

Original Research Article

The relationship between eating habits, socio-demographic characteristics and body mass index among undergraduate students from two selected universities, Tanzania

Japhet J. Msoga¹, Mackfallen Anasel^{2*}

¹Department of Nutrition, Katumba Folk Development College, Ministry of Education Science and Technology, Tanzania

²Department of Health Systems Management, Mzumbe University, Mzumbe, Tanzania

Received: 06 December 2019

Revised: 13 January 2020

Accepted: 16 January 2020

***Correspondence:**

Dr. Mackfallen Anasel,

E-mail: mganasel@mzumbe.ac.tz

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Obesity is a current public health concern for both developed and developing countries. Previous studies have demonstrated that, university students exhibit poor eating habits and gain body weight more rapidly than the general population. The aim of this study was to investigate how socio-demographic characteristics and eating habits relate to body mass index (BMI) among undergraduate students from two selected universities in Morogoro region, Tanzania.

Methods: This cross-sectional study was conducted at Mzumbe University and Jordan University College. Simple and cluster random sampling were used to select 200 students from the two universities. Questionnaire and Anthropometric measurements were used during data collection. One-way ANOVA and multiple linear regressions analysis were deployed with an assistance of computer software called SPSS.

Results: The findings showed that each additional healthy eating habit score was insignificantly associated with 0.043 units decrease in BMI ($p > 0.05$). This study found significant associations between mean BMI and female gender, age and place of origin ($p < 0.05$). The results showed that each additional year of age was significantly associated with 0.495 units increase in BMI and female respondents were having 2.168 higher BMI than males. In addition, respondents from rural had significant lower BMI by 1.59 as compared to their urban counterparts.

Conclusions: The study concluded that age, gender and place of origin relate with undergraduate student's BMI significantly. The study recommend that public health planners and implementers should target age, gender, place of origin as well as eating habit during fighting for obesity among undergraduate students.

Keywords: Body mass index, Eating habit, Socio-demographic characteristics, Tanzania, University students

INTRODUCTION

The prevalence of overweight and obesity is alarming particularly in low and middle income countries (LMICs).¹ Globally, the trends of obesity and the diet related non-communicable Diseases (NCDs) including heart disease, cancer, stroke and diabetes mellitus have

been projected to increase significantly between 1990 and 2020 worldwide.² Meanwhile, obesity has reached epidemic proportion worldwide, with more than 1.9 billion adults overweight, and over 650 million of the world's adult population are chronically obese.³ The obesity related NCDs currently kill 41 million people each year, equivalent to 71% of all deaths globally, about

37% of these deaths occur between the ages of 30 and 69 years.⁴ It has also been projected that, by 2020, the NCDs will account for almost three-quarters of all deaths worldwide, and that about 60% of these deaths will occur in LMICs.⁵

In Africa; particularly in the Sub-Saharan Africa (SSA), the burden of obesity and the diet related NCDs is also on the rise. In the year 2014 for example, about 3 billion adults aged 18 years and older were either overweight or obese.⁵ According to recent report by the WHO, the Africa region accounts for about 85 percent of the total premature deaths due to NCDs occurring in the world.⁴ In Tanzania, the burden of risk factors for NCDs such as overweight and obesity, unhealthy diet and lack of physical activity is high. According to the International Food Policy Research Institute (IFPRI), about 10 million (equivalent to 20%) of all Tanzanians are at higher risk for NCDs as a result of being overweight or obese.⁶ In addition, a number of studies showed that significant number of people in Tanzania have higher BMI values than the recommended threshold healthy BMI value.^{7,8} By the year 2020, the prevalence of overweight and obesity is estimated to be around 22% in males and 26% in females.⁹

The onset of obesity and the NCDs has been linked with unhealthy eating habits as a result of increased consumption of westernised diets characterized by energy dense foods, high sugar and salts.^{10,11} This shift in dietary habits “nutrition transition” particularly in developing countries is as result of lifestyles changes accompanied by urbanization; globalization and economic development.¹² Previous studies have found that, most of the college or university students exhibit unhealthy dietary practices and gain body weight more rapidly than the general population.¹³⁻¹⁵ Poor eating habits and weight gain during college life among students make them prone to healthy problems such as obesity and diet related NCDs not only during university life but also continue in later years of their life.^{16,17}

The data which provide the information on eating habits and BMI in connection with age, religious affiliation, and place of origin, residential status and family wealth background among undergraduate students are scarce. The lack of this information given the rising burden of obesity provided the motivation to undertake this study. The current study sheds light on the understanding of the link between eating habit, socio-demographic characteristics and body weight status among undergraduate students. Providing this evidence helps in the decision-making processes to be taken by public health stakeholders who are interested in obesity and NCDs prevention. This study also saves as the basis for further research since limited researches have focused in this study area so far particularly in Tanzania.

The main objectives of this study were to examine differences in eating habits across socio-demographic

characteristics, to examine variations in BMI across socio-demographic and eating habit groups and to determine associations between eating habit score, socio-demographic factors and BMI among undergraduate students of Mzumbe and Jordan Universities in Morogoro region, Tanzania.

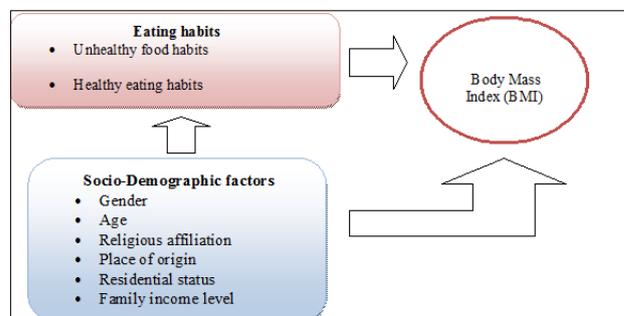


Figure 1: Conceptual framework.

METHODS

Research design and target population

This study employed a descriptive cross-sectional study design which was conducted from October 2018 to June 2019. The target population of the study included all continuing undergraduate students from Mzumbe University and Jordan University College. According to the admission officers, the two Universities had a total of 6542 and 2924 continuing students respectively.

The sample size was selected at 90% level of confidence and error level was 0.1. The minimum sample size from each university was calculated by using the Yamane method for known population size with a formula:

$$n = \frac{N}{1 + Ne^2}$$

Where,

N=Known population size of the study at each university

e=error level, =0.1

n =?

Then calculation follows:

Sample size at Mzumbe University

$$= \frac{6542}{1 + 6542 (0.1)^2}$$

$$= \frac{6542}{1 + 65.42}$$

$$= \frac{6542}{66.42}$$

$$= 98 \text{ respondents}$$

Sample size at Jordan University College

$$= \frac{2924}{1 + 2924 (0.1)^2}$$

$$= \frac{2924}{1 + 29.24}$$

$$= \frac{2924}{30.24} = 96 \text{ respondents}$$

Therefore, total sample size was expected to be 98+96=194.

However, 200 respondents were enrolled in this study, 104 from Mzumbe University and the remaining 96 from Jordan University College.

Sampling technique

Simple and Cluster random sampling were used in conducting this study. Simple random sampling using lottery method was used to select two universities out of the five universities operating in the region. The basis of clusters included faculties, departments and educational classification (i.e. certificate, diploma and bachelor degree). The process of selection of clusters is described below;

Stage 1: Selection of faculties

Two faculties in each university were randomly selected from the existing number of faculties in the school, using simple random sampling technique, giving a total of four faculties in the two universities.

Stage 2: Selection of departments

One department was randomly selected from each selected faculties using simple random sampling technique, giving a total of eight departments.

Stage 3: Selection of classes

Three classes based on educational classification (i.e. 1 class for certificate, 1 for diploma and 1 for bachelor degree students) were randomly selected from each selected departments using simple random sampling technique, making a total of twelve classes for the study (6 classes in each university).

Stage 4: Selection of respondents

About seventeen respondents were selected from each selected class by simple random sampling method; as a result, a total number of 200 respondents participated in this study.

Data collection tools

A self-administered questionnaire with close ended questions was designed to solicit participants' information (i.e., socio-economic and demographic characteristics) and eating habits. A five point likert scale was used to assess how often each respondent practiced each given eating habit. The options on the scale included; never, rarely, occasionally, often and repeatedly with scores range from 5 to 1 and scores range from 1 to 5 for each item of unhealthy and healthy eating habit respectively. Six items of unhealthy eating habits and seven items of healthy eating habits with a possible scores range from 6 to 30 and 7 to 35 respectively. The total scores in this section were $13 \times 5 = 65$ scores.

The eating habit of each participant was classified according to the earned total score as scores less than 50% of the total score indicated unhealthy eating habits, scores range from 50% to 69% of the total score represented average or neutral eating habits. In another words, students within this range practiced both healthy and unhealthy eating patterns and scores 70% or more of the total score) was regarded as healthy eating habits.

Anthropometric measurements

In order to determine BMI of the students, anthropometric data (i.e. height and weight) were taken from each participant using a length board and digital weighing scale respectively. Height was measured to the nearest 0.1 centimetres (cm) while body weight was measured to the nearest 0.25 kilogram (kg). BMI of each participant was calculated as the ratio of body weight (in kg) and squared height (in metres) (kg/m^2). The investigator then recorded the fact in the questionnaire.

Reliability

To ensure consistency of the findings, the tools for data collection were pre-tested prior to actual data collection activity. A Cronbach's Alpha was used to test internal consistency of the study questionnaire, specifically the measurement scale of healthy and unhealthy eating habits. The Cronbach's alpha for the measurement scale with seven items of healthy eating habit was 0.704, and that with six items of unhealthy eating habit was 0.713, suggesting that the items were measuring the same construct. This is because the Cronbach's alpha of 0.70 or higher is considered acceptable.

Validity

For internal validity, cluster and simple random sampling techniques were used for data collection with statistical measurement of descriptive, cross tabulation, and quantitative data analysis. The information was only collected from the study area and a cross-sectional design was used for data collection to avoid externalities in the changing environment.

Statistical data analysis

Descriptive statistics such as frequencies, percentages, arithmetic mean, standard deviation and cross tabulations were used to describe students' socio-demographic data, eating habits and BMI. One-way ANOVA was used to test the significant difference between respondents' mean eating habit score and socio-demographic groups (i.e. age, gender, type of residence, religious affiliation, place of origin and family wealthy background). One-way ANOVA was also used to determine the statistical significance difference between respondents' BMI and eating habit categories as well as socio-demographic groups. Finally, a multiple linear regression analysis was performed to examine the associations between students'

BMI and eating habit score, age, gender residential status, place of origin, religious affiliation as well as family wealthy background. The analysis was done using Statistical Package for the Social Sciences (SPSS) and a p value less than 0.05 was considered statistically significant.

Ethical considerations

This study was approved by the Directorate of Research, Publications and Post Graduate Studies of Mzumbe University. Apart from that, permission to conduct the study in each participating university was also obtained from directorates of students’ welfare prior to data collection process. Lastly, informed consent was obtained from each participant before data collection.

RESULTS

Socio-demographic information of the respondents

A total of 200 respondents with the mean age of 23 years participated in this study. 48% of the respondents were females while 52% others were males. 78.0% of the respondents were Christians and the rest were Muslims. Majority of the participants (53.0%) were pursuing bachelor degree programs. Most of the respondents were from urban areas (65.0%). The results also showed that 52.0% of the students live on campus. Majority (63.0%) considered themselves as coming from average income families, 23.0% considered themselves coming from well off families and 14.0% considered themselves coming from poor families (Table 1).

Distribution of the participants based on eating habit categories

The findings from this study reveals that, only 24.5% of undergraduate students had healthy eating habits, marked by high mean healthy eating scores (Figure 2).

Socio- demographic differences in eating habits among respondents

Table 2 shows significant differences between students’ mean eating habit score and groups by age, gender, religious affiliation, place of origin, type of residence and family wealthy background (as independent variables). There were no significant differences observed between the means of any of the socio-demographic group analysed (p>0.05).

Respondents’ anthropometric data and BMI

Results from this study reveal that, the participants’ BMI range from 16.95 kg/m² to 39.3 Kg/m² and the mean BMI is 23.4266 kg/m² (±4.28101) as indicated in Table 3.

Table 1: Respondents’ socio-demographic information (n=200).

Variables assessed	No. of respondents	Percentage (%)
Learning institution		
Jordan university college	96	48
Mzumbe university	104	52
Gender		
Females	96	48
Males	104	52
Age (in years)		
18-23	133	66.5
24-29	52	26
30 years or older	15	7.5
Minimum: 18, Maximum: 49, Mean age: 23.29		
Religious affiliation		
Christianity	156	78.0
Muslim	44	22.0
Marital status		
Single	181	90.5
Married	16	8.0
Separated	1	0.5
Divorced or widowed	2	1.0
Education level of study		
Certificate	36	18.0
Diploma	58	29.0
Bachelor degree	106	53.0
Place of origin		
Rural	70	35.0
Urban	130	65.0
Type of residence		
On campus	104	52.0
Off campus	96	48.0
Family wealthy background		
Poor	28	14.0
Average income	126	63.0
Well off	46	23.0

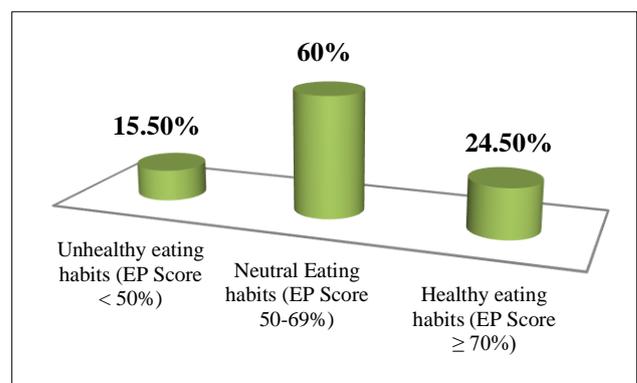


Figure 2: Respondents’ eating habit categories.

Table 2: Respondents’ differences in eating habits by socio-demographic characteristics.

Variables	Sum of squares	df	Mean square	F	Sig.
Eating habit score * age groups					
Between groups	61.676	2	30.838	0.653	0.522
Within groups	9304.244	197	47.230		
Total	9365.920	199			
Eating habit score * religious affiliation					
Between groups	35.449	1	35.449	0.752	0.387
Within groups	9330.471	198	47.124		
Total	9365.920	199			
Eating habit score * place of origin					
Between groups	14.179	1	14.179	0.300	0.584
Within groups	9351.741	198	47.231		
Total	9365.920	199			
Eating habit score * residential status					
Between groups	30.594	1	30.594	0.649	0.421
Within groups	9335.326	198	47.148		
Total	9365.920	199			
Eating habit score * family wealthy background					
Between groups	107.145	2	53.573	1.140	0.322
Within groups	9258.775	197	46.999		
Total	9365.920	199			

Table 3: Respondents’ anthropometric data.

Variables assessed	N	Minimum	Maximum	Mean±SD
Weight status (kg)	200	40.80	107.00	62.9900±11.69574
Height status (cm)	200	121.00	188.00	163.87±9.16018
BMI (kg/m²)	200	16.95	39.30	23.4266±4.28101

Differences in BMI between respondents’ socio-demographic and eating habit groups

A one-way ANOVA was also used to analyse differences in mean BMI between participants’ socio-demographic and eating habit groups. This was done by analysing the relationship between the continuous dependent variable (BMI) and categorical independent variables (gender, age groups, type of residence, and place of origin, religious affiliation, and eating habit category and family wealth background). The results in (Table 4) show that the relationship between BMI and age, gender and place of origin is statistically significant (p<0.05). The interpretation of these results would be that the BMI differs significantly with age, gender and place of origin.

Relationship between respondents’ socio-demographic, eating habit scores and BMI

Table 5 shows a multiple linear regression analysis was used to determine the association between socio-demographic factors, eating habits and BMI. This analysis was conducted specifically to know how much of the variation in BMI can be explained by the predictor variables. This was done by analysing the relationship

between the continuous dependent variable (BMI) and all independent variables of interest. The independent variables were; age, eating habit score, gender, type of residence, place of origin, religious affiliation and family wealth background.

First step

Except for age (in years) and eating habit score which are continuous variables, the investigators created dummy variables for the categorical independent variables as follows:

Gender (female=1, male=0), Place of origin (rural=1, urban=0) and Type of residence (on campus=1, off campus=0), Religious affiliation (Muslim=1, Christian=0) and family wealth background (well off=1, poor or average income=0). Then all these variables were included in regression analysis to examine the model fit. The results in (Table 5) show that significant associations exist between respondents’ BMI and gender (p=0.000), age (p=0.000) and coming from rural area (p=0.005). The results also show that the association between BMI and eating habit, religious affiliation, type of residence and family wealthy background is not statistically significant (p>0.05).

Second step

The variable that showed insignificant in first step (i.e. eating habit score, religious affiliation, type of residence

and family wealthy background) were removed from further analysis of the model. The remaining significant variables (age, gender and place of origin) were selected and included in the final regression model.

Table 4: Relationship between respondents’ socio-demographic, eating habits and BMI using one-way ANOVA.

Variables tested	Sum of squares	Df	Mean square	F	Sig.
BMI * age groups					
Between groups	633.723	2	316.861	20.715	0.000
Within groups	3013.365	197	15.296		
Total	3647.087	199			
BMI * gender					
Between groups	160.002	1	160.002	9.085	0.003
Within groups	3487.086	198	17.612		
Total	3647.087	199			
BMI * place of origin					
Between groups	104.412	1	104.412	5.836	0.017
Within groups	3542.676	198	17.892		
Total	3647.087	199			
BMI * residential status					
Between groups	62.108	1	62.108	3.430	0.066
Within groups	3584.979	198	18.106		
Total	3647.087	199			
BMI * family wealthy background					
Between groups	12.367	2	6.184	0.335	0.716
Within groups	3634.720	197	18.450		
Total	3647.087	199			
BMI * eating habit category					
Between groups	36.614	2	18.307	0.999	0.370
Within groups	3610.474	197	18.327		
Total	3647.087	199			
BMI * religious affiliations					
Between groups	0.295	1	0.295	0.016	0.899
Within groups	3646.792	198	18.418		
Total	3647.087	199			

Table 5: Multiple linear regression analysis for the relationship between socio-demographic, eating habits and BMI.

Independent variables	Regression coefficient (b)	T	P value
Constant/Intercept	13.569	5.402	0.000
Female gender	2.302	4.238	0.000
Age	0.483	6.940	0.000
Religion (Muslim)	-0.038	-0.060	0.952
From well off family	0.299	0.469	0.640
Eating habit score	-0.043	-1.121	0.264
Coming from rural area	-1.579	-2.809	0.005
On campus residence	-0.528	-0.919	0.359

Dependent variable: BMI (kg/m²).

Table 6 illustrates that all the three variables also show significances (p<0.05) in the final model. This study found significant positive associations between mean BMI and female gender (b=2.168, p=0.000) and age (b=0.495, p=0.000). This study also found significant negative association between mean BMI and place of origin (coming from rural) (b=-1.590, p=0.004). The

interpretation of these results would be that female students has higher BMI by 2.168 as compared with male students. It is also interpreted that each additional year of age is significantly associated with a 0.495 units increase in BMI. Respondents from rural have significant lower BMI by 1.59 as compared to respondents from urban. Results from this study show that age (t=7.111) is the

most predictor variable of BMI, followed by female gender ($t=4.128$) and then place of residence ($t=-2.905$).

Table 6: Final model of multiple linear regression analysis for the relationship between socio-demographic, eating habits and BMI.

Independent variables	Regression coefficients (b)	T	P value
Intercept	11.387	7.111	0.000
Female gender	2.168	4.128	0.000
Age in years	0.495	7.602	0.000
Coming from rural setting	-1.590	-2.905	0.004

Dependent variable: Body mass index (kg/m^2).

DISCUSSION

Socio-demographic differences in eating habits

Both undergraduate students showed equally unhealthy dietary patterns marked by low mean healthy eating scores despite their socio-demographic characteristics. Peer pressure among the students may be the strong factor in influencing their eating habits either positively or negatively. The findings of the current study are in line with that of other researchers who reported in their studies that, the eating patterns in undergraduate students did not vary extensively by their socio-demographic differences.¹⁸⁻²⁰ This is also in line with Mahmoud and Taha who revealed that there was no statistical difference in eating habits across gender among students.²¹

These findings are inconsistent with Ganasegeran et al who stated that, younger students had significantly lower eating habits score.²² As well, Santos reported that eating habits differ significantly between male and female Syrian university students.²³ Furthermore, Skemiene et al demonstrated significant differences amongst medical students in nutritional habits that involving all genders.²⁴ The possible reasons for these conflicting results in eating practices among university students may a consequence of doing research using different sample sizes and approaches on how to measure this variable. Another reason for these dissimilar results may be due to the fact that these studies were conducted in population with diverse socio-economic and demographic background. Some researchers have reported that, physical, economic, social and psychological factors are the possible reasons for differences in eating habits in university and college students.^{25,26}

The relationship between eating habit and BMI

Results from this study indicate that eating habit was not significantly associated with BMI among the undergraduate students. A possible explanation could be that majority of the students exhibited similar eating

patterns and body weight status. This finding are in line with Mahmoud and Taha, who did not find any statistical association between dietary intake and BMI among students and that of Gazibara et al who found that Students' BMI did not correlate with the eating habits.^{21,27}

However, a multiple linear regression analysis identified the regression coefficient to be negative; indicating that participants who had higher eating habit score (i.e., healthy eating habits) did have a lower BMI as compared to those with lower eating habit score (i.e., unhealthy eating habits). These findings are consistent with Gunes et al who reported that, unhealthy eating habits were significantly associated with a higher risk of obesity/overweight among freshman students.²⁸ This finding also supports previous studies that have found that students with healthy dietary behaviours tend to have a lower BMI.^{29,30} All these findings imply that healthy eating practices among students would result into lower BMI.

The relationship between gender and BMI

The current study established a significant association between gender and BMI. It was found that female respondents had significant higher BMI than the male counterparts. The results from this study imply that female students are more likely to have an elevated BMI than male students. These findings are in line with a study by Ayranci et al who reported that gender was significantly associated with BMI among the students.³¹ El Ansari et al also established a significant higher BMI in female than male students.³² This is corroborating with WHO projection as well that indicate by 2020 the females will have higher percentage of been obese as compared with males.⁹ In contrast, Gunes et al and Yahia et al reported in their study that female subjects had lesser BMI than male subjects.^{28,33} Farajian et al also revealed contradicting findings by pointing out that males were overweight and obese than female students.³⁴ Similarly, Gazibara et al found that female students had significantly lower BMI than their male counterparts.²⁷ This is in line with Kumar and Amruth who illustrated that male students had higher BMI than their female counterparts.³⁵

The relationship between age and BMI

Findings of the current study have confirmed that age and BMI are significantly correlated. It was found that an increase in age was associated with an increase in BMI. This information further suggests that older age students are more likely than their younger counterparts to have higher BMI. The possible explanations to this finding might be that, an increase in BMI could be a result of weight gain associated with changes of body composition as one grows older such as gain in muscle gain for males and gain in fat and muscle mass for females.³⁶ Other reasons for weight gain among the students may include sedentary lifestyles and unhealthy dietary habits, however

this was not confirmed in this study.³⁷ In agreement with the finding from this study Brignac et al found that BMI is significantly correlated with increase in age.³⁸ Similarly, Genena and Salama found that older age students were more likely to have higher BMI than younger students which concur with the findings of this study.³⁹

The relationship between place of origin and BMI

It was questioned whether students' place of origin would have any relationship with BMI. The current study confirmed that BMI differ significantly with place of origin. The study also established a significant association between place of origin and BMI. Students from rural had a significantly lower BMI compared to their urban counterparts. A possible explanation might be that the students from urban areas are likely to eat energy-dense foods which are mostly available in town. In contrary, students from rural areas are likely to eat natural and unprocessed food such as cassava, whole grains and vegetables which are common in the rural areas. This reflects that availability and consumption of a certain food type is likely to be affected by the nature of the area being rural or urban. This behaviour of consuming more calories than required by their bodies plus inadequate physical activities among the students from urban area might be suggestive reasons for elevated BMI. In this line of thinking, more studies are needed to investigate the effects of place of origin on BMI among the undergraduate students.

This study encountered some limitations that could threaten the validity and reliability of the findings and hence generalisation of the findings. However, necessary efforts were undertaken to mitigate the effects.

The issue of data collection using questionnaires that were completed by the respondents encountered setbacks. For example, on time of return, some respondents left some questions unanswered. However, the researchers ensured that all the questions were answered completely. This was possible because the researchers were personally on the field distributing and collecting the questionnaires.

Another limitation of the study has based on the fact that it has been conducted in only two universities. This brings another thought for generalizing the study findings to all Tanzanian undergraduate students. This is because the study population in each university might have unique characteristics. However, the investigators tried to minimize the potential bias by selecting the study sample by using probability sampling.

CONCLUSION

This study has illustrated that majority of undergraduate students have unhealthy eating habits marked by low healthy eating scores. Further, students' eating habits do

not differ significantly across socio-economic characteristics. Finally, the present study demonstrated that age, gender and place of origin are the predictors of BMI among undergraduate students.

Recommendations

Public health stakeholders and ministry of health in collaboration with the university management teams should provide nutrition education programmes to promote healthier dietary choices among the undergraduate students. Public health planners and implementers should take into consideration the issues of age, gender and place of origin when designing and implementing interventions aimed at addressing the problem of obesity among undergraduate students. The current study confirmed that the named three variables were statistically associated with BMI. The scope of future studies should be broadened to include a larger sample size of both undergraduate and postgraduate students from different universities and colleges in Tanzania.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of the Directorate of Research, Publications and Post Graduate Studies of Mzumbe University

REFERENCES

1. World Health Organization (WHO). Global Strategy on Diet, Physical Activity and Health. Geneva, World Health Organization. 2004.
2. Misra A, Khurana L. Obesity and Metabolic Syndrome in Developing Countries. *J Clin Endocrinol Metab.* 2008;93(11):9-30.
3. WHO. Obesity and overweight. Geneva: World Health Organization. 2016.
4. WHO. Non-communicable diseases key facts. Geneva: World Health Organization; 2018.
5. Aboderin I, Kalache A, Ben Shlomo Y, Lynch JW, Yajnik CS, Kuh D, et al. Life course perspectives on coronary heart disease, stroke and diabetes: key issues and implications for policy and research. Geneva. World Health Organization. 2002.
6. International Food Policy Research Institute (IFPRI). Global Nutrition Report: From Promise to Impact Ending Malnutrition by 2030. 2016.
7. Mbalilaki J, Hellenius M, Masesa Z, Hostmark A, Sundquist J, Stromme S. Physical activity and blood lipids in rural and urban Tanzanians. *Nutr Metab Cardio Dis.* 2007;17:344-8.
8. Unwin N, James P, McLarty D, Machybia H, Nkulila P, Tamin B, et al. Rural to urban migration and changes in cardiovascular risk factors in Tanzania: a prospective cohort study. *BMC Public Health.* 2010;10:272.

9. WHO. Global Status Report on Non Communicable Diseases. Geneva. World Health Organisation. 2010.
10. Ayse O, Ozcelik T, Asli U. Gender Differences in Adult's Knowledge about Dietary Fats, Cholesterol, Fiber and Energy: Asian Network for Scientific Information. *Pak J Nutr.* 2008;7(2):234-9.
11. Hernandez J, Dastan B, Miroslav H. Eating Behaviors of University Students. *Mendel Net;* 2016: 565-570.
12. Agriculture Organization. The double burden of malnutrition: Case studies from six developing countries. Food Agriculture Org; 2006.
13. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity.* 2008 Oct;16(10):2205-11.
14. Deliens T, Clarys P, Bourdeaudhuij I, Deforche B. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. *BioMed Central (BMC) Public Health.* 2014;14(53):1-12.
15. Shekhar R, Aslami N, Ranjan R, Kumar N. Lifestyle and body mass index among students of a nursing college in Bihar. *Biomed Res.* 2016:362-5.
16. Racette SB, Deusinger SS, Strube MJ, Highstein GR, Deusinger RH. Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *J Am Coll Health.* 2005 May 1;53(6):245-51.
17. Centres for Disease Control and Prevention (CDC). Non Communicable Disease Prevention and Control. Atlanta. 2013.
18. Arcan C, Kubik MY, Fulkerson JA, Story M. Sociodemographic differences in selected eating practices among alternative high school students. *J Am Dietetic Assoc.* 2009;109(5):823-9.
19. Cheung PC, Ip PL, Lam ST, Bibby H. A study on body weight perception and weight control behaviours among adolescents in Hong Kong. *Hong Kong medical journal.* 2007;13(1):16-21.
20. Musingo M, Wang L. Analysis of eating habits according to socio-demographic characteristics of college students. *Pak J Nutr.* 2009;8(10):1575-80.
21. Mahmoud M, Taha A. The Association between Eating Habits and Body Mass Index among Nursing Students. *J Nurs Health Sci.* 2017;6(3):14-26.
22. Ganasegeran K, Sami A, Al-Dubai S, Qureshi A, Aljunid S. Social and psychological factors affecting eating habits among university students in a Malaysian medical school: a cross-sectional study. *Nutr J.* 2012;11(1):48-56.
23. Santos S. Food habits and food choice motives among university students settled in London: The role of gender and culture. *Research Project; Porto University.* 2009.
24. Skemiene L, Ustinaviciene R, Piesine L, Radisauskas R. Peculiarities of medical students' nutrition. *Medicina.* 2007;43(2):145-52.
25. Brown M, Flint M, Fuqua J. The effects of a nutrition education intervention on vending machine sales on a university campus. *J Am Coll Health.* 2014;9(24):512-6.
26. Gower B, Hand CE, Crooks ZK. The relationship between stress and eating in college-aged students. *Undergrad Res J Human Sci.* 2008;39(4):67-78.
27. Gazibara T, Darija B, Tepavcevic K, Popovic A, Pekmezovic T. Eating Habits and Body-weights of Students of the University of Belgrade, Serbia: A Cross-sectional Study. *J Health, Popula Nutr.* 2013; 31(3):330-3.
28. Gunes FE, Bekiroglu N, Imeryuz N, Agirbasli M. Relation between eating habits and a high body mass index among freshman students: a cross-sectional study. *J Am Coll Nutr.* 2012;31(3):167-74.
29. Gradidge PJ, Cohen E. Body Mass Index and associated lifestyle and eating behaviours of female students at a South African university. *South Africa J Clini Nutr.* 2018;31(4):89-91.
30. Nakhoda R, Wiles N. Consumption of added sugars among undergraduate students at a South African university and its association with BMI. *South Africa J Clini Nutr.* 2018;32(1):76-85
31. Ayranci U, Erenoglu N, Son O. Eating habits, lifestyle factors, and body weight status among Turkish private educational institution students. *Nutr.* 2010; 26(7-8):772-778.
32. El Ansari W, Suominen S, Samara A. Eating habits and dietary intake: is adherence to dietary guidelines associated with importance of healthy eating among undergraduate university students in finland? *Central Euro J Public Health.* 2015; 23 (4): 306-13.
33. Yahia N, Achkar A, Abdallah A, Rizk S. Eating habits and obesity among Lebanese university students. 2008.
34. Farajian P, Risvas G, Karasouli K, Pounis GD, Kastorini CM, Panagiotakos DB. Young adulthood obesity prevalence and low adherence rates to the Mediterranean diet in Greek children: the GRECO study. *Atherosclerosis.* 2011;217(2):525-30.
35. Kumar A, Amruth M. A cross-sectional study on BMI and eating habits among students in a medical college in Kerala. *Inter J Commu Med Public Health.* 2019; 6(3):1285-94.
36. Pierre M, Gallagher D. Body composition changes with aging: The cause or the result of alterations in metabolic rate and macronutrient oxidation? *Nutr.* 2010; 26(2):152-5.
37. Agrawal P, Gupta K, Mishra V, Sutapa A. Effects of Sedentary Lifestyle and Dietary Habits on Body Mass Index Change among Adult Women in India: Findings from a Follow-Up Study. *Ecol Food Nutr.* 2013;52(5):387-406.
38. Brignac A, Bellar D, Jugde L, Smith J, Mazerat N, Troclair D. The Relationship of BMI to Grade

Point Average, Age and Multiple Fitness Tests. *J Strength Conditio Res.* 2011;25(1):121-5.

39. Genena DM, Salama AA. Obesity and Eating Habits among University Students in Alexandria, Egypt: A Cross Sectional Study. *World J Nutr Health.* 2017;5(3):62-8.

Cite this article as: Msoga JJ, Anasel M. The relationship between eating habits, socio-demographic characteristics and body mass index among undergraduate students from two selected universities, Tanzania. *Int J Community Med Public Health* 2020;7:406-15.