rooms in the house by school

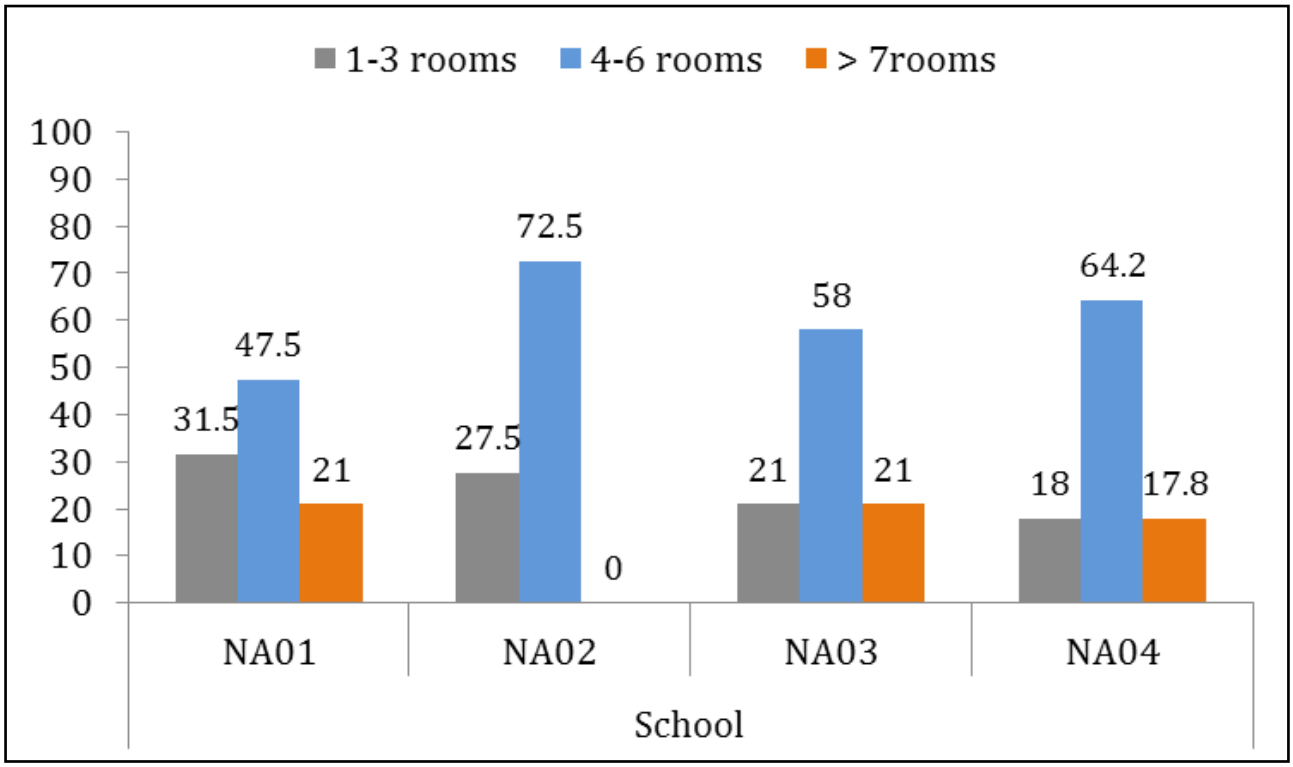


Figure 5: Type of toilet by school

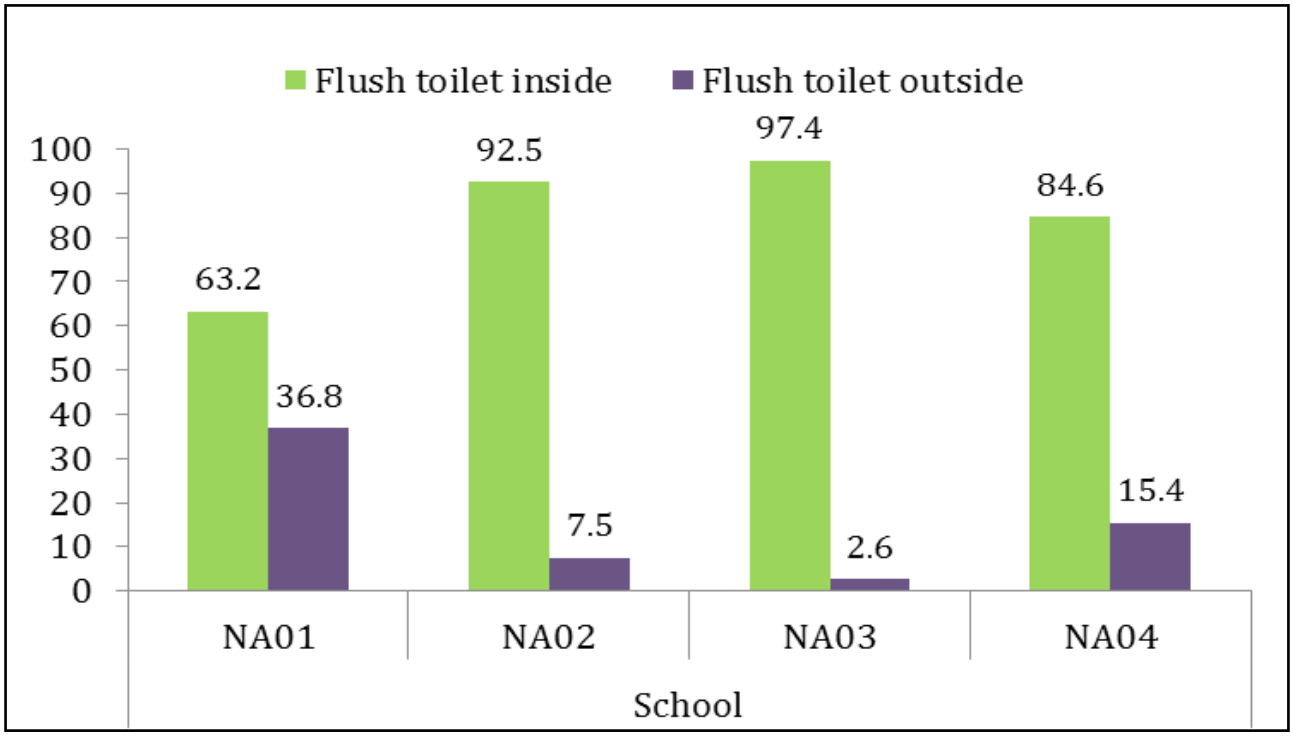


Figure 6: Source of water by school

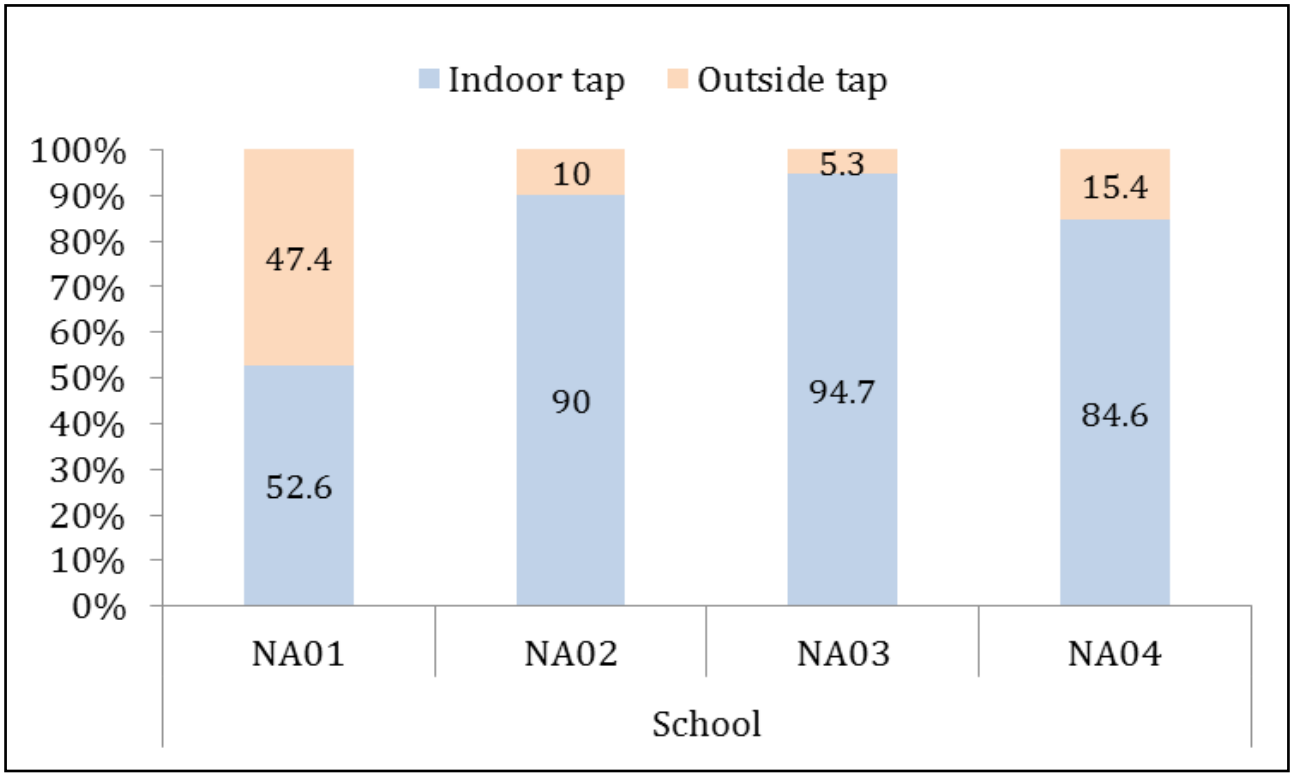


Figure 7: Energy used for Cooking

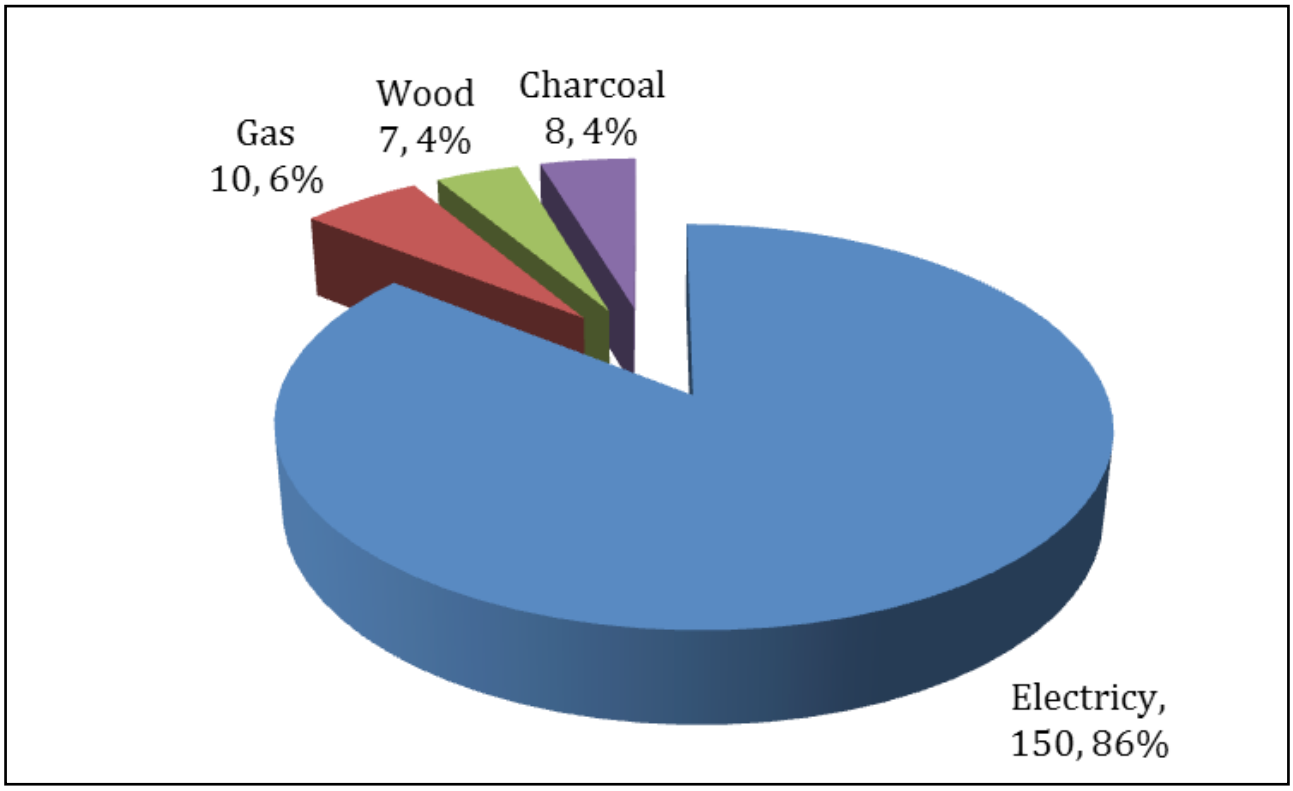


Figure 7 above shows that majority of the respondents' households used electricity for cooking, whereas 6% and 4% were using gas and wood respectively.

Figure 8: Household items

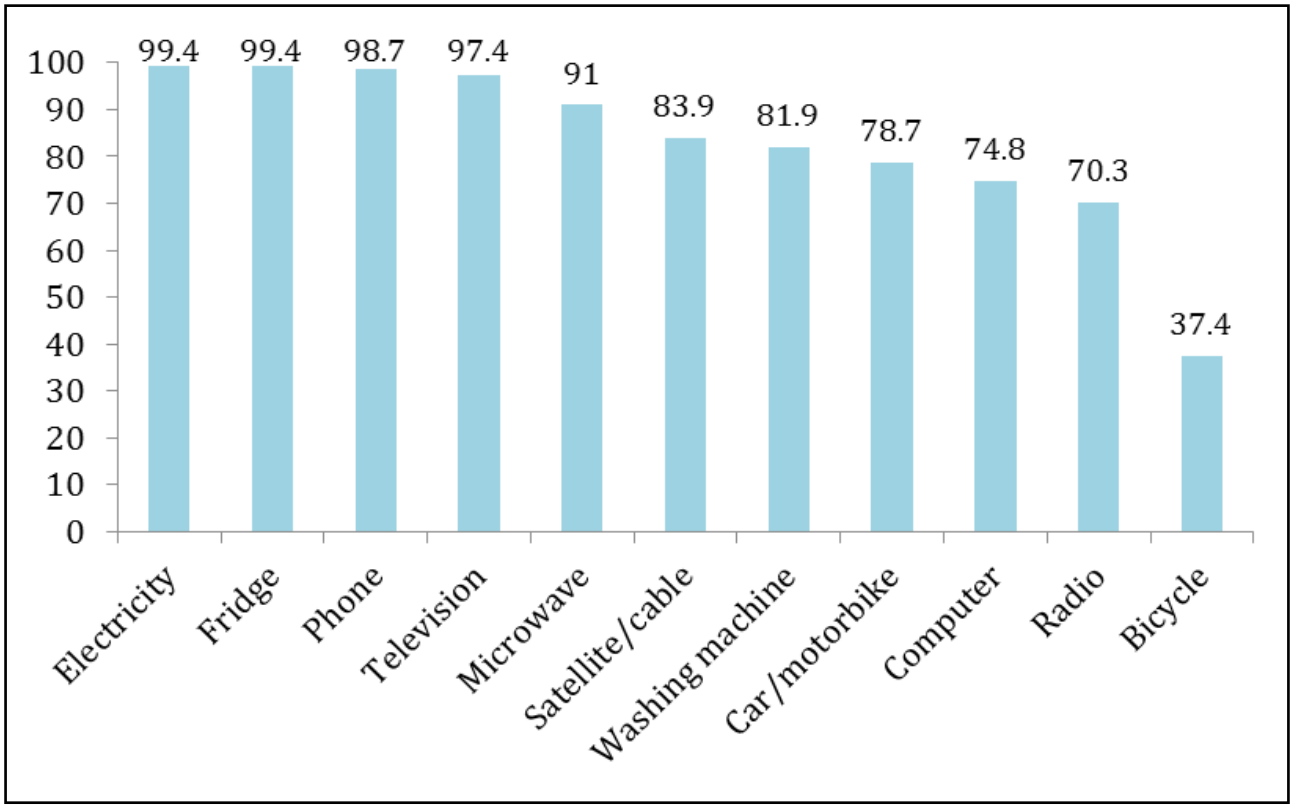


Figure 8 indicates that over 80% of the households owned most of the listed items as indicated in the graph. Close to 100% used electric appliances. This shows that the income of these households was above average and much of the housework was mechanized. Such lifestyle could contribute to a sedentary lifestyle which promotes lower PA in the whole family.

3.3 Nutritional status

The mean age of the children in months was 123 months (10.5 years), with the youngest child being 96 months (8 years) and the oldest 156 months (13 years) old. The mean weight, height and waist measurement was 35.9 kg, 139 cm and 67.9 cm respectively.

Table 4: Descriptive statistics

N=155	Mean ± SD	Min	Max	Variance
Age in months	123.2 ± 14.5	96	156	210.920
Height for age Z score	-0.13 ± 1.1	-3	3	1.212
BMI for age Z score	0.27 ± 1.4	-2.88	3.51	2.202
Waist cm	67.9 ± 10.9	51.2	110.05	118.755
Weight kg	36.0 ± 11.6	19.6	82.90	134.048
Height cm	139.1 ± 9.5	118.1	166.70	89.877

Table 5: Descriptive statistics by sex

	BOYS			GIRLS			*P value*
	Mean ± SD	**Min, max**	**Variance**	**Mean ± SD**	**Min, max**	**Variance**	
Age (months)	123.01±14.7	98, 156	216.58	123.4±14.75	96, 149	208.9	0.87
Weight (kg)	34±10.5	19.6, 64.9	110.4	37.5±12.1	20.4, 82.9	148.6	0.62
Height (cm)	137.2±8.7	118.1, 185.6	76.6	140.6±9.8	121.7, 166.7	96	**0.02**
Height-for-age Z score	-0.32±0.91	-2, 2	0.82	0.03±1.2	-3, 3	1.48	**0.047**
BMI-for-age Z score	0.15±1.5	-2.88, 2.96	2.31	0.36±1.46	-2.75, 3.51	2.12	0.39
Waist circumfe-rence(cm)	66.3±9.7	53.9, 90.9	93.3	69.1±11.7	51.2, 110.1	136.7	0.12

Boys were significantly taller than girls (P=0.02) and also had lower HAZ than girls (P=0.047)

Table 6: Nutritional Status

Nutritional Status (N = 155)	N	%
Prevalence of obesity	27	17.4%
Prevalence of overweight	23	14.8%
Prevalence of wasting	9	5.8%
Prevalence of stunting	7	4.5%

The prevalence of obesity in children 8 to 12 years in the sample in Windhoek was 17.4% while prevalence of overweight was 14.8%. Prevalence of stunting was 4.5% while that of wasting was 5.8%.

Table 7: Nutritional status by Sex

Nutritional status	Sex of respondents		
	Boy	Girl	Total
Obese	11 (16.2%)	16 (18.4%)	27
Overweight	7 (10.3%)	16 (18.4%)	23
Normal	45 (66.2%)	51 (58.6%)	96
Wasting	5 (7.4%)	4 (4.6%)	9
Total	68	87	155

The prevalence of overweight and obesity in girl was 18.4% while in boys it was 10.3% & 16.2% respectively. Seven percent of boys 7% were wasted compared to almost 5% of the girls.

Table 8: Nutritional status by Age

		Nutritional status				Total
		Wasted	Normal	Overweight	Obese	
Age in years	**8**	2	22	3	3	30
	9	1	23	4	9	37
	10	4	20	10	4	38
	11	1	25	4	10	40
	12	1	6	2	1	10
Total		**9**	**96**	**23**	**27**	**155**

Of the children found to be overweight and obese, the majority were aged 11 years (30%), 10 years (28%) and 9 years (26%). Of the children wasted, the majority (44.4%) were 10 years.

Table 9: Stunting by age

	Stunting		
Age in years	**Stunted**	**Not stunted**	**Total**
8	1 (3.3%)	29 (96.7%)	30
9	1 (2.7%)	36 (97.3%)	37
10	3 (7.9%)	35 (92.1%)	38
11	1 (2.5%)	39 (97.5%)	40
12	1 (10%)	9 (90%)	10
Total	**7**	**148**	**155**

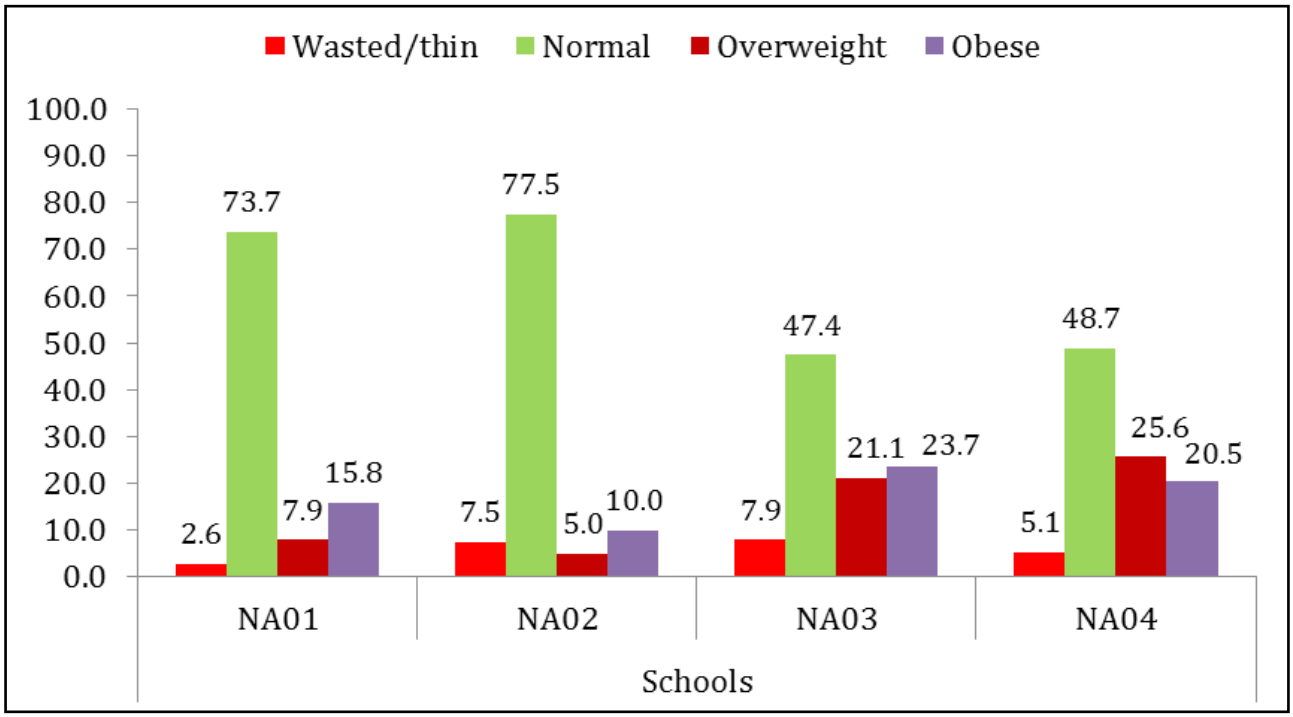
The prevalence of stunting was 4.5%. Three children aged 10 years were found to be stunted, whereas one child was found to be stunted in each of the other age categories.

Table 10: Stunting by sex

	Boys	**Girls**
Stunted	4 (5.9%)	3 (3.4%)
Not stunted	64 (94.1%)	84 (96.4%)
Total	**68**	**87**

There was no significant difference in stunting levels among the sexes.

Figure 9: Nutritional Status by schools



Summary of nutritional status based of BMI for age Z scores is shown in figure 5. Schools NA03 and NA04 had more overweight/obese children compared to NA02 and NA01. The differences in number of overweight/obese children compared to those with normal nutritional status between all four school was found to be statistically significant (p = 0.019). NA02 and NA03 each 7.5% and 7.9% of children wasted/thin, while NA01 and NA04 had 2.6% and 5.1% wasted/thin children respectively. NA04 also reported one severely wasted child with a BAZ score of less than -3.00. Differences in wasted/thin children between the four schools were not statistically significant (p = 0.597).

There were more learners with normal nutritional status than overweight/obese in all the four schools. However, there were differences in the proportions of overweight/obese learners in the school with schools NA03 and NA04 having more overweight/obese learners compared to the NA01 and NA02 (X2 = 0.019).

There were also more learners who were normal weight compared to wasted/ severely wasted. There were no difference between the 4 schools (p-value = 0.597).

3.4 Cardio-metabolic risk

Table 11: CMD risk by sex

Risk of CMD	Sex		Total
	Boy	Girl	
At risk of CMD	24 (32.4%)	50 (67.6%)	74
Not at risk of CMD	44 (54.3%)	37 (45.7%)	81

P=0.006

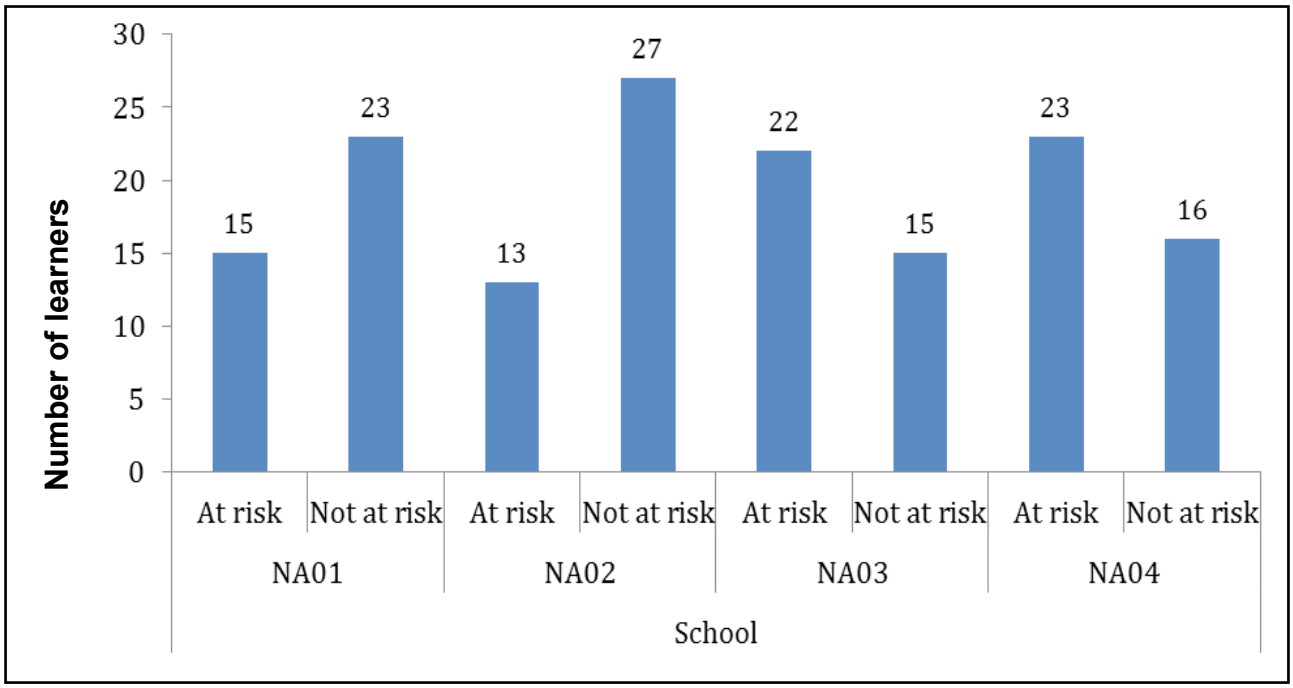
Table 12: CMD risk by age

	Risk of cardiovascular diseases		
Age in years	**At risk of CMD**	**Not at risk of CMD**	**TOTAL**
8	11 (36.7%)	19(63.3%)	30
9	21 (56.8%)	16 (43.2%)	37
10	19 (50%)	19 (50%)	38
11	20 (50%)	20 (50%)	40
12	3 (30%)	7 (70%)	10
Total	**74**	**81**	**155**

Cardio-metabolic risk of the learners was assessed by using waist circumference measurements to determine level of central obesity. Age and sex specific cut off points were used to asses' CMD risk of the learners.

Waist circumference data shows that more girls (67.6%) were at risk of CMD compared to boys (32.4%). In each age more girls were found to be at risk of developing CMD compared to boys, based on waist mean circumference measurements. Chi-square analysis showed that sex was significantly associated with CMD risk (OR = 3.25 (CI: 1.66-6.37), p = 0.0004). Age was however not significantly associated with CMD risk (OR = 2.26, p = 0.6888).

Figure 10: Cardio-metabolic risk by school



The above graph describes the level CMD risk by school in Khomas region. School NA03 and NA04 had more learners at risk of developing CMD compared to learners at NA01 and NA02 (X2 = 8.77, p = 0.0325). CMD risk was highest among learners from NA04 and lowest among learners in NA02.

3.5 Body Fat percentage by Deuterium dilution

Overall, equal number of children (50%) had normal and high body fat percentage.

Table 13: Mean percentage fat mass by sex

Sex	n	Mean	P value
Boy	66	25.4 ± 9.2	<0.005
Girl	85	33.3 ± 8.5	

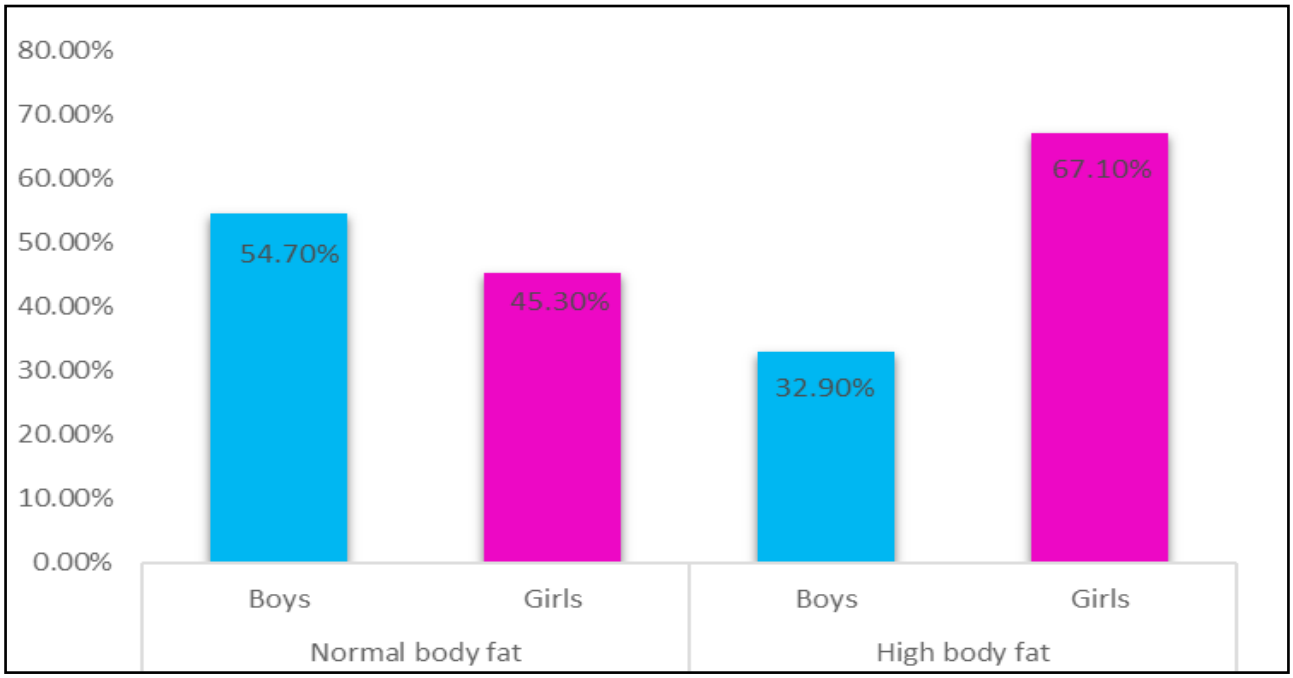
Girls had a significantly higher mean percentage fat mass than boys (P<0.005).

Table 14: Percentage body fat by age

Age in years	Normal body fat percent	High body fat percent
8	19 (63.3%)	10 (33.3%)
9	14 (37.8%)	22 (59.5%)
10	16 (42.1%)	20 (52.6%)
11	19 (47.5%)	21 (52.5%)
12	7 (70%)	3 (30%)

Children aged 9-11 years had higher body fat percentage compared to those aged 8 and 12 years. The table shows that 76 individuals (50%) had high body fat percentage. This compares to a prevalence of overweight and obesity of 32% by BMI-for-age z-score, and a prevalence of obesity of 27/155 of 17%- this means that the prevalence of high body fat percentage was nearly three times higher than the prevalence of obesity.

Figure 11: Body fat by sex



More girls 67.1% (n=51) than boys 32.9% (n=25) had high body fat percentage.

Table 15: Body fat by schools

	Normal body fat percent	High body fat percent
NA01	22 (29.3)	14 (18.4)
NA02	24 (32)	14 (18.4)
NA03	12 (16)	26 (34.3)
NA04	17 (22.7)	22 (28.9)

P = 0.017

The study shows that one school has high number of learners (34.3%) with high body fat while other schools are almost at the same range.

Table 16: Risk of CMD by body fat percentage

		Normal body fat percentage	High body fat percentage
Boy	Not at CMD risk	39 (84.8%)	7 (15.2%)
	At risk of CMD	2 (10%)	18 (90%)
Girl	Not at CMD risk	15 (28.8%)	37 (71.2%)
	At risk of CMD	-	33 (100%)

All the girls and 90% of boys at risk of CMD had high body fat percentage.

Table 17: Body fat by nutritional status

	Normal body fat percentage	High body fat percentage
Wasted	9 (100%)	0
Normal	66 (68.8%)	26 (27.1%)
Overweight	0	23 (100%)
Obese	0	27 (100%)

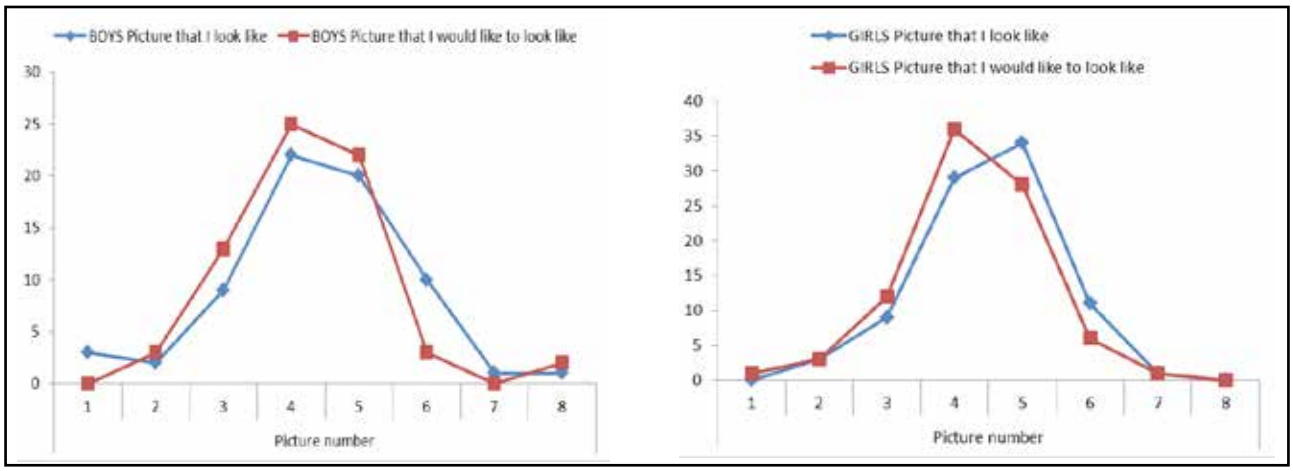
All the overweight and obese children had high body fat whereas none of the wasted children had high body fat. It is of significance important to take note that a relatively large number of children with BMI for age in the healthy range (27.1%) were actually over-fat.

Table 18: Body fat percent by hypertension stage

Hypertension stage	Normal body fat percent	High body fat percent
Normal	64 (48.1%)	56 (49.6%)
Pre-hypertension	11 (52.4%)	9 (42.9%)
Hypertension	0	1 (100%)

Slightly less than half (42.9%) of the children with pre-hypertension had high body fat percent. The hypertensive child also had high body fat

Figure 12: Perception on personal physical resemblance



Majority (32.4%) of boys perceived themselves to resemble pictures 4 and 36.8% would have liked to resemble the same picture. On the other hand, the majority of girls (39.1%) perceived themselves to resemble picture 5 but 41.4% would have preferred to resemble picture 4.

3.6 Hypertension

Hypertension was defined as systolic pressure greater than 140 and diastolic greater than 90. Normal blood pressure was defines as systolic pressure less than or equal to 120 and diastolic less than or equal to 80.

Table 19: Hypertension status using blood pressure

Status of hypertension	n (%)
Normal	133 (85.8%)
Pre-hypertension	21 (13.5%)
Hypertension	1 (0.6%)

The prevalence of hypertension in children 8 – 12 years in this sample was 0.6% and pre-hypertension was 13.5%.

Table 20: Hypertension by age

Age in years	Hypertension status			
	Normal	Pre-hypertension	Hypertension	Total
8	25(83.3%)	5 (16.7%)	0	30
9	32 (86.5%)	5 (13.5%)	0	37
10	34 (89.5%)	4 (10.5%)	0	38
11	34 (85%)	5 (12.5%)	1 (2.5%)	40
12	8 (80%)	2 (20%)	0	10

Majority of children in all ages had normal blood pressure.

Table 21: Hypertension by Sex

	Sex		Total
	Boy	Girl	
Normal	55 (80.9%)	78 (89.7%)	133
Pre-hypertension	13 (19.1%)	8 (9.2%)	21
Hypertension	0	1 (1.5%)	1

More girls (19.1%) than boys (9.2%) were found to be pre-hypertensive. Only 1 girl was found to be hypertensive.

Table 22: Girls menstruation status by age

		Started menstruating n (%)	Not started menstruating n (%)
Age in years	8	0	16 (100%)
	9	0	21 (100%)
	10	0	21 (100%)
	11	3 (14.3%)	18 (85.7%)
	12	1 (14.3%)	6 (85.7%)

In total three girls aged between 11 and 12 years had started menstruating.

3.7 Physical activity

Physical activity was assessed using a questionnaire for all 155 participants. Out of 155 children sampled, 39 were given accelerometer to wear for seven days; of which 44.7% girls, 55.3% boys participated in this study (mean age = 10.30 ± 1.41years) (mean weight = 39.20 ± 11.68 Kg).

Table 23: Physical Activity as per accelerometer

	Boys n=22	Girls n=17	P value
MVPA	54.20 ± 25.18 min/day	46.51 ± 27.55 min /day	*P* = 0.368
Physical active	42.9%	27.8%	*P* = 0.07
Average steps	10071.5 ± 2908.64	8934.55 ± 2320.67	*P* = 0.191

The children spent an average of 50.65 ± 26.23min/day in moderate to vigorous physical activity (MVPA) and 860.35±182.40min/day in sedentary time. In addition, they spent an average of 9546.76 ± 2681.78 steps per day.

Although Boys accumulated more minutes of MVPA compared with girls (54.20 ± 25.18 min/ day vs 46.51 ± 27.55 min /day) there was no significant difference (P=0,368) furthermore; there was no significant difference according to gender in sedentary time. (P =0,750). More boys (42.9%) met the recommendation of at least 60 minutes/day compared to 27.8% of girls.

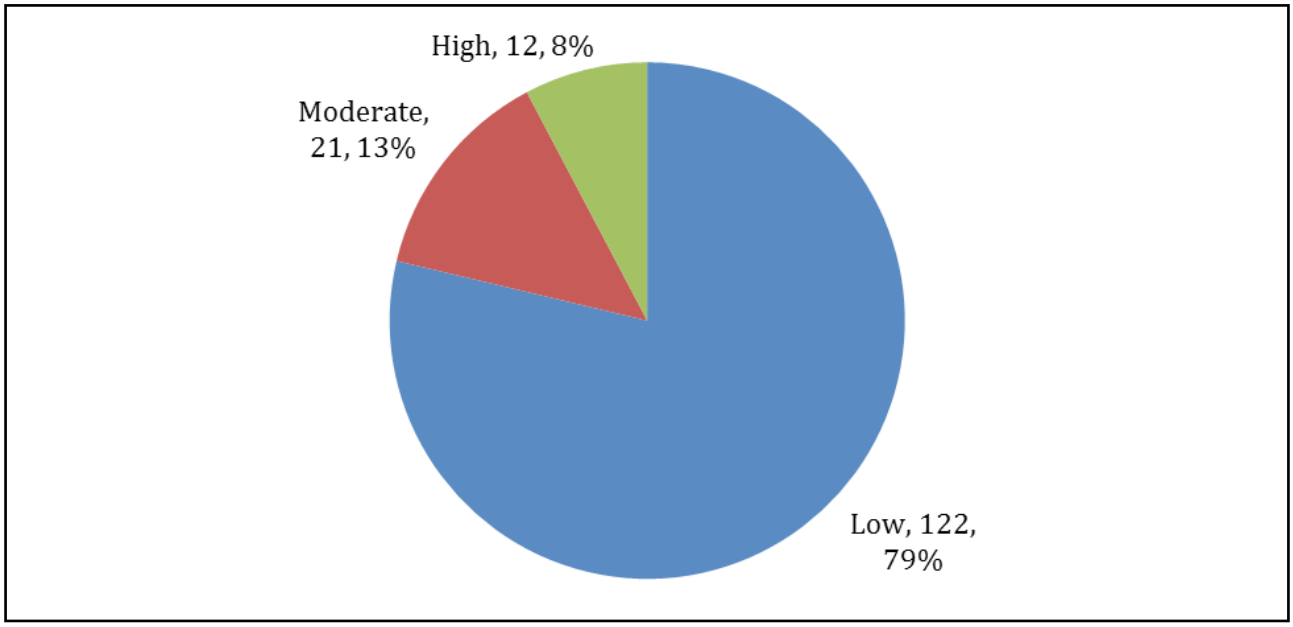
However, there was no significant difference in recommended physical activity per day between boys and girls (p=0.07). On the other hand boys spent more steps per day than girls (10071.5 ± 2908.64 VS 8934.55 ± 2320.67). There was no significant difference in steps per day between girls and boys (P =0.191).

Table 24: Physical activity during the previous 7 days during school time

		Boy	Girl
Past 7 days, how often were you active during PE	Not active	7 (10.3%)	8 (9.2%)
	Sometimes	37 (54.4%)	43 (49.4%)
	Very often	24 (35.3%)	36 (41.4%)
Past 7 days, what did you do most at break time	Low physical activity	11 (16.2%)	19 (21.8%)
	Moderate activity	28 (41.2%)	30 (34.5%)
	High activity	29 (42.6%)	38 (43.7%)
Past 7 days, what did you normally do at lunch time	Low physical activity	22 (32.4%)	37 (42.5%)
	Moderate activity	26 (38.2%)	26 (29.9%)
	High activity	20 (29.4%)	24 (27.6%)
Past 7 days, how many times after school did you do sports	None	12 (17.6%)	15 (17.2%)
	3 times or less	39 (57.4%)	45 (51.7%)
	4 times or more	17 (25%)	27 (31%)

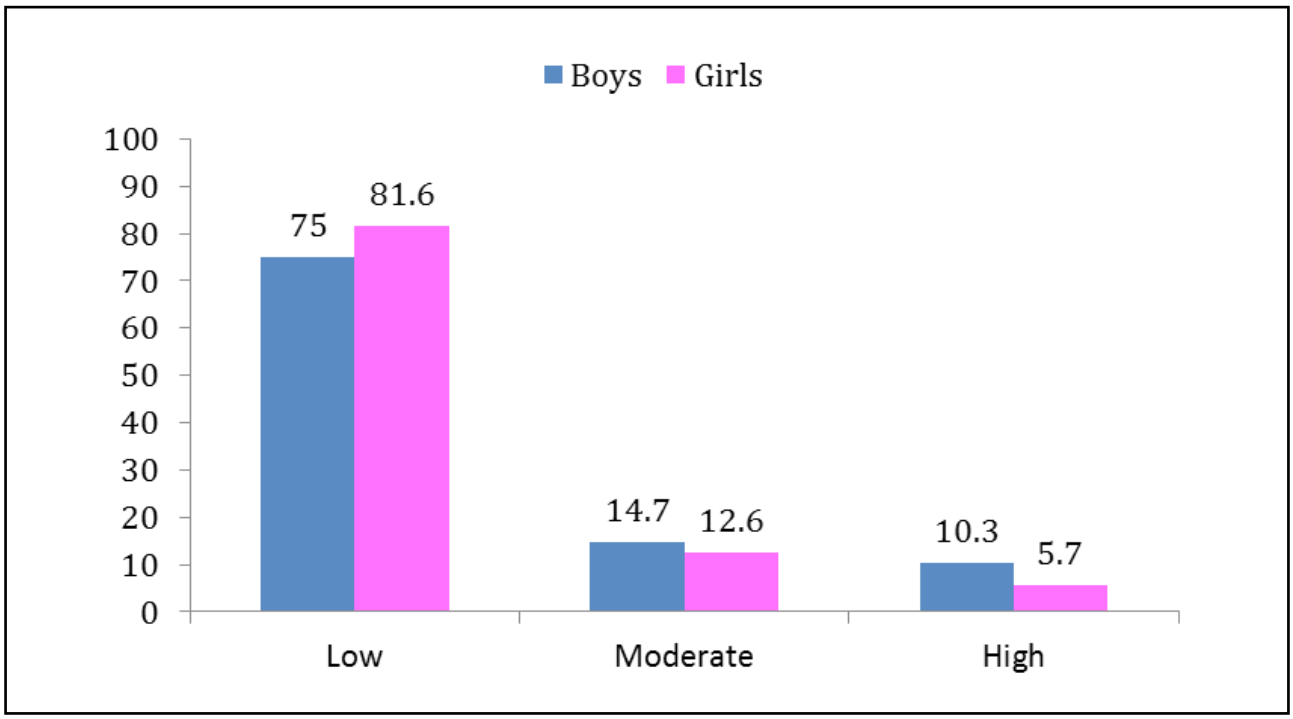
The findings indicate that majority of the children were active and participated in physical activities at various levels at lunch and break time. Almost equal percentage of girls and boys were involved in high and moderate physical activity at lunch and break time. The majority of the respondents were 3 times or less/week participating in sport. More girls (31%) than boys (25%) participate in sport 4 times and more/week.

Figure 13: Level of physical activity during the previous 7 days on free time



Overall, 79%, 13% and 8% of children reported engaging in low, moderate and high physical activity respectively during the previous 7 days on free time.

Figure 14: Level of physical activity during free time by sex



Seventy five percent of boys and 82% of girls reported low activity level during their free time. Approximately 10% of both boys and 6% of girls engaged in high level physical activity.

Table 25: Levels of physical activity versus nutritional status

Level of activity	Nutritional status			
	Wasted/ thin	Normal	Overweight	Obese
Low	7 (5.7%)	77 (63.1%)	13 (10.7%)	25 (20.5)
Moderate	1 (4.8%)	12 (57.1%)	7 (33.3%)	1 (4.8%)
High	1 (8.3%)	7 (58.3%)	3 (25%)	1 (8.3%)

The study also found that majority of children that were involved in low physical activity were overweight or obese.

Table 26: Frequency of sport participation after school

	Boys		Girls	
	≤ 3 times	4 or more times	≤ 3 times	4 or more times
Past 7 days, how many days right after school did you do sports	51 (75%)	17 (25%)	60 (69%)	27 (31%)
Past 7 days, how many evenings did you do active sports	48 (70.6%)	20 (29.4%)	68 (78.2%)	19 (21.8%)
Last weekend, how many times did you do active sports	46 (67.6%)	22 (32.4%)	64 (73.6%)	23 (26.4%)

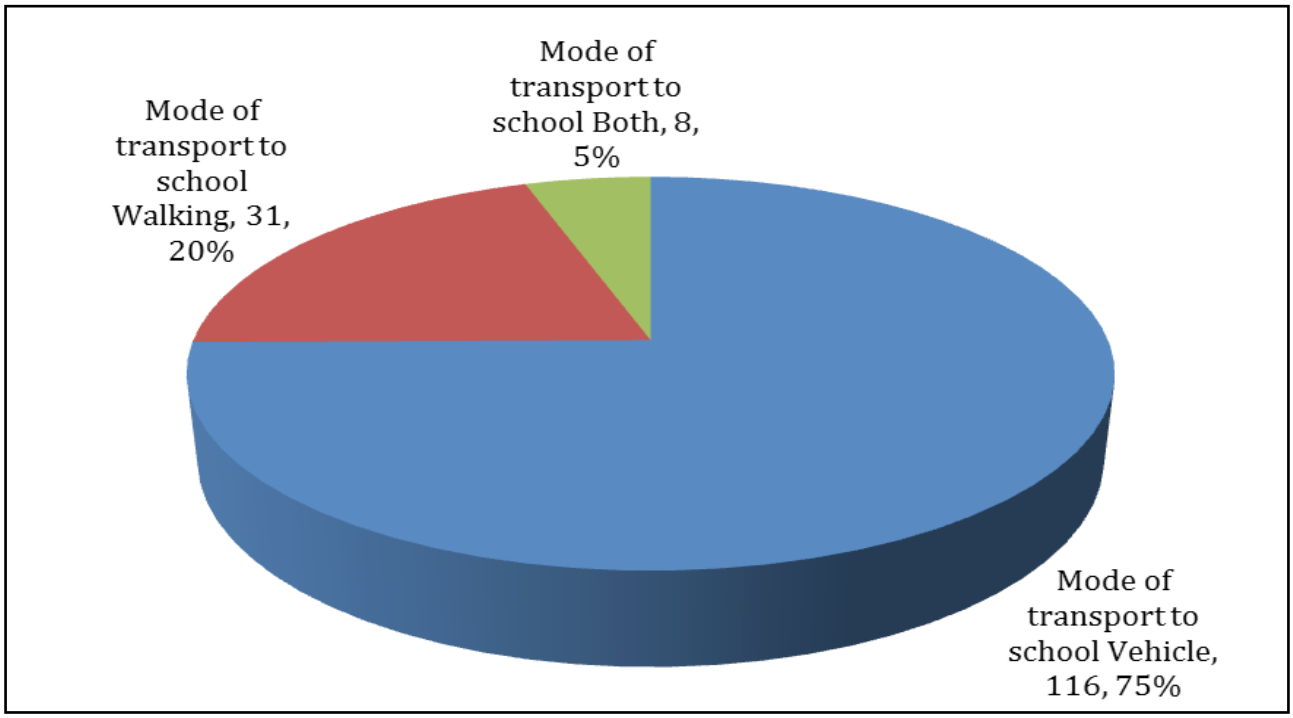
The highest percentage of boys and girls falls in the group of not very often physically active throughout the week from Monday to Sunday. In all the days of the week, more girls were not often active compared to boys.

Table 27: Frequency of daily physical activity of boys and girls over the past 7 days

	Boys		Girls	
How often did you do physical activity	Not very often n (%)	Very often n (%)	Not very often n (%)	Very often n (%)
Last week Monday,	53 (77.9%)	15 (22.1%)	76 (87.3%)	11 (12.7%)
Last week Tuesday	53 (77.9%)	15 (22.1%)	76 (78.2%)	19 (21.8%)
Last week Wednesday	53 (77.9%)	15 (22.1%)	75 (86.2%)	12 (13.8%)
Last week Thursday	47 (69.1%)	21 (30.9%)	68 (79.3%)	18 (20.7%)
Last week Friday	42 (61.8%)	26 (38.2%)	57 (65.5%)	30 (34.5%)
Last week Saturday	37 (54.4%)	31 (45.6%)	55 (63.2%)	32 (36.8%)
Last week Sunday	51 (75%)	17 (25%)	65 (74.7%)	22 (25.3%)

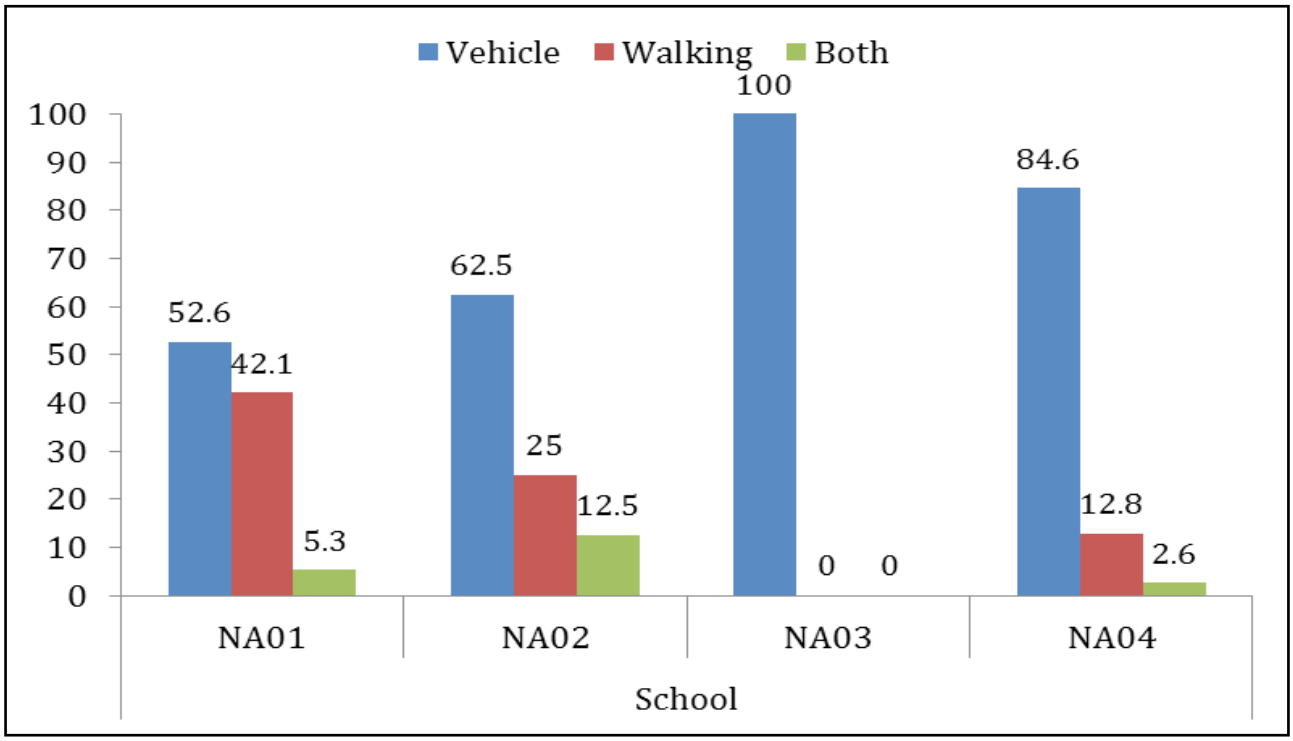
Sport participation could contribute towards higher levels of PA especially on a Saturday. The table above shows that on daily basis more than 50% of learners do not do physical activity very often.

Figure 15: Mode of transport to school



Three quarters of the children were driven to and from school. Only one fifth walked to school and back.

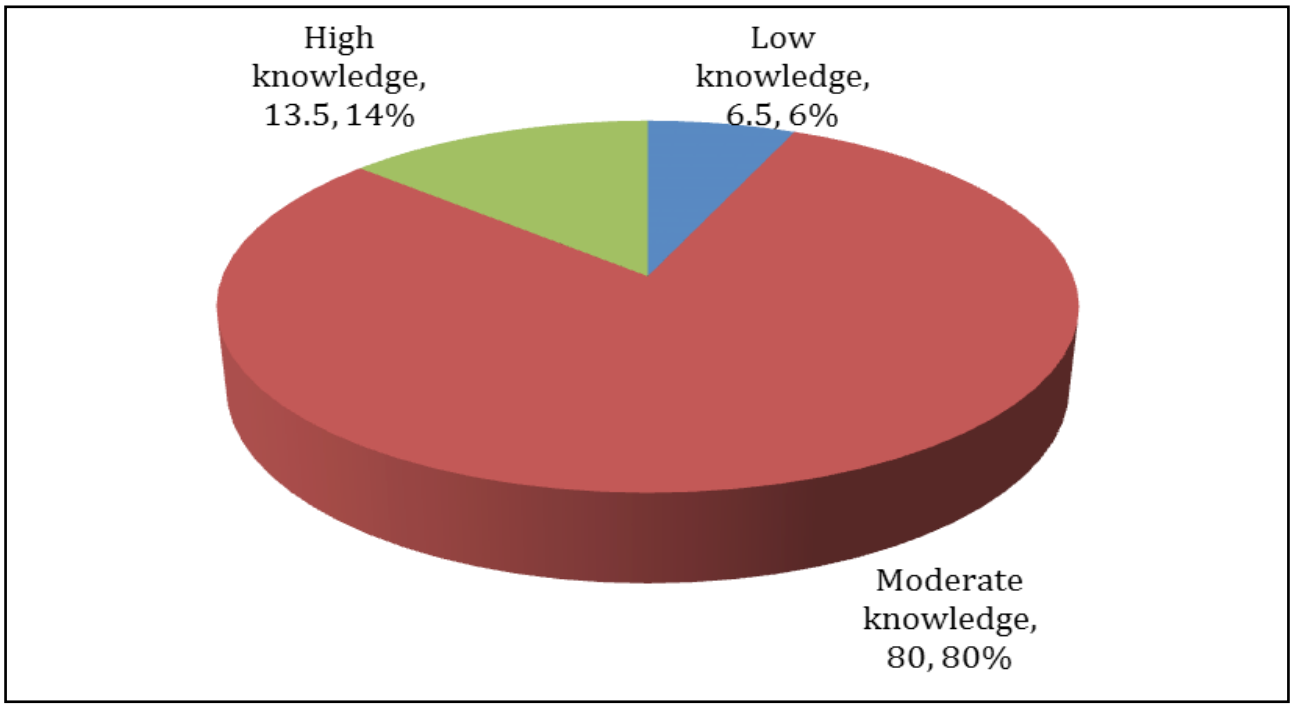
Figure 16: Mode of transport by school



Majority of the children in all the schools used vehicles to and from school. It was interesting to note that most respondents in schools NA01 and NA02, which are located in low or medium socio-economic area walked to and from school compared to school NA03 and NA04 located in a higher socio-economic area.

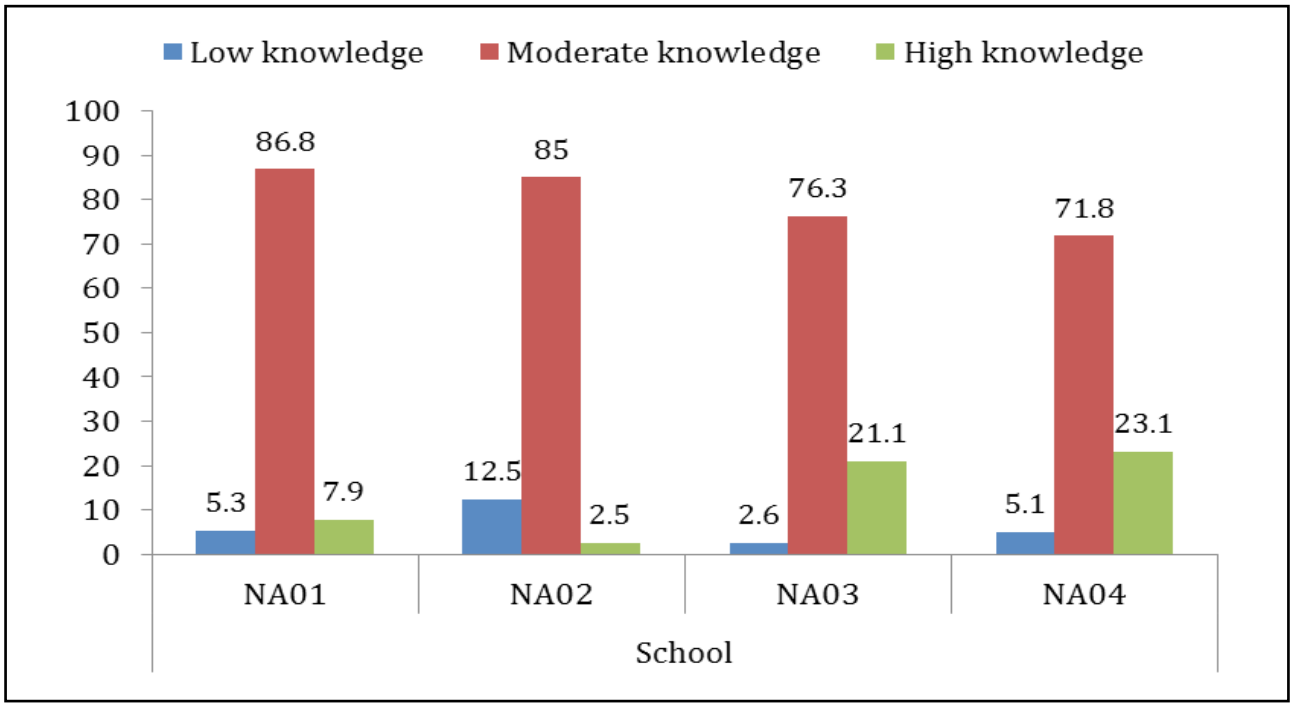
3.8 Nutrition knowledge, attitudes and practices

Figure 17: Levels of nutrition knowledge



As per figure above, this study shows that majority (80 %) of the learners have moderate nutrition knowledge and only 14 % have high knowledge on nutrition.

Figure 18: Schools level of nutrition knowledge



Most learners in all the school had moderate knowledge on nutrition.

Table 28: Knowledge on healthy habits

Nutrition knowledge tested	Number	% of correct answer
Eating fruits and vegetables boosts immunity	139	89.7
School lesson teaching healthy eating	132	85.2
Fruits are healthy	148	95.5
Eating a lot of sugar and sweet makes one fat	69	44.5
Eating a lot of sugar and sweet Is bad for the teeth	142	91.6
Eating a lot of sugar and sweet is good for health	147	94.8
Too much fat makes one fat	105	67.7
I worry about the kind of food I eat despite being young	93	60
I like sports	128	82.6
It is important to exercise daily	150	96.8

The findings indicated that majority of the children interviewed had received lessons on health eating and were aware of good health habits. Eighty-five percent reported that they had received lessons on healthy eating and 89.7% were aware of the importance of eating fruits and vegetable in boosting immunity. Ninety-six percent of the children were aware of the importance of engaging in exercise and as such liked sports.

Table 29: Correct knowledge on food groups

			Food group to eat most daily (cereals and staples)	Food group to eat least daily (sugars, sweets, fats/ oil)	Food group that gives best energy (cereals and staples)	Food group for building muscle (animal and plant protein)	Food group that builds immunity (fruits and vegetables)
	Age years	n	n (%)	n (%)	n (%)	n (%)	n (%)
Boys	8	14	2 (14.3%)	8 (57.1%)	2 (14.3%)	7 (50%)	4 (28.6%)
	9	16	3 (18.8%)	11 (68.8%)	0	7 (43.8%)	6 (37.5%)
	10	17	2 (11.8%)	14 (82.4%)	4 (23.5%)	5 (29.4%)	11 (64.7%)
	11	19	2 (10.5%)	15 (78.9%)	3 (15.8%)	6 (31.6%)	10 (52.6%)
	12	2	1 (50%)	2 (100%)	1 (50%)	2 (100%)	2 (100%)
Girl	8	16	3 (18.8%)	8 (50%)	3 (18.8%)	4 (25%)	8 (50%)
	9	21	1 (4.8%)	17 (81%)	2 (9.5%)	9 (42.9%)	13 (61.9%)
	10	21	0	18 (85.7%)	4 (19%)	9 (42.9%)	13 (61.9%)
	11	21	2 (9.5%)	20 (95.2%)	7 (33.3%)	13 (61.9%)	17 (81%)
	12	8	1 (12.5%)	6 (75%)	1 (12.5%)	4 (50%)	4 (50%)

The results show that majority of the boys and girls reported that sugars, sweets, fats and oil have to be eaten least daily whereas below average had knowledge on the importance of energy giving and body building food. Above average of the children expressed knowledge on importance of foods that build immunity. Knowledge on the food groups and their importance was more in older children (9-12 years) compared to the young ones. However, knowledge on energy giving foods was in the same range across the age groups.

3.9 Nutrition practice

This study shows that 73.5% of children bring their lunch boxes to school every day whereas 10.3% bring boxes sometimes and 16.1% do not carry lunch boxes at all. Those who did not carry lunch boxes 92.3% reported that there was no one at home to prepare for them food whereas 84.5% lacked of food at home. Forty percent of the children shared their lunch boxes with their friends.

More than half of the children 55.5% only bring money to school sometimes whereas the other 26.5% and 18.1% bring every day and not at all respectively. For the children who bring money to school, 25.8% reported that they did not buy anything from the canteen at all. Ten percent of the children participated in school feeding every day while 3.9% participated only sometimes.

Table 30: Lifestyle during the previous 7 days

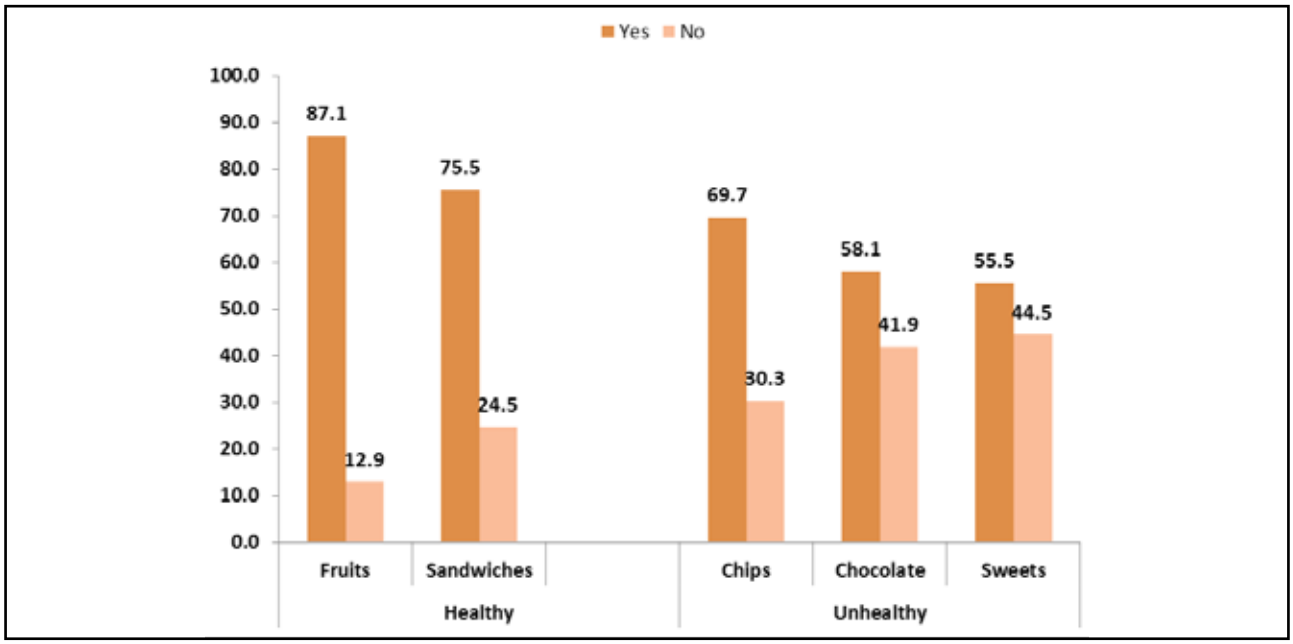
	Everyday	Sometimes	Not at all
Comes with lunchbox to school	114 (73.5%)	16 (10.3%)	25 (16.1%)
Reasons for not carrying lunch box			
Children eat my food	32 (20.6%)	8 (5.2%)	115 (74.2%)
No food at home	16 (10.3%)	8 (5.2%)	131 (84.5%)
No one at home to help	8 (5.2%)	4 (2.6%)	143 (92.3%)
Brought money to school	41 (26.4%)	86 (55.5%)	28 (18.1%)
Shared lunch with friends	62 (40%)	43 (27.7%)	50 (32.3%)
Bought food items from canteen	82 (52.9%)	33 (21.3%)	40 (25.8%)
Participated in school feeding programme	16 (10.3%)	6 (3.9%)	133 (85.8%)

Table 31: Healthy and unhealthy habits

	Daily	No	Sometimes (2-3 times a week)
Healthy habits	**n (%)**	**n (%)**	**n (%)**
Ate with family	103 (66.5%)	18 (11.6%)	34 (21.9%)
Ate breakfast before school	110 (71%)	25 (16.1%)	20 (12.9%)
Ate vegetables	109 (70.3%)	25 (16.1%)	21 (13.6%)
Reasons for eating vegetables Because I like the taste Because people at home eat Because I was told to eat	 89 (68.5%) 56 (43.1%) 51 (39.2%)	 41 (31.5%) 74 (56.9%) 79 (60.7%)	 0 0 0
Ate fruits	137 (88.4%)	18 (11.6%)	0
Reasons for eating fruits Because I like the taste Because people at home eat Because I was told to eat	 111 (81%) 51 (37%) 55 (40.1%)	 26 (19%) 86 (63%) 82 (59.9%)	 0 0 0
Unhealthy habits	**n (%)**	**n (%)**	**n (%)**
Ate watching TV	95 (61.3%)	24 (15.5%)	36 (23.2%)
Ate fast foods	63 (40.6%)	34 (21.9%)	58 (37.5%)
Drunk sweetened beverages	53 (34.9%)	15 (9.9%)	84 (55.2%)
Went to bed hungry because of no food	30 (19.4%)	125 (80.6%)	-

The results showed that 66.5% of the children reported eating with other family members and 61.3% ate food while watching television. Notably 16.1% went to school on an empty stomach. A considerable percentage (70.3%, 88.4%) of children ate vegetables and fruits respectively. The majority of the children ate fruits and vegetables because they liked the taste. Forty-one percent of children reported to eat fast foods and 34.9% had drunk sweetened beverages. It's worthy to note that 19.4% of the children slept on an empty stomach because of lack of food at home.

Figure 19: Type of snacks that children ate



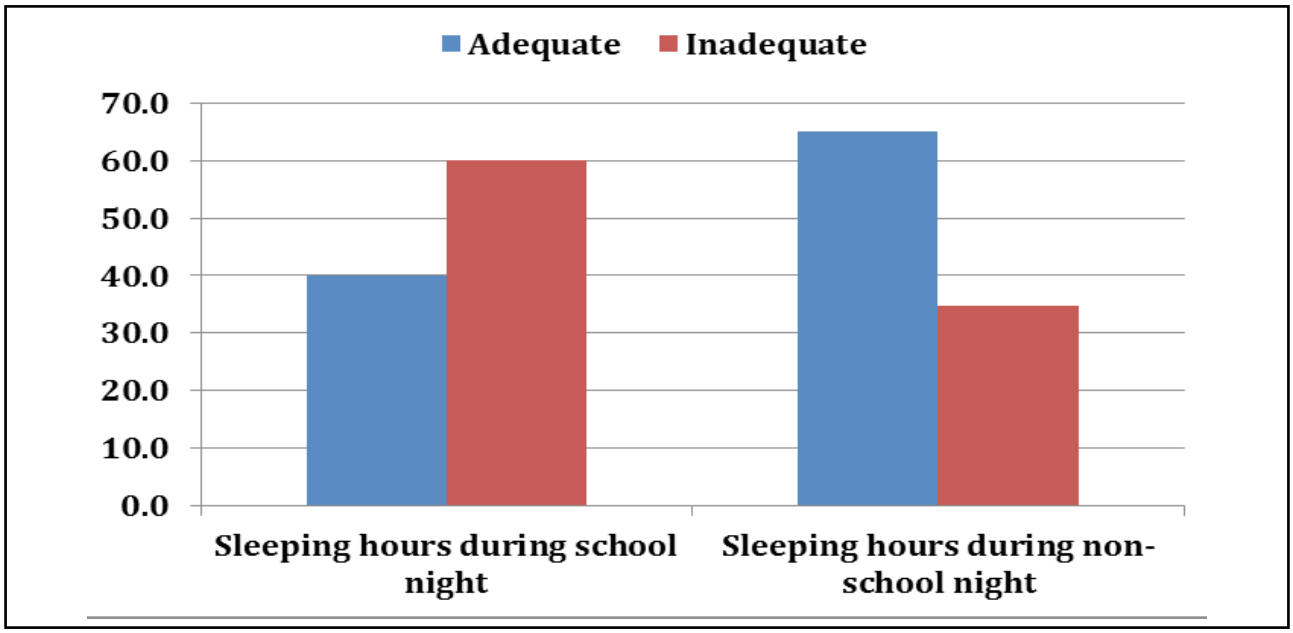
Eighty seven percent and 75.5% of the children stated that they ate heathy snacks (fruits and sandwiches) compared to 69.7%, 58.1% and 55.5% who ate unhealthy snacks (chips, chocolate and sweets respectively).

3.10 Sleep

Table 32: Means of sleeping hours during school and non- school days

	Sleep hours on a non-school day	Sleep hours on a school day
Mean ± SD	10.6 ± 2.81	9.3 ± 1.12
Min - max	2.00 – 24.00	5.00 – 13.00

Figure 20: Number of sleep hours during school and non-school days



Only 40% of children slept for the minimum recommended 10 hours per night during school nights while 65% achieved this during non-school nights. It seems that the majority of the children go to bed late during school and this contribute to not getting enough sleep.

3.11 Comparison analysis

Table 33: Nutritional status by hypertension

Nutritional status	Normal	Pre-hypertension	Hypertension
Obese	22 (81.5%)	5 (18.5%)	0
Overweight	20 (87%)	3 (13%)	0
Normal	83 (86.5%)	12 (12.5%)	1 (1%)
Wasted	8 (88.9%)	1 (11.1%)	0
Total	**133**	**21**	**1**

Slightly more children with pre-hypertension were obese or overweight compared to those who were wasted or had normal nutritional status.

Table 34: Nutritional status by risk of CMD

	Risk of cardiovascular diseases		
Nutritional status	**At risk of CMD**	**Not at risk of CMD**	**TOTAL**
Obese	27 (100%)	0	**27**
Overweight	19 (82.6%)	4 (17.4%)	**23**
Normal	28 (29.2%)	68 (70.8%)	**96**
Wasted	0	9 (100%)	**9**
Total	**74**	**81**	**155**

All the obese children were found to be at risk of CMD, with 82.6% of the overweight children also at risk. Seventeen percent of overweight children are not at risk of CMD. Majority of the children not malnourished (70.8%) and all of the wasted ones were not at risk of CMD.

Table 35: Nutritional status by stunting

Nutritional status	Stunted	Not stunted	TOTAL
Wasted	1 (11.1%)	8 (88.9%)	**9**
Normal	6 (6.3%)	90 (93.8%)	**96**
Overweight	0	23 (100%)	**23**
Obese	0	27 (100%)	**27**
Total	**7**	**148**	**155**

Only one of the wasted children was stunted. However, 6 of the normal children were stunted.

Table 36: Stunting by hypertension

Hypertension status	Stunted	Not stunted	Total
Normal	5	128	133
Pre hypertension	0	21	21
Hypertension	0	1	1

All the stunted children had normal blood pressure

Table 37: Hypertension status by CMD risk

Hypertension status	At risk of CMD	Not at risk of CMD
Normal	62 (46.6%)	71 (53.4%)
Pre-hypertension	11 (52.4%)	10 (47.6%)
Hypertension	1(100%)	0
Total	**74**	**81**

Slightly more than half the children with pre-hypertension were also at risk of CMD.

Table 38: Nutritional status by watching TV and playing computer games

	How often do you watch TV, play computer or video games?		
	Everyday	**Most days**	**Only weekends**
Overweight and obese	14 (51.9%)	8 (29.6%)	5 (18.5%)
Normal	45 (37.8%)	36 (30.3%)	38 (31.9%)
Wasted	4 (44.4%)	2 (22.2%)	3 (33.3%)

Children who watch TV everyday are leading in all the categories of nutritional status. Those who are overweight and obese are more (51.9% and 29.6%) in watching TV and play games on daily basis and on most days respectively, while children with normal nutritional status are at 37.8% on daily basis and 30.3% on most days.

Table 39: Knowledge on healthy /unhealthy practices by nutritional status

	Choose activities that you like most			Choose activities that your friends like most			Choose activities that are best for your health		
	Overweight	Normal	Wasted	Overweight	Normal	Wasted	Overweight	Normal	Wasted
TV watching, reading, computers	11	36	1	4	15	1	0	7	2
Eating with family and friends	1	10	1	2	16	0	4	35	1
Playing games, gardening	6	20	1	12	52	6	5	22	4
Organized team sports	9	53	6	9	36	2	18	55	2
Total	**27**	**119**	**9**	**27**	**119**	**9**	**27**	**119**	**9**

Approximately 40% of the overweight and obese children liked watching TV, reading and playing computer games as compared to over 60% of the wasted who like organized team sports. However, more than 60% of overweight and obese children agreed that organized team sports are good for their health while slightly more than 20% of wasted children agreed that playing games and gardening was good for their health.

3.12 Physical activity

Majority (56.1%) of children who reported engaging in high physical activity within the previous 7 days were of normal nutritional status. It is also worth noting that 24.4% of children engaged in physical activity were overweight and 20% of those in low level activity are obese.

Table 40: Nutritional status by level of activity

	Low activity	Moderate activity	High activity
Wasted	7 (7.1%)	1 (6.3%)	1 (2.4%)
Normal	60 (61.2%)	13 (81.3%)	23 (56.1%)
Overweight	11 (11.2%)	2 (12.5%)	10 (24.4%)
Obese	20 (20.4%)	0	7 (17.1%)
Total	**98**	**16**	**41**

Table 41: Hypertension status by level of activity

	Low activity	Moderate activity	High activity	TOTAL
Normal	102 (76.7%)	20 (15%)	11 (8.3%)	133
Pre-hypertension	19 (90.5%)	1 (4.8%)	1 (4.8%)	21
Hypertension	1 (100%)	0	0	1
Total	**122**	**21**	**12**	**155**

Majority of the children with pre-hypertension (90.5%) reported low levels of physical activity during the previous 7 days.

Table 42: Activity level by CMD risk using waist height ratio

	Not at CMD risk	At CMD risk
Low activity	12 (75%)	4 (25%)
Moderate activity	63 (64.3%)	35 (35.7%)
High activity	27 (65.9%)	14 (34.1%)

Slightly more than 1/3 of children who reported engaging in moderate and high physical activity within the past 7 days were at risk of CMD compared to a quarter of those who reporting engaging in low physical activity.

Table 43: Activity level by CMD risk using waist circumference

	Not at CMD risk	At CMD risk
Low activity	10 (62.5%)	6 (37.5%)
Moderate activity	53 (54.1%)	45 (45.9%)
High activity	18 (43.9%)	23 (56.1%)

About 38% of children who reported engaging in low physical activity in the previous 7 days were at risk of CMD. However, 45.9% and 56.1% of those who reported moderate and high level of activity were also at risk of CMD respectively.

Table 44: Body fat percent by level of activity

	BOYS n=66			GIRLS n=85		
	Low activity	Moderate activity	High activity	Low activity	Moderate activity	High activity
Normal body fat percent	6 (14.6%)	27 (65.9%)	8 (19.5%)	3 (8.8%)	24 (70.6%)	7 (20.6%)
High body fat percent	1 (4%)	13 (52%)	11 (44%)	6 (11.8%)	32 (62.7%)	13 (25.5%)

The boys with high body fat percentage involved in high physical activity are 44% compared to 19.5% for those who have normal body fat percentage. Same scenario applies to girls who are at 25.5% and 20.6%.

3.13 School Environment Survey and Audit

The school environment survey and audit was conducted in four schools in Khomas by interviewing either the Principal, deputy principal or the Head of department.

Table 45: School demographics

Name of primary school	Number of classes	Number of learners	Number of teachers
NA01	39	1535	47
NA02	29	1160	36
NA03	33	963	34
NA04	41	1417	44

The four schools which participated in the study, two schools have from Grade 0 to 7 while the other two have Grade 1 to 7 levels. Three schools described the socioeconomic status of the learners within the school and community that it serves as mixed low, moderate or high socioeconomic status in relation to the region, only one school describe it low to moderate socioeconomic status.

Mode of transport

Most learners travel to school by either using private or public transport. It was interesting to note that only one school located in a low/moderate socioeconomic surrounding reported having most learners walking.

School surrounding

Two respondents described the surrounding area as mostly residential urban or suburban while the other two schools described their areas as mixed land use (residential and business or commercial).

Table 46: School surrounding

	NA01	NA02	NA03	NA04
Shops/Markets within school walking distance	Agree	Agree	Agree	Disagree
Bus stops within 10-15min walk from school	Agree	Agree	Agree	Agree
Sidewalks in most streets surrounding school	Agree	Agree	Agree	Agree
Paths for bicycles or walking near school	Agree	Agree	Agree	Agree
Free/low cost parks or recreation facilities	Agree	Disagree	Agree	Disagree
Crime rate high in the area at night	Agree	Agree	Disagree	Agree
Too much traffic on streets making cycling or walking difficult	Agree	Agree	Agree	Disagree
Many people in neighbourhood walking, jogging or cycling	Agree	Agree	Disagree	Agree
Interesting places to go and things to look at while walking	Agree	Disagree	Disagree	Disagree
Many 4-way intersections in neighbourhood	Agree	Disagree	Disagree	Agree
Crime rate high in the area during the day	Disagree	Agree	Agree	Agree
School surrounding is free from litter, rubbish and graffiti	Disagree	Agree	Agree	Agree

This study reveals that there are many shops and markets to buy things within the walking distance to schools and there is bus stop / taxi rank within 10-15-minute walk from schools. There are sidewalks on most of the streets in the neighbourhood surrounding the schools. Two schools reported that in their neighbourhood there were free/low cost facilities like recreation centres, parks and playgrounds where children could play, while two schools neighbourhoods' had nothing. There was high crime rate during day and night which makes it unsafe for walking. In the schools neighbourhood there are too much traffic on the street that makes it difficult to walk or cycle. Three schools indicated that there are no interesting places to go and things to look at while walking and the physical surrounding near the schools is free from litter, rubbish and graffiti.

Shops in the school neighbourhood

The 3 out of 4 schools indicated that the shops and stores in their neighbourhood have a large selection of high quality fresh fruits and vegetables as well as low –fat products. Three schools also reported presence of fast food restaurants or vendors that sell low quality food including foods high in fat and sugar.

Safety accessing school

Access to all the schools is through the busy roads with high vehicle traffic and presence of traffic calming zebra crossings and speed humps. Three schools have signage denoting school zone/ pedestrian crossing and have separate entrance for pedestrians and cyclists or motorists. Only one school did not supervise learners entering or leaving the school premises.

Condition of school building

Three schools reported the condition of the buildings as clean, neat, and well looked after with regular maintenance and no evidence of vandalism or broken windows. All the school buildings were either painted, had planted beds, benches for sitting or with trees for shade. It was interesting to note that one school had a school board sponsored by a fizzy drink company.

Availability of amenities

All the schools reported having electricity and running tap water for drinking. Three schools reported having teachers supervising learners during break times. Two schools have an indoor hall for physical activity and education in case of bad weather. Two school also had visible posters or messages concerning healthy eating and physical activity.

Table 47: Playgrounds and condition

Condition of playgrounds				
Grass	**Sand with stones**	**Cement or tarred**	**Free of dangerous objects like glass**	**Free of litter**
None	NA02 NA03	NA01 NA03 NA04	NA01 NA02 NA03 NA04	NA01 NA02 NA03 NA04

The survey reported that all schools had between 3 to 8 playgrounds. All the schools had sand with stones or cement/tarred playgrounds. The playgrounds are clear of litter and dangerous objects like glass.

Table 48: Availability of playing equipment

	Gyms/climbing frames		Slides or see-saws		Swings/hanging tyres		Playground drawings	
	Available	Functional	Available	Functional	Available	Functional	Available	Functional
NA01	Yes	Yes	Yes	Yes	Yes	Yes	No	N/A
NA02	No	No	No	No	No	No	Yes	N/A
NA03	No	No	No	No	No	No	No	N/A
NA04	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A

Most of the playing equipment (climbing frames, see-saws, slides, and swings or hanging tyres) was only available in two of the schools.

Availability of sports fields

Most of the schools had 1 or 2 sports fields. However, school NA04 had 7 sports fields.

Table 49: Condition of sports fields

Condition of sports fields				
Grass	**Sand with stones**	**Cement or tarred**	**Free of dangerous objects**	**Free of litter**
NA01 NA03 NA04	NA02	NA02 NA04	NA01 NA02 NA03 NA04	NA01 NA02 NA04

Most of the schools are having grass sports fields. None of the schools had fields with dangerous objects like glass.

Table 50: Availability and functionality of playing equipment

	Nets or goal posts		Courts or painted lines		Swimming pool		Netball, basketball, volleyball or tennis court	
	Available	Functional	Available	Functional	Available	Functional	Available	Functional
NA01	Yes	Yes	Yes	Yes	No	No	Yes	Yes
NA02	Yes	Yes	Yes	Yes	No	No	Yes	Yes
NA03	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NA04	Yes	Yes	Yes	Yes	No	No	Yes	Yes

Despite only one school having a functional swimming pool, all the schools had functional playing equipment such as nets, goal posts, painted courts for activities like netball, volleyball, basketball or tennis.

Table 51: Availability of equipment

	NA01	NA02	NA03	NA04
Skipping ropes	-	Few	-	Many
Hoola hoops	-	Many	-	Many
Indigenous games	-	-	-	Many
Soccer ball or goals	Many	Many	Few	Many
Net balls or posts	Many	Many	-	Few
Basketball or nets	Many	Many	-	-
Cricket pads, wickets or bats	Many	-	Few	None
Hockey sticks, balls, pads or goals	Many	-	-	-
Rugby balls or posts	Many	Few	Many	Many
Tennis racquets, nets or balls	Many	Few	Few	Few
Weight lifting equipment	Many	-	-	-
Gymnastics equipment	Many	-	-	-
Whistles, beacons or bibs	Many	Many	Few	Many
Athletics equipment	Many	Many	Few	Many

All the schools apart from NA03 seemed to have a lot of sports equipment. The most common being soccer balls, rugby balls, whistles, beacons, bibs and athletics equipment.

Structured physical activity and education in time table

All the schools reported having 1-2 sessions per week of structured physical activity and education in their school timetable. Each session was between 40 – 45 minutes long.

School feeding and nutrition policies

All the schools apart from NA03 offered subsidized feeding schemes at school. None of the schools had policies in respect to buying and selling of food by vendors within and/or adjacent to the school.

Table 52: Items sold in school canteen or tuck shop

Unhealthy foods/snacks	**NA01**	**NA02**	**NA03**	**NA04**
Sweets	Yes	Yes	Yes	Yes
Chocolate	Yes	-	Yes	Yes
Crisps	Yes	Yes	Yes	Yes
Fizzy cools drinks	Yes	Yes	Yes	Yes
Sports drinks	-	-	-	Yes
White bread sandwich	Yes	Yes	Yes	Yes
Hamburgers/hotdogs	Yes	Yes	Yes	Yes
Doughnuts/*Koeksisters*	-	-	Yes	-
Chips/chip rolls	Yes	-	-	Yes
Sausage rolls/pies	-	-	Yes	Yes
Ice cream/ice suckers		Yes	Yes	Yes
Vetkoek, curry, bunny, soup	Yes	Yes	-	-
100% fruit juice	Yes	-	Yes	-
Healthy foods/snacks				
Fresh fruits or salads	-	-	Yes	-
Cooked balanced meals	-	-	Yes	Yes
Brown bread sandwich	-	-	Yes	-

All the schools reported having a school canteen or tuck shop that stocked and sold a variety of unhealthy food and snacks. Sweets, crisps, fizzy cool drinks, white bread sandwich and hamburgers/hotdogs were being sold in all the schools. However, it is worth noting that all the listed healthy food/snacks were being sold at NA03.

School vegetable garden

None of the schools reported having a vegetable garden.

Table 53: Items sold by formal or informal vendors adjacent to the school

Unhealthy foods/snacks	NA01	NA02	NA04
Sweets	Yes	Yes	Yes
Chocolate	Yes	-	Yes
Crisps	Yes	Yes	Yes
Fizzy cools drinks	-	-	-
Sports drinks	-	-	-
White bread sandwich	-	-	-
Hamburgers/hotdogs	-	-	-
Doughnuts/*Koeksisters*	-	-	-
Chips/chip rolls	Yes	-	-
Sausage rolls/pies	-	-	-
Ice cream/ice suckers		-	-
Biscuits	Yes	Yes	-
Healthy foods/snacks			
100% fruit juice	-	-	-
Fresh fruits or salads	-	-	-
Cooked balanced meals	-	-	-
Brown bread sandwich	-	-	-

Three schools reported having vendors selling items adjacent to the school. The vendors in all these three schools sold sweets and crisps while none sold healthy food or snacks. One school has no formal or informal vendors adjacent to school.

Table 54: Health problem experienced by learners and teachers

	NA01		NA02		NA03		NA04	
	Learners	Teachers	Learners	Teachers	Learners	Teachers	Learners	Teachers
Tobacco use		3						
Substance abuse		2						
Lack of physical activity			1	1		1		
Unhealthy diet	1		2	2	1	2	1	1
Overweight							2	2
Underweight	2						3	3
Chronic lifestyle diseases		1	3	3		3		
Sexuality related diseases & pregnancy	3							

In learners, unhealthy diet was mentioned as among the top three problems by all in all the schools. Whereas the same problem was also top three in teachers in 3 schools. It was also worth noting that chronic lifestyle disease was top three among teachers in 2 schools.

Table 55: Top three barriers to health promotion programmes

	NA01	NA02	NA03	NA04
Too little time in timetable	3		1	1
Too many competing priorities	2		2	2
Lack of capacity of human resource	1			
Lack of financial resource				
Inadequate facilities				
Lack of interest from outside organizations		1		3
Lack of interest from learners			3	
Lack of interest/support from teachers		2		
Lack of interest/support from parents		3		
Unsafe for learners to stay after school				

Three of the schools mentioned too little time in timetable and too many competing priorities as among the top three barriers to health promotion in their school. Lack of interest from outside organizations was mentioned by two schools. Other barriers mentioned included lack of capacity of human resource, lack of interest from learners, lack of interest/support from teachers and lack of interest/support from parents.

CHAPTER 4: DISCUSSION

This study involved 155 children who consist of 68 boys and 87 girls. Informed consent was obtained from the parents of all participating learners. The four schools which took part in the study are public and in Windhoek urban area. In this study more girls were interviewed than boys. About 73% of respondents reported that both their parents/guardians were employed either in private or public sectors or self-employed. All respondents had access to tap water and flush toilets. The mean age was 10 years, with the youngest child being 8 years and the oldest being 12 years. The mean weight, height and waist measurement was 35.9 kg, 139 cm and 67.9 cm respectively. Girls were significantly taller than boys (P=0.02) and boys had lower Height for Age Z-score (HAZ) than girls (P=0.047).

The study shows the prevalence of overweight and obesity in girls was high (18.4%) then in boys it was 10.3% & 16.2% respectively. The prevalence of obesity in children 8 to 12 years was 17.4% while prevalence of overweight was 14.8%. The combined overweight and obese is 32% in 8-12 years old schoolchildren in Windhoek. These percentages are high compared to 9% overweight and 4 % obesity in 6-13 years old schoolchildren in Stellenbosch area, South Africa. This is also higher than the global prevalence of 10% in schoolchildren but low than combined overweight and obese in 5-14 years of age in Mexico in 2004 (South African Journal of Clinical Nutrition, 2013). Interventions have to be implemented in order to halt the increase of overweight and obesity in childhood.

Prevalence of stunting was 4.5% while that of wasting was 5.8%. The proportion of boys who were wasted was 7% compared to almost 5% of the girls. According to the Demographic Health Survey (DHS) (2013), the national prevalence of children under 5 years old with stunting was 24%, wasting was 6%, underweight 13% and overweight 3.4%. Namibia is faced with double burden of malnutrition since there are still schoolchildren suffered from stunting and wasting and then overweight and obese on the other hand.

It was shown in the study that more girls (68%) were at risk of CMD compared to boys (32.4%) by using waist circumference. The saliva analysis which was done to determine the body composition shows that more girls 67.1% than boys 32.9% had high body fat percentage.

It was interesting to note that 27% of children had high body fat although their BMI fell within the normal range category. This finding was not unique to Namibia as other studies have established similar levels. Craig et al (2015), in a study conducted in KwaZulu-Natal, South Africa among children and adolescents aged 7,11 and 15 years, reported that girls were at significantly increased risk of overweight and overfatness (overweight: 73.9 % and 26.1% females and males respectively (p=0.0001); overfat: 72.7 % and 27.3% females and males respectively (p = 0.0001)).

This study shows an extremely high prevalence of overfatness (50%) compared to a prevalence of overweight and obesity combined of 32% by BMI z score. The prevalence of obesity of 17% means that the prevalence of overfatness was nearly three times higher than the prevalence of WHO BMI defined obesity. Currently, the body mass index (BMI) is most commonly used to determine adiposity. However, BMI presents as an inaccurate obesity classification method that underestimates fatness. This is confirmed in the study done in USA by Braverman & Shahn, (2012) that found out that BMI characterized 26% of

the subjects as obese, while Duel-energy x-ray absorptiometry (DXA) indicated that 64% of them were obese. 39% of the subjects were classified as non-obese by BMI, but were found to be obese by DXA.

In general, this study shows that majority of children (63, 2%) involved in low activity during their free time which may result in overweight and obese. It was also found out that only 20% of children walking to and from school. Majority (56.1%) of children who reported engaging in high physical activity within the previous 7 days were of normal nutritional status. It is worth noting that 24.4% of children engaged in physical activity were overweight and 20% of those in low level activity are obese. So there is some evidence that not only does low physical activity cause obesity, but once obese, obesity causes low physical activity.

On the other hand it seems that children are more active during free time breaks. The majority of the respondents were 3 times or less/week participating in sport. More girls (31%) than boys (25%) participate in sport 4 times and more/week. This could be a health enhancing factor for the respondents. The respondents spent an average of 50.65±26,23min/day in Moderate to Vigorous physical activity (MVPA) and 860.35±182,40min/day in sedentary time.

Boys accumulated more minutes of MVPA compared with girls (54.20 ±25.18 min/day vs. 46.51±27.55 min /day). There was no statistical significance (p≥0,368) between the two groups with regards to MPVA.

One of the biggest public health challenges is the development of non-communicable diseases (NCD's), starting at an early age. According to World Health Organisation (2016) research evidence proves that physical activity can prevent non-communicable diseases such as cardiovascular disease, hypertension, diabetes, obesity and high cholesterol. In this study, majority of the children with pre-hypertension (90.5%) reported low levels of physical activity during the previous 7 days. To prevent such non-communicable diseases, children and youth (5-17 years of age) should accumulate an average of at least 60 minutes of physical activity per day with moderate intensity. Apart from aerobic exercises muscle and bone strengthening activities should be incorporated on at least 3 days of the week.

Sallis et al, (2012) refers to Physical education as "health optimizing physical education" or HOPE. Physical education forms thus an important part of the education system contributing to public health of any country. Lack of physical activity during PE classes places a huge burden on leisure time physical activity (Myer, 2015). In this regard the majority of boys and girls were inactive or engaged in moderate active (sometimes).

The high crime / safety concerns as reported by the school principals, and low prevalence of active commuting probably reduced physical activity, increase time spent indoors/eating, and hence contributing to the high prevalence of overfatness in the children. The results showed that 61.3% of the children ate food while watching television. The more time children spent watching TV, the more likely they were to be overweight or obese and the more likely they were to have a greater BMI and waist circumference because exposure to this obesogenic environment (WHO, 2016).

Eighty-five percent reported that they had received lessons on healthy eating and 89.7% were aware of the importance of eating fruits and vegetable in boosting immunity. This study shows that 73.5% of children bring their lunch boxes to school every day whereas 10.3%

bring boxes sometimes and 16.1% do not carry lunch boxes at all. Knowledge on the food groups and their importance was higher in older children (9-12 years) compared to the younger ones.

A survey done by Hoque et al (2016) among school children in Malaysia also identified that students understood the definition of healthy food and the types of food that are considered healthy. Although these school children have knowledge on healthy habits, they still consume unhealthy food with high sugar, saturated fat and high salt. Only having knowledge about healthy eating habits is not sufficient; the practical aspect should also be emphasized to learners, because there is no purpose of learning without implementing what has been taught (Woodruff & Hanning, 2009).

Only 40% of children slept for the minimum recommended 10 hours per night during school nights and this shows that the majority of the children go to bed late during school and this contribute to not getting enough sleep. This prevalence of self-reported inadequate sleep is quite high among these school children, which is risk factor for NCDs, because lack of sleep tends to promote unhealthy eating and is a cause of obesity in western countries (WHO, 2016).

Studies have established that children with a waist circumference greater than the 90th Percentile (Central obesity) are more likely to have multiple risk factors for metabolic syndrome (Hirschler, 2005). In this study, waist circumference data shows that more girls (67.6%) were at risk of CMD compared to boys (32.4%). Metabolic syndrome, is a clustering of cardio-metabolic disease (CMD) risk factors such as hypertension, ischaemic heart disease and stroke, high levels of blood lipids, hyperinsulinaemia and raised blood pressure (McCarthy, 2006). Rather than excess general fatness (assessed by BMI), it is excess abdominal fatness, quantified by waist circumference measurement, which is a better measure of risk for these metabolic abnormalities in children of all ages (McCarthy, 2006). Other conditions found in association with overweight and obesity in childhood and adolescence include the risk of developing asthma, or an increase in the severity of existing asthma, low-grade systemic inflammation, obstructive sleep apnoea, early onset of puberty, foot and other skeletal abnormalities, and fatty liver disease (Rossouw, et al, 2012).

In addition, several studies have reported a higher probability for obese children to remain obese in adulthood (Brunet, Chaput, & Tremblay, 2007). This study found more girls than boys at risk of developing CMD (OR= 3.25; P = 0.0004). This result is similar to studies carried out on South African children and adolescents that showed a higher prevalence of overweight or obesity in girls than in boys (Rossouw, et al, 2012).

Factors suggested to play a role in this gender disparity include possible differences in the energy needs between boys and girls, in the levels of physical activity, in behavioural or cultural phenomena and in the timing of sexual maturation (Rossouw, et al, 2012).

The children's age was however not significantly associated with CMD risk (OR = 2.26, p = 0.6888). The results of the study showed that school children from NA03 and NA04 had a higher risk of developing CMD compared to children from the other two schools (X2 = 8.77, p = 0.0325). School children from NA03 and NA04 had a mixed social economic status namely low, moderate and high. In comparison, according to Özdemir (2015), there was a decrease in the prevalence of obesity among adolescents with high-socioeconomic

status, whereas among the low socioeconomic status adolescents' obesity prevalence continued to increase.

The overall prevalence of high blood pressure (Hypertension) among the learners was 0.6% while pre-hypertension was 13.5%. There were no significant difference with blood pressure prevalence among the 4 schools (p value = 0.7). In a study conducted by Özdemir (2015) school children who were obese were identified to have sustained elevations in blood pressure levels suggesting a close association between childhood obesity and essential hypertension.

This study revealed that the school environment is contributing to obesity by: selling unhealthy food in the canteen as well as by the vendors; and low physical activity. All the schools reported having a school canteen that sold a variety of unhealthy food and snacks such as: sweets, crisps, fizzy cool drinks, white bread sandwich and hamburgers/hotdogs. However, it is worth noting that at least the canteen at school NA03 is also selling healthy food/snacks. No school has policy or guidelines on what food to be sold at school canteen or by vendors to the learners. It was also found out that no school has a vegetable garden. It was indicated in the study that the barriers to health promotion in the schools includes: too little time in timetable; too many competing priorities; lack of interest from outside organizations; lack of capacity of human resource; lack of interest from learners; lack of interest/support from teachers and lack of interest/support from parents. This results shows that interventions to reduce obesity and unhealthy lifestyle among the children should involves all those caring and come in contact with the children on daily basis either at home, at school as well as the surrounding environment.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

There are some limitations in the study such sample size and generalizability to the whole country since it was done only in public schools. More studies need to be conducted in different areas of the country. Despite some limitations, this study is important because it is the first of its kind to look at the nutritional status of the children more particular the body composition in that age categories 8-12 years old. It is the first study using stable isotopes to assess the body composition in children in Namibia. The results shows that the prevalence of combined overweight and obesity in girls was high (36.8%) then in boys it was 26.5%. The prevalence of obesity in children 8 to 12 years was 17.4% while prevalence of overweight was 14.8%. The combined overweight and obese was 32% in 8-12 years old schoolchildren in Windhoek. It was found out that BMI-for-age underestimated the overweight and obese (32%) in comparison with body overfatness by deuterium which is (50%).

It was of significant importance to take note that physical activity was low because majority of the respondents did not comply to the minimum standards of healthy PA levels for health benefits. They did not accumulate the recommended 60 minutes/day of moderate to vigorous physical activity (MVPA).

All school canteens as well vendors were selling unhealthy food which may have contributed to consumption of junk foods hence causing of overweight and obese. The general low physical activity, increase in sedentary life such as watching TV, inadequate sleeping hours and car as mode of transport for most learners may also have contributed to the increase of overweight and obese in school children.

Interventions need to be put in place to tackle this increasing prevalence of overweight and obese in children. School is the bet platform to instill healthy eating and lifestyle habits and put mechanism in place to promote healthy lifestyle, which includes healthy food, physical activity and mitigate and control poor lifestyle by limiting advertisement of junk food/ fizzy drinks to the children. Promoting of a diverse diet which promoted traditional foods and even introducing school gardening as an activity could be integrated into an action plan to control obesity in school children.

5.2 Recommendation

- Nutrition and physical education to be integrated into the curriculum and being implemented in all schools.
- More physical activity sessions in school.
- Have a policy on provision of nutritious food available in schools' canteen and food to be packed in the lunch box.
- Educate vendors near schools to sell healthy food to children.
- Training for teachers, other school staff and parents, on the importance of healthy food and physical activity.

- Regulate advertise of unhealthy food to children at schools and in the community
- Employ specialised coordinators to work with schools and communities to increase physical activity and promote simple healthy eating messages using a variety of strategies, including traditional healthy diets and introduction of school gardens as a standard in school extra-mural activities.
- Increase awareness among those professionals who support parents and guardians of the importance of the home environment as a major influencer of children's weight and eating habits.
- Provide support and training for health professionals who have a role in preventing or treating childhood obesity in addressing weights issue (sensitively) with parents, and in promoting healthy eating, and being active in families.
- Support parents/guardians to recognize and become aware of what constitutes a healthy/unhealthy weight for themselves and also their children.
- Engage and support schools to implement health promotion initiatives including nutrition and physical activity policies which promote education and supportive environments to eat healthily and be active.
- Inform parents and children on physical activity guidelines and encourage a reduction in TV viewing time every day by both parents and their children. The recommended are: at least 60 minutes of moderate intensity physical activity every day for children and at least 30 minutes of moderate intensity physical activity on 5 days a week or 150 minutes a week for adults.
- All relevant Stakeholders such as (Namibia Breweries, Food outlets which sell junk food, Ministry of Information and Technology, Ministry of Education and Culture, Ministry of Youth and Sport, Ministry of Agriculture, Water and Forestry, Ministry of Local Government and Housing, NGOs and Private Practitioners) to be involved in the prevention of obesity, promotion of healthy lifestyle such as physical activity and healthy diet.
- The use of a validated PA questionnaire must be considered in the future. More respondents should be included in the use of the accelerometer.

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APPENDICES

Appendix A: Learner questionnaire

GROWTH, HEALTH AND PHYSICAL ACTIVITY IN SCHOOL CHILDREN IN NAMIBIA

Country _____ Country code _____

Name of school _____ SchoolNumber_____

Class _____

Name of administrator/interviewer _____

Date Questionnaire administered_____(dd/mm/yyyy)

Questionnaire ID _____(– 4 digits)

Section A:

This section collects information concerning you and your household. Please answer all questions truthfully. As earlier explained all the information will be kept confidential and used for research purposes only.

(Instructions: Circle the response that corresponds with the most correct answer. In questions where spaces have been left, write the appropriate response.)

1. Name _____
   (Write your name in full, do not use abbreviations)

1. Are you a boy or a girl? (circle) 1. Boy 2. Girl

2. How old are you? _____ Years.

3. Including yourself, how many people currently live in your home? _____

4. How many rooms are there in your house, including the kitchen, dining room, lounge/ sitting room, and bedrooms and outside structures excluding bathrooms? _____

5. In your home, what is the main source of water?
   1. Indoor tap water
   2. Outside tap water
   3. Other water source

7. What kind of toilet do you usually use at home?

8. Flush toilet inside the house
9. Flush toilet outside the house
10. Pit latrine/bucket
11. Other type, Specify _____

8. Tick all items that you have in your home now?

Household items	1. Yes	2. No
Electricity		
Television		
Radio		
Car/motorbike		
Bicycle		
Fridge		
Washing machine		
Telephone/Cell phone		
Computer		
Satellite/cable		
Microwave		

9. What is used for cooking in your home? You can circle more than one.
    1. Gas
    2. Electricity
    3. Wood
    4. Charcoal
    5. Paraffin stove
    6. Other, specify _____

10. Does your mother/guardian work? 1. Yes 2. No

11. If yes, what type of work does she do? _____

12. Does your father/guardian work? 1. Yes 2. No

13. If yes, what type of work does he do? _____

The following section has statements about different aspects of nutrition and physical activity. Kindly indicate whether you agree, disagree or are neutral.

12. When you eat too much fat you can become fat (Knowledge)
    1. Agree
    2. Neutral
    3. Disagree

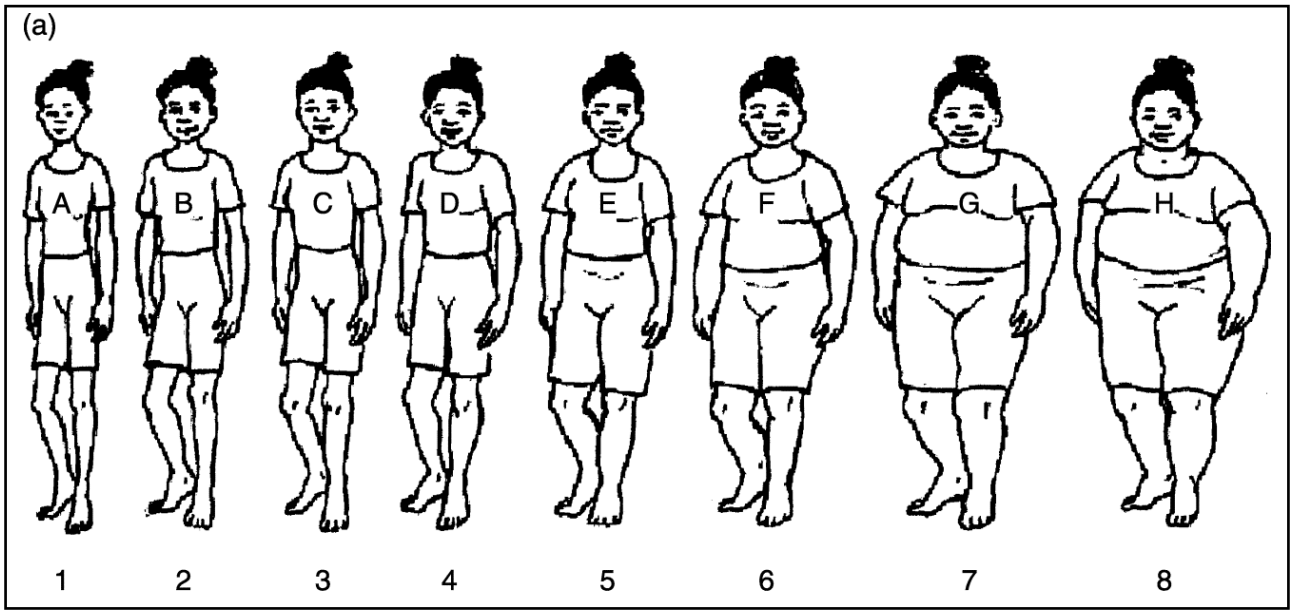
13. Fruits are a healthy snack (knowledge)
    1. Agree
    2. Neutral
    3. Disagree

14. I do not have to worry about the kind of foods I eat because I am still young (attitude)
    1. Agree
    2. Neutral
    3. Disagree

15. I do not like sport ((attitude)
    1. Agree
    2. Neutral
    3. Disagree

16. It is important to do sport/exercise everyday in order to keep your body healthy (knowledge)
    1. Agree
    2. Neutral
    3. Disagree

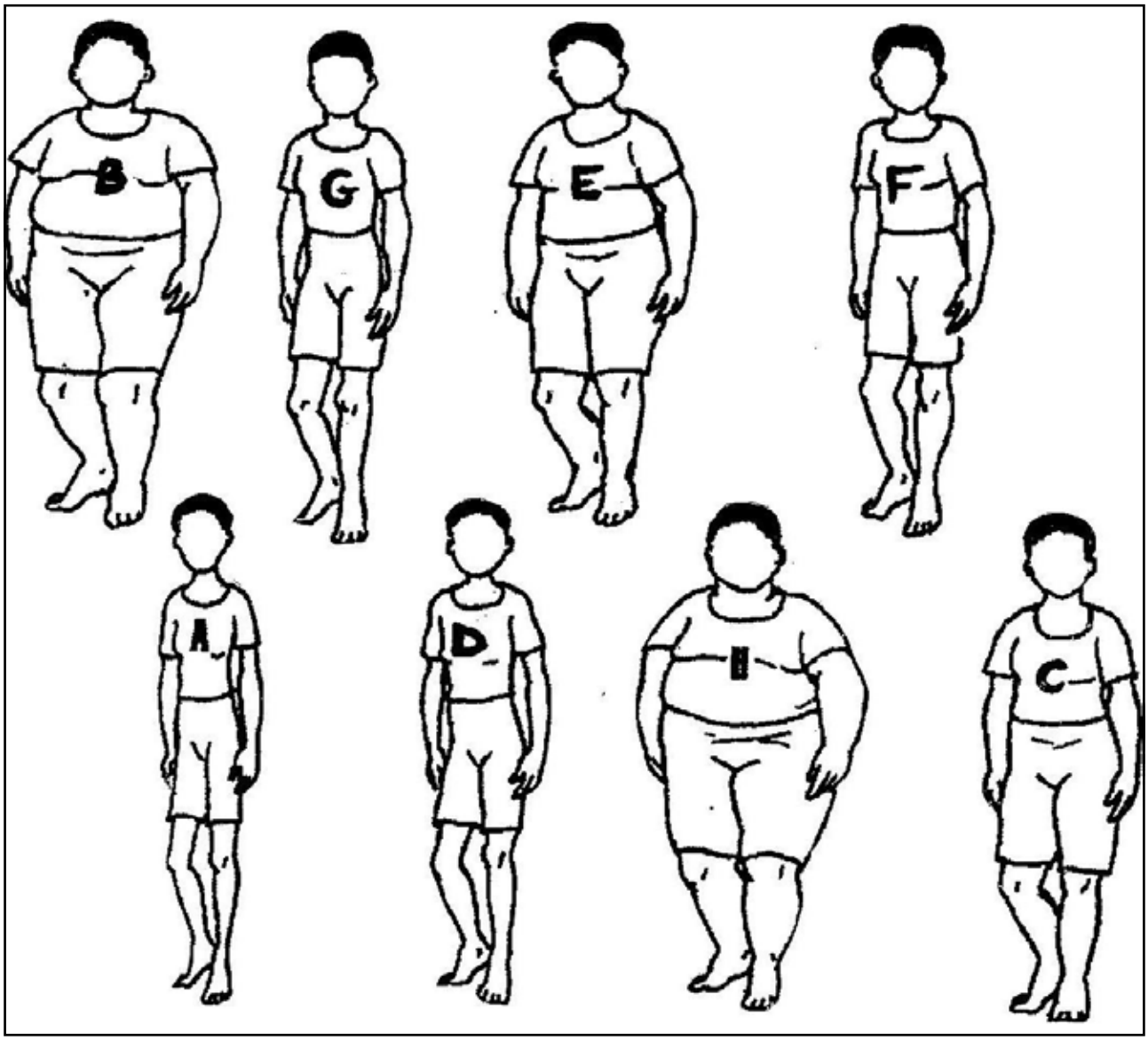
Girls only



17. When you look at these pictures, which one do you think you look like? ___Attitude__

18. Which one would you like to look like? _Attitude____

For boys only



19. When you look at these pictures, which one do you think you look like? _____

20. Which one would you like to look like? _____

LEARNER MEASUREMENTS

1. CHILD'S AGE: years
2. CHILD'S DATE OF BIRTH (d/m/y) _____ (verify by school records)
3. CHILD'S ANTHROPOMETRY :
    a) WEIGHT (kg.):1st:_____ 2nd:_____mean:_____
    b) HEIGHT (cm.): 1st:_____ 2nd:_____ mean:_____
    c) WAIST CIRCUMFERENCE (cm):

1st:_____ 2nd:_____ mean:_____

4. BLOOD PRESSURE (mm/Hg):

First reading: systolic: _____ diastolic:_____

Second reading: systolic:_____ diastolic:_____

Third reading: systolic:_____ diastolic:_____

Mean (2nd and 3rd): systolic: _____ diastolic:_____

CHILDS PUBERTAL STATUS:

(Girls only) Have you started menstruating (bleeding every month/period)? YES/NO

LIFESTYLE AND HEALTH

In the last 7 days, did you eat in front of the television/computer?

Yes		No		Sometimes (2-3 times per week)	

In the last 7 days did you eat your main meal with your family?

Yes		No		Sometimes (2-3 times per week)	

In the past 7 days did you eat breakfast before school?

Yes		No		Sometimes (2-3 times per week)	

If no, is it difficult for you to eat breakfast at home because:

3.1 the people at home do not eat breakfast?

Yes		No	

3.2 there is no food in the house to eat for breakfast?

Yes		No	

In the past 7 days did you bring a lunchbox to school?

Yes		No		Sometimes (2-3 times per week)	Not allowed lunchboxes at school

5. Is it difficult for you to take a lunchbox to school because other children will want your food?

Yes		No		Sometimes (2-3 times per week)	

6.Is it difficult for you to take a lunchbox to school because there is nothing at home to put in your lunchbox?

Yes		No		Sometimes (2-3 times per week)	

7. Is it difficult for you to take a lunchbox to school because no one at home can help you to make a lunchbox?

Yes		No		Sometimes (2-3 times per week)	

4.5 Do you share or exchange what you have in your lunchbox with friends?

Yes		No		Sometimes (2-3 times per week)	

How many days in the last 7 days do you bring money to school?

Every day (5 days)		2-3 times/wk	Never

6. In the past 7 days did you buy anything from the tuck shop/school canteen/vendor?

Yes		No		Sometimes (2-3 times per week)	

6.4 Do you participate in the school feeding scheme?/Do you receive lunch (a meal) from your school every day?

Yes		No		Sometimes (2-3 times per week)	

7. In the past 7 days did you eat fruit?

Yes		No	

7.1 If you do eat fruit, why do you eat them?

7.2 because you like the taste?

Yes		No		Sometimes (2-3 times per week)	

7.3 because people at home eat fruit

Yes		No		Sometimes (2-3 times per week)	

7.4 because you are told to eat them

Yes		No		Sometimes (2-3 times per week)	

8. In the past 7 days do you eat vegetables?

Yes		No		Sometimes (2-3 times per week)	

8.1 If you do eat vegetables, why do you eat them?
8.2 Because you like the taste

Yes		No		Sometimes (2-3 times per week)	

8.3 because people at home eat vegetables

Yes		No		Sometimes (2-3 times per week)	

8.4 because you are told to eat them

Yes		No		Sometimes (2-3 times per week)	

9. When you feel like a snack, what do you eat?

9.1Chips

Yes		No		Sometimes (2-3 times per week)	

9.2 Sweets

Yes		No		Sometimes (2-3 times per week)	

9.3 Fruit

Yes		No		Sometimes (2-3 times per week)	

9.4 Sandwich or cereal

Yes		No		Sometimes (2-3 times per week)	

9.5 Chocolate

Yes		No		Sometimes (2-3 times per week)	

Other
Yes No Sometimes (2-3 times per week)

10. In the past 7 days, did you consume sweetened beverages (cold drinks, fizzy drinks, squash, soda, sweet drink)?

Yes(everyday)		No		Sometimes (2-3 times per week)	

10.1 In the past 7 days have you eaten fast foods (e.g (hot) chips, French fries, burger, hotdog, pizza, shawarma, ikota/Gatsby/rolex)?

Yes		No		Sometimes (2-3 times per week)	

11. In the last 7 days have you ever gone to bed hungry because there was no food?
How many times

Never		1-2 days		>3 days	

KNOWLEDGE

1. Do you have school lessons where you talk about healthy eating?

Yes		No	

2. Is eating fruit and vegetables every day good for our bodies to fight against illnesses like colds and flu (knowledge)

Yes		No		I don't know	

2.4 Eating a lot of sugar, sweets and sweet food…

2.5 Is good for health

Yes		No		I don't know	

2.6 Can make you fat

Yes		No		I don't know	

2.7 Is bad for your teeth

Yes		No		I don't know	

3. Look at the following pictures and fill in the LETTER (A, B, C, D, E, F or G)of the food group you think best fits the answer to the questions below (You can choose a group more than once)

Meat, Chicken, Fish, Eggs	Brown Bread, Rice, Samp, Mealie meal	Vegetables	Fruit	Sugar, Sweets	Fats, oils	Milk, Maas, Yoghurt, Cheese
A	B	C	D	E	F	G
						

3.1 Choose the food group that you should eat the MOST of every day (knowledge) ☐

3.2 Choose the food group that you should eat the LEAST of every day (knowledge ☐

3.3 Choose the food group that gives your body the best ENERGY (knowledge) ☐

3.4 Choose the food group that your BODY uses to BUILD MUSCLES (knowledge) ☐

3.5 Choose the food group that best PROTECTS THE BODY AGAINST ILLNESSES (knowledge) ☐

PHYSICAL ACTIVITY

We are trying to find out about your level of physical activity from the last 7 days (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like skipping, running, climbing, and others.

Remember:
1. There are no right and wrong answers — this is not a test.
2. Please answer all the questions as honestly and accurately as you can — this is very important.

---

1. Physical activity in your spare time outside the school hours: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

	1 No	2 1-2	3 3-4	4 5-6	5 7 times or more
Skipping/clapping & jumping	◯	◯	◯	◯	◯
Roller blading/roller skating/skate boarding.....	◯	◯	◯	◯	◯
Tag/on-on/tip/dodge ball	◯	◯	◯	◯	◯
Walking for exercise/hiking	◯	◯	◯	◯	◯
Bicycling	◯	◯	◯	◯	◯
Jogging or running/cross country.....	◯	◯	◯	◯	◯
Aerobics	◯	◯	◯	◯	◯
Swimming	◯	◯	◯	◯	◯
Baseball/rounders	◯	◯	◯	◯	◯
Dance	◯	◯	◯	◯	◯
Rugby	◯	◯	◯	◯	◯
Badminton/tennis/squash	◯	◯	◯	◯	◯
Soccer/football	◯	◯	◯	◯	◯
Volleyball	◯	◯	◯	◯	◯
Hockey ……	◯	◯	◯	◯	◯
Basketball/netball	◯	◯	◯	◯	◯
Ice skating……	◯	◯	◯	◯	◯
Cricket ……	◯	◯	◯	◯	◯
Running with wheels/tyres……	◯	◯	◯	◯	◯
Judo/karate/boxing ……	◯	◯	◯	◯	◯
Gymnastics……..	◯	◯	◯	◯	◯
Trampoline……...	◯	◯	◯	◯	◯
Other: _____.....	◯	◯	◯	◯	◯
_____.....					

2. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

I don't do PE .....
Hardly ever .....
Sometimes .....
Quite often .....
Always .....

3. In the last 7 days, what did you do most of the time at break? (Check one only.)

Sat down (talking, reading, doing schoolwork)…
Stood around or walked around .....
Ran or played a little bit .....
Ran around and played quite a bit .....
Ran and played hard most of the time .....

4. In the last 7 days, what did you normally do at lunch (besides eating lunch)? (Check one only.)

Sat down (talking, reading, doing schoolwork).…
Stood around or walked around .....
Ran or played a little bit .....
Ran around and played quite a bit .....
Ran and played hard most of the time .....

5. In the last 7 days, on how many days right after school, did you do sports, dance, or play games in which you were very active? (Check one only.)

None .....
1 time last week .....
2 or 3 times last week .....
4 times last week .....
5 or more times last week .....

6. In the last 7 days, on how many evenings did you do sports, dance, or play games in which you were very active? (Check one only.)

None .....
1 time last week .....
2 or 3 times last week .....
4 or 5 last week .....
6 or 7 times last week .....

7. On the last weekend, how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

None .....
1 time .....
2 — 3 times .....
4 — 5 times .....
6 or more times .....

8. Which one of the following describes you best for the last 7 days? Read all five statements before deciding on the one answer that describes you.
A. All or most of my free time was spent doing things that did not require much physical effort .....……
B. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) .....…… ..
C. I often (3 — 4 times last week) did physical things in my free time .....…….. ..
D. I quite often (5 — 6 times last week) did physical things in my free time ……... ..
E. I very often (7 or more times last week) did physical things in my free time …….. ..

9. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.
Little Very

	None	Little bit	Medium	Often	Very often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

10. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)
Yes .....
No .....
If Yes, what prevented you? _____

11. How do you travel to and from school? (Check only one)
By bus, car, van, train/tram ……
I walk ……
Both ……..

12. What time do you go to bed on a school night? .....

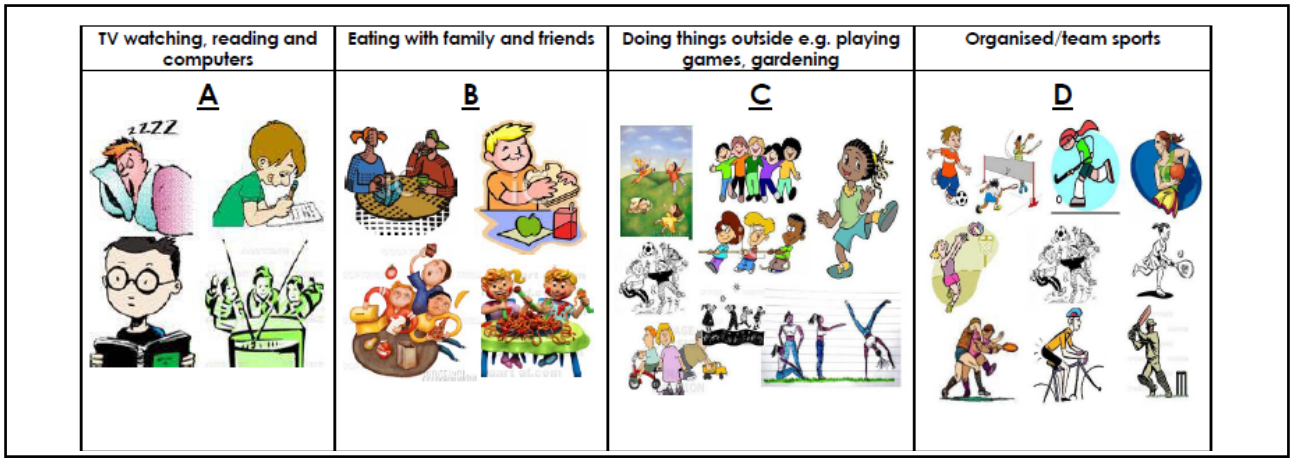
13. What time do you go to bed on a non-school night (on a weekend or on holiday)? ……
……

14. What time do you wake up on a school morning?.....

15. What time do you wake up on a non-school morning (on a weekend or on holiday)?.....

16. How often do you spend time watching TV, playing on the computer, playstation, phone, video games? (check only one)
Everyday……
Most days……
Only on weekends……

Look at the pictures provided below, and fill in the LETTER (A, B, C or D) of the activities which BEST answers each question



17.1 Choose the activities that YOU like the most ☐

17.2 Choose the activities that your FRIENDS like the most ☐

17.3 Choose the activities that are BEST for your health ☐

Appendix B: Key Informant Questionnaire

School Environmental Survey and Observational Schedule

Country _____ Country code _____
Name of school _____ School Number _____
Name of interviewer _____ Date_____(dd/mm/yyyy)
Name of observer _____ Date_____(dd/mm/yyyy)
Position at school of person being interviewed: _____
Date of Consent signed: _____(dd/mm/yyyy)

Section A: School Demographics and Neighborhood Environment

We would like to learn more about your school and the learners and community that your school serves. All answers will remain confidential, and your school will never be mentioned by name or area in any communication or publications emanating from this project.

1. **Grade levels in your school: From Grade ____ to Grade _____**
2. **Number of classes: _____**
3. **Number of learners in your school: _____**
4. **Number of teachers: _____**

5. **The socioeconomic status of the learners within the school and the community that it serves may best be described as:**

____a) lowest socioeconomic status in relation to the region
____b) low to moderate socioeconomic status in relation to the region
____c) mixed low, moderate or high socioeconomic status in relation to the region
____d) upper middle income groups in relation to the region
____e) do not know

6. **How do most learners travel to your school?**

_____a) car or private vehicle
_____b) walk
_____c) ride bicycles
_____d) public transport (bus or train)
_____e) other, specify _____

7. **Which best described the area or community surrounding your school?**

_____a) mostly residential urban or suburban
_____b) mixed land use, (residential and business or commercial)
_____c) mostly commercial or business or industrial
_____d) informal settlements urban
_____e) deep rural
_____f) other _____

8. Please answer the following questions as they best describe the physical environment of the neighborhood surrounding the school:

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
a. There are many shops, markets or other places to buy things within easy walking distance of the school.	□	□	□	□	□
b. There are transit stops (bus, taxi or train) within a 10-15 minute walk from the school.	□	□	□	□	□
c. There are sidewalks on most of the streets in the neighborhood surrounding the school.	□	□	□	□	□
d. There are facilities to bicycle or walk near school, such as separate paths or shared use paths	□	□	□	□	□
e. In the neighborhood, there are several free/low cost facilities, like recreation centres, parks, & playgrounds.	□	□	□	□	□
f. The crime rate in the neighborhood near the school makes it unsafe to go walking at night.	□	□	□	□	□
g. There is so much traffic on the street that it makes it difficult or unpleasant to walk or cycle in this neighborhood.	□	□	□	□	□
h. There are many persons being active in this neighborhood, including walking, cycling, jogging or playing sports.	□	□	□	□	□
i. There are many interesting places to go and things to look at while walking in this neighborhood.	□	□	□	□	□
j. There are many four-way intersections in this neighborhood.	□	□	□	□	□
k. The crime rate in this neighborhood makes it unsafe to go walking even during the day.	□	□	□	□	□
l. The neighborhood near the school is relatively free from litter, rubbish and graffiti.	□	□	□	□	□

9. Please answer the following questions as they best describe the food environment of the neighborhood surrounding the school:

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
a. There is a large selection of fresh fruits and vegetables available in shops & stores in this neighborhood.	□	□	□	□	□
b. The fresh fruits and vegetables in shops & stores in this neighborhood are of high quality.	□	□	□	□	□
c. There is a large selection of low-fat products available in shops & stores in this neighborhood.	□	□	□	□	□
d. There are many fast food restaurants or vendors that sell high fat, or high sugar, low quality foods in this neighborhood.	□	□	□	□	□

10. Is access to the school associated with the following?

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
a. Busy roads with high vehicle traffic	□	□	□	□	□
b. Traffic calming zebra crossings and/or speed humps	□	□	□	□	□
c. Sidewalks and/or pavement for walking on one or both sides of the road.	□	□	□	□	□
d. Signage denoting school zone or pedestrian crossing.	□	□	□	□	□
e. Designated cycle paths	□	□	□	□	□
f. Separate entrance for pedestrians and cyclists vs motorists	□	□	□	□	□
g. Supervision of younger learners prior to school and at the end of the school day entering and leaving the premises	□	□	□	□	□
h. Designated bus stop or public transport stop outside of school used by learners	□	□	□	□	□

Section B. School health, physical activity and nutrition environment observation

11. Which of the following describes the condition of the school/buildings/surrounds?

	No, not at all	A little or somewhat	Yes, very much
a. Clean, with very little litter present	□	□	□
b. Neat, well-looked after, and regular maintenance	□	□	□
c. Disrepair and evidence of vandalism, broken windows, graffiti, and similar	□	□	□
d. Painted murals, planted beds, shade trees, benches for sitting or similar	□	□	□
e. The name board of the school sponsored by a food / beverage company?	□	□	□

12. Please indicate whether the following amenities/facilities are available at the school:

	No, not available	Yes, available
a. Electricity	□	□
b. Running water and taps for drinking for learners	□	□
c. An indoor hall for activity and physical education in bad weather?	□	□
d. Teachers/supervisors seen supervising learners during break times	□	□
e. Posters or messages visible concerning healthy eating, physical activity	□	□

13. Please indicate the number of playgrounds/designated play areas for learners.

Number of playgrounds/designated play areas: _____

14. Describe the condition of these playgrounds:

	No	Yes
a. Mostly grass	□	□
b. Mostly sand with stones	□	□
c. Cement or tarred surfaces	□	□
d. Generally free of glass and other dangerous objects,	□	□
e. Some/ a lot of glass and other dangerous objects	□	□
f. Generally, Grounds clear of litter	□	□

15. Please indicate whether the equipment listed is available for use by learners (and the number if available) as well as, the state of the equipment.

	No/ Non-functional	Yes- number/ Mostly or fully functional
a. Jungle gyms and/or climbing frames	□	_____
b. if yes, what is the condition?	□	□
c. Slides and/or see-saws	□	_____
d. if yes, what is the condition?	□	□
e. Swings / hanging tyres	□	_____
f. if yes, what is the condition?		
g. Playground drawings (hopscotch, four-square, snakes and ladders, fantasy-type markings, or similar)	□	□

16. Please indicate the number of sports fields available for learners.

Number of sports fields: _____

17. Describe the condition of these sports fields:

	No	Yes
a. Mostly grass	□	□
b. Mostly sand with stones c. Cement or tarred surfaces	□ □	□ □
d. Generally free of glass and other dangerous objects,	□	□
e. Some/ a lot of glass and other dangerous objects	□	□
f. Generally, Grounds clear of litter	□	□

18. Please indicate whether the equipment listed is available for use by learners (and the number if available) as well as, the state of the equipment.

	No/ Non-functional	Yes- number/ Mostly or fully functional
a. Nets or goal posts	□	_____
b. if yes, what is the condition?	□	□
c. Painted lines or courts	□	_____
d. if yes, what is the condition?	□	□
e. Swimming pool	□	_____
f. if yes, what is the condition?	□	□
g. Netball/basketball/volleyball/tennis courts	□	_____
h. if yes, what is the condition?	□	□

19. Please indicate the availability of the equipment listed below in this school:

	None	A few	Many
a. Skipping ropes	□	□	□
b. Hoola hoops	□	□	□
c. Indigenous games	□	□	□
d. Soccer			
balls	□	□	□
soccer goal	□	□	□
e. Netball			
balls	□	□	□
Nets/Posts	□	□	□
f. Basketball			
balls	□	□	□
Nets/Posts	□	□	□
g. Cricket			
bats	□	□	□
pads	□	□	□
wickets	□	□	□
h. Hockey			
sticks	□	□	□
balls	□	□	□
pads	□	□	□
goals	□	□	□
i. Rugby			
balls	□	□	□
goal	□	□	□
j. Tennis			
Racquets	□	□	□
nets	□	□	□
balls	□	□	□
k. Weight training equipment	□	□	□
l. Gymnastics equipment	□	□	□
m. Whistles/Beacons/Bibs	□	□	□
n. Athletics equipment	□	□	□
o. Other: ……	□	□	□
p. Other: ……	□	□	□

19. Is structured physical activity currently in the weekly timetable for the learners?
_____Yes _____No If yes;

a. How many sessions per week? _____ Sessions/week

b. How long is each physical activity session? _____ Minutes/session

20. Is structured physical education currently in the weekly timetable?
_____Yes _____No If yes;

a. How many sessions per week? _____ Sessions/week

b. How long is each physical activity session? _____ Minutes/session

Section C. School feeding programme /nutrition policies/vendors:

21. Please provide the answer that best apply to the nutrition policy at the school:

	No	Yes
a. Does the school offer a subsidized feeding scheme?	□	□
b. Does the school have a policy concerning sale of soft drinks or sweets/ chips in the tuck shop or by vendors?	□	□
c. Does the school have a policy concerning the sale of soft drinks or sweets/chips for school functions?	□	□
d. Are learners able to leave school during the day to purchase food or snacks?	□	□
e. Does the school have a policy concerning the types of foods and beverages offered by vendors either within or adjacent to the school?	□	□

22. Is there a tuck shop/snack shop/canteen at the school? If so, please indicate the items that are sold in the shop from the list provided:

	No		Yes
a. Is there a tuck shop/snack shop at the school? If yes, which of the following items are available?	□		□
i. Sweets	ii.	□	□
iii. Chocolates	iv.	□	□
v. Chips (crisps)	vi.	□	□
vii. Fizzy cool drinks or other cool drinks	viii.	□	□
ix. Sports drinks, such as Energade™	x.	□	□
xi. 100% Fruit juice	xii.	□	□
xiii. Fresh fruits or salads	xiv.	□	□
xv. Cooked meals (w/ protein, vegetables, starch)	xvi.	□	□
xvii. White bread sandwiches	xviii.	□	□
xix. Brown bread sandwiches	xx.	□	□
xxi. Hamburgers / hotdogs	xxii.	□	□
xxiii. Koeksisters / doughnuts	xxiv.	□	□
xxv. Slap chips / chip roll	xxvi.	□	□
xxvii. Sausage rolls / pies	xxviii.	□	□
xxix. Ice suckers – bunny licks / ice cream	xxx.	□	□
xxxi. Other: specify_____	xxxii.	□	□
xxxiii. Other: specify_____	xxxiv.	□	□

23. Is there a vegetable garden at the school? If so, please indicate the purpose of the garden and the food produced:

	No	Yes
a. Is there a vegetable garden at the school? If so, please indicate the purpose of the garden and the food produced	□	□
a. To grow food for the learners / feeding scheme	□	□
b. To grow food to give to community members	□	□
c. To grow food to sell to the learners / community members	□	□
d. To teach the learners responsibility	□	□
e. As a recreational activity for the learners	□	□
f. To support the curriculum	□	□
g. To teach learners how to grow vegetable gardens at home	□	□
h. Other: _____	□	□

24. Are there formal or informal vendors at or adjacent to the school? If so, please indicate the items that are sold by these vendors from the list provided:

	No	Yes
a. Are there formal or informal vendors at or adjacent to the school? If so, please indicate the items that are sold by these vendors?	□	□
a. Sweets	□	□
b. Chocolates	□	□
c. Chips (crisps)	□	□
d. Fizzy cool drinks or other cool drinks	□	□
e. Sports drinks, such as Energade™	□	□
f. 100% Fruit juice	□	□
g. Fresh fruits or salads	□	□
h. Cooked meals (w/ protein, vegetables, starch)	□	□
i. White bread sandwiches	□	□
j. Brown bread sandwiches	□	□
a. Hamburgers / hotdogs	□	□
b. Koeksisters / doughnuts	□	□
c. Slap chips / chip roll	□	□
d. Sausage rolls / pies	□	□
e. Ice suckers – bunny licks / ice cream	□	□
f. Other: _____	□	□
g. Other: _____	□	□

Section D. Health challenges for learners and teachers (key informant interview, optional)

24. We are interested in the following health problems. Please select and prioritise the top three health problems experienced by your learners and educators in the last 6-12 months.

	Learners	Educators
a. Tobacco use among	□	□
b. Substance abuse among	□	□
c. Lack of physical activity among	□	□
d. Unhealthy diet among	□	□
e. Overweight among	□	□
f. Underweight among	□	□
g. Chronic diseases of lifestyle, e.g. diabetes, heart disease, high blood pressure	□	□
h. Health problems related to issues of sexuality, e.g. HIV/AIDS, teenage pregnancy		

25. What are the top three barriers to health-promotion programmes in schools? Place a 1, 2 or 3 next to the applicable barrier.

	Priority
a. Too little time within the timetable	□
b. Too many competing priorities	□
c. Lack of capacity / training and availability of human resources	□
d. Lack of financial resources	□
e. Inadequate facilities	□
f. Lack of interest / willingness from outside organisations	□
g. Lack of interest from learners	□
h. Lack of interest / support from teachers	□
i. Lack of interest / support from parents	□
j. Unsafe for learners to stay after school to participate	□

Appendix C: Informed Consent Form

Participant consent form

Instructions: Use the participant consent form to get permission from the parent / guardian to allow the child participates in the study.

Introduction

Thank you for letting us talks to your child and do observation. This Consent Form contains information about the obesity study. The study is being conducted by the Ministry of Health and Social Services (MOHSS), Food and Nutrition Sub-division in collaboration with the International Atomic Energy Agency (IAEA). To make sure that you are adequately informed about your possible participation in this study, we ask that you read (or have read to you) this Consent Form.

Reason for the activity

This study is being done to determine the magnitude of obesity and physical activity levels among school children to design school-based interventions; To use stable isotopes field techniques to assess body composition and physical activity that can be used in large situation assessments and; To identify factors that contributes to the development of obesity and related health risks in school children.

Participation in the activity

Your child is being asked to take part in this study because she/he meets the criteria for participation. We are asking your permission to do the following for your child:

- Do measurements such as: weight, height, waist circumference and blood pressure.
- Child will be given treated water which will help us to measure his/her body composition. The child will be asked to give saliva 3 times i.e. before he/she drinks the treated water, after 2 hours and 3 hours later.
- Monitor physical activity, whereby the child will be required to wear the Accelerometer for 24 hours/day for at least 7 full days.
- Child will be interviewed using a questionnaire that should take about 30minutes.

Your child's participation is completely voluntary. If you prefer your child not to participate, simply say that you do not want.

Possible risks

We do not anticipate any risks to your child if she/he decides to participate in this activity. Refusing to participate in this study will not affect your child in any way.

Possible benefits

Your participation will help us to assess body fat and physical activity to inform the design and improvement of interventions aimed at prevention and control of obesity and related health risks such as diabetes among children between age 8- 11 years in Namibia and Africa in general. It is also important to validate simpler field techniques to assess body composition and physical activity levels that can be used in larger surveys. Furthermore, there is a

need for more data on overweight and obesity in school children using more sophisticated techniques to generate a Namibian data set which would be of local and regional interest.

Confidentiality

If you decide your child to participate in the study, his/her participation and all information your child provide to us is completely confidential and will not be shared with others. She/he will not be identified or named in any reports.

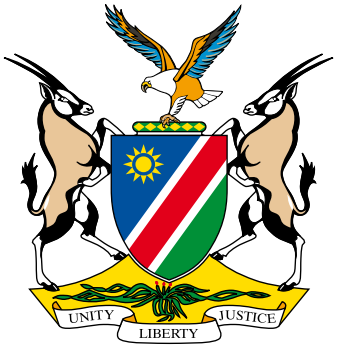
By signing this form with your initials, you are acknowledging that you give consent for your child to participate in this study. Thank you for your help.

_____
Name of the Child

_____
Name of Parent/ Guardian

_____ _____
Signature of Parent/ Guardian (thumb print if signature is not possible) Date

Appendix D: Parents Information



Ministry of Health and Social Services

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Parents' information about the obesity study which will be conducted at the school

- The child can eat breakfast at home in the morning before he/she comes to school, after which the child will only eat after the examinations/assessments at around 12h30.
- The study team will start activities at 08h00 and will be done by 12h30
- The following measurements will be done: Weight, Height, Waist Circumference and Blood Pressure monitor.
- Child will be given treated water which will help us to measure his/her body composition. The child will be asked to give saliva 3 times i.e. before he/she drinks the treated water, after 2 hours and 3 hours later.
- Randomly selected children will be given the Accelerometer to wear for 24 hours/ day for at least 7 full days. These children will be given an Accelerometer Instruction form with the picture and monitor form to be filled on a daily basis.
- Child will be interviewed using a questionnaire that should take about 30minutes.
- The child will receive a nutritious lunch pack after the activities done.

Thanks for your kind co-operation.

Appendix E: Research Field Team Members

	Name	Position	Name of organization
1	Ms. Hilde Nashandi	SHPA	Ministry of Health and Social Services
2	Ms. Nicole Angermund	SHPA	Ministry of Health and Social Services
3	Ms. Sophia Nicodemus	SHPA	Ministry of Health and Social Services
4	Mr. Herman Haingura	SHPA	Ministry of Health and Social Services
5	Mr. Stefanus Chiedzu	Data Clerk	Ministry of Health and Social Services
6	Mr. Tuutaleni Shilyomunhu	CBHC Coordinator	Ministry of Health and Social Services
7	Mr. Antony Samakomva	Registered Nurse	Ministry of Health and Social Services
8	Mr. Fred Alumasa	Project manager	FANTA 3
9	Ms. Rachael Mhango	Nutrition Advisor	I-TECH
10	Mr. Panduleni Kondombolo	Logistic Officer	CDC
11	Dr. Ronnie Bock	Head of Department and Laboratory	University of Namibia
12	Mr. Augustinus Mbangu	Laboratory Technician	University of Namibia
13	Ms. Sylvia Nafuka	Laboratory Technician	University of Namibia
14	Ms. Hilya Arthur	Volunteer	Ministry of Health and Social Services

Appendix F: Participating Schools

1	People's Primary School
2	Elim Primary School
3	Suiderhof Primary School
4	Van Ryhn Primary School

Appendix G: Additional analyzed table

G.1 Physical Activity

Table G.1.1 Number of times respondents engaged in physical activity in the previous 7 days

	No	1-2	3-4	5-6	7 or more
Skip/clap/jump	62 (40%)	38 (24.5%)	23 (14.8%)	11 (7.1%)	21 (13.5%)
Rollers	119 (76.8%)	17 (11%)	12 (7.7%)	3 (1.9%)	4 (2.6%)
Tag/catches	69 (44.5%)	43 (27.7%)	20 (12.9%)	3 (1.9%)	20 (12.9%)
Walking/hiking	53 (34.2%)	40 (25.8%)	23 (14.8%)	13 (8.4%)	26 (16.8%)
Cycling	94 (60.6%)	29 (18.7%)	5 (3.2%)	10 (6.5%)	17 (11%)
Running/jogging	59 (38.1%)	43 (27.7%)	21 (13.5%)	12 (7.7%)	20 (12.9%)
Aerobics	129 (83.2%)	11 (7.1%)	4 (2.6%)	4 (2.6%)	7 (4.5%)
Baseball	129 (83.2%)	14 (9%)	2 (1.3%)	4 (2.6%)	6 (3.9%)
Dancing	56 (36.1%)	46 (29.7%)	21 (13.5%)	11(7.1%)	21 (13.5%)
Rugby	117 (75.5%)	16 (10.3%)	6 (3.9%)	5 (3.2%)	11 (7.1%)
Tennis	114 (73.5%)	23 (14.8%)	8 (5.2%)	5 (3.2%)	5 (3.2%)
Soccer	79 (51%)	25 (16.1%)	17 (11%)	9 (5.8%)	25(16.1%)
Volleyball	131 (84.5%)	9 (5.8%)	5 (3.2%)	3 (1.9%)	7 (4.5%)
Hockey	134 (86.5%)	10 (6.5%)	3 (1.9%)	3 (1.9%)	5 (3.2%)
Basketball/netball	83 (53.5%)	34 (21.9%)	12 (7.7%)	9 (5.8%)	17 (11%)
Ice skating	152 (98.1%)	1 (0.6%)	1 (0.6%)	1 (0.6%)	-
Cricket	129 (83.2%)	14(9%)	7 (4.5%)	1 (0.6%)	4 (2.6%)
Running with wheel	123 (79.4%)	14 (9%)	7 (4.5%)	5 (3.2%)	6 (3.9%)
Karate/judo	112 (72.3%)	26 (16.8%)	7 (4.5%)	4 (2.6%)	6 (3.9%)
Gymnastics	129 (83.2%)	12 (7.7%)	5 (3.2%)	5 (3.2%)	4 (2.6%)
Trampoline	121 (78.1%)	10 (6.5%)	7 (4.5%)	7 (4.5%)	10 (6.5%)
Swimming	98 (63.2%)	24 (15.5%)	17 (11%)	6 (3.9%)	10 (6.5%)

Table G.2: Boys risk of CMD by waist circumference and waist to height ratio

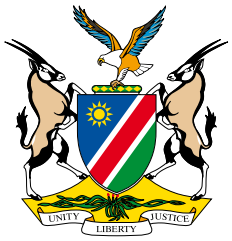
Boys age in years						
		8	9	10	11	12
Waist height ratio	At risk of CMD	14.3%	31.2%	29.4%	36.8%	50%
	Not at risk of CMD	85.7%	68.8%	70.6%	63.2%	50%
Waist circumference	At risk of CMD	14.3%	37.5%	41.2%	42.1%	50%
	Not at risk of CMD	85.7%	62.5%	58.8%	57.9%	50%

Table G.3: Girls risk of CMD by waist circumference and waist to height ratio

Girls Age in year						
		8	9	10	11	12
Waist height ratio	At risk of CMD	25%	33.3%	38.1%	57.1%	25%
	Not at risk of CMD	75%	66.7%	61.9%	42.9%	75%
Waist circumference	At risk of CMD	56.3%	71.4%	57.1%	57.1%	25%
	Not at risk of CMD	43.7%	28.6%	42.6%	42.9%	75%

Using Waist to Height Ratio boys at the age of 12 years old (50%) are centrally obese therefore they are at risk of CMD while girls at the same age are at 25%. Except at the age of 12 years old, generally girls at all other age categories are more at risk of CMD compared to their counterpart boys of the same age. By comparing waist to height ratio and waist circumference to assess the risk of CMD, this study shows that more girls are at risk of CMD when using waist circumference but less when using waist to height ratio. On the side of the boys, it seems there is not much difference for those at risk of CMD by using waist to height ratio and waist circumference.

NOTES



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