

Determinants of Dietary Patterns and Obesity among Secondary School Adolescents in Harare, Zimbabwe, 2016

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Abstract: *Background:* The dietary patterns are becoming a major public health concern. The current data from various studies in Zimbabwe shows that there was an increase in the prevalence of obesity among secondary school adolescents in Harare. There is a link between eating habits and obesity. This study was conducted to explore the factors influencing dietary practices among adolescents in Zimbabwean schools.

Methods: A school based analytic cross sectional study was conducted with 283 pupils aged 13-19 years. Systematic random sampling was used. Data was collected using self-administered questionnaire based on the ecological framework. The aim of the study was to identify the relationship between dietary patterns and occurrence of obesity. Bivariate and multivariate logistic regression analysis was used to identify the relationship between dietary patterns and obesity.

Findings: The prevalence of obesity was 11.4%. Females were 6.79 (95% CI: 2.17-21.22 p=0.001) more likely to be obese. Consumption of sugar and sweetened beverages were associated with occurrence of obesity; beverages (AOR=3.62, 95%CI=1.99-10.91 p=0.025); eating of snacks in between meals (AOR=2.40, 95%CI=1.03-5.64 p=0.004); so was being located in high density suburb (OR=0.45, 95CI=0.21-0.99 p=0.023); consuming burgers (OR=4.41, CI=1.54-12.64 p=0.006); being a pupil in lower adolescent with age less than 16 (OR=1.99 95%CI=0.99-4.27 p=0.038). Consuming a special diet that is recommended or as a choice was protective from obesity though this was not statistically significant. Not removing visible fat from meat was a risk factor for developing obesity. Eating the traditional maize meal staple food, sadza was protective to being obese (OR=0.3514, 0.16-0.78)

Conclusions: The study showed that obesity is a cause for concern among school children as seen by 11.4% prevalence. Choice of meals is done by parents, eating a home cooked meal such as sadza, participating in meal planning was found to be reinforcing factors. There is need to create awareness on students, parents, teachers and the wider community to increase the adoption of healthy dietary practice among school children.

Keywords: Dietary patterns, obesity, determinants, secondary school adolescents, ecological model.

INTRODUCTION

The adolescent obesity epidemic is a global issue [1]. The Global Burden of Disease (GBD) estimates that individual unhealthy dietary factors contribute up to 4% of the global disease burden [2]. Several studies have shown that obesity is a risk factor for developing chronic conditions such as diabetes and hypertension. The adolescent stage is important for the establishment of eating behaviours which are carried into adulthood [3]. The eating habits of adolescents raise major concern for public health, since some studies have shown an association between inadequate diet during this phase and the occurrence of chronic diseases in adulthood [4]. It is thus imperative to establish dietary patterns among adolescents and their relationship to obesity so as to come up with appropriate interventions. Worldwide patterns of neither diets nor their trends are well established [5]. Whilst it is necessary to support dietary interventions, few studies are in place to address the characteristics adolescents [6].

According to Adnan Saleem, prevalence of obesity is increasing throughout the world at unprecedented rate. In developing countries obesity has been linked to rapid changes in lifestyle, urbanisation and rapid economic development [7]. Even though dietary patterns among adolescents have been assessed in several countries [4], Global Burden of Diseases report encouraged a critical scientific re-evaluation of the hard evidence underpinning policies on risk factors as it can be fashionable and easy to blame the fast food industry for obesity, without exploring important initiative for improving health such as increasing fruit intake [2].

STATEMENT OF THE PROBLEM

In Figure 1 below, information from the Zimbabwe Demographic Health Survey (ZDHS) 2010-11 showed that 12.6% of women aged 15-19 were overweight and obese compared to 11.3% prevalence noted for the same age group in 2005-06. This showed a rise in overweight and obesity from 2005 to 2010 as illustrated below. Similarly, whilst the ZDHS of 2005-06 did not capture prevalence of overweight and obesity among men aged 15-19; prevalence was noted to be 1% among men aged 15-19 in 2010-11 ZDHS. The ZDHS also showed that obesity was high among men and

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adolescents in urban settings of Zimbabwe (ZDHS 2010-11).

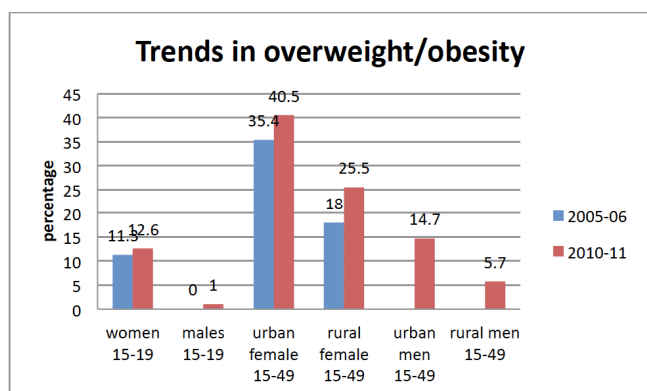


Figure 1: Trends in overweight/obesity according to ZDHS.

NOTE: Overweight BMI > 25; Obesity \geq BMI 30.

SOURCE: ZDHS 2005-6 and ZDHS 2010-11.

Both ZDHS 2005-06 and ZDHS 2010-11 reviewed Harare as having a greater burden of overweight and obesity compared to all other provinces of the country. In response to this finding the study was carried out in Harare to identify relationship between dietary patterns of adolescents and occurrence of obesity in secondary schools.

The study therefore sought to explore the relationship between dietary patterns and occurrence of obesity among adolescents in secondary schools of Harare since it had the highest burden of obesity according to the ZDHS trends.

BACKGROUND

Adolescent in this study is defined as a person in the state of development between puberty and maturity and being on the age 13 through to 19 years old. Lower adolescents are the pupils whose age is less than 16 years, whilst older adolescents are those in the age group 16 to 19. Diet refers to the type and amount of food nutrients a person takes and the dietary patterns are the routine diets of people. Dietary patterns were assessed 24 hours, 7 days and over long periods of time. Adolescents are encouraged to eat a healthy diet plate which comprise of half the portion of vegetables, quarter of proteins and a quarter of carbohydrates. Any deviation from a healthy diet plate is referred to as unhealthy dietary patterns.

Obesity in this study was referred to as risk factor for developing chronic conditions such as diabetes and hypertension. Adolescents who do not follow the recommended healthy dietary plates are at risk of

having obesity. Body Mass Index (BMI) is an anthropometric index of weight and height that is defined as body weight in kilograms divided by height in metres squared. BMI is an accepted index for classifying adiposity and it is recommended for use in both adults and adolescents. However, BMI has its own limitations of classifying some people as obese when they are not. It is encouraged to measure the body fatty of the child to conclusively confirm the risk of obesity in them. However, the digital instruments present at the time of the study could measure weight and height of the pupils only. Hence, BMI was only used as the proxy to measure the prevalence of obesity among adolescents. The BMI is both gender and age specific in adolescents because adiposity varies with age and gender during childhood and adolescence. The BMI of the adolescents is plotted on a screening tool for boys and girls. BMI for age at or above the 95th percentile is classified as overweight and between 85th and 95th percentiles is classified as at risk of overweight ("CDC: Safer-Healthier People," 2016). Therefore BMI charts for boys and girls were used for boys and girls respectively.

For adolescents with the age of 18 and 19 are classified as adults to measure their nutritional status. Therefore the following classifications were used in this study, based on WHO guidelines. The classifications are also age-independent for same both sexes

Table 1: WHO BMI Classification

Classification	BMI Principal cut off points (kg/m ²)
Underweight	<18.50
Normal range	18.5-24.99
Overweight	\geq 25.00
Obese	\geq 30.00

Ene-Obang *et al.* found an 11.4% and 2.8% prevalence of overweight and obesity, respectively, among adolescents in Nigeria's secondary schools. The study showed females were more likely to be obese than males, and location affected the proportion of overweight and obesity [8]. A study in Dubai, United Arab Emirates showed that adolescent boys were more likely to be obese at 14 years whilst girls were likely to be obese at 13 years. The same study showed a significant association between obesity and snacking conducted between breakfast and lunches. It showed that eating breakfast at schools especially among girls and fast food consumption by boys at home was associated with increased risk of obesity [9]. Most

adolescents in Zimbabwe carry packed lunches to school and some of them skip specific meals at home and the association of such patterns with their nutritional status is not clear.

Another study in Saudi Arabia showed that three anthropometric proxies for the participants' nutritional status (BMI, Height-for-age and Weight-for-age) were found to be significantly correlated with none of the traditional correlates of family size, parents' education, family income and mother work. The only exception is the significant negative correlation between the family monthly income and the respondent height-for-age [10]. The use of ecological approach in a study by Dipt A Dev resulted in the children whose parents used restrictive measures being 1.75 times more likely to be overweight or obese [11]. In the study on adolescents in Harare's secondary schools, it was interesting to see the association of such factors in relation to their dietary patterns and the problem of obesity among school children.

Irregular eating habits or snacking patterns increases during adolescence. This is a cause for concern because children who engage in irregular eating or snacking are at increased risk of being overweight [12]. A study in West Scotland pointed out that adolescents consumed at least one or more of crisps, sweets/chocolate, biscuits, fresh fruit, soft drinks and cereals on daily basis as snacks [13]. It was therefore imperative to find out the frequency of eating poultry feeds, fish, fruit juice and the dairy products among selected study participants in Harare's secondary schools. This study sought to explore on the component of self-regulation behaviour and the subjective norms to see how they influence the dietary patterns and obesity among adolescent children in Harare, Zimbabwe.

A qualitative study conducted among adolescents in Tehran indicated that majority of adolescents who ate fast foods frequently were more likely to be from middle income families. The inclusion criteria of the Tehran study recruited boys and girls aged between 15 and 18, living in Tehran and only those willing to participate in the study were recruited [14]. In a study conducted in Australia by Sarah A. McNaughton *et al.*, socio economic indicators were not associated with dietary patterns [4]. Another separate cross national comparison of obesity among adolescents showed that higher socio economic status subjects were more likely to be obese in Russia and China, but this was contrary in the United States where low socio economic status

subjects were at greater risk [15]. It was therefore importance to recruit children of school going age in secondary schools of Harare, Zimbabwe and the participants were therefore drawn from both uptown schools and the high density schools. The schools whose children were randomly selected into the study were essentially representative of adolescent population in secondary schools of Harare.

In a study by Maria del Mar Bibiloni, most over-fat boys were not worried about their body weight whilst girls who were over-fat wanted to be thinner. This had a bearing on them having more restrictions on their Western diets [16].

A systematic review and meta-analysis study by Lisa Te Morenga showed that increase in the consumption of sugar sweetened foods was associated with the relative increase of children's weight. The intervention trial assessed by the same study showed that advice given to children to reduce sugar sweetened food was associated with low compliance which made it difficult to conclude on the weight changes observed [17]. In another review by Vasanti S Malik showed that daily increase in sugar sweetened beverages was associated with a 0.06 increase in the BMI of the children [18]. Most pupils in the secondary schools do take sugar sweetened beverages in Zimbabwe and it is important to understand the effects of these sugars to their nutritional status.

In a food and nutrition education programme among adolescent population in São Paulo, dietary patterns of adolescents improved, making it a viable and inexpensive method to prevent disease and improve health and quality of life. The understanding of food labels and the dietary patterns coupled with an increase of intake of legumes, milk, dairy products, fruits, and vegetables was seen. A comprehensive intervention should include more about family habits and culture, which are effective on long-term food practices, which appears to be the case of excessive intake of high-sugar and high-fat foods [19]. A different study by Diana B Cumba showed that whilst family and teacher education on healthy diet resulted in many changes; it did not result in BMI changes among adolescents [20]. According to the nutrition departments in Harare, few studies were in place to give recommendations on alternative interventions which can help improve the dietary patterns of adolescents and therefore fight to reduce the prevalence of obesity. It was interesting to explore how the adolescents were actually eating in Harare to map up possible interventions.

In a study by M. Anitha Rani, 40.7% of the participants ate fruit more than once per day whilst 74.5% of the pupils ate vegetables more than once per day [21]. Eating more fruit and vegetables is associated with reduced risk of obesity [22]. It is a concern that pupils in schools actually eat less of fruit and vegetables. The home and peer support towards eating of fruits and vegetables had to be explored under their dietary patterns.

A study by Melisa N Laska showed that people in the mid to late twenties who took pleasure in food preparation to include vegetables were more likely to have been regularly involved in food preparation during adolescents' stage. Taking part in food preparation during adolescents was a good predictor of a healthier dietary pattern five years later [23].

In a study by Ahmad Allafi *et al.*, most pupils spent more time watching television (TV) or sitting on a computer, and girls had a tendency to spend more time on TV, and thus it limited their time to participate in physical exercise or sport [24]. Lack of physical exercise, dietary patterns and sedentary lifestyles can also lead to cases of obesity among adolescents. Very little information is written about the effects of these factors towards obesity and mainly the effects of dietary patterns on obesity among adolescents. Bhurosy and Jeewon also call interventions at various levels of education institutions to address issues of physical exercise [25]. Beyond dietary patterns of adolescents lack of physical and sedentary lifestyles can affect the prevalence of obesity and overweight.

In a study conducted by Fan *et al.* in Korea, children who had more adherence to the issued national dietary guidelines had lower BMI values compared to those who showed little adherence. Those who adhered fed more on milk and dairy products. Countries in the developing regions need to consider the feasibility of utilising such guidelines to curb obesity, and Zimbabwe as a country is should not be spared.

In a study by SichiriRosely conducted in Brazil, traditional diet which comprised of rice and beans were strong negative patterns towards the occurrence of obesity, whilst fat (mainly butter and margarine) were strong positive dietary patterns which led to the occurrence of obesity. The Western diet which comprised of deep fried snacks and dairy products were strongly associated with becoming obese [26]. The western diets are growingly being accepted in developing countries, and in Harare, Zimbabwe.

Associations of such dietary patterns thus remained a gap to be explored.

Garry Egger *et al.* (1997) [27] highlighted ecological approach to be crucial in containing obesity pandemic. Garry Egger *et al.* also suggested that research should generate an understanding and measuring the "obesogenic" environment is critical to realize the success. Sarah L. Booth, PhD *et al.* (2001) [28], they highlight the importance of shaping dietary patterns behaviour, yet few strategies are available for focus on changing environmental factors to address the negative dietary patterns and reduce the prevalence of obesity on key populations, including the adolescent population age group. This points to address dietary factors beyond traditional eating patterns.

Socioeconomic and Cultural Contexts

Savage *et al.* (2007) [29] indicate that babies are born into various perspectives of cultural beliefs and food variety that help them to learn acquire and embrace what food is given to them and they eat the food for survival.

They further explain that the parents can easily influence the type amount and variety of food at household level as influenced by culture and socio-economic conditions. Cultural orientation affects perception and attitudes towards certain foods and this can feed into the whole process of food choices and preparation. The findings from our study supports that in most cases children eat what is cooked by the mother. Culturally it is unheard of that a child will deviate from what parents have put on the table.

Ruth Oniang'o *et al.* (2003) [30] indicate that food choice constitutes a form of cultural expression. They confirm that despite globalization in Africa food choice is very much local specific This is so because of the following factors: selection of seeds to grow food, cultivation; growing of food, harvesting, storage, preparation of food are all culturally related rituals. The whole process in Africa is sanctioned by does and don'ts that have guided food choices in communities for centuries. In Zimbabwe for instance black Zimbabweans have totems which usually relate to animals, fish crocodile plants or trees. The significance of the totem is that one is not allowed to eat meat or plant or anything related to ones totem. Thus a child may be prevented from eating e.g. fish in their diet and the mother will prepare meals that maybe controlled by cultural beliefs.

Justification

It was therefore necessary to develop and make use of an ecological framework, in Figure 2 below, to explore the various individual and family factors which influence the dietary patterns of adolescents and their nutritional status and these were included in the data collection process. The findings from this study will be used to develop nutrition education in schools and to provide evidence for policy makers.

Research Question

What is the relationship between dietary patterns and obesity among adolescents in secondary schools of Harare, Zimbabwe?

Broad Objective

- To explore the relationship between dietary patterns and occurrence of obesity among adolescents in secondary schools of Harare, Zimbabwe.

Specific Objectives

- To determine the prevalence of obesity among adolescents in secondary schools of Harare, 2016.
- To identify individual factors associated with occurrence of obesity among adolescents in secondary schools of Harare, 2016.
- To identify the social-cultural factors associated with obesity among adolescents in secondary schools of Harare, 2016.

- To determine family environment factors associated with obesity among adolescents in secondary schools of Harare, 2016.

METHODS

Study Design

The aim of the study was to explore the relationship between dietary patterns and occurrence of obesity among adolescents in secondary schools of Harare, Zimbabwe. A cross sectional study design was used to assess dietary patterns of adolescents and measurement of the BMI index was done. The study design allowed the researcher to come up with the snapshot of prevalence of obesity and it was most suitable as it provided suitable platform to observe and analyse the relationship between dietary pattern variables and obesity.

The study setting included pupils from secondary schools in Harare and the target population were students in form 1 to form 6 within the secondary schools of Harare. Study participants were pupils enrolled in the secondary schools of Harare. The participants were recruited from both public and private institutions. The pupils who refused to volunteer into the study were excluded from the study and the study only recruited adolescents who were enrolled in the secondary schools of Harare.

In the sampling procedure, secondary schools registered by the Ministry of Primary and Secondary Education were stratified, that is on the basis of whether they were government or private and based on

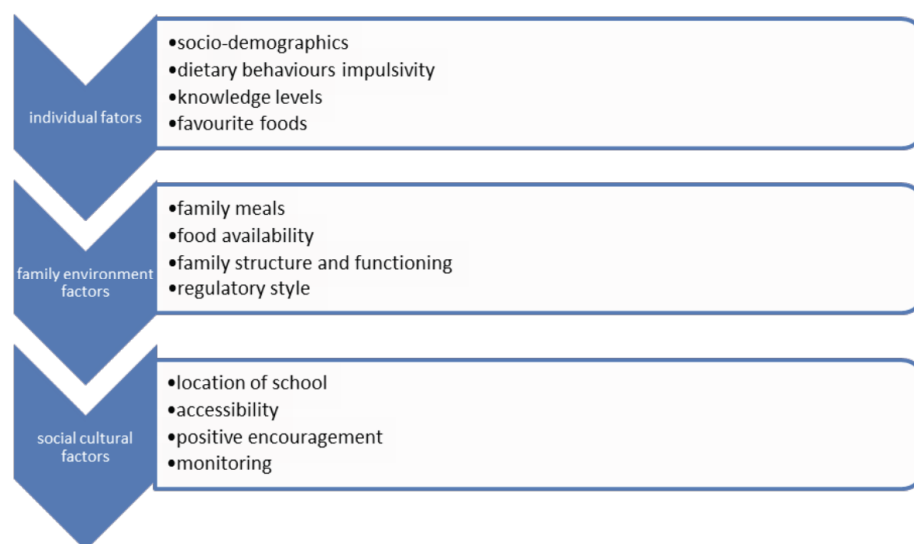


Figure 2: The ecological framework below was used to guide the study.

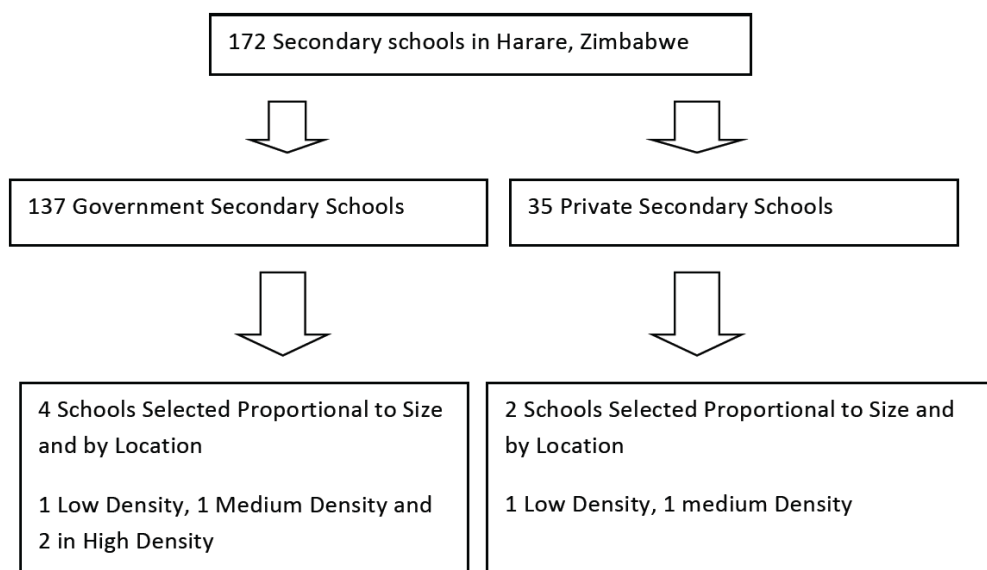


Figure 3: Sampling procedures.

their geographic location, that is, located in low density, medium density and high density.

Each school was asked to provide the list of classes for each form from form 1 to form 6. The researcher randomly selected one class per stream without replacement. The selected classes provided a list of pupils in their class registers. A total of 6 pupils were randomly selected from each of the classes without replacement. If the pupils selected were absent or refused to take part of the study, then they were excluded from the study. The study required the researcher to sample pupils from different classes in all the secondary streams in order to ensure that all the age groups were covered, and the study had to be conducted in different school settings. At the end of the study, all the age groups were represented.

The minimum sample size was calculated using the Dobson formulae as indicated at 95% CI, with minimum error to be deleted (d) being 5%. Using the prevalence of obesity of 12.6% noted among women 15-19 years in Harare province as stated within ZDHS 2010, the following sample size calculations were reached.

$$n = \left(\frac{Z_{\alpha/2}}{d} \right)^2 p(1 - p)$$

Where $z_{\alpha/2}$ (95 CI) = 1.96, p (prevalence) $[(z_{\alpha/2})^2 p(1 - p)] / d^2 = 0.5$, d (minimum error) = 0.05

$$N = [(1.96)^2 (0.126 \times 0.874)] / 0.05^2$$

$$N = 169.15$$

Hence, minimum sample size required for the study was 169.

In order to cater for non-response 10% was added to the sample to cater for adolescents who were left out due to opting out and from absenteeism from school. The sample size therefore ended comprising of 283 participants. The factoring in the attrition from participants increased sample size and power of the study.

During the development of data collection tools, a self-administered questionnaire was developed consisting of open and closed ended questions. The questionnaire was pretested at Herentals Highfields College. After pretesting, a pilot study was conducted at St Peters Kubatana secondary school and modifications to the entire study and tools were made.

The Using the weight and height measurements obtained during the study, Body Mass Index (BMI) was calculated using the following formula;

$$BMI = \frac{Mass (kg)}{[height (m)^2]}$$

A set of BMI for age chart tools for boys and for girls were drawn from the World Health Organization [WHO] and Centres of Diseases Control (CDC) international referencing and these were used to classify the nutritional status of children aged between 13 and 17. The children were classified as being obese, normal or undernourished for their age. Those 18 and 19 years of age were classified using the World Health

Table 2: Socio Demographic Characteristics of Study Participants

Socio-demographic characteristic		Frequency (N=283)	Percentage (%)
Sex	Male	129	45.6%
	Female	154	54.4%
Religion	African tradition	1	0.4%
	Muslim	3	1.1%
	Apostolic	74	26.1%
	Pentecostal	99	35.0%
	Protestant	106	37.5%
Child lives with	Both parents	196	69.3%
	Mother only	53	18.7%
	Father only	11	3.9%
	Not living with either parents	23	8.1%
Survival status of parents	Both parents alive	223	78.8%
	Mother alive but father is dead	39	13.8%
	Father alive but mother is dead	13	4.6%
	Both parents are dead	8	2.8%

Organization's BMI classifications for adults as such classifications are slated for their age below and the classifications were applied to both sexes.

During data processing and analysis the prevalence, frequencies, proportions, odds ratios, stratified Chi square tests and logistic regression analysis were obtained, using Epi info 3.5.3 and Microsoft Excel® 2007 was used to generate graphs. All calculations were made at 95% confidence interval (95% CI). Univariate analysis was initially conducted to produce tables and graphs. This was followed by bivariate analysis to examine relationship between dietary patterns and obesity. Stratified analysis was done for factors found to be statistically significant in the bivariate analysis to control for confounding and identify effect modification. Stepwise logistic regression analysis was used to estimate measures of association for significant variables found in the bivariate analysis at the $p = 0.25$ level. The researcher conducted logistic regression analysis for all the variables at the 0.05 level (95% CI) removing all non-significant variables until all variables had been factored.

LIMITATIONS AND DELIMITATIONS OF THE STUDY

- Physical activity was not included in the study and there is need to include it in future research as it can have influence on obesity.
- The BMI was used in relation to distribution of body weight only and shape of the body of the pupils was not considered.
- The education level of the parents was not assessed and it will be worthwhile for future

studies to correlate education levels of parents to the dietary patterns and knowledge levels among adolescents.

- Adolescents were encouraged to tell the truth during the interviews and assurance of non-disclosure of personal information was guaranteed through-out the study. Recall bias was limited by using Likert scale responses and allowing adolescents to freely provide information on what they had eaten in the previous day and in last week(s).

RESULTS

The findings are presented in the form tables, graphs and figures with related descriptions and explanations provided.

Table 2 above shows that 31 out of 283 participants (11.4%) were obese or overweight. The mean Body Mass Index (BMI) of the pupils was 20.38 kg/m² (StdDev=3.355, Variance=11.258). The study also showed 25th percentile BMI of 18.794 kg/m² whilst the 75th percentile was 34.51 kg/m². The mode BMI was 16.05 kg/m², whilst minimum BMI=14.3 kg/m², and the maximum BMI was 34.51 kg/m².

Table 3 below shows that female students were 6.64 times likely to be obese compared to male students. Obesity was more common in lower adolescent age group (age<16 years) with lower adolescent showing 1.99 times more likelihood of being obese compared to the older adolescents (Age=16-19 years). Those enrolled in high density suburbs of

Table 3: Bivariate Analysis on Factors Associated with Obesity among Adolescents

Factor	Crude OR	CI	P-value
Sex	6.64	2.26-19.54	<0.001
Lower adolescent(<16 years)	1.99	0.99-4.27	0.038
Location	0.45	0.21-0.99	0.023
Eating fast food chickens	3.59	1.05-12.22	0.033
Eating pizza	4.00	1.15-18.37	0.025
Eating burgers	4.41	1.54-12.63	0.006
Snacking	2.52	1.12-5.69	0.011
Consuming sugar sweetened beverage drinks	4.96	1.82-13.47	0.002
Eating sadza	0.31	0.16-078	0.004
Living with neither parent	0.35	0.05-2.68	0.157
Receiving pocket money	0.30	0.11-0.84	0.018
Carrying packed lunch	2.31	0.96-5.56	0.028
Receiving most shopping responsibility	0.66	0.31-1.40	0.142
Having most meal planning responsibility	0.86	0.40-1.89	0.357
Having most meal preparing responsibility	1.18	0.50-0.36	0.362
Eating most breakfasts at home	2.33	0.53-10.24	0.131
Eating most lunches at home	1.34	0.61-2.95	0.240
Eating most dinners at home	0.48	0.13-1.79	0.149
Ever received information on a healthy diet	3.05	0.89-10.36	0.028
Following a special diet	1.15	0.55-2.43	0.355
Not removing visible fat from pork, beef or lamb	1.09	0.44-2.69	0.422
Caregiver employed	1.16	0.42-3.19	0.403

Harare were 0.45 times less likely to be obese compared to adolescents enrolled in the Central business district schools or in low density situated schools. Those who ate the traditional sadza were 0.35 times less likely to be obese than those who did not eat sadza as the main traditional meal.

Pupils who ate fast food chickens were 3.59 times more likely to be obese compared to those who didn't eat them. Burgers eaters were 4.41 times more likely to be obese compared to non-eaters of burgers. Snacking habit among adolescents was 2.52 times more likely to result in obesity compared to those who did not eat snacks both within the school and the home environment.

Pupils who carried packed lunches to school were 2.31 times more likely to be obese or overweight compared to those who didn't carry any packed food to school.

Pupils who received health information about a healthy diet remained 3.05 times more likely to be obese than those who had not received any health information.

Table 4: Various Sources of Information on Healthy Diet

Source of information	Frequency	Percentage
Parents	75	31%
Media	59	24.4%
Teachers	52	21.5%
Health service provider	44	18.2%
Church	12	5.0%
Total	242	100%

Table 4 above shows that 31% of the pupils received information on healthy diet from their parents. Media was responsible for 24.4% of healthy diet information disseminated to the children whilst teachers were responsible for the 21.5% of the information disseminated.

Table 5: Special Types of Diets Followed by Secondary School Adolescents in Harare, Zimbabwe

Type of special diet	Frequency (n)	Percentage (%)
Low fat	57	48.3%
Weight reduction	28	23.7%
Low cholesterol	15	12.7%
Ulcer	7	5.9%
Diabetic	6	5.1%
Low sodium	5	4.2%
Total	118	100%

Table 5 above shows that most pupils (48.3%) were on low fat diet whilst 23.7% were on weight reduction diets.

Table 6: Independent Factors Associated with Obesity among Secondary School Adolescents in Harare, Zimbabwe

Independent factor	Crude OR	Adjusted OR	CI	P-Value
Sex	6.64	6.79	2.17-21.22	0.001
Sugar sweetened beverage drinks	4.96	3.62	1.99-10.91	0.025
Snacking	2.52	2.40	1.03-5.64	0.004

Table 6 above shows that sex of the child was associated with obesity. Females were 6.64 times more likely to be obese than male pupils. The consumption of fizzy drinks and snacking habits were the independent factors associated with obesity among adolescents in this study. Those who consumed fizzy drinks were 4.96 times to be obese compared to those who didn't drink the fizzy drinks. Snacking was 2.52 times more likely associated with becoming overweight or obese.

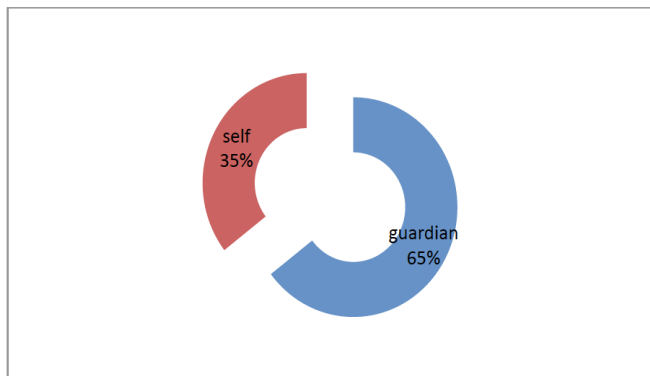


Figure 4: People who decide food eaten at home.

Figure 4 above shows that 65% of the guardians decide the food eaten at home whilst only 35% of the pupils decided they food they ate.

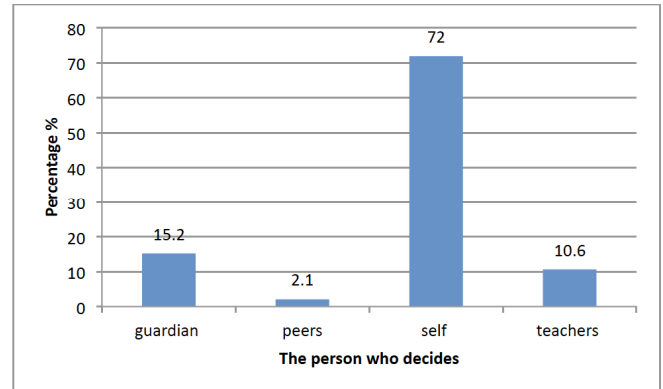


Figure 5: People who decide food eaten at school.

According to Figure 5 above, most pupils (72%) decided the food they eat within the school environment. Guardians, peers and teachers very little influence on what the pupils eat at school.

Table 7: Food Preferences among Adolescents

Type of food	Frequency (n=283)	Percentage
Sadza	155	54.8%
Bread	126	44.5%
Chicken	92	32.5%
Vegetables	84	29.7%
Rice	69	24.4%
Potatoes	50	17.7%
Eggs	42	14.8%
Spaghetti	30	10.6%
Beans and peas	25	8.8%
Fruits	21	7.4%
Dairy foods	19	6.7%
Burgers	19	6.7%
Pork	18	6.4%
Fish	17	6.0%
Macaroni	16	5.7%
Pizza	13	4.6%
Salads	9	3.2%
Cheese	3	1.1%

According to Table 7 above, most preferred food among adolescents was sadza (54.8%), followed by bread (44.5%), chicken (32.5%) and rice (24.4%). Burgers, pizza, salads and cheese were also among the food favourites of adolescents.

Table 8: Motivation Towards Food Preferences

Motivation	Frequency(n)	Percentage
Good tasty food	93	35.9%
Easy food availability	71	27.4%
Least expensive	67	25.9%
Easy to prepare	7	2.7%
All of the above	21	8.1%

Table 8 above shows that most pupils' food preferences were motivated by the taste of the food (35.9%), easy availability (27.4%), and the least expensiveness of the food items bought (25.9%).

Table 9: Frequency of Reading Food Labels among Adolescents

Reading of the labels	Frequency (n)	Percentage (%)
Sometimes	133	47.0%
Always	101	35.7%
Regularly	18	6.4%
seldom	12	4.2%
Never	19	6.7%

In Table 9 above, only 35.7% of the pupils were in the habit of always reading the food labels. A total of 4.2% and 6.7% seldom or never read the food labels respectively.

According to Table 10 below, most pupils (2.79) on the Likert scale were more on the agreeing side that they can't buy vegetables at school, whilst most of the (2.70) agreed that vegetables are inexpensive. Most pupils (2.90) liked vegetables and 2.98 agreed that fruit was available at home, and most of them disagreed that to fruit being expensive to buy.

In Table 11 below, most households were in support side eating of vegetables (3.30) and eating of fruits by their children (3.39). Most of the parents bring their adolescents fruit and vegetables to try at home.

Table 12 below shows that pupils complement each other towards eating a healthy diet (2.56), though at much lower rates compared to household support. Most of them brings or give each other fruit to try (2.93), but very few of them actually bring each other the fruit to try (2.34).

DISCUSSION

The study agreed that obesity is actually a notable problem of concern within schools. The prevalence of

obesity found at 11.4%. This is comparable to the prevalence of overweight and obesity found by Ene-Obong in Nigeria [8]. This shows that adolescents in Harare have not been spared by the problem of obesity, putting them at a greater risk of developing chronic heart failure and suffering stroke later in life. Earlier interventions are necessary by ascertaining the diets being followed by most of these pupils.

The problem of obesity was significant mostly among girls compared to boys. Lower adolescents whose age group is less than 16 were more likely to be obese compared to the older adolescents who age group lays between 16 and 19. This finding is in agreement with a study by Bin Zaal *et al.*, and they observed that more boys were likely to obese at 14 years and girls were likely to be obese at 13 years [9]. Both of these age groups do lay in the lower adolescent category.

Dietary patterns show significant association with obesity. The habit of snacking in between meals were (AOR=2.43, CI= 1.03-5.64, p=0.004) more likely to be associated with being obese. This is in line with other studies which showed snacking as associated with obesity. Consumption of sugar sweetened beverage drinks was also seen as a significant risk factor for being obese as those who drank the sugar sweetened carbonated drinks were (AOR=3.62, CI=1.99-10.91, p=0.025) more likely to be obese than those who did not. This is in line with Malik *et al.* who showed that sugar sweetened beverages were associated with a 0.06 increase in children's BMI [18]. Lisa TeMorenga also showed that increase in the consumption of sugars was associated with relative increase in BMI [17].

Removing a small part or not removing a small part of fat on pork, beef or lamb was not statistically with presents of obesity among adolescents during the study. However, a study conducted in Brazil indicated that eating deep fried products and taking high fat products (margarine and butter) was significantly associated with being obese [26]. The use of such products should however be recommended only in average proportion without replacing the traditional dietary foods such as sadza which were found to be protective among adolescent who took it as the main meal compared to western diets. This agrees with Sichieri as they observed traditional foods tended to be protective from being obese [26].

The pizza eating subjects were more likely to be obese compared to those who did not eat pizza, whilst

Table 10: Attitudes of Pupils Towards the Eating of Fruit and Vegetables on the Likert Scale
(Strongly disagree=1, Disagree=2, Agree=3, strongly agree=4)

Attitudes towards eating fruit and vegetables	Strongly disagree	Disagree	Agree	Strongly agree	Score
I can't get vegetables in restaurants	19.8%	45.0%	25.9%	9.4%	2.25
A member of my household won't eat vegetables	33.9%	44.3%	16.1%	5.7%	1.94
Fruit is available at home	2.8%	17.8%	58.4%	21.1%	2.98
I like most vegetables	7.1%	22.5%	48.9%	21.4%	2.90
I don't like fruit	53.6%	35.7%	5.7%	5.0%	1.62
I think vegetables are inexpensive	13.9%	24.3%	39.3%	22.5%	2.70
I don't have time to prepare vegetables	21.5%	55.9%	16.1%	6.5%	2.01
I usually carry fruit to school	8.2%	33.2%	45.4%	13.2%	2.64
I usually buy lots of vegetables	16.8%	19.6%	31.4%	32.1%	2.44
I can't afford to buy fruit	36.4%	49.3%	10.4%	3.9%	1.82
I can't buy vegetables at school	16.8%	19.6%	31.4%	16.8%	2.79

Table 11: Household Support Towards a Healthy Diet
(Never=1, Seldom=2, Sometimes=3, Often=4)

Household support towards a healthy diet	Never	Seldom	Sometimes	Often	Score
Complements your attempts to eat a healthy diet	9.6%	7.1%	46.8%	36.5%	3.10
Make you guilty or pester you for not eating	27.3%	6.4%	40.4%	25.9%	2.22
Encourage you to eat vegetables	7.4%	6.0%	35.7%	50.9%	3.30
Encourage you to eat fruits	3.9%	7.1%	35.5%	53.5%	3.39
Talk about food and nutrition with you	16.0%	8.5%	51.1%	24.5%	2.84
Brings fruits home for you to try	6.0%	7.4%	52.8%	33.7%	3.14
Bring vegetables home for you to try	6.4%	4.3%	40.8%	48.6%	3.16

Table 12: Peer Support Towards a Healthy Diet
(Never=1, Seldom=2, Sometimes=3, Often=4)

Peer support towards a healthy diet	Never	Seldom	Sometimes	Often	Score
Complements your attempts to eat a healthy diet	26.2%	7.1%	51.1%	15.6%	2.56
Make you guilty or pester you for not eating	37.9%	6.4%	43.3%	24.4%	2.65
Encourage you to eat vegetables	31.6%	9.2%	41.1%	18.1%	2.46
Encourage you to eat fruits	16.0%	9.6%	41.1%	33.3%	2.92
Talk about food and nutrition with you	25.5%	8.9%	45.7%	19.9%	2.60
Brings fruits home for you to try	36.2%	6.7%	44.0%	13.1%	2.93
Bring vegetables home for you to try	48.8%	22.8%	23.5%	5.06%	2.34

burger eaters were 4.41 times more likely to be obese compared to non-eaters of burgers. Those who consumed fast food fried chicken were 3.59 times more likely to be obese compared to those who did not practice the eating of fast food chickens regularly.

It is also surprising that pupils who admitted to receiving information on a healthy diet were 3.05 times more likely to be obese than those who had not received any health education. The most important source of information among these adolescents is from

parents (31%), followed by media (24.4%), and teachers (21.5%). This agrees with a study by Cunha *et al.* findings that family and teacher education resulted in dietary changes but it did not result in the changes in children's BMI [20]. However, Balsado *et al.* showed that food and nutrition education improved dietary patterns of adolescents [19]. However, a study by Dipti A Dev *et al.* suggested that the use of restrictive measures by the parents could result in 1.75 times more likelihood of being overweight or obese depending on the parents' food preferences [11].

The pupils who also carried packed lunch to school were also 2.31 times more likely to be obese compared to those who did not carry any packed lunch to school. In the school environment, most pupils (72%) were responsible for the decisions they made on the food to eat whilst at school. Guardians represented 15.2% whilst teachers were responsible for 10.6% of decision making. This raises the need for parents to monitor the packed lunches of pupils to include a balanced diet. Most parents need to be educated on healthy diet as most of them tend to impose their health diets on pupils whether bad or good. The pupils need to be educated on what food healthier diets. Melisa N Laska indicated that most pupils who carry healthier food practices and preparation during adolescents' stage were likely to carry it into the mid and late twenties of their life [23].

Apparently, most pupils (35.9%) are driven by taste of food whilst 27.4% are driven by the food available in the school canteens. A small section (25.4%) is driven by the low cost of food in the school canteen.

Pupils learning in high density secondary schools were 0.45 times (CI=0.21-0.99, $p=0.038$) less likely to be obese compared to pupils enrolled in the low density area or in the Central Business District of Harare. Pupils whose caregivers were either formally or informally employed were 1.16 times likely to be obese though not statistically significant (CI=0.42-3.18, $p=0.40$). This is in agreement with a cross national comparison by Youfa *et al.* which showed that less socio economic status subjects were more likely to be obese in the United States. A similar study in Russia and Japan showed that high socio economic status subjects were more likely to be obese [15].

Most pupils in secondary schools of Harare were very worried with their weight. This was seen by the 43.8% low fat diet and 23.7% weight reduction diet. This is in agreement with a study by Maria del which indicated that over-fat resulted in most pupils restricting

most Western diets [16]. However the study findings failed show statistical significance between being on a special diet and being obese.

It is of interest to note that whilst this study agreed to most pupils liking the vegetables to eat, most of them also agreed to vegetables being least expensive, but they admitted to the school environment not offering support to ensure vegetable as a common dish. This contradicted with the home food environment as most households offered to bring them various vegetables to try. In the school environment few of the pupils offered to bring vegetables for others to try. However, most pupils share or bring each other fruit to try in school environment. At times the pupils find it difficult to buy the fruit to try in school environment as they fail to afford it especially the low resourced pupils. The eating of fruit and vegetables should be promoted in the school environment as it is associated with the reduced risk of being obese [22]. The responsible Ministry of Health and Child Care, and the Ministry of Primary and Secondary Education need to consider instituting the dietary guidelines to the eating habits of adolescents and help in the reduction of obesity. The nutrition department and health promotion departments could take the leading roles and there are greater chances of such interventions going a long way to reduce obesity and tackle nutrition challenges among adolescents and other school going children. Adherence to the dietary guidelines used in North Korea was shown to be successfully associated with occurrence of lower BMI outcomes among their own adolescents. We need to consider the use of dietary guidelines in schools to ensure right information is disseminated in secondary schools of Harare.

For those pupils who were obese it could be interesting to find out whether physical exercise has a bearing on their nutritional status. It is known that those who participation in physical exercise have reduced chances of being obese. This can yield better results if coupled with interventions to reduce sedentary lifestyle among adolescents [24]. Bhurosy and Jeewon goes a step further by calling for more incentives which goes beyond dietary patterns to target physical exercise at various levels of education system, ultimately leading to reduction of cases of obesity among adolescents (Bhurosy and Jeewon, 2014) [25].

CONCLUSION

Obesity is a common problem among adolescents in secondary schools of Harare with a notable

prevalence of 11.4% observed during the study. Fast food fried chickens, snacking and consumption of sugar sweetened beverages was mostly associated with occurrence of obesity. Obesity was also found as more common problem among adolescent girls compared to boys. Being a student of the high density was actually protective to being obese compared to those pupils who were actually enrolled in the schools within the Central Business District of Harare and in the schools within the low density suburbs. Therefore, there is need to educate adolescents on healthy dietary patterns for all children from financially able families yet residing in both high density and low density suburbs of Harare. The eating of traditional sadza was found to be very protective to being obese among adolescents who participated in the study. The school food environment should be targeted to sell more of the traditional meals and not to have a limit on fast foods or fried snacks.

RECOMMENDATIONS

1. More targeted interventions are needed at various educational levels in secondary schools of Harare. The targeted food environments around schools should be made to ensure the presents of much healthier foods at low costs and this should include more of the fruit and vegetables.
2. The interventions need to include the parents and teachers of the pupils who need to be educated on the risk factors of obesity and various dietary measures of preventing obesity. The quality of education given to pupils is poor, it makes it difficult for them to come up with healthier lunch packs and they will end up buying more of the fast fried western foods compared to the traditional foods like sadza which were found protective of being obese.
3. Since most pupils eat their dinners at home in the presents of the guardians, health workers and school health masters need to equip parents and guardians of the children with the right information to result in proper dietary informed decision.
4. Pupils should partake in food preparation at home as several studies point out that those who take part in food preparation at home during adolescents' stage will continue to be protected even into their mid or late twenties of their life.

5. Routine screening of obesity in schools is necessary for adolescents. Most of them lack the monitoring of their weight and height, thus ending up overweight by not closely monitoring their BMI.
6. More studies which go beyond dietary patterns and obesity should aim to include issues of physical excises and target to see on the effects of obesity.
7. The Ministry of Health and Child Care together with the City of Harare Health Department should work towards formulation of dietary guidelines which strengthens adolescent healthy eating behaviours.
8. A similar study should be conducted in rural settings of Zimbabwe before coming up with dietary guidelines to rule out obesity and dietary patterns as a challenge within such settings.

LIST OF ABBREVIATIONS

BMI	= Body Mass Index
CI	= Confidence Interval
HIV	= Human Immune Deficiency Syndrome
JREC	= Joint Research Ethics Committee for University of Zimbabwe, College of Health Sciences and the Parirenyatwa group of Hospitals
LMIC	= Low and Middle Income Countries
MOHCC	= Ministry of Health and Child Care
MRCAZ	= Medicine Research Control Authority of Zimbabwe
NCDs	= Non Communicable Diseases
NNS	= National Nutrition Strategy
TB	= Tuberculosis
WHO	= World Health Organization
ZDHS	= Zimbabwe Demographic Health Survey
ZIMASSEST	= Zimbabwe Agenda for Sustainable Socio-Economic Transformation

DECLARATIONS

Ethics Approval and Consent to Participate

Ethical approval to conduct the study was obtained from Joint Research Ethics Committee for University of Zimbabwe, College of Health Sciences and the Parirenyatwa group of Hospitals (JREC Ref:172/16). A clearance to conduct the study was also obtained from Medical Research Council of Zimbabwe (MRCZ/B/1109).

A permission to conduct the study was also granted by the Ministry of Primary and Secondary Education Offices at national, provincial, district and school level during the conduct of the study.

Consent for Publication

Ascent to participate in the study was obtained from the pupils and care givers of adolescents, giving permission for children to participate in the study. The pupils who were aged 18 and above gave their own consent by signing informed consent forms during the study. The study does not expose personal details of study participants.

Availability of Data and Materials

The dataset for the study is available upon request from the author(s).

Competing Interests

The author(s) have no conflict of interest whatsoever in this study.

FUNDING

The project was self-funded by the authors of this study.

AUTHORS' CONTRIBUTIONS

All authors were involved in the planning and implementation of the study. All authors were also involved in the writing of the final report upon the completion of analysis of study findings.

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