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Prevalence and Determinants of Overweight and Obesity among the Catholic University of Eastern Africa Staff, Langata Campus, Nairobi, Kenya

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Abstract

Background: Overweight and obesity are escalating global problem, causing multiple life threatening non-communicable diseases including cardiovascular disease, dyslipidemia, hypertension, type 2 diabetes, osteoarthritis and some forms of cancer [1] [2]. Although the burden is particularly heavy in developing countries including Kenya, yet extensive data is still lacking in these countries. Therefore, the aim of this study was to determine the prevalence and risk factors for obesity and overweight among the Catholic University of Eastern Africa (CUEA) staff, Langata Campus, Nairobi, Kenya. **Methods and Materials:** A cross sectional, descriptive study was carried out among 301 CUEA staff. WHO stepwise-structured questionnaire was used to collect the data regarding respondents' socio-demographic, lifestyle characteristics and anthropometric. Data were analyzed using SPSS software version 22.0. Descriptive Data were descriptively analyzed into proportions and frequency tables, while to determine relationships between various variables; One-Way ANOVA was employed. The ethical approval to conduct the study was obtained from KNH-University of Nairobi Ethical Review Committee. The institutional permission was granted by the administration of CUEA. The consent was obtained from the respondents before data collection was commenced. **Results:** The prevalence of overweight and obesity among the respondents was 47.5% and 36.3% respectively. Based on waist circumference (WC), the prevalence of overweight and obesity among men was 42.6% and 37.2% respectively. While among the women the prevalence of overweight and obesity was 56.8% and 19.5% respectively. The mean BMI ($p = 0.006$) and the mean WC ($p = 0.004$) were significantly higher among respondents aged ≤40 years old. Additionally, the mean WC was significantly higher

among male respondents compared to the female counterparts (p = 0.003). Daily consumption of vegetables (p = 0.022) and fruits (p = 0.017) was significantly associated with lower WC. While, higher WC (p = 0.015) and BMI (p = 0.003) were significantly associated with daily consumption of fast foods. Respondents who had involved in vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week had significantly lower mean BMI (p = 0.025) and mean WC (p = 0.002) compared to respondents who did not involve in any vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week respectively. Additionally, respondents who had involved in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week had significantly lower mean BMI (p = 0.011) and mean WC (p = 0.023) than respondents who did not involve in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week respectively. Moreover, both mean BMI (p = 0.002) and WC (p = 0.005) were significantly higher among respondents who drink alcohol ≥ 3 standard drinks per drinking occasion compared to those who drink less than 3 standard drinks per drinking occasion. **Conclusion and recommendation:** There is a high prevalence of overweight and obesity among the respondents. Consumption of fast foods and excessive alcohol is a predictor for obesity. While high consumption of fruits and vegetable and engaging in physical activities are protective against obesity. Institution like the Catholic University of Eastern Africa should be involved in lifestyle modification programs that lead to improve nutrition, physical activity and behavioral change.

Keywords

Prevalence, Determinants, Overweight/Obesity

1. Introduction

Low- and middle-income countries, including Kenya, are facing rising prevalence of obesity and obesity related cardiometabolic complications. Overweight and obesity are major risk factors for a number of non-communicable diseases (NCDs), including type 2 diabetes, cardiovascular diseases, some forms of cancers and increase medical expenditures. Overweight is defined as body mass index (BMI) ≥ 25 kg/m^2 and obesity as BMI ≥ 30 kg/m^2. Over recent years, rates of overweight and obesity have escalated rapidly in many parts of the world to epidemic proportions, mostly because of increased consumption of energy dense diets high in fats and sugars, compounded by declining physical activitylevels. The worldwide prevalence of obesity has nearly doubled between 1980 and 2008. In 2008, 10% of men and 14% of women in the world were obese (BMI ≥ 30 kg/m^2), compared with 5% for men and 8% for women in 1980 [3]. Globally 1.9 billion adults aged 18 years and above are overweight, of these, over 650 million are obese. Evidence from the Kenya Demographic Health Survey (KDHS) (2008-09) indicated that there is increasing prevalence of overweight and obesity in Kenya.

The proportion of women aged 15 - 49 who are overweight and obese has increased from 23% in 2003 to 25% in 2008-09 with uneven prevalence distribution between rural (20%) and urban areas (39%) [4].

The global burden of overweight and obesity is increasing rapidly and will have significant social, economic and health consequences unless urgently addressed. Worldwide, 2.8 million people die each year as a result of being overweight and obesity [5]. Excess weight tends to increase low density lipoprotein (LDL) level, triglycerides and lowers high density lipoprotein (HDL) which predisposes a person to type 2 diabetes and cardiovascular diseases. The more fat there is in the body, the harder time insulin has in getting glucose into the cells. Conversely, minimizing fat intake and reducing body fat help insulin do its job much better [6].

Teaching institutions like the Catholic University of Eastern Africa are important risk factors for overweight and obesity due to their lifestyles factors. Staff from universities usually suffer from lack of sufficient physical activity because of the nature of the work. People in such work environment spend too much time in office probably sitting the whole day and then drive back to home which is one of the major risk factors for obesity and related health problems. Although the prevalence of overweight and obesity in some developing countries including Kenya is extremely high, less attention has been given to mitigate the problem as more attention has been concentrated on infectious diseases and under-nutrition or malnutrition of children [7] [8]. If preventive measures are not put in place, the problem will affect millions of Kenyans and overburden the health care system. Therefore, there is a need to put measures in place to arrest the problem of overweight and obesity and to prevent the negative health and socio-economic consequences in the country. In order to address the burden of overweight and obesity, it is critically important to examine the problem and understand the local determinants of overweight and obesity; thus corrective strategic measures can be implemented. Hence, the aim of the study was to determine the factors associated with overweight and obesity among the Catholic University of Eastern Africa, Nairobi, Kenya (**Table 1**).

2. Methods and Materials

2.1. Study Setting

The study was carried out at the Catholic University of Eastern Africa (CUEA), Langata Campus which is located at Langata, Nairobi, Kenya. The institution in Kenya was established in 1984 as a private faith based University. The Institution offers several courses from Undergraduate to PhD programmes.

2.2. Study Design and Respondents

A descriptive, cross sectional study design was employed among three hundred and one (301) academic and nonacademic staff working at the University in two months period (April-May, 2018). During the study period, the University had

Table 1. Categories of body mass index and waist circumference for adults.

Body mass index (BMI)		
BMI < 18.5		Underweight
BMI =18.5 - 24.9		Normal
BMI = 25 - 29.9 kg/m^2		Overweight
BMI = 30.0 - 34.9 kg/m^2		Obesity I
BMI = 35.0 - 39.9 kg/m^2		Obesity II
BMI ≥ 40.0 kg/m^2		Obesity III
Waist circumference (cm)		
Men	Women	Value
<94 cm	<80 cm	Normal
94 - 101.9 cm	80 - 87.9 cm	Overweight
≥102 cm	≥88 cm	Obesity
	Waist-hip ratio	
0.95 or below	0.80 or below	Normal (Low Risk)
0.96 to 1.0	0.81 to 0.85	Moderate Risk
1.0+	0.85+	High Risk

415 staff and all of them were included in the study. However, after excluded some of the staff members who were away or on leave during the study period and those who did not want to participate in the study, 301 staff participated in the study.

2.3. Data Collection Tools

Data was collected using a pre-tested, WHO stepwise-structured questionnaire. Two research assistants having a bachelor's degree in Nursing were trained to collect the data on: socio-demographic characteristics, physical activity, dietary intake patters and anthropometric measurements. The questionnaire had four sections. The first section was used to collect socio-demographic information. The second section was used to collect data on physical activity during work, transportation and leisure time in a typical week. The third section was used to collect information on dietary intake and eating habits. This was done using a food frequency questionnaire. The final section of the questionnaire was used to collect anthropometric parameters including weight, height, body mass index (BMI) and waist circumference (WC), measured using standard measurement units. Both BMI and waist circumference (WC) were used to determine the prevalence of overweight and obesity.

2.3.1. Physical Activity

The physical activity of the respondents was collected using the Global Physical

Activity Questionnaire regarding type, frequency, duration and intensity of physical activity during work, transportation and leisure time in a typical week [9]. The tool is developed by the World Health Organization (WHO) for physical activity surveillance.

2.3.2. Dietary Intake Patterns

The food frequency questionnaire (FFQ) was used to capture information on the type and frequency of foods consumed by the respondents. The questionnaire focused on food recall on types of foods including fast foods, vegetables, fruits, beverages such as alcohol consumption, including the frequency of their consumption.

2.3.3. Anthropometric Measurements and Procedures

Physical measurements including weight, height, body mass index (BMI) and waist circumference (WC) were measured and recorded. Body weight in light clothes was measured to the nearest 0.1 kg using a Sohenle mechanical weighing scale. Height (in metres) to the nearest 0.5 cm was measured using a portable stadiometer, with subjects standing upright on a flat surface without shoes, the back of the heels and the occiput on the stadiometer. BMI was calculated as the ratio of weight in kilograms over height in meters squared [weight (kg)/height (m^2)]. WC was taken at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest (hip bone) (WHO, 2000). Men with WC of < 94 were classified as normal weight, 94 - 101.9 overweight and ≥102 cm obese. Women were also classified in same categories of <80, 80 - 87.9 and ≥88 cm for normal weight, overweight and obese, respectively.

2.3.4. Validity and Reliability

Validity of the questionnaire was examined by an expert in the field of nutrition and non-communicable diseases. He examined the questionnaire and provided feedback to the researcher. The recommendations and suggestions were incorporated in the final questionnaire.

The test re-test method was used to test reliability of the questionnaires in producing the same results. The pre-test sample comprised of 10 respondents who were randomly sampled outside the study area. Areas of the questionnaire that were found to be deficient were revised and the questionnaire adapted accordingly.

2.3.5. Pilot Study

The questionnaires were pre-tested for accuracy and clarity prior to the commencement of data collection on a sample of 21 adults (5% of the sample size) with similar characteristics to the actual sample, but who were not included in the final study.

2.4. Data Analyses

Completed questionnaires were checked, cleaned and coded before data entry.

Computer software, (SPSS V. 22) was used to analyze the data. The data was descriptively analyzed into proportions and frequency tables, while one-Way ANOVA was used to determine relationships between various variables. A p value of less than 0.05 was considered to be significant.

2.5. Ethical Consideration

The ethical approval to conduct the study was obtained from Kenyatta National Hospital-University of Nairobi Ethical Review Committee (KNH-UoN ERC) (Approval number (UP 592/10/2017). The institutional permission was granted by the administration of the Catholic University of Eastern Africa. The consent was obtained from the respondents after explanation regarding the study both verbally and in written before data collection was commenced.

3. Results

3.1. Socio-Demographic Characteristics of Respondents

Of the respondents, 68.1% were in the age group of 31 - 50 years, 60.5% were males and 62.8% were married. Among the respondents, 94% had university/college degree and 52.8% were academic staff. The majority, (92.7%) were belongs to Christian religion and most, (66.4%), were residents of Nairobi (Table 2).

Table 2. Socio-demographic characteristics of the respondents.

Variables	N	Percent (%)	Variables	N	Percent (%)
Age in years			**Religion**		
20 - 30	27	9.0	Christian	279	92.7
31 - 40	96	31.9	Pagan	22	7.3
41 - 50	109	36.2	Residence		
51 - 60	49	16.3	Nairobi	200	66.4
>60	20	6.6	Outside of Nairobi	101	33.6
Gender			**Employment categories**		
Male	182	60.5	Academic	159	52.8
Female	119	39.5	Non-academic	142	47.2
Marital status			**Level of education**		
Married	189	62.8	Primary	5	1.7
Single	69	22.9	Secondary	13	4.3
Divorced/Separated	21	7.0	Tertiary	283	94
Widowed	10	3.3			
Cohabiting	12	4.0			

3.2. Physical Measurements (BMI and WC) of the Respondents

The prevalence of overweight (BMI = 25 - 29.9 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) among the respondents were 47.5% and 36.3% respectively. Of the obese respondents, 30.2% had obesity I (BMI = 30.0 - 34.9 kg/m^2), 3.4% obesity II (BMI = 35.0 - 39.9 kg/m^2) and 2.7% obesity III (BMI ≥ 40.0 kg/m^2). Using the European group for study of insulin resistance (EGIR, 2004) definition, majority, (79.8%) men and (76.3%) women had abnormal high waist circumference (WC) measurements (≥94 cm for men and ≥80 cm for women). Based on WC, the prevalence of overweight and obesity among men were 42.6% and 37.2% respectively. While among the women the prevalence of overweight and obesity were 56.8% and 19.5% respectively. Further analyses with One-Way ANOVA and independent samples T-test revealed that the mean BMI (F (2215) = 6.185, p = 0.006) and the mean WC (t = 2.021, df = 217, p = 0.004) were significantly higher among respondents aged ≤ 40 years old respectively. Additionally, the mean WC was significantly higher among male respondents compared to the female counterparts (t = 2.014, df = 216, p = 0.003) (Table 3).

Table 3. Measurements of body mass index (BMI) and waist circumference (WC) of the respondents.

Body mass index (BMI) kg/m^2	Category	N	Percent (%)
BMI < 18.5	Below normal	1	0.3
BMI =18.5 - 24.9	Normal	48	15.9
BMI = 25 - 29.9	Overweight	143	47.5
BMI = 30.0 - 34.9	Obesity I	91	30.2
BMI = 35.0 - 39.9	Obesity II	10	3.4
BMI ≥ 40.0	Obesity III	8	2.7

Waist Circumference (cm)

Men	N	Percent (%)	Women	N	Percent (%)
<94	37	20.2	<80 cm	28	23.7
94 - 101.9	78	42.6	80 - 87.9 cm	67	56.8
≥102	68	37.2	≥88 cm	23	19.5
Total	183	100	Total	118	100

BMI and WC measurements in relation to respondents' age and gender

Measurement	Age*			p-value	Gender**		p-value
	≤40	41 - 60	>60		Male	Female	
Mean BMI	30.3	26.9	25.7	0.006	27.1	26.8	0.153
Mean WC	92.0	85.0	80.0	0.004	96.0	89.0	0.003

Analysis with: *One-Way ANOVA; **Independent Samples T test.

3.3. Relationship between Respondents' Dietary Practice and Physical Measurements (WC and BMI)

Of the respondents, a good number had eaten processed foods, often at 16.9% and always at 14% respectively. Nearly half, (49.2%), of the respondents consumed fruits 1 - 2 days in a week and majority, (52.8%) consumed vegetables 3 - 4 days per week. A One-Way ANOVA test was used to establish the relationship between eating habits and anthropometric measurements. Respondents who consumed vegetables ($F(2, 241) = 3.663$, $p = 0.022$) and fruits ($F(2, 207) = 10.743$, $p = 0.017$) on daily basis were likely to have low WC. However, higher WC ($F(2, 204) = 10.745$, $p = 0.015$) and BMI ($F(2, 207) = 12.026$, $p = 0.003$) were significantly associated with daily consumption of fast foods (Table 4).

Table 4. Relationship between fruits, vegetables and fast foods consumption and BMI.

Frequency of eating processed foods						
Variable		N			Percent (%)	
Always		42			14.0	
Often		51			16.9	
Sometimes		75			24.9	
Rarely		128			42.5	
Never		5			1.7	
Frequency of fruits consumption						
1 - 2 days per week		148			49.2	
3 - 4 days per week		56			18.6	
5 - 7 days per week		97			32.2	
Frequency of vegetables consumption						
1 - 2 days per week		110			36.5	
3 - 4 days per week		159			52.8	
5 - 7 days per week		32			10.6	
Relationship between respondents' eating habits and BMI measurement						
Variables	Eat vegetables	p-value	Eat fruits	p-value	Eat fast foods	p-value
Mean BMI		0.321		0.271		**0.003**
Daily	25.7		26.4		28.1	
Frequently	25.3		25.0		26.3	
Rarely	27.0		26.1		25.1	
Never	26.1		27.0		24.9	
Total						
Mean WC		**0.022**		**0.017**		**0.015**
Daily	86.8		83.6		101.3	
Frequently	88.2		94.1		99.3	
Rarely	100.1		97.7		89.6	
Never	99.9		98.7		87.4	
Total						

Key abbreviations: WC = Waist circumference, BMI = Body circumference, Analysis with One-Way ANOVA.

3.4. Anthropometric Measurements in Relation to Physical Activities of the Respondents

Majority, (89.4%) and (87.7%) of the respondents' work did not involve vigorous intensity and moderate intensity activities respectively. Of the respondents, most, (64.8%) did not involve in any vigorous intensity sports or recreation activities. Majority, (90%) of the respondents had spent seating for ≥5 hours per day. Further analysis revealed that respondents who had involved in vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week had significantly lower mean BMI ($F(2, 217) = 3.470$, $p = 0.025$) and mean WC ($F(2, 207) = 7.046$, $p = 0.002$) compared to respondents who did not involve in any vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week respectively. Additionally, respondents who had involved in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week had significantly lower mean BMI ($F(2, 211) = 5.194$, $p = 0.011$) and mean WC ($F(2, 140) = 3.479$, $p = 0.023$) than respondents who did not involve in in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week respectively (Table 5).

Table 5. Anthropometric measurements in relation to physical activities of the respondents.

Variables	Yes		No	
	N	%	N	%
Whether respondents' work involve **vigorous** intensity activity	32	10.6	269	89.4
Whether respondents' work involves **moderate** intensity activity	37	12.3	264	87.7
Whether respondents involve in any vigorous intensity sports or recreation activities	106	35.2	195	64.8
Time spend seating per day	N		%	
≤4 hours	28		9.4	
5 - 8 hours	226		75.0	
>8 hours	47		15.6	

Relationship between physical activities and BMI and WC

Variables	Do vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week		p-value	Do moderate intensity physical activity for ≥30 minutes for ≥5 days in a week		p-value
	Yes (N = 32)	No (N = 269)		Yes (N = 28)	No (273)	
Mean BMI	21.8	27.9	0.025	24.3	29.9	0.011
Mean WC in cm	79	101	0.002	82	97	0.023

Analysis with: *One-Way ANOVA; **Independent Samples T test.

3.5. Relationship between Alcohol Consumption and Physical Measurements

Most, (61.1%) of the respondents consumed alcohol. Majority, (67.6%) of those who consumed alcohol, consumed ≥3 standard drinks in one drinking occasion. Further analyses with One-Way ANOVA and independent samples T-test revealed that both mean BMI ($F(2191) = 3.282$, $p = 0.002$) and mean WC ($t = 2.051$, $df = 1169$, $p = 0.005$) were significantly higher among respondents who had drunk ≥ 3 standard drinks per drinking occasion than respondents who had drunk less than 3 standard drinks per drinking occasion (Table 6).

4. Discussion

Our study findings revealed that age, gender, physical activity, consumption of fruits, vegetables, fast foods and alcohol were the variables significantly associated with overweight and obesity among the study respondents. The subsequent discussion will be based on these findings.

4.1. Relationship between Respondents' Age and Gender and Physical Measurements

Using BMI, the prevalence of overweight and obesity among the respondents were 47.5% and 36.3% respectively. Of the obese respondents, 30.2% had obesity I, 3.4% obesity II and 2.7% obesity III. Using the European group for study of insulin resistance (EGIR, 2004) definition, majority, (79.8%) men and (76.3%) women had abnormal high waist circumference (WC) measurements (≥94 cm

Table 6. Relationship between alcohol consumption and physical measurements.

Variables	N	Percent (%)
Alcohol consumption status		
Yes	184	61.1
No	117	38.9
Frequent of alcohol consumption per week (N = 184)		
≤2 days	152	82.6
≥3 days	32	17.4
Standard drinks per drinking occasion (N = 184)		
1 - 3 standard drinks	84	45.7
>3 standard drinks	100	54.3

Relationship between alcohol consumption and physical measurements

Variables	Standard drinks per drinking occasion		p-value
	1 - 3 standard drinks	≥3 standard drinks	
Mean BMI	26.2	39.6	0.002
Mean WC in cm	85.3	94.7	0.005

Key abbreviations: BMI = Body mass index. WC = Waist circumference, Analysis with: *One-Way ANOVA; **Independent Samples T Test.

for men and ≥80 cm for women). Based on WC, the prevalence of overweight and obesity among men were 42.6% and 37.2% respectively. While among the women the prevalence of overweight and obesity were 56.8% and 19.5% respectively. The prevalence of overweight is higher in women at 56.8% compared to 42.6% in men, while, the prevalence of obesity is higher in men at 37.2% compared to 19.5% in women. In the current study, this prevalence of overweight/obese (42.6%) among Kenyan women is higher than the prevalence recorded in 2009 at 39% in Nairobi, the main capital city of Kenya [10]. The observed high prevalence rate of overweight/obese in this study could be due to the fact that the respondents were University staff with higher standards of living than the general population and also the nature of their work, sedentary behavior, might predispose them to overweight/obese than the general population.

Further analyses revealed that mean BMI and the mean WC were significantly higher among respondents aged ≤40 years old compared to respondents aged above 40 years. Additionally, the mean WC was significantly higher among male respondents compared to the female counterparts ($p = 0.044$). This finding is in agreement with many previous studies which found that young adults (below 40 years old) had abnormal higher BMI and WC compared to individuals above 40 years old [11] [12] [13] [14]. Young adults are more prone to obesity than older adults because of several reasons. Firstly, young adults eat a lot of fast foods and drink more alcohols than older adults which might put them at higher risk of obesity. People younger than 40s have higher chances of engaging in socialization and involving in unhealthy lifestyles (eating and drinking) than individuals above 40s, characteristics which might put them to overweight/obese. Fast foods are high in calories, salt and sugar, which are known risk factors for obesity [15]. WHO data revealed that consumption of processed foods and/or fast foods promotes obesity due to their high contents of salt, sugar and fats compared to low-energy foods such as fruits and vegetables [16]. Secondly, adults above 40 years old are more knowledgeable about lifestyle changes because they visit health facilities more frequently than young adults which might play a significant role in adapting healthier lifestyle behavior. Obesity has negative health consequences, both in increased morbidity and mortality as well as social stigma and limitations to healthy social functioning.

4.2. Relationship between Dietary Intake Patterns and Physical Measurements

The study revealed that daily consumption of vegetables and fruits were significantly associated with lower WC; while, higher WC and BMI were significantly associated with daily consumption of fast foods. Dietary intake has been cited as one of the leading forces in the development of overweight and obesity. Over the years, the diets of populations have been changing towards diets that favour the weight gain as traditional diets are gradually replaced with modern diets and this is particularly significant in Nairobi (the capital city of Kenya) where the study

was carried out. The adoption of unhealthy eating habits such as increased consumption of soft drinks, sweets, fried and processed foods, favours an increase in the amount of body fat and thus obesity [10]. Fruits and vegetables on the other hand reduce weight because they have low energy density, high water, fiber, and low fat content. The high-fiber content is attributed to weight loss through the feeling of stomach fullness or enhances satiety without additional calories. On the other hand, fast foods, high calorie beverages and diet rich in calories, but lacking fruits and vegetables are associated with weight gain [15] [17] [18] [19]. WHO data revealed consumption of processed foods and/or fast foods promotes obesity due to their high contents of salt, sugar and fats compared to low-energy foods such as fruits and vegetables [16]. Consumption of unhealthy diets and changing lifestyles has resulted in increased levels of obesity, cardiovascular diseases, cancers and diabetes and represent a significant development challenge [10].

4.3. Relationship between Physical Activity and Physical Measurements

Majority, (89.4%) and (87.7%) of the respondents' work did not involve vigorous intensity and moderate intensity physical activities respectively. Of the respondents, most, (64.8%) did not involve in any vigorous intensity sports or recreation activities. Majority, (90%) of the respondents had spent seating for ≥5 hours per day. The WHO defines insufficient physical activity as less than five times 30 minutes of moderate physical activity per week, or less than three times 20 minutes of vigorous physical activity per week [20]. Further analysis revealed that respondents who had involved in vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week had significantly lower mean BMI and mean WC compared to respondents who did not involve in any vigorous intensity physical activity for ≥20 minutes for ≥3 days in a week respectively. Additionally, respondents who had involved in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week had significantly lower mean BMI and mean WC than respondents who did not involve in moderate intensity physical activity for ≥30 minutes for ≥5 days in a week respectively.

This finding is in line with other studies which found that engaging in physical activities reduces both BMI and WC [21] [22] [23] [24]. Physical activity contributes to energy consumption, prevents obesity, favors weight loss, and reduces the risk of developing cardiovascular diseases, type 2 diabetes mellitus and some forms of cancer [25] [26]. Adequate physical activity has been shown to have many health promoting properties and has a direct, independent role in reducing CVDs mortality. Inactivity on the other hand is one of the most important factors that have been known to fuel overweight and obesity.

Kenyans today rely more on personal and public vehicles to move even the shortest of distance. This is particularly significant for people, who work in teaching institutions; they usually drive from home to work place and then drive

back to home after sitting the whole day in office, sedentary behaviors which predispose them to obesity. Physical inactivity is recognized as one of the four major risk factors for the four major Non-communicable diseases which contribute for multiple deaths and disability. People who do not involve in physical activity have a 20% - 30% increased risk of all-cause mortality compared to those who involve in at least 30 minutes of moderate intensity physical activity for ≥5 days in a week [WHO, 2009]. Research revealed that weekly engagement in 150 minutes of moderate intensity physical activity reduces the risk of ischaemic heart disease by approximately 30%, the risk of diabetes by 27% and the risk of breast and colon cancer by 21% - 25% [20]. Regular physical activity also helps the body cells take up glucose and thus lower blood glucose levels. Adequate physical activity can prevent the development of diabetes by reducing body weight, increasing insulin sensitivity and blood sugar control. It also helps control blood cholesterol and blood pressure. Conversely, insufficient physical activity decreases insulin sensitivity, which can lead to diabetes [27].

4.4. Relationship between Alcohol Consumption and Physical Measurements

Most, (61.1%) of the respondents consume alcohol. Of those who consume alcohol, majority, (67.6%) consumed ≥3 standard drinks in one drinking occasion. Further analyses with One-Way ANOVA and independent samples T-test revealed that both mean BMI and mean WC were significantly higher among respondents who had drunk ≥3 standard drinks per drinking occasion as compared to respondents who drink less than 3 standard drinks per drinking occasion. The amount and frequency of alcohol consumption have been found to correlate with BMI and WC. A study using national surveys in the United States found that people who consumed ≥4 drinks per day had significantly higher BMI than those who consumed one drink per day [28] [29] [30] [31]. There are several reasons alcohol and weight gain are linked. Alcohol can cause weight gain simply because it has calories. If there is too much alcohol, it can also turn into fat in the liver, which then turns into fat which is likely to be stored as fat in the body and thus weight gaining. Alcohol is an appetite stimulant, so people may be more likely to eat more and also make poorer food choices if they're drinking [32] [33]. Alcohol may also fail to trigger the physiologic mechanism that produces the feeling of fullness in the short term, long-term, frequent drinkers which may predispose heavy drinkers to overeating and thus weight gain [34].

5. Conclusion

Our findings show that there is high prevalence of overweight and obesity among the respondents. Consumption of fast foods and excessive alcohol is predictors for obesity. While high consumption of fruits and vegetable and engaging in both moderate and vigorous physical activities is protective against obesity. Institution like the Catholic University of Eastern Africa should be involved

in lifestyle modification including supervised weight loss programs leading to improved nutrition, physical activity and behavioral change.

Limitation of the Study

Biochemical profiles (lipid and blood glucose levels) should be checked to establish a comprehensive image on the general cardiovascular health status of the study population.

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Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions

Both authors were instrumental in conception, research development and study design. FO contributed in data collection. OT was instrumental in statistical analysis. OT contributed in discussion and manuscript revision. Both authors read and gave final approval for the manuscript's submission and publication.

Ethics Approval and Consent to Participate

The ethical approval to conduct the study was obtained from Kenyatta National Hospital-University of Nairobi Ethical Review Committee (KNH-UoN ERC) (Approval number (UP 592/10/2017)). The institutional permission was granted by the administration of the Catholic University of Eastern Africa. The consent was obtained from the respondents after explanation regarding the study both verbally and in written before data collection was commenced.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Yusuf, S., Hawken, S., Ounpuu, S., Bautista, L., Franzosi, M.G., Commerford, P., *et al.* (2005) Obesity and the Risk of Myocardial Infarction in 27,000 Participants from 52 Countries: A Case-Control Study. *The Lancet*, **366**, 1640-1649. https://doi.org/10.1016/S0140-6736(05)67663-5

[2] Pischon, T., Boeing, H., Hoffmann, K., Bergmann, M., Schulze, M.B., Overvad, K.,

et al. (2008) General and Abdominal Adiposity and Risk of Death in Europe. *The New England Journal of Medicine*, **359**, 2105-2120. https://doi.org/10.1056/NEJMoa0801891

[3] Finucane, M.M., *et al.* (2011) National, Regional, and Global Trends in Body-Mass Index since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 960 Country-Years and 9.1 Million Participants. *The Lancet*, **337**, 557-567. https://doi.org/10.1016/S0140-6736(10)62037-5

[4] Kenya National Bureau of Statistics (KNBS) and ICF Macro (2010) Kenya Demographic and Health Survey 2008-09. Calverton.

[5] World Health Organization (2012) Obesity and Overweight. Fact sheet N 311.

[6] Howarth, N.C., Saltzman, E. and Roberts, SB. (2001) Dietary Fiber and Weight Regulation. *Nutrition Reviews*, **59**, 129-139. https://doi.org/10.1111/j.1753-4887.2001.tb07001.x

[7] Philip, W. and James, T. (2005) The Challenges of Obesity and Its Associated Chronic Diseases. Nutrition Transition, Obesity and Non-Communicable Diseases: Drivers, Outlook and Concerns. FAO United Nations System Standing Committee on Nutrition.

[8] World Health Organization (2000) Obesity: Preventing and Managing the Global Epidemic: Report of a WHO Consultation. Geneva.

[9] Armstrong, T. and Bull, F. (2006) Development of the World Health Organization Global Physical Activity Questionnaire (GPAQ). *Journal of Public Health*, **14**, 66-70. https://doi.org/10.1007/s10389-006-0024-x

[10] Ministry of Health of Kenya (2015) Kenya National Strategy for the Prevention and Control of Non-Communicable Diseases, 2015-2020.

[11] Ng, T.P., Jin, A., Chow, K.Y., Feng, L., Nyunt, M.S.Z. and Yap, K.B. (2017) Age-Dependent Relationships between Body Mass Index and Mortality: Singapore Longitudinal Ageing Study. *PLoS ONE*, **12**, e0180818.

[12] Reas, D.L, Nygard, J.F., Svensson, E., Sorensen, T. and Sandanger, I. (2007) Changes in Body Mass Index by Age, Gender, and Socio-Economic Status among a Cohort of Norwegian Men and Women (1990-2001). *BMC Public Health*, **7**, 269.

[13] Droyvold, W.B., Nilsen, T.I., Kruger, O., Holmen, T.L., Krokstad, S., Midthjell, K. and Holmen, J. (2006) Change in Height, Weight and Body Mass Index: Longitudinal Data from the HUNT Study in Norway. *International Journal of Obesity*, **30**, 935-939. https://doi.org/10.1038/sj.ijo.0803178

[14] Wilsgaard, T. and Arnesen, E. (2006) Body Mass Index and Coronary Heart Disease Risk Score: The Tromso Study, 1979 to 2001. *Annals of Epidemiology*, **17**, 100-105.

[15] World Health Organization (2007) Prevention of Cardiovascular Disease: Pocket Guidelines for Assessment and Management of Cardiovascular Risk. Geneva.

[16] World Health Organization (2017) Global Strategy on Diet, Physical Activity and Health. Geneva.

[17] Vrieze, A., Holleman, F., Zoetendal, E.G., de Vos, W.M., Hoekstra, J.B. and Nieuwdorp, M. (2010) The Environment within: How Gut Microbiota May Influence Metabolism and Body Composition. *Diabetologia*, **53**, 606-613.

[18] Utsugi, M.T., Ohkubo, T., Kikuya, M., Kurimoto, A., Sato, R.I., Suzuki, K., Metoki, H., Hara, A., Tsubono, Y. and Imai, Y. (2008) Fruit and Vegetable Consumption and the Risk of Hypertension Determined by Self Measurement of Blood Pressure at Home: The Ohasama Study.

[19] Bertoia, M.L., Mukamal, K.J., Cahill, L.E., Hou, T., Ludwig, D.S., Mozaffarian, D., Willett, W.C., Hu, F.B. and Rimm, E.B. (2015) Changes in Intake of Fruits and Vegetables and Weight Change in United States Men and Women Followed for up to 24 Years: Analysis from Three Prospective Cohort Studies. *PLoS Medicine*, **12**, e1001878. https://doi.org/10.1371/journal.pmed.1001878

[20] World Health Organization (2009) Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks. Geneva.

[21] Ahmed, H.S., Khalid, M.E.M., Osman, O.M., Ballal, M.A. and Al-Hashem, F.H. (2016) The Association between Physical Activity and Overweight and Obesity in a Population of Children at High and Low Altitudes in Southwestern Saudi Arabia. *Journal of Family & Community Medicine*, **23**, 82-87. https://doi.org/10.4103/2230-8229.181011

[22] Lee, O., Lee, D.-C., Lee, S. and Kim, Y.S. (2016) Associations between Physical Activity and Obesity Defined by Waist-to-Height Ratio and Body Mass Index in the Korean Population. *PLoS ONE*, **11**, e0158245. https://doi.org/10.1371/journal.pone.0158245

[23] Rauner, A., Mess, F. and Woll, A. (2013) The Relationship between Physical Activity, Physical Fitness and Overweight in Adolescents: A Systematic Review of Studies Published in or after 2000. *BMC Pediatrics*, **13**, 19.

[24] Byrne, S., Barry, D. and Petry, N.M. (2012) Predictors of Weight Loss Success: Exercise vs. Dietary Self-Efficacy and Treatment Attendance. *Appetite*, **58**, 695-698. https://doi.org/10.1016/j.appet.2012.01.005

[25] Abelson, R. (2010) An Insurer's New Approach to Diabetes. The New York Times, New York, 14.

[26] Qi, L., Hu, F.B. and Hu, G. (2008) Genes, Environment, and Interactions in Prevention of Type 2 Diabetes: A Focus on Physical Activity and Lifestyle Changes. *Current Molecular Medicine*, **8**, 519-532.

[27] Bassuk, S. and Manson, J. (2005) Epidemiological Evidence for the Role of Physical Activity in Reducing Risk of Type 2 Diabetes and Cardiovascular Disease. *Journal of Applied Physiology*, **99**, 1193-1204.

[28] Traversy, G. and Chaput, J.-P. (2015) Alcohol Consumption and Obesity: An Update. *Current Obesity Reports*, **4**, 122-130.

[29] French, M.T., Norton, E.C., Fang, H. and Maclean, J.C. (2010) Alcohol Consumption and Body Weight. *Health Economics*, **19**, 814-832. https://doi.org/10.1002/hec.1521

[30] Breslow, R.A. and Smothers, B.A. (2005) Drinking Patterns and Body Mass Index in Never Smokers: National Health Interview Survey, 1997-2001. *American Journal of Epidemiology*, **161**, 368-376.

[31] Wannamethee, S.G. and Shaper, A.G. (2003) Alcohol, Body Weight, and Weight Gain in Middle-Aged Men. *The American Journal of Clinical Nutrition*, **77**, 1312-1317.

[32] Cordain, L., Bryan, E.D., Melby, C.L. and Smith, M.J. (2007) Influence of Moderate Daily Wine Consumption on Body Weight Regulation and Metabolism in Healthy Free-Living Males. *The Journal of the American College of Nutrition*, **16**, 134-139.

[33] Arif, A.A. and Rohrer, J.E. (2005) Patterns of Alcohol Drinking and Its Association with Obesity: Data from the Third National Health and Nutrition Examination Survey, 1988-1994. *BMC Public Health*, **5**, 126. https://doi.org/10.1186/1471-2458-5-126

[34] Cordain, *et al*. (1997) Influence of Moderate Daily Wine Consumption on Body Weight Regulation and Metabolism in Healthy Free-Living Males. *The Journal of the American College of Nutrition*, **16**, 134-139. https://doi.org/10.1080/07315724.1997.10718663