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The role of Fruit and Vegetable Consumption in preventing Obesity among Adolescents in Ilala Municipality in Dar es Salaam

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ABSTRACT

In spite of the growing body of evidence highlighting the protective effect of fruits and vegetables, their intake is still low. The aim of the study was to determine the role of fruit and vegetable consumption on preventing obesity among the students of Ordinary Level Secondary Schools in Ilala Municipality in Dar es Salaam. A cross-sectional study was carried out to 111 Ordinary Level Secondary School students aged between 13 and 19 years, comprising 51.4% males and 48.6% females. The subjects were conveniently selected to participate in the study. A questionnaire was used to collect information on subjects' profiles, fruit and vegetable consumption as well as nutritional status. Chi-square test was used to determine the relationship between the various factors such as fruit and vegetable consumption, education and occupation status of the head of household on obesity. A p-value ≤ 0.05 was considered statistically significant. Most students consumed less than the Ministry of Health of the United Republic of Tanzania's recommended daily intake of 280g, with 78.5% not meeting the fruit requirement and 98.7% not meeting the vegetables requirement. Maternal influence emerged as a significant factor in shaping the consumption of fruit and vegetable habits. The educational and occupational status of heads of households were found to be associated with the consumption of fruits (p=0.004) and vegetables (p=0 .049). Regarding the nutritional status of the students, 65% had a body mass index within the normal range, 28.8% were underweight, 2.3% were overweight, and 4.0% were obese. Inadequate fruit and vegetable consumption in the study area necessitates targeted campaigns to promote increased intake among students.

Keywords: *School children, students, adolescents, consumption pattern, nutritional status, food preference*

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INTRODUCTION

Fruits and vegetables (FV) are foods with low energy density in relation to the volume consumed, which favours the maintenance of healthy body weight (Tande *et al*, 2021**).** Therefore, they are an important component of a healthy human diet. They are good sources of vitamins and minerals, proteins and dietary fibres which help to prevent constipation (Wallace *et al*., 2020; Balasubramanian and Ragunathan 2012). Regular consumption of adequate amounts of FV could prevent major diseases such as cardiovascular diseases (CVD) and some cancer (Bellavia *et al*., 2016**)**. These diseases are major causes of morbidity and mortality worldwide. They contribute to the rapid epidemic growth of non-communicable diseases (NCDs) in developing countries (WHO, 2002**)**. A lot is known about FV intake among adolescents (Seidu *et al*, 2021; Bakker *et al* 2020; Nijhuis *et al*, 2020; Sirfan *et al*, 2020; Ziaei *et al*, 2019; Kpodo *et al*, 2015). In spite of the growing body of evidence highlighting the protective effect of FV (Aune *et al*, 2017, Wang *et al*, 2014, Liu, 2013**)**, their intake is still inadequate in both developed and developing countries (Layade and Adeyo, 2014). Despite of the significant roles played by FV; little is known about its consumption.

In Tanzania, like other developing countries, most studies have focused on the production, processing and marketing of FV (Tylewc *et al*, 2019; Phogat *et al*, 2016), with less attention to their consumption, especially among students. Furthermore, current data revealed that adolescents are highly affected by overweight and obesity as a result of poor lifestyle behaviours. Therefore, they are predisposed to risks of NCDs such as diabetes, kidney diseases, high blood pressure, and many others (Sahoo *et al*, 2015). In Tanzania, little is known about FV consumption and its effects on obesity among Tanzanian students. Thus, the present study aims to assess the effects of FV consumption on obesity in this population. This information may help determine efficient and age-appropriate strategies for health promotional activities to increase FV intake, thereby preventing obesity and related chronic diseases among adolescents.

METHODOLOGY

Study design

The current study was cross-sectional in design aimed at examining the effects of consuming FV on obesity among students of secondary schools in Ilala Municipality in Dar es Salaam region. The intended outcome of the study is to determine the prevalence, types, frequency, and quantity of FV consumption among students. Additionally, the study will identify the factors promoting FV consumption.

Study area

The current study was conducted in Ilala Municipality, one of the five Municipalities in Dar es Salaam region, Tanzania. The researchers selected this Municipality as it is renowned for its diverse socio-economic demographics, encompassing both affluent and lower-income populations. This diversity offers the opportunity to gain a comprehensive understanding of FV consumption patterns across various socio-economic groups. Additionally, Ilala Municipality is centrally located within Dar es Salaam, making it a strategic choice in terms of research accessibility and logistical

considerations. It is bordered by Temeke Municipality on the South and Kinondoni Municipality on the North. The Municipality covers an area of about 273 Square Kilometers and has a population of 1,220,611 (NBS and OCGS, 2013**)**. Administratively, Ilala Municipality has 26 wards with a total of 98 registered Ordinary Level Secondary Schools with 49 Government and 49 private schools. The total number of students attending ordinary level secondary schools in Ilala Municipality was 54,084 (Verbal communication from Ilala Municipal Office, 2020). Ilala Municipality, faces several urban challenges affecting FV availability and accessibility. Inefficiencies in supply chains, poor infrastructure, and long distances from rural farms lead to delays and higher costs, reducing FV freshness and availability (Lema *et al*., 2014). Economic disparities also hinder access, with high poverty rates pushing residents toward cheaper and less nutritious foods. Rapid urbanization brings lifestyle changes such as busy schedules and limited space for home gardening, further decreasing FV intake. Local markets offer inconsistent FV quality and variety, while supermarkets provide better options at higher prices, limiting access for low-income families.

Sample size and sampling procedure

All students between Forms I to IV constituted the sampling frame. Adolescents were chosen because it is a crucial stage for forming lifelong dietary habits. Researching FV consumption among students allows for the identification of current dietary patterns and opportunities to instill healthy eating habits early in life. Additionally, adolescents' dietary habits have significant implications for their current and future health. Understanding FV consumption among students can inform public health initiatives aimed at reducing the prevalence of diet-related diseases and improving overall well-being. A sample size of 111 subjects was calculated for the current study following formula by Ndunguru, (2007). This sample size was calculated by considering the population of students in Ilala Municipality (54,084), the prevalence of FV consumption (52%) (Anggraeni *et al*, 2017), the confidence level of 95% and the desired level of precision of 0.05. Considering the total number of schools in the Municipality, a sample of 34 schools (a third) was chosen to participate in the study. These exemplary schools were picked randomly from each ward such that 17 schools were Government and 17 schools were private. Inclusion criteria encompassed children with a regular school attendance record, approved by their parents/guardians/teachers to participate in this study. Another criterion involved students without any known dietary restrictions or medical conditions significantly affecting FV consumption. Exclusion criteria applied to students whose parents/guardians/teachers did not provide consent for participation in the study, those allergic to particular FV and students with a history of irregular school attendance. Additionally, students with chronic health conditions or dietary restrictions that may impact their FV consumption were excluded from the study. The process of getting respondents from each school was through a random sampling procedure. The researchers assigned yes' or 'no' words to each piece of paper telling whether one could or could not participate in the study respectively.

Thereafter the papers were folded to hide their content in them. Each student was then asked to randomly pick the paper.

Data Collection

A semi-structured questionnaire was employed in collecting data for this study. The questionnaire was used to collect information on subjects' profiles and FV consumption. The first section collected information on socio-demographic and economic information. Other sections included students' preferences on FV, parental intake of FV and their influence on the same to the student. Another section solicited information on home availability and accessibility of FV, students' competition of FV over unhealthy foods and nutrition benefits of FV. The last section sought information on the nutritional status of the subjects. Questionnaires were self-administered to all the students in their respective schools through guidance from the researcher especially on clarifying unclear questions and or instructions. Data were collected in the mid-morning before the students' brains are exhausted with other class activities of the day. Weight was measured following standard procedures. The respondent was required to stand on the adjusted weighing scale with minimal clothes and bare feet so as to attain actual body weight. The reading observed was recorded to the nearest 0.1 kg. Height was measured using a wooden height board. The respondent was required to stand straight on the board, without shoes while laying the 'back of the head' and the heel of the feet on the board of a scale. Then the measuring board was adjusted to determine the height of an individual and recorded to the nearest 0.1 cm. Thereafter, the measurements of height and weight were used to calculate the body mass index (BMI) by using WHO Anthroplus. Furthermore, the study collected information on promoters to FV consumption.

Statistical Analysis

Quantitative data was entered into an Excel spreadsheet and statistical analysis was conducted using the software IBM Statistical Product and Service Solutions (SPSS) version 24. The participants' characteristics, including demographics, and individual responses to statements were presented as frequencies (n) and percentage (%). Furthermore, mean and standard deviations were used for presenting continuous data. The independent variable in this study is the consumption pattern of FV, while the dependent variable is the risk of obesity. A Chi-square test ($\chi 2$) statistic was used assess the association between dependent and independent variables. Body Mass Index of below 18.5 indicates underweight, 18.5-<24.9 indicates normal, 25-29.9 indicates overweight and ≥30 indicates obesity (WHO, 2000). A p-value ≤ 0.05 was considered statistically significant.

Ethical approval

This study was approved by the Research Committee of the Department of Biological and Food Sciences, at The Open University of Tanzania. In addition, administrative approval to conduct the study in the sampled schools was obtained from the Education Department in Ilala Municipal Council, and the Heads of the study schools. Consent to participate in the study was sought from the respondents and their parents or guardians.

RESULTS

Socio-demographic and economic characteristics of the respondents

Of 111 students involved in the study, 51.4% were males and 48.6% were females. Their mean age was 15.23, ranging between 13 and 19 years. The majority of respondents (68.5%) were between form I and II, while 31.5% were between form III and IV. The average family size was six people with males (69.4%) being the predominant household heads (HHH). Nearly half (44.2%) of HHH was educated to University and College levels while 38.7% were educated to Ordinary and Advanced secondary level education. About 7.2% of HHH were educated to the primary school level and the rest (9.9%) had an informal education. Fifty seven percent of HHH were formerly employed while 42.4% were running a business and a few (1%) were peasants. About 83.6% of the students were provided with daily pocket money while 16.4% were not. With regards to the spending of the pocket money given, it was revealed that 59% of students used their pocket money to buy other foodstuffs like samosas, chocolates and soft drinks such as carbonated drinks. However, 41% of the respondents spent their pocket money on non-food stuff such as cigarette, gambling and *'upatu',* a saving scheme that involves daily or any other agreed time and amount of contribution by every member of a group with the intention of distributing the money for its members in any agreed time such as daily, weekly or monthly. Thereafter, each member obtains credit without incurring interests, usually done by rotating. The money collected was mainly used for buying goods such as clothing, airtime and shoes (62.4%), parties (16.6%) and gambling (12%), while a few (8.1%) and (0.9%) spent on buying FV respectively.

Daily consumption of fruits and vegetables among adolescents and factors associated with their intake

It was revealed that the majority of students (69.4%) did not consume fruits on the daily basis while 30.6% did. Among those who consumed fruits frequently, bananas were the most common, with 22.8% reporting regular consumption. In addition, Vitamin A-rich fruits such as mangoes (18.7%), watermelon (15.7%) and others (5.3%) namely, pawpaw and cucumber were frequently consumed by the students. Vitamin C-rich fruits including oranges (17.4%), apples (8.4%), pineapples (5.0%), avocado (4.7%) and others such as guava and passion (2.0%) were frequently consumed by students. The majority of respondents (78.5%) consumed far less than the recommended two servings (280g) of fruits per day (Ministry of Health of the United Republic of Tanzania, 2023). Very few (2.4%) met the recommended daily intake. Students had perceived reasons for the most common fruits consumed. The most frequently mentioned reasons for the choice of fruits were such as nutritional benefits (54.6%) and personal preferences (28.2%). Other mentioned reasons included availability (6.4%) and affordability (6.4%). In the current study, the occupational status (employed versus unemployed) of HHHs was found to be positively associated with fruit consumption in the students (χ^2=17.414, p=0.004).

Regarding vegetables consumption, 83.2% reported not to consume vegetables daily, while 16.8% did. Among those who

consumed vegetables frequently, spinach was the most common, with 32.2% reporting regular consumption. The following vegetables were least consumed; sweet potato leaves (19.2%), amaranths (17.4%) and cabbage (12.6%). Other vegetables (18.5%) included pumpkin leaves, green beans, cassava leaves, Chinese cabbage and kales were least consumed. The majority of the respondents (86.23%) often consumed vegetables far less than the recommended amount of two servings (280g) per day (Ministry of Health of the United Republic of Tanzania, 2023). A handful (1.3%) met the recommended intake. The perceived reasons for the choice of the vegetables commonly consumed by students were nutritional benefits (69.9%) and personal preference (14.3%). Other reasons included its availability (9.9%) and family influence (5.9%). About 18.5% of subjects occasionally consumed vegetables. The current study revealed that the occupational status of HHHs was found to be positively associated with vegetable consumption in the students (χ^2=11.141, p=0.049).

Family influence on the intake of fruits and vegetables among students

Seventy two percent of the students were influenced to eat fruits by their family members while 27.9% were not influenced by anyone. The current study revealed that mothers (45.0%) played a major role in influencing FV consumption among respondents (Table 1).

Table 1: Person influencing student to consume fruits and vegetables

Person influencing	Fruits		Vegetables	
	Frequency	Percent	Frequency	Percent
consumption of FV				
Mother	50	45.0	50	45.0
Self	34	30.6	43	39.0
Father	14	12.6	9	8.0
Others*	13	11.8	9	8.0
Total	111	100.0	111	100.0

Others (grandparents, siblings, uncle or aunt)*

Availability and accessibility of fruits and vegetables among students

Nearly all students (91.9%) reported an easy availability of fruits in their homes while a few of them (8.1%) had some difficulties. It was revealed that 80.2% of students were obtaining fruits from local markets located near their homes. Other students reported getting fruits from their home gardens (11.9%) and supermarkets (7.9%). About 9.2% of the students had vegetable gardens in their homes while majority (90.8%) had not. Ninety four percent of households without gardens reported obtaining vegetables from local markets close to their homes and and supermarkets (5.9%). Many students (71%) reported having fruits sold around their school premises while 28.8% reported not having one. On comparing the prices of fruits and other foods available at schools, the majority of students (69.4%) failed to compare the prices. Some of the students (16.2%) said that fruits were cheaper while 11.7% said that fruits were relatively expensive. On the other hand, only 2.7% of students said that the price of fruits was equal to that of other foods. Slightly more than half of the students (58.6%) reported not having vegetables sold around their school compounds while 41.4% reported having them. On comparing the prices of

vegetables and other foods available at schools, the majority of students (70.3%) could not compare the prices. Only 13.5% of students reported the price of vegetables sold at school to be relatively cheaper as compared to other foods. Other students (11.7%) reported vegetables to be relatively expensive compared to other foods available at their school compounds. The rest of the students (4.5%) said that the cost of buying vegetables is equal to the cost of buying other foods available at their schools.

Nutritional knowledge on fruits and vegetable consumption among students

The findings revealed that 99.0% of students did not know the recommended amount of FV a person should consume daily while a handful, (1%) knew about it. With regard to the benefits of consuming FV, 63.6% of respondents knew the benefits while 36.4% did not know any benefit. Those who knew mentioned the benefits such as strengthening immunity (52.3%), improving vision (22.1%), increasing iron levels (16.6%) and enhancing growth (9.0%). Furthermore, the current study revealed no association between knowledge of students on the consumption of FV and nutritional status ($\chi 2=0.541$, $p=0.773$).

Nutritional status of the subjects and its association with fruit and vegetable consumption

Sixty five percent of students had BMI that fell under a normal range ($18.5 \leq BMI < 25$) (Fig 1). The study revealed that there was no association between fruits ($\chi^2 = 3.060$, $p=0.217$) and vegetable consumption ($\chi^2=1.659$, $p=0.437$) on the nutritional status of subjects. On the other hand, occupational status of the HHH was found to be associated with the consumption of fruits ($p=0.004$) and vegetables ($p=0.049$) among students.

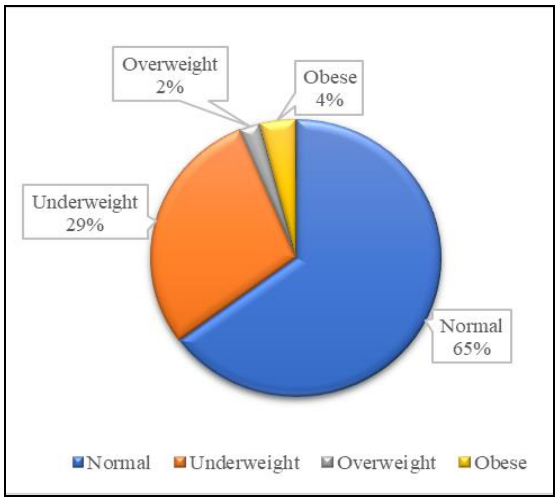

Figure 1: Nutritional status of respondents

DISCUSSION

Fruits and vegetable consumption and its associated factors among adolescents

The current study revealed that intake of fruits was below the daily recommendation of two servings per day, very few respondents met the recommended daily intake for fruits. This was partly due to limited knowledge on the recommended servings of fruits a person should consume per day. Furthermore, the findings revealed low daily consumption of fruits among students with bananas being the frequent fruit consumed on a daily basis. The low consumption of fruits experienced in the current study has been mentioned elsewhere (Alkazemi and Salmean, 2021; Darfour-Oduro *et al*, 2018; Attorp *et al,* 2014). Likewise, vegetables were least consumed by students, with Spinach being the frequent consumed vegetables, accounting for 32.5% only. In addition, the frequency of daily vegetables consumption was reported low by students (16.8%), corroborating previous studies (Taylor & Johnson, 2022; Freedman et al, 2017;

Micha et al, 2017; Ene-Obong et al, 2012). The school curriculum should be updated to include basic nutrition knowledge for students in order to establish healthy dietary habits.

Promoters of fruits and vegetables consumption among students

Mothers were the main players in influencing students to consume FV. These findings are in line with a study by Gross *et al*. (2010) which revealed that students who perceived parental support for eating FV had higher average daily consumption than those who did not. This could be attributed to the key position played by mothers in determining the family diet, including FV consumption, hence improving its availability and accessibility. Furthermore, a child who observes a parent eating FV increases the acceptance of such foods. Therefore, any interventions focusing on adolescents' consumption of FV should include mothers as their roles in the current study is highly appreciated. Furthermore, much emphasis should also be put in place of other family members on the role of influencing the consumption of FV in order to support mothers as well as replace mothers during the time they are away from home. This support is necessary for building adolescents' self-efficacy to improve FV consumption.

Another factor influencing FV consumption among students was self-motivation. It was noted from the current study that when at school, many students spent their pocket money buying other foodstuff and or snacks such as samosa, fried cassava and chocolates than FV. These could be due to students' personal preferences and attraction to other foodstuffs than FV. Corroborating research works by Pearson e*t al.* (2011) who revealed that consumption of FV behaviour of adolescents was associated with their dietary self-efficacy rather than a direct parental influence. Hence, intervention programmes aimed at improving adolescents' dietary behaviour should be tailored to boost their self-efficacy in consuming healthy diets in order to overcome perceived barriers. Furthermore, school food environment and policies such as not offering unhealthy meals should be developed in order to promote healthy behaviour among adolescents. Despite knowing the benefits of consuming FV, most students had limited knowledge of the recommended daily intake. Low awareness of the daily FV requirements has been reported elsewhere (Alkazemi and Salmean, 2021; Darfour-Oduro *et al.*, 2018; Attorp *et al.*, 2014). The limited knowledge may stem from poor nutrition education in schools. According to the Food and Agriculture Organisation (FAO, 2011), inadequate nutrition education in school curricula is a major challenge in promoting healthy eating habits among school-going children. The current study revealed an association between the occupational status of HHH and consumption of FV in students. Students from families whose HHHs were formerly employed consumed more servings of FV than the ones from the business and farming sectors. This could be partly contributed by school exposure of the HHHs on the benefits of FV as well as their economic potentials that made easy affordability of FV at homes. This is inconsistent with Attorp *et al.* (2014) who indicated that parent-reported source of income was not significantly related to FV consumption among Canadian children. The fact that child-reported affluence is a

surrogate measure for income may reflect slight differences in the measures compared to parent-reported affluence. Parent-reported income is an absolute measure, not adjusted for items like family size, housing costs, debt, etc.

Evidence on the relationship between the intake of FV and body weight is inconclusive. In the current study, there was no association between the number of servings of FV students consumed per day and obesity. Our findings are not consistent with previous studies that have generally reported an association between increasing FV intake and decreased weight gain (Wan *et al.,* 2020; Yu *et al.,* 2018 ; Anggraeni *et al.,* 2017). This inconsistency may be partly attributed to the limited intake of FV among the majority of respondents experienced in the current study, which likely prevented any potential beneficial effects of FV consumption on weight gain from being realized.

Limitations of the study

Some limitations of this study need to be acknowledged. Since most of the information was collected by a self-administered questionnaire, objectivity could have been impaired for some variables. For example, socio-economic status was just reported, and no further investigations were done. Furthermore, it is also true that FV consumption patterns may vary according to season; thus, the effect of seasonality would be important to explore. A variety of factors such as ethnicity, student residence, sex, lifestyle and SES not considered in this study could provide further insight. Despite these limitations, the study has several strengths. It included a sample drawn from the general population, comprising both FV consumers and non-consumers, represented a broad spectrum of opinions. Schools were purposively selected to take part in the research, ensuring representation from both private and government schools across various geographical locations and socioeconomic levels. Therefore, this diverse sample can provide valuable insights into promoting behaviour change through increased FV intake among students.

CONCLUSION

Despite the growing body of evidence highlighting the protective effect of FV, their intake is still inadequate in Sub Saharan Africa, Tanzania inclusive. The current study therefore, sought to investigate FV consumption among students of ordinary level secondary schools in Ilala Municipality. Fruit and vegetable intake by students in Ilala Municipality was less than the recommended amount of two servings per day. Teachers and parents who are the most in contact with the students need awareness regarding FV consumption. Further research is needed to develop an intervention to improve intake of FV among students hence preventing obesity and related chronic diseases.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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