International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 06-08-2018; Accepted: 09-09-2018
www.medicalsciencejournal.com
Volume 4; Issue 10; October 2018; Page No. 22-34

Assessment of risk factors for the four major non-communicable diseases among the catholic university of eastern Africa staff, Langata campus, Nairobi, Kenya

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Abstract
Background: Non-communicable diseases (NCDs) are the leading cause of global disability and premature death. The negative consequences are particularly heavy in developing countries in terms of the impact on health and psycho-social stress on the affected individual, the family and the nation at large. Annually, NCDs contribute for 15 million people premature death (30 and 69 years), and over 85% of these "premature" deaths occur in low- and middle-income countries. Besides the deaths and disability, NCDs pose a huge social-economic burden to the affected individual, the family, the community and the nation at large especially in low and middle income countries like Kenya. Globally, the four major NCDs, cardiovascular diseases (hypertension, heart attack and stroke), diabetes, cancer and chronic obstructive pulmonary diseases, account for the majority of the diseases burden and of premature mortality (Action Plan for implementation of the European Strategy for the Prevention and Control of NCDs, 2012−2016). These major NCDs share four behavioral risk factors namely: unhealthy diet, physical inactivity, tobacco and harmful use of alcohol.
Objective: The objective of this study was to assess the risk factors for the four major non-communicable diseases among the Catholic University of Eastern Africa (CUEA) staff.
Methods and Materials: A descriptive, cross sectional, quantitative study was conducted among 301 CUEA staff. Data were collected using WHO stepwise-structured questionnaire regarding respondents' socio-demographic, lifestyle characteristics, anthropometric and clinical. SPSS software version 22.0 was used to analyzed the data. Descriptively analyzed was done in terms of proportions and frequency tables, while the Chi-square test of independence, Fisher's Exact test and one-Way ANOVA were used to determine relationships between various variables. The research proposal was reviewed and approved by the Ethics and Research Committee of KNH/UON. Permission to collect data was obtained from the Catholic University administration and consent was obtained from the participants before administering the questionnaire.
Results: Of the respondents, majority (90.7%), were physically inactive, (53.9%) had consumed ≥5 teaspoons of sugar per day and close to half, (49.2%) had consumed fruits 1-2 days per week and a good number, 30.9% always had eaten processed foods. The mean body mass index (BMI) ($p = 0.026$) and the mean waist circumference (WC) ($p = 0.045$) were significantly higher among respondents aged below or equal to 40 years old respectively. The study also found that male respondents significantly had consumed more standard alcohol drinks in one sitting ($p = 0.001$) and smoked ($p= 0.000$) than female respondents respectively. Majority, (94%), had abnormal high BP, either prehypertension (60.8%) or overt hypertension (33.2%). The study further revealed that higher mean systolic BP was significantly associated with smoking ($P= 0.003$), alcohol consumption ($p = 0.004$). However, Lower systolic BP was significantly associated with daily consumption of vegetables ($p = 0.041$) and fruits ($p=0.031$), vigorous intensity physical activity ($P= 0.001$) and moderate intensity physical activity ($P= 0.003$). Higher mean diastolic BP was significantly associated with advanced age (above 60 years) ($p = 0.031$), alcohol consumption ($p = 0.013$) and daily consumption of fast foods ($p = 0.032$). But lower mean diastolic BP was significantly associated with daily consumption of vegetable ($p = 0.001$) and fruits ($p= 0.004$), vigorous intensity physical activity ($P= 0.013$) and moderate intensity physical ($P= 0.041$). Lower mean BMI ($p= 0.025$) and mean Waist circumference ($p= 0.002$) were significantly associated with vigorous intensity physical activity. Additionally, lower mean BMI ($p= 0.011$) and mean Waist circumference ($p= 0.023$) were significantly associated with moderate intensity physical. However, higher BMI were significantly associated with daily consumption of fast foods ($p = 0.003$).
Conclusion and recommendation: Higher institutions like The Catholic University of Eastern Africa are at high risk of developing non-communicable diseases due to lack of sufficient physical activities, exposure to unhealthy foods and harmful use of alcohol. It is therefore, highly recommended that higher institutions to have physical activity sessions for the staff, periodic inspection of canteens around the institutions and provide continuous health education sessions on the main risk factors for non-communicable diseases and their preventive measures.

Keywords: non-communicable diseases, risk factors

1. Introduction
Non-communicable diseases (NCDs) are the primary concern of public health problem accounting for more than 60% of all deaths and nearly 80% of these deaths occur in low- and middle-income countries [2]. The World Health Organization (WHO) estimates that NCDs will cause 73% of global deaths

by 2020. Sixteen million of NCD deaths occur before the age of 70 with 82% of these "premature" deaths occurred in low- and middle-income countries. Besides the health related burden, NCDs threaten progress in the post-2015 development agenda as poverty is closely linked with NCDs. The rapid rise in NCDs is predicted to impede poverty reduction initiatives in low-income countries, particularly by increasing household costs associated with health care. Vulnerable and socially disadvantaged people get sicker and die sooner with NCDs than people of higher social positions, because they are at greater risk of being exposed to harmful products, such as tobacco or unhealthy food, and have limited access to health services.

Globally, the four major non-communicable diseases (NCDs), cardiovascular diseases, diabetes, cancer and chronic obstructive pulmonary diseases, account for the majority of the disease burden and of premature death (Action Plan for implementation of the European Strategy for the Prevention and Control of NCDs, 2012−2016). The four major NCDs account for 82% of all NCD related deaths. Cardiovascular diseases contribute for most NCD related deaths account for 17.7 million people annually, representing 31% of all global deaths, followed by cancers (8.2 million), respiratory diseases (4 million), and diabetes (1.5 million). Kenya is in the state of epidemiological transition from predominantly communicable to non-communicable diseases with rapidly escalating prevalence of behavioral and lifestyle-related diseases. In Kenya, NCDs contribute to over 50% of hospital admissions and 55%% of hospital deaths as well as causing significant social and economic burden to the communities into and thus slowing down economic progress of the nation (Kenya Stepwise survey for non-communicable diseases risk factors 2015 report).

The four major risk factors for the four major non-communicable diseases are insufficient physical activity, unhealthy diet, tobacco smoking and harmful use of alcohol.

Insufficient physical activity is defined as less than five times 30 minutes of moderate physical activity per week, or less than three times 20 minutes of vigorous activity per week. Insufficient physical activity is the fourth leading risk factor for mortality. According to the WHO, involving in weekly 150 minutes of moderate physical activity, reduce the risk of ischaemic heart disease by about 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21–25% [3]. Unhealthy diet, high fat diets, rich in salt and processed sugars are known to contribute to high levels of blood pressure, blood sugar and blood cholesterol which are the main risk factors for cardiovascular diseases and diabetes. Fast foods are high in calories, salt and sugar which contribute to weight gain. There is evidence that consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables [1].

Tobacco smoking increases the risk of developing insulin resistance, which predisposes a person to both diabetes and CVDs. It may also decrease high-density-lipoprotein (HDL), cholesterol in the blood, raising the risk of a heart attack. In addition, smoking plays significant role in narrowing the coronary artery by releasing excess catecholamine. Smoking tobacco contains over 4000 chemicals, of which 50 are known to be carcinogenic [4]. Harmful use of alcohol is recognized as one of the four major risk factors for NCDs contributing for both chronic disabilities and premature deaths (WHO, 2009e). In more recent years, the role of alcohol in non-communicable diseases including heart disease, liver cirrhosis, cancer, high blood pressure and high triglycerides, is increasing across the world and Kenya is no exception [5]. An estimated 4.5% of the global burden of disease – as measured in Disability Adjusted Life-years (DALYs) – is caused by harmful use of alcohol.

1.1 The four major non-communicable diseases

1.1.1 Cardiovascular Diseases: Cardiovascular diseases (CVDs) will continue to be a significant public health concern worldwide unless community-wide primary preventive measures are undertaken. CVDs are the number 1 cause of death globally, more people die annually from CVDs than from any other cause. In Kenya, cardiovascular diseases (CVDs) are responsible for much of the NCD burden, accounts for 25% of hospital admissions and 13% of deaths. According to the world health statistics report of 2015, the global prevalence of hypertension among adults aged 18 years and above was 22.2% in 2014; while in the African Region it was 29.6% [6]. In Kenya, the prevalence of hypertension was 23.8% and 8% of Kenyans have severe hypertension (Kenya stepwise survey for non-communicable diseases risk factors, 2015). According to the National STEPwise Survey for NCDs carried out in 2015, in Kenya, hypertension is the most significant risk factor for CVDs.

1.1.2 Diabetes: The rise in diabetes burden is associated with demographic and social changes such as globalization, urbanization and adoption of unhealthy lifestyles such as consumption of unhealthy diets, physical inactivity and harmful use of alcohol. The global prevalence of type 2 diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 [7]. According to the International diabetic Federation (IDF) in 2015, 1 in 11 adults had diabetes and in 2040, 1 in 10 adults will have diabetes [8]. In Africa, the prevalence of diabetes is estimated to be 1–3% in rural areas and 5-6% in urban [9]. The Kenya national prevalence of diabetes is estimated to be 4.2% (Kenya National Diabetes Strategy, 2010) and is as high as 12% in urban areas, the highest rate found in Sub-Saharan Africa [10]. However, two-thirds of diabetics may be undiagnosed [11]. Diabetic patients face long term, life threatening complications including limb amputation, cardiovascular events, eye problems, nerve and renal complications. In Kenya, majority of patients referred for specialized end organ damage treatment at the national referral hospitals and outside the country are diabetes patients [11].

1.1.3 Cancer: Cancer is one of the leading causes of death worldwide accounting for 13% of all global mortality. In 2015, cancer caused over 8.7 million deaths globally and was the second leading cause of death behind cardiovascular diseases [12]. In Kenya, it is also estimated to be the second leading cause of NCD related deaths after cardiovascular diseases and accounting for 7% of overall national mortality [13]. Research reveals that up to 40% of global cancers are preventable through protection against exposure to

environmental and occupational carcinogens and behavioral and lifestyle changes such as controlling of tobacco smoking, reducing consumption of alcohol, promotion of healthy diets and physical activity [14].

1.2 Chronic obstructive pulmonary disease (COPD)

COPD is a life threatening lung disease that may progressively lead to death. Despite high prevalence in developed nations, almost 90% of COPD deaths occur in low- and middle-income countries. The main drivers of COPD include tobacco smoking, indoor air pollution (from use of biomass fuel for cooking and heating), outdoor air pollution and occupational dusts and chemicals. In Kenya COPD is estimated to cause approximately the same amount of DALYs as ischemic heart disease, stroke and epilepsy indicating that it is grossly underdiagnosed and treated.

2. Methods and materials

2.1 Study Setting

The study was conducted 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 University and it offers several courses from PhD to Undergraduate courses.

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 Catholic University of Eastern Africa (CUEA). During the study period, the University had 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 regarding respondents' demographic information, history of raised blood pressure, tobacco use (whether the respondents had ever smoked, past and current smoking status, frequency and duration of smoking, types and number of cigarettes smoked in a day, in a week), alcohol intake(past and current alcohol consumption status, whether formal, local or both formal or local drinks, frequency and amount and duration of alcohol consumption), diet (frequency of fruits and vegetable consumption, daily amount of salt and sugar consumption, types of oils used for cooking, frequency of eating fast foods or processed foods, frequency of eating meals outside home) and frequency and duration of physical activity/exercise. Anthropometric parameters including weight, height, body mass index (BMI) and waist circumference (WC) were measured using standard measurement units. Blood pressure was recorded two times in sitting position, in the right arm, using a standard electronic device of BP apparatus. Respondents were interviewed and examined by two trained nurses recruited as research assistants. Written consent was obtained after comprehensive explanation of study objectives, risks, benefits and confidentiality issues of the study. The clinical and anthropometric measurements were performed after the informed consent by trained nurse research assistants.

2.3.1 Clinical Variables: Hypertension was defined and categorized according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7). Jama. 28 9(19):2560–72 (Chobanian *et al*., 2003) as follows:

Table 1

Diagnostic category	SBP (mmHg)	DBP (mmHg)
Normal	90- 119	60-79
Prehypertension	120-139	80-89
Stage/Grade 1 (mild) HTN	140- 159	90-99
Stage/Grade 2 (moderate) HTN	160 179	100-109
Stage/Grade 3 (severe) HTN	≥180	And/or ≥110
Isolated systolic hypertension	>140	And <90

SBP= systolic blood pressure, DBP= diastolic blood pressure, HTN = Hypertension

Respondents were requested to sit and relax in a room with minimal disturbance for 5 minutes before their BP was taken on the right arm. The measurements were taken twice in sitting position using appropriate calibrated digital BP machine, with appropriate cuff sizes. The BP was measured with an electronic automatic monitor (OMRONM4, Omron Healthcare GmbH, Hamburg, Germany). The final BP was the average of two consecutive readings obtained from the respondent.

2.3.2 Anthropometric measurements: Anthropometric measures including weight, height, body mass index (BMI), and waist circumference (WC), were measured by standard methods. WC was determined by measuring waist circumference at midpoint between iliac crest and lower border of tenth rib, with an average of three measurements considered as WC. The European group for study of insulin resistance (EGIR, 2004) definition was used to determine the cut-off point for waist circumference. Central obesity was WC ≥ 94 cm and ≥ 80 cm as defined for male and female participants, respectively. BMI was calculated based on weight in kilogram divided by square of height in meter (kg/m2). Waist and hip circumferences were measured using a non elastic tape measure (Seca, Germany). Weight was obtained using weighing scale with a stadiometer (Seca GmbH, Co.kg, Germany) and height was measured and recorded to the nearest 0.1 cm, thereafter, used to calculate body mass index (BMI). While the waist circumference was measured with a none stretchable tape measure to the nearest 0.1 cm.

2.4 Validity and reliability

The validity and reliability of the data collection tools were secured by using standard methods of measuring tools as described in detailed on page 5. Validity of the instruments was also checked by carrying out a pilot test. Moreover all the data collection procedures were carried out my two trained nurses as indicated on page 5 under data collection tools.

2.5 Data analyses
Computer software (SPSS V. 22) was used to analyze the data. Descriptive analysis was done in terms of proportions and frequency tables. To establish relationship between the study variables, Chi-square test of independence, Fisher's Exact test and one-Way ANOVA were utilized. The cut-off point for the level of significance was set at P 0.05.

2.6 Ethical consideration
Ethical clearance of the study was reviewed and approved by Kenyatta National Hospital/ University of Nairobi (KNH/UoN) Ethics and Research Committee (Approval number: Up 592/10/2017). Permission to collect data was sought from 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 BP and anthropometric measurements in relation to respondents' age and gender
Analyses with One-Way ANOVA and independent samples T-test revealed that the mean diastolic BP was significantly higher among respondents aged above 60 years old ($F(2,218) = 3.256$, $p = 0.031$). However, the mean body mass index (BMI) ($F(2,215) = 6.185$, $p = 0.026$) and the mean waist circumference (WC) ($t = 2.021$, $df = 217$, $p = 0.045$) were significantly higher among respondents aged below or equal to 40 years old respectively. Additionally, the mean WC was significantly higher among male respondents compared to the female counterparts ($t = 2.014$, $df = 216$, $p = 0.044$) (Table 3).

Table 3: Blood pressure and physical measurements in relation to age and gender of the respondents

Measurement	Age*			p-value	Gender**		p-value
	≤ 40	41 – 60	> 60		Male	Female	
Mean systolic	138	143	141	0.142	146	138	0.462
Mean diastolic	71	79	81	0.031	78	81	0.234
Mean BMI	28.3	26.9	25.72	0.026	27.1	26.8	0.214
Waist circumference in cm	91.0	87	80	0.041	96	89	0.044

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

3.3 Dietary habits of the respondents
Nearly half, (49.2%), of the respondents had consumed more than five (5) teaspoons of sugar per day. Majority, (92%), of the respondents had consumed less than or equal to 1 teaspoon of salt per day. Although, majority, (70.8 %), of the respondents never been advised to reduce salt in their diet, a small number, 17.9%, of the respondents always add salt after the food is being cooked. Nearly half, (48.5%) of the respondent's never added salt after the food is being cooked. Concerning the types of oils used by the respondents, most, (83.7%) had used vegetable oil to prepare meals. Majority, (79.1%) of the respondents had never been advised to reduce fat in their diet. Of the respondents, majority, (64.5%) had eaten five (5) or more meals per week outside home and a good number, 30.9% always had eaten processed foods (Table 4).

Table 4: Dietary habits of the respondents

Variables	N	Percent (%)
Frequency of adding salt after the food is being cooked (on table)		
Never	146	48.5
Rarely	69	22.9
Sometimes	32	10.6
Always	54	17.9
Amount of salt consumption per day (N=258)		
≤ 1 teaspoon	237	92
>1 teaspoon	21	8.0
Whether the respondents had ever been advised to reduce salt intake		
Yes	88	29.2
No	213	70.8
Amount of sugar consumption per day		
≤ 2 teaspoon	47	15.6
3-5 teaspoon	106	35.2
>5 teaspoon	148	49.2
Types of oil used by the respondents		
Vegetable oil	252	83.7
Margarine	29	9.6
Butter or ghee	15	5.0
Don't know	5	1.7
Whether the respondents had ever been advised to reduce fat in diet		
Yes	63	20.9
No	238	79.1
Frequency of eating processed foods		
Always	93	30.9
Sometimes	75	24.9
Rarely	128	42.5
Never	5	1.7
Frequency of meals eaten outside of home per week		
Never	19	6.3
1-2 meals	45	14.9
3-4 meals	43	14.3
≥ 5 meals	194	64.5

3.4 Weekly consumption of Fruit and Vegetable among the respondents

Table 5. below shows respondents' weekly consumption of fruit and vegetables. Nearly half, (49.2%) of the respondents had consumed fruits 1-2 days per week and 18.6% consumed 3-4 days in a week, while 32.2% had consumed 5-7days per week. Moreover, majority, (85.7%), of the respondents had taken 1-2 servings of fruits in a day. Regarding vegetables consumption, majority, (89%) of the respondents had consumed 1-2 servings of vegetables per day.

Table 5: Fruit and Vegetable consumption of respondents

Variables	N	Percent (%)
Respondents' weekly consumption of fruits		
1- 2 days	148	49.2
3-4 days	56	18.6
≥ 5 days	97	32.2
Number of servings of fruits per day		
1-2	258	85.7
3-4	42	14.0
Above 4	1	0.3
Number of servings of vegetables per day		
1-2	268	89.0
3-4	32	10.6
5-7	1	0.4

3.5 Relationship between respondents' eating habits and BP and BMI measurements

A One-Way ANOVA test was used to determine the relationship between consumption of fruits, vegetables and fast foods and Body Mass Index (BMI) and Blood Pressure (BP) (Table 6). Respondents who had consumed vegetables on daily basis had significantly lower systolic BP ($F(2, 214) = 3.790$, $p = 0.041$) and diastolic BP ($F(2, 215) = 3.682$, $p =$

0.001) than respondents who had not consumed fruits on daily basis. In addition, the mean systolic BP (F (2, 205) = 9.745, p = 0.031) and mean diastolic BP (F (2, 207) = 7.047, p = 0.004) were significantly lower among respondents who had consumed fruits daily compared to respondents who had not consumed fruits on daily basis. However, higher diastolic BP (F (3, 205) = 3.186, p = 0.032) and BMI (F (2, 212) = 4.561, p = 0.003) were significantly associated with daily consumption of fast foods.

Table 6: Relationship between fruits, vegetables and fast foods consumption and BP and BMI

Variable	Eat vegetables	p-value	Eat fruits	p-value	Eat fast foods	p-value
Mean systolic		0.041		0.031		0.423
Daily	129		132		141	
Frequently	118		136		139	
Rarely	134		137		140	
Never	137		141		117	
Total						
Mean diastolic		0.001		0.004		0.032
Daily	64		61		84	
Frequently	67		66		81	
Rarely	70		69		61	
Never	84		82		64	
Total						
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						

3.6 Smoking and alcohol consumption status of the respondents

Table 7. below shows smoking and alcohol consumption status of the respondents. Of the respondents, very few (2.7%) were smokers and all of them were males. However, majority, (61.1%) of the respondents had consumed alcohol. Of those who had consumed alcohol, majority, (73.9%), had taken 3 or more Standard Drinks (SD) in one sitting. Further analysis with a Chi-Square test of independence revealed that male respondents significantly consumed more standard alcohol drinks per drinking occasion or in one sitting ($p < 0.001$) and smoked ($p= 0.000$) than females respondents respectively.

Table 7: Relationship between socio-demographic characteristics and smoking and alcohol consumption of the respondents

Variable	Take alcohol		Total	p-value	Smoke		Total	p-value
	Yes (%)	No (%)			Yes (%)	No (%)		
Gender				0.153				0.000
Male	115 (63.2)	67 (36.8)	182 (100)		8 (4.4)	175 (95.6)	183 (100)	
Female	69 (58)	50 (42)	119 (100)		0 (0)	118 (100)	118 (100)	
Total	184 (61.1)	117 (38.9)	301 (100)		8 (2.7)	293 (97.3)	301 (100)	

Analysis with Chi-Square test of independence

Characteristics	Standard drinks per drinking occasion		Total	□□	Df	p-value
	1 - 3 standard drinks N (%)	More than 3 standard drinks N (%)				
Age				**1.89**	**2**	**0.187**
≤ 40	21(29.2)	51(70.8)	72(100)			
41- 60 years	26(28)	67(72)	93(100)			
Over 60 years	5(26.3)	14(73.7)	19(100)			
Gender				14.52	1	< **0.001**
Female	40(58.8)	28(41.2)	68(100)			
Male	27(23.3)	**89**(76.7)	116(100)			
Marital status				1.74	2	0.241
Single	8(22.9)	27(77.1)	35(100)			
Married	34(27.4)	89(72.4)	123(100)			
Separated/Divorced/Widowed	7(26.9)	19(73.1)	26(100)			

Analysis with Chi-Square test of independence

3.7 Relationship between smoking and alcohol consumption and Blood Pressure

Table 8 below shows relationship between smoking and alcohol consumption and blood pressure. An independent t-test revealed that higher systolic BP was significantly associated with both smoking (P= 0.003) and alcohol

consumption (p = 0.004) respectively. Additionally, higher diastolic BP was significantly associated with alcohol consumption (p = 0.013).

Table 8: Relationship between smoking and alcohol consumption and Blood Pressure

Blood pressure	Take alcohol	N	Mean BP	p	Smoke	N	Mean BP	P
Systolic pressure				**0.004**				**0.003**
	Yes	184	142		Yes	8	141	
	No	117	132		No	293	134	
Diastolic pressure				0.013				0.153
	Yes	184	89		Yes	8	86	
	No	117	79		No	293	81	

Analysis with independent t-test

3.8 Physical activity (exercise) of the respondents

Table 9. below shows physical activity of the respondents. Majority, (89.4%), of the respondents did not involve in vigorous intensity physical activities for 20 minutes for 3 or more days in a week. Moreover, majority, (90.7%), of them did not involve in moderate intensity physical activities for 30 minutes for 5 or more days in a week. Additionally, most, (90%) of the respondents had spent seating for 5 or more hours per day.

Table 9: Physical activity of the respondents

Variables	N	Percent (%)
Whether respondents had involved in vigorous physical activity for 20 minutes for 3 or more days in a week		
Yes	32	10.6
No	269	89.4
Whether respondents had involved in moderate intensity physical activity for 30 minutes for 5 or more days in a week		
Yes	28	9.3
No	273	90.7
Time spend seating per day		
1-2 hours	28	9.4
5-8 hours	226	75.0
More than 8 hours	47	15.6
Whether respondents use cycle or walk for 10 or more minutes per day for 5 or more days in a week		
Yes	44	14.6
No	257	85.4

3.9 Blood pressure and anthropometric measurements in relation to physical activities of the respondents

Respondents who had involved in vigorous intensity physical activity for 20 or more minutes for 3 or more days in a week had significantly lower mean systolic BP (P= 0.001), mean diastolic BP (P= 0.013), mean BMI (p= 0.025) and mean Waist circumference (p= 0.002) compared to respondents who did not involve in vigorous intensity physical activity for 20 or more minutes for 3 or more days in a week respectively. Additionally, respondents who had involved in moderate intensity physical activity for 30 or more minutes for 5 or more days in a week had significantly lower mean systolic BP (P= 0.003), mean diastolic BP (P= 0.041), mean BMI (p= 0.011) and mean Waist circumference (p= 0.023) than respondents who did not involve in in moderate intensity physical activity for 30 or more minutes for 5 or more days in a week respectively (Table 10).

Table 10: Blood pressure and anthropometric measurements in relation to physical activities of the respondents

Measurement/Variables	Do vigorous intensity physical activity for 20 minutes for 3 or more days in a week		p-value	Do moderate intensity physical activity for 30 minutes for 5 or more days in a week		p-value
	Yes (N=32)	No (N=269)		Yes (N=28)	No (273)	
Mean systolic BP	111	149	0.001	123	139	0.003
Mean diastolic BP	70	91	0.013	82	87	0.041
Mean BMI	21.8	27.9	0.025	24.3	29.9	0.011
Mean Waist circumference in cm	79	101	0.002	82	97	0.023

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

3.10 Measurements of blood pressure (mmHg) of the respondents

Table 11. below shows current blood pressure measurements of the respondents. The BP was defined and categorized as normal, prehypertension and hypertension using the "Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure" (JNC 7) definition (Chobanian *et al*., 2003). Accordingly, the

study found that, 283 (94%) of the respondents had abnormal high BP. Of the 94% with abnormal high BP, majority, 183 (60.8%) were pre-hypertensive and 100 (33.2%) were found to be hypertensive. Of the hypertensive respondents, 90,(29.9%) had stage I (mild) hypertension, 6 (2%) stage II (moderate) hypertension and 4 (1.3%) had stage III (severe) hypertension. Therefore, only 18 (6%) of the respondents had normal blood pressure (90-119/60-79 mmHg).

Table 11: Measurements of blood pressure (BP mmHg)) of the respondents

Category	Systolic	N	Percent	Diastolic	N	Percent
Normal	90-119	18	6.0	60-79	38	12.6
Elevated/prehypertension	120-139	183	60.8	80-89	168	55.8
Stage 1	140–159	90	29.9	90–99	77	25.6
Stage 2	160–179	6	2.0	100–109	8	2.7
Stage 3 (hypertensive crisis	≥180	4	1.3	≥110	10	3.3
Total		301	100	Total	301	100

3.11 Measurements of body mass index (BMI) of the respondents

Table 12. below shows body mass index and waist circumference measurements of the respondents. Majority, (83.8%), of the respondents were either obese or overweight (BMI ≥ 25 kg/m2). Of the respondents, 47.5% were overweight (BMI = 25-29.9 kg/m2) and 36.3% were obese (BMI ≥30kg/m2). Of the obese respondents, 30.2% had obesity I (BMI = 30.0–34.9 kg/m2), 3.4% obesity II (BMI = 35.0–39.9 kg/m2) and 2.7% obesity III (BMI ≥ 40.0 kg/m2).

Table 12: Measurements of body mass index (BMI) of the respondents

Body mass index (BMI)	Category	N	Percent (%)
BMI <18.5	Below normal	1	0.3
BMI =18.5- 24.9	Normal	48	15.9
BMI = 25-29.9 kg/m2	Overweight	143	47.5
BMI = 30.0–34.9 kg/m2	Obesity I	91	30.2
BMI = 35.0–39.9 kg/m2	Obesity II	10	3.4
BMI ≥ 40.0 kg/m2	Obesity III	8	2.7

3.12 Measurements of waist circumference (WC) of the respondents

Table 13. below shows waist circumference (WC) of the study subjects. The European group for study of insulin resistance (EGIR, 2004) definition was used to determine the cut off point for waist circumference. Of the respondents, majority, 146, (79.8%) men and 90, (76.3%) women had abnormal high waist circumference (WC) measurements (≥ 94 cm for men and ≥ 80 cm for women). Of the 79.8% of men with abnormal high WC, 42.6% were overweight and 37.2% were obese. Of the 76.3%% of women with abnormal high WC, 56.8% were overweight and 19.5% were obese.

Table 13: Measurements of waist circumference (WC) of the respondents

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

4. Discussion

The study revealed that respondents aged above 60 years old had significantly higher mean diastolic blood pressure (BP) compared to respondents below 60 years old. This finding is in line with previous studies who found that higher blood pressure is associated with older ages [15, 16, 17, 18]. The fact as why older people have higher BP compared to the young is that as our age advances, there is structural and vasculature changes including arterial stiffness and reduces arterial buffering capacity which gives rise to age-associated changes in both systolic and diastolic blood pressure [19, 20, 21, 22]. Arteries tend to narrow and harden as we age, predisposing old people to high blood pressure. Additionally, as we age, the ability of the body to process dietary salt decreases, tends to accumulate more salt in the bloodstream causing age related high blood pressure. Decreased kidney function is another reason for increased risk of hypertension in older people. When renal blood flow is reduced, the renin–angiotensin–aldosterone system (RAAS) is activated resulting in retain more sodium and water, predisposing old people to hypertension [23].

However, the mean body mass index (BMI) and the mean waist circumference (WC) were significantly higher among respondents aged below or equal to 40 years old compared to respondents aged above 40 years old. 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 [24, 25, 26, 27]. Young adults are more prone to obesity than older adults because of several reasons. Firstly, young adults eat a lot of

fast foods in terms of both quantity and quality and drink more alcohols than older adults which might put them at higher risk of obesity. Fast foods are high in calories, salt and sugar, which are known risk factors for obesity [28]. There is evidence that consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables [29]. 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 to follow healthy life styles behavior. Obesity has negative health consequences, both in increased morbidity and mortality as well as social stigma and limitations to healthy social functioning.

4.1 Dietary habits of the respondents

4.1.1 Sugar and Salt intake: Nearly half, (49.2%), of the respondents had consumed more than five (5) teaspoons of sugar per day which is above the World Health Organization recommendation of maximum of 5 teaspoons (25 grams) of sugar per day for adults with normal body mass index. Consumption of high amount of sugar is a significant risk factor for cardiovascular disease, diabetes and many types of cancer. Majority, (92%), of the respondents had taken less or equal to 1 teaspoon (5 grams) of salt per day. The WHO recommends salt consumption of less than 5 grams per adult person per day for the prevention of cardiovascular disease [30, 28]. Studies have found that reducing the amount of sodium in diet lowers the risks of heart diseases by reducing blood pressure which is the leading risk factor for heart disease [14].

4.1.2 Consumption of fatty foods: Of the respondents, a good number, (16.9%) often had eaten processed foods. Majority, (61.8%) of the respondents had eaten 5-7 meals per week outside home. High fat diets, rich in salt and processed sugars are known causes of high levels of blood cholesterol, diabetes and high blood pressure. A diet that's high in calories, lacking in fruits and vegetables, full of fast foods and loaded with high-calorie beverages also contributes to weight gain [29]. Consumption of unhealthy diets and changing lifestyles has resulted in increased levels of cardiovascular diseases, cancers and diabetes, which are closely related to obesity [5].

4.1.3 Fruit and vegetable consumption: The study revealed that respondents who had consumed vegetables on daily basis had significantly lower systolic BP and diastolic BP than respondents who had not consumed vegetables on daily basis. In addition, the mean systolic BP and mean diastolic BP were significantly lower among respondents who had consumed fruits daily compared to respondents who had not consumed fruits on daily basis. However, higher diastolic BP and BMI were significantly associated with daily consumption of fast foods. Vegetables and fruits have cardio-protective properties [31] by reducing both systolic and diastolic blood pressure [32, 33]. Additionally, eating substantial vegetables and fruits, helps with weight loss and body mass index [34]. Fruits and vegetables 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 are associated with weight gain [28].

The mechanism in which vegetables and fruits lower blood pressure are related to their high flavonoids content. The flavonoids are known to exhibit cardio-protective properties such as; antioxidant, anti-inflammatory, and induction of apoptotic effects [37, 38, 39, 40], with resultant reduced cardiovascular mortality [41]. Furthermore, vegetables and fruits are rich in potassium, an important cofactor in the regulation of blood pressure. Thus, when dietary potassium is low, physiologically, the body retains more sodium resulting in increased blood pressure [42]. Conversely, with high dietary potassium, the kidneys excrete more salt and water, thus decreasing the blood pressure as well as the heart rate [43].

4.2 Relationship between smoking and blood pressure of the respondents

The prevalence of smoking among the respondents was 2.7% and all the smokers were males. This finding is by far lower than the national prevalence of smoking in Kenya at 11.6% (19.1% of men and 4.5% women (the Kenya Global Adult Tobacco Survey (GATS), 2014). The low prevalence (2.7%) of smoking among the respondents compared to national prevalence (11.6%) might be due to several factors. Firstly, being a Catholic institution, there is less likely for the staff to be involved in smoking habits probably due to their identity and uniqueness of the Catholic Church which may contribute for a positive behavior. Secondly, majority of the respondents were highly educated which are more likely to take less risk behaviors like smoking than the general population. Further analysis with an independent t-test revealed that higher systolic BP was significantly associated with smoking. Other previous studies showed similar findings that smoking increases blood pressure [44, 45, 46, 47].

Tobacco smoking may raise blood pressure and accelerate atherothrombotic processes through a variety of potential mechanisms, including deleterious effects on endothelial function, inflammation, lipids, and thrombosis [44]. Smoking also causes coronary spasms and increases blood pressure by increasing catecholamine release [48]. It may also decrease high-density-lipoprotein (HDL), cholesterol in the blood, raising the risk of a heart attack. Of the 4000 chemicals found in tobacco, 50 are known to be carcinogenic chemicals putting smokers at higher risks of developing cancers. Almost 6 million people die from tobacco use and exposure each year, accounting for 6% of all female and 12% of all male deaths in the world [3].

4.3 Relationship between alcohol consumption and blood pressure among the respondents

Majority, (61.1%) of the respondents had consumed alcohol. Of those who consumed alcohol, most, (67.6%) consumed alcohol, 3 or more standard drinks in one sitting. The study also revealed that there was a significant relationship between alcohol consumption and blood pressure. Respondents with history of alcohol consumption had significantly higher both systolic and diastolic BP as compared to those who did not consumed alcohol. The results are consistent with the World Health Organization findings [3] report linking alcohol consumption to raised BP. Locally, alcohol consumption

especially beer and spirits have been linked to hypertension among Military personnel [49] consistent with this and other studies [31]. Indeed, a direct relationship between frequency and/or amount of alcohol and hypertension has been established [50]. Another study also found that alcohol intake by hypertensive individuals worsens the blood pressure level [51]. Conversely, reduction in alcohol consumption has been shown to cause a decline in both the systolic and diastolic blood pressure [52]. The mechanism of alcohol-related elevated BP is poorly understood. However, possible mechanisms have been proposed including: stimulation of the sympathetic nervous activity, activation of the renin-angiotensin-aldosterone system, impairment of the regulatory mechanisms of baroreceptors, and vasopressin-related vasoconstriction with resultant inhibition of endothelium-dependent vasodilatation [53]. Furthermore, loss of relaxation as a result of inflammation and oxidative injury to the endothelium by angiotensin II leading to inhibition of endothelium-dependent nitric oxide production appears to be a major pathway for the alcohol-induced hypertension [54].

Globally, harmful use of alcohol, one of the four major NCDs, is a leading risk factor for multiple disabilities and premature deaths [3]. In more recent years, the role of alcohol in non-communicable diseases, e.g., heart disease, liver cirrhosis, cancer and high blood pressure and high triglycerides (cholesterol), is increasing across the world and Kenya is no exception [5]. Harmful use of alcohol causes about 4.5% of the global burden of diseases. Additionally, harmful use of alcohol is the leading cause of accidents and injuries resulting in millions of disabilities and deaths. Alcohol is also associated with many serious social issues, including violence, divorce, child neglect and abuse, and absenteeism in the workplace [55].

4.4 Anthropometric and BP values in relation to respondents' physical activity

Majority, (89.4%) and (87.7%) of the respondents did not involve in vigorous and moderate intensity physical activity respectively. Moreover, majority, (90%) of the respondents had spent seating for 5 or more hours per day. Insufficient physical activity is defined by the WHO as less than five times 30 minutes of moderate activity per week, or less than three times 20 minutes of vigorous activity per week [3]. Further analysis revealed that respondents who had involved in vigorous intensity physical activity for 20 or more minutes for 3 or more days in a week had significantly lower mean systolic BP, mean diastolic BP, mean BMI and mean waist circumference compared to respondents who did not involve in vigorous intensity physical activity for 20 or more minutes for 3 or more days in a week respectively. Additionally, respondents who had involved in moderate intensity physical activity for 30 or more minutes for 5 or more days in a week had significantly lower mean systolic BP, mean diastolic BP, mean BMI and mean Waist circumference than respondents who did not involve in moderate intensity physical activity for 30 or more minutes for 5 or more days in a week respectively. Other previous studies also found the same results that involving in both vigorous and moderate physical activity reduces both systolic and diastolic blood pressure [15, 56, 57].

Physical inactivity is recognized as one of the four major risk factors for the four major Non-communicable diseases and for multiple causes of death 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 or more on days in a week [3]. Research revealed that participation in 150 minutes of moderate intensity physical activity each week is estimated to reduce 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% [3]. Regular physical activity helps the body cells take up glucose and thus lower blood glucose levels. Insufficient physical activity decreases insulin sensitivity, which can lead to diabetes. Regular physical activity also helps with weight loss as well as controlling blood cholesterol and blood pressure. On the other hand, adequate physical activity can prevent the development of diabetes through its effect on body weight, insulin sensitivity and glycemic control [58].

4.5 Anthropometric measurements (values) of the respondents

Close to half, (47.5%), of the respondents were overweight (BMI = 25-29.9 kg/m2) and 36.3% were obese (BMI ≥30kg/m2). Of the obese respondents, 30.2% had obesity I (BMI = 30.0–34.9 kg/m2), 3.4% obesity II (BMI = 35.0–39.9 kg/m2) and 2.7% obesity III (BMI ≥ 40.0 kg/m2). Additionally, according to the European group for study of insulin resistance (EGIR, 2004), criteria, the study found that of the respondents, majority, (79.8%) men and (76.3%) women had abnormal high waist circumference (WC) (≥ 94 cm for men and ≥ 80 cm for women). The mean waist circumference was higher among male respondent at 96 cm as compared to women respondents at 89 cm.

This finding is by far higher than the national prevalence of obesity in Kenya. According to the Kenya stepwise survey for non-communicable diseases risk factors, (2015), 27% of the population is either overweight or obese and the prevalence is significantly higher among women at 38.5% compared to men at 17.5%. The high prevalence of obesity and overweight among the respondents could be due to the following factors. Firstly, majority, 89.4% and 87.7%, of the respondents did not involve in vigorous and moderate physical activity respectively, which might contribute to the high prevalence of overweight and obesity. Secondly, their age, majority, (91%) of the respondents were aged above 30 years, which probably put them at higher risk for overweight or obesity due to reduced physical activity compared to people blow 30 years old. Moreover, majority, (90%) of the respondents had spent seating for 5 or more hours per day. Thirdly, their lifestyle, since they are highly educated and employed, they are more likely to have better lifestyle e.g. driving personal care, than the general population which predisposed them to obesity or overweight. Additionally, some (16.9%) of the respondents often had eaten processed foods. There is evidence that consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables [29].

Lack of sufficient physical activity is a known major risk factor for obesity or overweight.

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol and insulin resistance [59]. Increased BMI or Waist circumference is associated with increased prevalence of hypertension, dyslipidaemia, insulin resistance and diabetes mellitus. Globally, overweight and obesity contribute for 2.8 million people death each year [3]. Being overweight and obese increases the risks of premature death and disabilities from NCDs that reduce the quality of life. Excess weight tends to increase LDL level, triglycerides and lowers HDL [60]. Waist circumference is a better estimate of visceral fat, the dangerous internal fat which coats the organs. It is therefore, a more accurate predictor of cardiovascular risk and type 2 diabetes.

4.6 Blood pressure (BP) values of the respondents

Of the respondents, 58, (19.8%) were known hypertensive. Shockingly, according to the 7th Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure" (JNC 7) [61], the study found that majority, 283, (94%) of the respondents had abnormal high BP. Of those with abnormal high BP, majority, 183 (60.8%) were prehypertensive, one third, 100, (33.2%) had overt hypertension. Of the hypertensive respondents, 90,(29.9%) had stage I (mild) hypertension, 6 (2%) stage II (moderate) hypertension and 4 (1.3%) had stage III (severe) hypertension. As they become older, it is more likely that many of the pre hypertensive respondents (60.8 %) will progress to develop full hypertension, if appropriate measures are not in place.

The prevalence of overt hypertension, (33.2%), is higher than the national prevalence of hypertension, (23.8%). However, the prevalence of severe hypertension (1.3%) in this study is less than the national prevalence at 8% (Kenya stepwise survey for non-communicable diseases risk factors, 2015). The reason for the high prevalence of hypertension in this study can be due to the fact that majority (87.7%) were physically inactive, take alcohol (61.1%), low consumption of fruits and vegetables (less than 5 servings in a day). Furthermore, majority, (83.8%) of the study subjects were obese (36.3%) or overweight (47.5%) which might predispose them to high BP than the general population. For the low prevalence of severe hypertension (1.3%) in the current study, can be due to high treatment adherence and awareness in managing their condition as the majority (94%) were highly educated compared to the general population. Furthermore, the study revealed that respondents aged above 60 years old had significantly higher mean diastolic BP compared to respondents below 60 years old. Many previous studies also confirmed the direct relationship between age and high blood pressure [15, 16, 17, 18].

Hypertension is the leading risk factor for coronary heart disease and stroke (Policy and action for cancer prevention, 2009). Globally, it is believed that hypertension causes 7.5 million deaths, approximately 12.8% of the total of all annual deaths [3]. A meta-analysis of one million adults from 61 prospective studies demonstrated that mortality rate of ischemic heart disease (IHD) and stroke linearly increased when the systolic and diastolic BP readings were above 115 mm Hg and 75 mm Hg respectively [62].

5. Conclusion

The study concluded that, majority of the respondents had eaten unhealthy diet as measured by high consumption of sugar, eating processed foods, low consumption of fruits and vegetables and harmful consumption of alcohol. Moreover, majority of the respondents were physically inactive. Therefore, majority of the respondents are at high risk of developing non-communicable disease including cardiovascular diseases, diabetes, cancer and chronic obstructive pulmonary diseases unless they change their lifestyle and behavioral practices promptly. Further the study concluded that advanced age (above 60 years), low consumption of fruit and vegetable, cigarettes smoking, harmful use of alcohol, insufficient physical activity and daily consumption of fast foods are the variables significantly associated with high blood pressure. Additionally, higher mean body mass index (BMI) and mean waist circumference are significantly associated with physical inactivity and daily consumption of fast foods. Shockingly, the study found that majority, (94%), of the respondents had abnormal high BP, either prehypertension (60.8%) or overt hypertension (33.2%). Higher institutions like The Catholic University of Eastern Africa are at high risk of developing non-communicable diseases due to lack of sufficient physical activities, exposure to unhealthy foods, and harmful use of alcohol. It is highly recommended that higher institutions to have physical activity sessions for the staff, periodic inspection of canteens around the institutions and provide continuous health education sessions on the main risk factors for non-communicable diseases.

6. Limitation of the study

Biochemical profiles (lipid and blood glucose levels) should be checked to establish the cholesterol and blood glucose levels of the respondents.

7. Acknowledgements

The authors are grateful for all study participants who took part in the study for their time.

8. Conflict of interest

The authors have no conflict of interest.

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