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## PUBLIC HEALTH | RESEARCH ARTICLE

# The prevalence and factors associated with overweight and obesity among University of Botswana students

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**Abstract:** Recently, overweight and obesity were found to be an increasing public health crisis in Botswana. Despite these findings, there is scant epidemiological studies carried out to investigate the prevalence and risk factors of obesity among tertiary students in Botswana. The aim of this study was to determine the prevalence and factors associated with overweight/obesity among University of Botswana (UB) students. A descriptive cross sectional study was conducted at University of Botswana between February and April 2016 using convenient sampling to recruit participants. A total of 202 students in the age range of 18–30 with mean age  $21.59 \pm 1.81$  completed the study procedures. Self-administered questionnaires were used for data collection, body mass and height were measured from participants in order to calculate Body Mass Index (BMI) to determine whether they fall under the category of being overweight/obese. The prevalence of overweight and obesity was 36.8%. Overweight and obesity among students was significantly associated with age (Odds Ratio [OR]: 1.72, 95% Confidence Interval [CI]: 1.06–4.46), year of study (OR: 1.60, 95%CI: 1.09–3.99), physical activity and ones opinion about him/her being overweight/obese ( $p < 0.05$ ). The findings also revealed that gender,



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### ABOUT THE AUTHOR

Roy Tapera is an Epidemiologist and Medical informatician with more than 10 years of experience in the field of Public Health. He is currently a lecturer of Epidemiology and Health Informatics at the University of Botswana, School of Public Health. He teaches undergraduates and MSc in Nursing, Epidemiology and Master of Public Health Medicine students in health informatics. His research interests are in bio-statistical methods for epidemiological studies in communicable and non-communicable disease/condition like the current study on obesity. He is also interested in behavioral sciences and health promotion which is part of this research. He possesses fine skills in programming, designing, implementation, and evaluation medical information systems. Marogwe Thato Merapelo is a graduate from the department. Tshephang Tumoyagae, Titus M Maswabi, Patience Erick, Baemedi Letsholo and Bontle Mbongwe teaches on the BSc in Environmental Health program in the Department of Environment Health, School of Public Health.

### PUBLIC INTEREST STATEMENT

Overweight and Obesity are diseases with multiple causes that increase chances for developing health risks. Botswana is not an exemption from these conditions. This study was carried at the University of Botswana to find the possible causes of obesity and overweight and estimate the number of people with the condition. Students who wanted to participate were given a questionnaire to complete from five points at the University were students are found socializing. A total of 202 students answered the questionnaire and their height and weight were measured. A total of 36.8% students were overweight and obese. As people age they are likely to gain more weight. Sedentary lifestyle associated with aging also increases the risk of being overweight and obese. Unhealthy eating practices were found to be linked to overweight and obesity. Therefore modifying one's lifestyle behaviors will work wonders in stopping or reversing these conditions.

faculty of study, family history of obesity and alcohol are not significantly associated with obesity. The prevalence of obesity is relatively high (36.8%) among UB students. Obesity and overweight are associated with age and level of studies. Students practiced unhealthy dietary practices and lifestyle behaviors that should be targeted and modified. Promoting healthy dietary and weight management practices might be of great importance when developing health education programs.

**Subjects: Health & Society; Health Conditions; Public Health Policy and Practice**

**Keywords: overweight; obesity; physical activity; UB; sedentary lifestyle**

### 1. Introduction

Obesity has become a serious epidemic health problem, estimated to be the fifth leading cause of mortality at global level (WHO, 2012). According to WHO (2012), obesity has reached epidemic proportions globally, with at least 300 million of people being clinically obese. Current obesity levels range from below 5% in China, Japan and certain African nations, to over 75% in urban Samoa (WHO, 2012). According to Sørensen, Virtue, and Vidal-Puig (2010) the risk functions for obesity have been used to define 'overweight and or obesity' as an excess storage of fat in the body to such an extent that it causes health problems leading to excess morbidity and mortality.

Obesity risk factors among university students may include different chronic diseases such as type 2 diabetes mellitus, cardiovascular diseases, hypertension, dyslipidemia (Franssen, Monajemi, Stroes, & Kastelein, 2011), metabolic syndrome, osteoarthritis, insulin resistance (Nguyen, Magno, Lane, Hinojosa, & Lane, 2008), skin problems such as poor wound healing (Guida et al., 2010), psychosocial problems (stress, depression, anxiety, and low self-esteem), decreased academic and professional performance, and low overall quality of life (Moretti et al., 2014). These conditions may cause system disability and subsequently premature death because its development is progressing slowly with the above stated harmful effects and people hardly notice they are becoming obese. According to Kumah, Akuffo, Abaka-Cann, Afram, and Osae (2015) there are several factors associated with overweight and obesity which include; socioeconomic factors, environmental factors, psychosocial factors, demographic factors, medical conditions, genetics and lifestyle habits. University students are at high risk of being obese because university or college life is a critical period in terms of overweight and or obesity since it is the period generally accompanied by a reduction in physical activity levels, increased stress, and the adoption of unhealthy eating habits such as increased consumption of soft drinks, sweets, fried and processed foods and skipping meals, factors that favour an increase in the amount of body fat (Ramalho, Dalamaria, & Souza, 2012). According to Clark, Fonarow, and Horwich (2011) the risk factors of overweight and obesity as indexed by high body mass index (BMI) include: genetics, inactivity, unhealthy diet and eating habits, family lifestyle, alcohol consumption, pregnancy and post maternal weight gain (Ovesen, Rasmussen, & Kesmodel, 2011).

Evidence from prospective studies shows that obesity is associated with increased morbidity and mortality worldwide. In recent years, the prevalence of obesity in Botswana has increased with the rapid socioeconomic development (Letamo, 2011). Considering the public health implications of obesity, it is essential that all health care professionals increase their knowledge of obesity and related comorbidities and recognize it as a complex disorder that requires long-term follow-up and care.

The main purpose of the study is to estimate the prevalence and establish the factors associated with overweight and obesity among University of Botswana students. The findings will help come up with interventions to establish effective prevention strategies.

## 2. Methodology

Quantitative research approach was used to ascertain the prevalence and factors associated with obesity amongst University of Botswana Students. It was chosen because it involves the use and analyses of numerical data using statistical techniques (Creswell, 2013) thus helped us estimate the prevalence of and factors associated with overweight and obesity among students

The study design was a descriptive cross-sectional study conducted at University of Botswana from February to April 2016. It involved the administration of structured questionnaires to students to ascertain the prevalence and determinants of overweight and obesity among students.

Convenient sampling was conducted by locating five points at the University where students gather and socialize. These places were the Biological sciences block, faculty of engineering block, business block and student center and the researcher recruited any student who were at the five sites. Consent was sought from the participants and those who agreed were given a questionnaire to answer and their body height and weight were measured so as to calculate Body Mass Index (BMI).

The study was carried out in University of Botswana with an enrollment for 2015/2016 of 18,176 for full time students. Using Yamane (1967) formula the population size of  $N = 18,176$  and a 93% confidence level with a precision of 0.07, the required sample size for the study was 202.

$$\begin{aligned} &= \frac{N}{1 + N(e)^2} \\ &= \frac{18,176}{1 + 18,176(0.07)^2} \\ &= 202 \end{aligned}$$

Structured questionnaires were used to collect information from UB students in order to estimate the prevalence and determinants associated with obesity amongst the students. The questionnaire was translated to Setswana from English and back translated again to English. Questionnaires covered the following sections, demographic data, and genetic disposition of obesity, diet, physical activity and measurement for calculation of BMI.

Height and body mass measurement were measured from participants using weight height balance. The Body Mass Index (BMI) were calculated by dividing weight in kilograms by square of standing height ( $\text{kg}/\text{m}^2$ ), World Health Organization (WHO) diagnostic criteria was used to determine whether students are obese (see Table 1). Body mass index (BMI in  $\text{kg}/\text{m}^2$ ) was categorized using the WHO definitions:

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 22 software. Descriptive statistics were computed to describe demographic variables in Table 2 and variables in Figures 1 and 2. Missing data was excluded from analysis. Binary logistic regression test was used to investigate association between dichotomous dependent variables (not obese and obese/overweight) in Table 3 against categorical independent variables (year of study, faculty, frequency of alcohol consumption and frequency of physical activity). The chi-square test was used to find an association between categorical variables in Table 4. Odds ratios (ORs) and 95% confidence intervals were calculated. We set the significance level at 5% alpha.

Permission to conduct the study was sought from the Office of Research and Development (ORD) at UB, permit number, REF: X: REF: UB/RES/ETHI/703. Once permission was guaranteed by ORD, written consent was sought from students and the collected data was kept in a password protected computer to make sure that the participants' confidentiality and anonymity is guaranteed. The data obtained were only accessible to the principal investigator, supervisor and the course coordinator.

**Table 1. The International classification of adult underweight, overweight and obese**

Classification	BMI (kg/m <sup>2</sup> )
	Principal cut off point
<i>Underweight</i>	<18.50
Severe thinness	<16.00
Moderate thinness	16.00–16.99
Mild thinness	17.00–18.49
<i>Normal range</i>	18.50–24.99
<i>Overweight</i>	≥25.00
Pre-obese	25.00–29.00
<i>Obese</i>	≥30.00
Obese class 1	30.00–34.99
Obese class 11	35.00–39.99
Obese class 111	≥40.00

Source: Adapted from WHO (2004).

### 3. Results

A total of 202 questionnaires were returned from a total of 202 that was distributed, yielding a response rate of 100%. Of these participants, 85 (42.1%) were male whereas 117 (57.9%) were female. The mean age of participants was  $21.59 \pm 1.813$  years, the overall prevalence rates of underweight, normal, overweight and obese were 9.5, 53.7, 24.9 and 11.9% respectively. A total of 95.5% (201) respondents were single while 1(0.5) of the participants were married as shown in Table 2.

The results revealed that the older you become, the more you become overweight/obese (OR: 1.72, 95% CI: 1.06–4.46). The risk of being overweight and obesity was found to increase as the year of study increases (OR: 1.60, 95% CI: 1.09–3.99). Other variables; gender, faculty of study and alcohol use with being overweight or obese were not statistically significant ( $p > 0.05$ ).

The prevalence of overweight/obese was found to be high among students who think they are obese 19 (82.6%) as compared to those who think they are not obese 4 (17.4%), (OR: 3.4, 95% CI: 1.01–3.60),  $p = 0.001$  as shown in Table 3. There was an association between physical activity and weight ( $p = 0.019$ ). Those who were constantly involved in physical activity were 0.40 times less likely to be overweight and obese (OR: 0.40, 95% CI: 0.39–0.78). The association between frequency of physical activity, sleeping during the day, hours slept during the day and family history of obesity with being overweight/obese were not statistically significant ( $p > 0.05$ ).

Ninety-six percent (193) of students ate carbohydrates in their meals, 63.4% (128) fats were in their meals, 84.2% (170) ate proteins in their meals, 29.7% (60) students ate minerals, 31.2% (63) ate vitamins in their meals while the others students 7.4% (15) specified other constituents which are commonly in their meals as sugars and salts (Figure 1).

Regular soda 62% (125) and fruit juice 52% (105) were the main consumed beverages with the least consumed being diet soda 2% (3).

### 4. Discussion

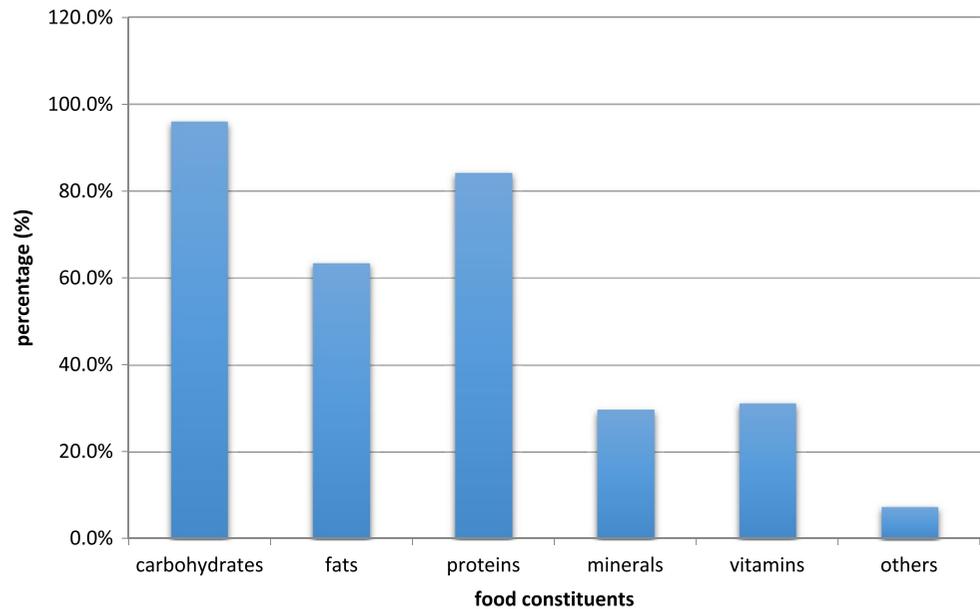
The results of this study showed that the overall prevalence of overweight and obesity was 36.8% which is higher than the prevalence in most African Universities (Peltzer et al., 2014). In Egyptian tertiary institutions overweight and obesity was found to be 21%, South Africa 19.4%, Namibia 12.3%. The African countries with the least prevalence of overweight and obesity were Ivory Coast and Madagascar with 2.9% and 1.3% respectively (Peltzer et al., 2014). In another study done by Mogre, Nyaba, and Aleyira (2014) at the University of Development studies in Ghana the prevalence

**Table 2. Demographic characteristics of the respondents**

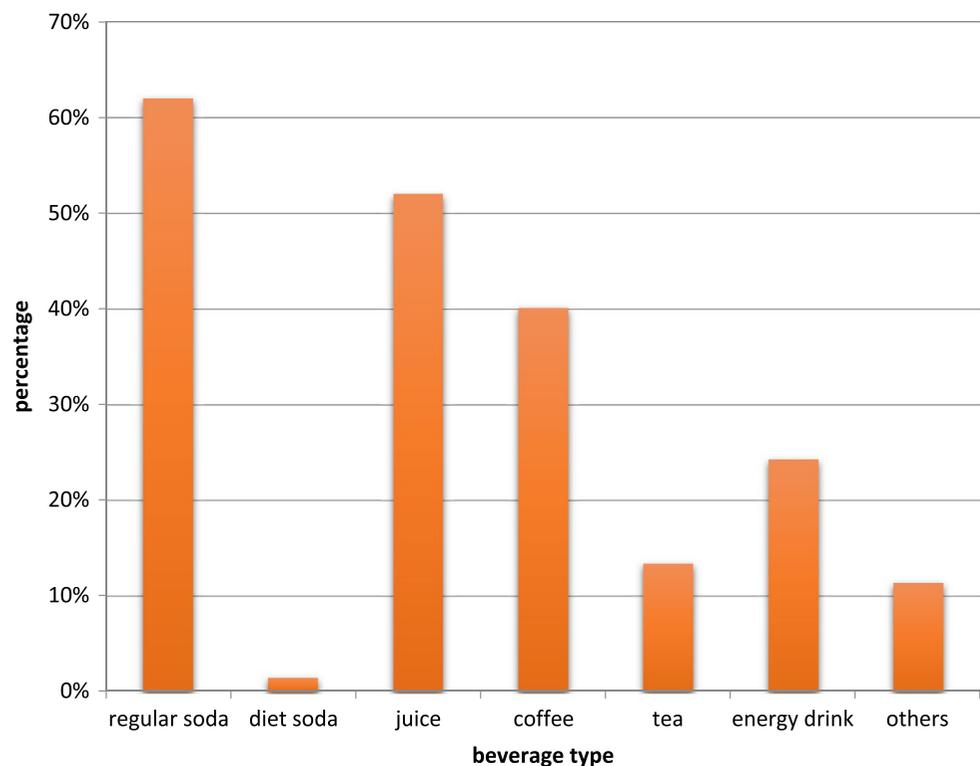
Variables	Frequency (N = 202)	Percentage (%)
Sex		
Males	85	42.1
Females	117	57.9
Total	202	100
Age (years)		
Below 22	141	69.8
23–26	57	28.2
26 and above	4	1.98
Total	202	100
Weight		
Underweight	19	9.5
Normal	109	53.7
Overweight	50	24.9
Obese	24	11.9
Total	202	100
Marital status		
Single	201	99.5
Married	1	0.5
Total	202	100
Level of study		
1st year	45	22.3
2nd year	72	35.6
3rd year	42	20.8
4th year	40	19.8
5th year	3	3
Total	202	100
Faculty of study		
Science	37	18.3
Social science	33	16.3
Health science	19	9.4
Medicine	9	4.5
Humanities	25	12.4
Education	29	14.4
Business	22	10.9
Engineering	28	13.9
Total	202	100

of obesity and overweight was found to be 11.2%. The high prevalence in overweight and obesity at the University of Botswana could be due to the fact that Botswana is now an upper-middle income country compared to other African countries (World Bank, 2016). Students are given allowances for food and others basics. The results of our study is congruent to a study done by Moretti et al. (2014) who found a prevalence of overweight and obesity to be (35.6%) among Acre University students. Pengpid and Peltzer (2014) found 37.5% prevalence of overweight or obese among Indian university students.

**Figure 1. Food constituents consumed by participants.**



**Figure 2. Frequency of beverages consumed.**



The prevalence of underweight and normal weight (not obese) among the students in the current study was 63.2%. The results are inconsistent with several studies conducted among tertiary students which reported overall lower prevalence rates of overweight and obesity (Fahmi, 2015; Moretti et al., 2014). This inconsistency may be explained by differences across different universities which may be attributed to socio-cultural factors, environmental, physical activity levels and nutritional knowledge and health awareness in these diversities of study samples across countries (El-Kassas, Itani, & El Ali, 2015).

**Table 3. Relationship between BMI and predictor variables (Year of study, Faculty and alcohol use)**

Variable	Not obese (BMI < 25 kg/m <sup>2</sup> ) N = 127 (63.2%)		Overweight/obese (BMI ≥ 25 kg/m <sup>2</sup> ) N = 74 (36.8%)		p-value	OR	95% CI
	No.	%	No.	%			
Age (Years)							
18-21	73	57	29	40	0.001	1.72	1.06-4.46
22-25	55	43	40	55			
26-30	0	0	4	5			
Year of study							
1st	38	30	7	9.5	0.001	1.60	1.09-3.99
2nd	46	36.2	25	33.8			
3rd	22	17.3	20	27			
4th	21	16.5	19	25.6			
5th	0	0	3	4.1			
Faculty							
Science	23	62.2	14	37.8	0.870	0.99	0.65-2.78
Social science	15	45.5	18	54.5			
Health science	17	89.8	2	10.5			
Medicine	8	88.9	1	11.1			
Humanities	16	64	9	36			
Education	21	75	7	25			
Business	13	59.1	9	40.9			
Engineering and Technology	14	50	14	50			
Frequency of alcohol consumption							
Every day	0	0	1	100	0.207	1.20	0.98-4.43
3-5 times a week	0	0	1	100			
Once a week	3	50	3	50			
Every weekend	17	51.5	16	48.5			
Sometimes	18	62.1	11	37.9			
Frequency of physical activity							
Once a day	24	61.5	15	38.5	0.185	1.00	0.70-2.45
Twice a day	1	100	0	0			
Sometimes	41	74.5	14	25.5			

Notes: OR = Odds Ratio; CI = Confidence Interval.

The prevalence of obesity increases significantly ( $p = 0.001$ ) with age and year of study ( $p = 0.001$ ) which concurs with findings from other universities. These findings were consistent with the results of similar studies by Peltzer et al. (2014) who found that overweight/obesity was increasing with age and the level of study. Allen (2013) also found out that, regarding academic grades, prevalence of obesity was found to be higher among students of third and fourth grades (34.2 and 32.1%, respectively) than those in the first and second grades (25.3 and 16.4%, respectively) thus the difference was statistically significant ( $p = 0.01$ ). The study also showed higher prevalence rate of obesity among males (40.5%) as compared to that of females (34.2%) with insignificant association of ( $p = 0.550$ ). This is consistent with findings of several studies (Peltzer et al., 2014; Sira & Pawlak, 2010) who found a significant percentage of males who were overweight and obese as compared to females. The results are also in agreement of Al-Ghabban (2013) who found out that prevalence of

**Table 4. Relationship between BMI and predictor variables (Gender, physical activity, sleeping during the day, and family history of obesity, self-perception and alcohol use)**

Variable	Not obese (BMI < 25 kg/m <sup>2</sup> ) N = 127		Overweight/obese (BMI ≥ 25 kg/m <sup>2</sup> ) N = 74		p-value	OR	95% CI
	No.	%	No.	%			
Gender							
Female	77	65.8	40	34.2	0.550	1.22	0.85–2.11
Males	50	59.5	34	40.5			
Physical activity							
Yes	66	70.9	27	29.1	0.019	0.40	0.39–0.78
No	61	51.7	57	48.3			
Sleeping during the day							
Yes	65	64.4	36	35.6	0.09	0.97	0.71–2.20
No	62	47.7	38	52.3			
Family history of obesity							
Yes	38	59.3	26	40.6	0.445	1.50	0.50–3.32
No	89	65	48	35.0			
Do you think you are obese							
Yes	4	17.4	19	82.6	0.001	3.4	1.01–3.60
No	123	1.8	55	98.2			
Alcohol use							
Yes	42	56.8	32	43.2	0.149	1.46	0.97–2.76
No	85	66.9	42	33.1			

Notes: OR = Odds ratio; CI = Confidence interval.

overweight/obesity was more common among male students compared to females (27.4 vs. 18.9 respectively) and there was no association between gender and obesity.

Physical activity has been noted as one of the key determinant of obesity among UB students. Overweight/obesity were found to be higher among students who were physically inactive 48.3% as compared with 21.3% who were physically active with significant association ( $p < 0.019$ ). This was in agreement with several studies Issa (2015) and Peltzer et al. (2014) which showed an association between level of physical activities and overweight and obesity. According to Moretti et al. (2014) physical activity is vital in our everyday activities as it leads to an elevation in daily energy expenditure and increases resting energy needed to promote fat oxidation thus which decreases body fat mass.

The most constituents of food that were commonly present in participants' meals were found to be carbohydrates, fats and proteins and there were less or no vitamins and minerals in their meals. The majority of respondents 30.7% (193) ate more of carbohydrates which was mostly common in their meals, 20.3% (128) responded that fats were also commonly available in their meals, 27% (170) ate proteins in their meals, 9.5% (60) students ate minerals, 10% (63) ate vitamins in their meals while the others students 2.40% which make up 15 students specified other constituents which are common in their meals such as sugars and salts. This study is in accordance with that of Issa (2015), the high prevalence of obesity may be explained by students having lack of high quality food and depend more on carbohydrates and fats in their eating which are the source of high energy and fat depositions. Increased intake of carbohydrates with less vitamins and minerals by University Of Botswana students may reflect characteristics of nutritional pattern in UB. This is supported by the results of earlier studies which reported that diets of the university students living away from the family are characterized by a number of undesirable practices affecting their healthy lifestyles

(El-Ghazali, Ibrahim, Kanari, & Ismail, 2010). Significant decrease in the consumption of fruits, fresh and cooked vegetables, seafood and pulses together with increased intake of sugar and fast foods were the major dietary changes reported for university students living away from the family home (El-Ghazali et al., 2010).

The reason behind this may be because in towns people may not have time to cook low-calorie meals at home but rather buy high calorie meals (Andegiorgish, Wang, Zhang, Liu, & Zhu, 2012). Suleiman et al. (2009) found out that various factors determine college student's selection of food. These factors include shortage of time, convenience, cost, taste, health, physical and social environment (Suleiman et al., 2009). Students also receive little allowance thus may cause some them to buy high-calorie processed foods such as fast foods because they typically cost less than healthier foods. Poor eating habits is a major public health concern among young adults who experienced transition into university life during which they are exposed to stress and lack of time (El-Kassas et al., 2015). These factors pose a barrier against adoption of healthy behaviors, such as poor eating habits and substance abuse such as alcohol. The prevalence of overweight and obesity among people who uses alcohol was found to be 43.2% with insignificant association of ( $p > 0.05$ ). The reason why there might be high prevalence of obesity among students who consume alcohol is because alcohol adds calories to the diet, increases appetite, and may interfere with a person's ability to make good choices about healthy meals and portion sizes (Peltzer & Pengpid, 2014).

The most common beverage consumed by participants were found to be regular soda (31.7%), juice (26.6%), coffee (20.6%), energy drinks (12.4%), tea (6.9%) and diet soda (0.80%) respectively. Rising consumption of sugary drinks has been a major contributor to the obesity epidemic (West et al., 2006). A typical 20-oz soda contains 15 to 18 teaspoons of sugar and upwards of 240 calories. A 64-oz fountain cola drink could have up to 700 calories. According to West et al. (2006) intake of sugar-sweetened beverages such as soda has been implicated as a likely contributing factor to the growing obesity rates among young adults West et al. (2006), in large part because sugared beverages represent a significant source of calorie consumption in this population. Young adults consume 20% of their total energy intake from added sweeteners, the majority of which are consumed in sodas and fruit drinks (West et al., 2006). Among adolescents, over 10% of the total calories they consume come from soda and fruit drinks alone (West et al., 2006).

Concerning family history of obesity, there was no association between obesity and family history of obesity. Study results showed prevalence of high overweight and obesity (40.6%) among students with history of parental obesity or family history of easily weight gain were more than among students with no history of parental obesity or family (35.0%) with insignificant association ( $p > 0.05$ ). The results are inconsistent with that of (Al-Nakeeb et al., 2012; Pengpid & Peltzer, 2014) who found that having family history of obesity is a predictor of obesity because having obese relatives increases one's risk for obesity, even if family members do not live together or share the same patterns of exercise and food intake.

## 5. Conclusion

In conclusion, overweight and obesity is a problem among University of Botswana as the study found a high prevalence of overweight/obesity among University of Botswana students. Age was one of the risk factors that was found to be predictor of overweight/obesity, that is the older you become the more obese you become. Students had also shown a relatively alarming prevalence of unhealthy dietary practices and lifestyle behaviors that should be targeted and modified. This could be achieved through promoting intervention programs that lead to changing the built environment, weight management practices, counselling and affecting behavioral modification of student's lifestyle and dietary habits. The current research provides valuable data that could be used by university directors to plan strategies aiming at improving the health of future generations in University of Botswana.

### What is already known on this subject?

Obesity is associated with increased morbidity and mortality worldwide.

### What this study adds?

Physical activity and its frequency were dependent on someone's weight whilst sleeping during the day, hours slept during the day and family history of obesity were not statistically significant ( $p > 0.05$ ) not associated with being overweight/obese.

### Contributorship statement

Roy Tapera conceptualized the idea and was responsible for data curation. Roy Tapera also designed the study with Marogwe Thato Merapelo. Roy Tapera, Marogwe Thato Merapelo, Tshephang Tumoyagae, Titus M. Maswabi, Patience Erick, Baemedi Letsholo, Bontle Mbongwe were involved in data analysis, interpretation and writing the paper. All authors have reviewed and provided comments on this article. All authors had final approval of the submitted and published versions.

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### Competing Interests

The authors declare no competing interest.

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