



Dietary Pattern and Risk Factors Associated with Cardiovascular Diseases Among Non-Academic Staffs of Bowen University, Iwo, Nigeria

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ABSTRACT

Cardiovascular diseases (CVD) encompass a spectrum of abnormal conditions affecting the heart and blood vessels. The study assessed the dietary patterns and risk factors associated with cardiovascular diseases. The study assessed 238 willing participants with the use of a pretested questionnaire to collect the respondents' responses. Dietary pattern was assessed with the use of a food frequency questionnaire, and anthropometric measurements (weight, height, and body mass index) were assessed. The blood pressure was measured by using the sphygmomanometer. This study showed that more than half of the respondents (55.0%) were between 30 and 40 years old while 34.0% were between 41 and 50 years old. There were more females (55.0%) than males (45.0%) and the majority of the respondents (95.4%) were Christians and Yorubas (77.7%). The majority (46.6%) have a normal body mass index, about one-third (33.6%) are overweight, more than one-tenth (15.1%) are obese and a lower percentage of the respondents (4.6%) are underweight. More than half (54.8%) had normal blood pressure, most of the respondents (84%) were non-alcoholic and almost all the respondents (99.6%) were smokers. It was also found that there is no association between the respondents' lifestyle practices and anthropometric status. Conclusively, the majority had a normal body mass index and blood pressure and practiced healthy habits like not consuming alcohol or smoking. The lack of association between lifestyle practices and anthropometric status is an interesting finding that could warrant further investigation.

Keywords: cardiovascular disease; body mass index; blood pressure; lifestyle; anthropometric measurements

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INTRODUCTION

The cardiovascular system, comprising the heart and blood vessels, plays a vital role in maintaining the body's circulatory functions (**Thiriet, 2018**). According to the **American Heart Association (2023)**, CVD encompasses a range of conditions, including coronary heart disease (CHD), stroke, heart failure, high blood pressure, and arterial disease.

Alarmingly, CVD stands as a leading cause of global mortality, claiming an estimated 17.9 million lives annually, with heart attacks and strokes accounting for more than four out of every five CVD-related deaths (**World Health Organization, 2021**). One-third of these occur in individuals under the age of 70, emphasizing the urgency of understanding and addressing the factors contributing to cardiovascular health (**World Health Organization, 2021**). In 2017 alone, cardiovascular diseases were responsible for 17.8 million deaths worldwide, resulting in 330 million years of life lost and 35.6 million years of disability (**Mensah et al., 2019**). The number of people who die from CVDs, mainly from heart disease and stroke, will increase to 23.6 million by 2030 (**Nante et al., 2021**).

The causes of CVDs are multifactorial, and several risk factors have been identified. One of the most important risk factors is an unhealthy diet, which contributes to the development of CVDs (**Francula-Zaninovic and Nola, 2018**). Dietary patterns that are high in saturated and trans fats, cholesterol, salt, and added sugars have been linked to an increased risk of CVDs. These dietary patterns are often associated with the consumption of processed and fast foods, which are high in calories and low in nutrients. On the other hand, diets that are rich in fruits, vegetables, whole grains, nuts, and seeds have been associated with a lower risk of CVDs (**Clemente-Suárez et al., 2023**).

In addition to diet, several other risk factors have been identified for CVDs, including smoking, physical inactivity, high blood pressure, high cholesterol, and diabetes. These risk factors interact with each other and can exacerbate the risk of CVDs (**Sharifi-Rad et al., 2020**). It is on this note that this research studies the dietary patterns and risk factors associated with cardiovascular diseases among non-academic staff at Bowen University.

MATERIALS AND METHODS

Study Design

This was a descriptive cross-sectional survey.

Sampling Technique

The non-teaching staff departments were selected using a simple random sampling method. The selection of participants from each department was done using simple random sampling.

Study Location

The study was carried out at Bowen university located in Iwo in Osun State, Nigeria. Bowen University is a private Baptist Christian Nigerian university owned and operated by the Nigerian Baptist Convention. The university was founded in 2001 for learning and research. It is the first and largest Baptist university in Africa and is housed in the old 1,300-acre (6 km²) campus of the Baptist College, a teacher-training institution on a hill just outside the city. The motto of the university is “Excellence and Godliness”.

Sampling Size

The ample size used for the analysis was determined using;

$$n = \frac{N}{1 + N(e)^2}$$

n = sample size

e = margin error at 5% (standard value of 0.05)

N= size of population

Using the formula

$$n = \frac{572}{1 + 572(0.05)^2}$$

= 235

Study Population

The study included all non-academic staff (non-teaching staff) of Bowen University Iwo.

Pilot Study

A pretested questionnaire was administered to 10 respondents. The questionnaire used included anthropometric measurements, a food frequency questionnaire, lifestyle practices, and socio-demographic and economic data. This was carried out to test the validity of the questionnaire.

Data Collection

The dietary pattern was assessed using the food frequency questionnaire, and the risk factors for cardiovascular diseases were assessed using the Digital Weighing Scale and Stadiometer for the anthropometric measurements and the Digital Sphygmomanometer for the blood pressure status of respondents.

Anthropometric Measurements

Weight: A digital weighing scale, calibrated in kilograms from zero to 220 kg was used to measure the mass of the respondents without the need for a power supply.

Height: The Stadiometer calibrated in centimeters was used to measure the heights of respondents.

BMI: The BMI was derived by dividing the weight by the square of the height.

Blood Pressure Range: A Digital Sphygmomanometer also referred to as a blood pressure monitor was used to determine the systolic and diastolic range of the respondents ensuring the accuracy of the measurements of the blood pressure monitor.

Data Analysis

Data and statistical analysis were performed using (SPSS) statistical package for social sciences Version 20.0 for Windows. The socio-demographic and economic characteristics, lifestyle practices, and food frequency questionnaire were presented using frequencies and percentages for categorical variables and using a significance level of P< 0.05. Descriptive statistics was used to present socio-demographic and economic data such as gender, age, ethnicity, monthly allowance, physical activity level, body mass index, religion, etc.

Ethical Consideration

Ethical approval was obtained from Bowen University Ethics Review and Committee and informed consent was sought from the respondent. This research work was confidential, and the

identities of the research participants were kept confidential. This was done by allowing the research participants fill the questionnaires in private and informing them the need not to write their names on the questionnaire.

RESULTS

Table 1: Socio-demographic and economic characteristics of the respondents

VARIABLES	FREQUENCY	PERCENTAGE
AGE (Years)		
30 – 40	131	55.0
41 – 50	81	34.0
51 – 60	26	11.0
SEX		
Male	107	45.0
Female	131	55.0
RELIGION		
Christianity	227	95.4
Islam	11	4.6
ETHNICITY		
Yoruba	185	77.7
Igbo	15	6.3
Hausa	1	0.5
Others	37	15.5
MONTHLY SALARY		
Less than 30,000	23	9.7
31,000 – 40,000	31	13.0
41,000 – 50,000	58	24.4
Greater than 50,000	126	52.9
MARITAL STATUS		
Married	161	67.6
Single	74	31.2
Widow/Widower	3	1.3
EDUCATIONAL LEVEL		
Primary education	2	0.9
Secondary education	51	21.4
Tertiary education	185	77.7
Total	238	100.0

More than half of the respondents (55.0%) were between 30 and 40 years while 34.0% were between 41 and 50 years. There were more females (55.0%) than males (45.0%) while the majority (95.4%) were Christians and Yorubas (77.7%). Slightly above fifty percent of the respondents (52.9%) receive above 50,000 Naira monthly while a minority (9.7%) receive less than 30,000 Naira. About two-thirds (67.6%) were married and 31.2% were single. The majority (77.7%) have tertiary education while 21.4% have secondary education.

Table 2: Lifestyle Practices

Variables	Frequency	Percentage
I engage in Physical Activity 30 minutes, three times or more per week		
Yes	44	18.5
No	194	81.5
I engage in Physical Activity 30 minutes less than three times per week		
Yes	58	24.4
No	180	75.6
I don't engage in any physical exercise except for work and domestic activities		
Yes	156	65.5
No	92	34.5
I spend most of my time at work sitting		
Yes	146	61.3
No	92	38.7
I am easily stressed		
Yes	54	22.7
No	184	77.3
Do you consume alcohol		
Yes	38	16.0
No	200	84.0
How many drinks containing alcohol do you consume on a typical; day when you are drinking		
1 or 2	31	13.0
3 or 4	7	2.9
Never	200	84.0
How often do you have a drink containing alcohol		
Never	200	84.0
Less than 1 month	9	3.8
Monthly	24	10.1
Weekly	3	1.3
Daily or almost daily	2	0.8
Do you smoke		
Yes	1	0.4
No	237	99.6
How many sticks of cigarette do you take on a typical; day when you are smoking		

1 – 2	1	0.4
Never	237	99.6
Are you currently exposed to passive smoke indoors at home or at the workplace		
Yes	43	18.1
No	195	81.9
How often do you experience passive smoking indoors at home or at the workplace		
None (less than once a week)	195	81.9
1-2 times a week	36	15.2
3-4 times a week	7	2.9
Total	238	100.0

Majority of the respondents (81.5%) do not engage in 30 minutes physical activity 3 times or more per week, 24.4% engage in physical activity for 30 minutes less than 3 times per week, two-third (65.5%) don't engage in any physical exercise except for work and domestic activities, 61.3% spend most of their time at work sitting, majority (77.3%) says they were not easily stressed while 84.0% don't take alcohol. Majority (99.6%) do not smoke although 18.1% were exposed to passive smoke in fact, 15.2% were exposed 1-2 times weekly.

Table 3: Food Consumption Pattern

Foods	Never	Rarely	1-2x per week	3-4x per week	5-6x per week	Once per day	2 or more times per day
Cereal							
Boiled rice	1 (0.4)	2 (0.8)	52 (21.8)	84 (35.3)	50 (21.0)	38 (16.0)	11 (4.6)
Boiled maize	23 (9.7)	79 (33.2)	71 (29.8)	50 (21.0)	11 (4.6)	3 (1.3)	1 (0.4)
Roasted maize	49 (20.6)	162 (68.1)	21 (8.8)	3 (1.3)	1 (0.4)	1 (0.4)	1 (0.4)
Pap	10 (4.2)	106 (44.5)	56 (23.5)	38 (16.0)	19 (8.0)	9 (3.8)	-
Agidi/Eko	37 (15.6)	120 (50.4)	53 (22.3)	19 (8.0)	5 (2.1)	4 (1.7)	-
Bread	5 (2.1)	48 (20.1)	100 (42.0)	61 (25.6)	9 (3.8)	11 (4.6)	4 (1.7)
Semolina	10 (4.2)	93 (39.1)	74 (31.1)	44 (18.5)	8 (3.4)	7 (2.9)	2 (0.8)
Spaghetti	32 (13.4)	105 (44.1)	60 (25.2)	23 (9.7)	12 (5.0)	5 (2.1)	1 (0.4)
Indomie	49 (20.5)	106 (44.7)	54 (22.7)	22 (9.2)	2 (0.8)	4 (1.7)	1 (0.4)
Roots and Tuber							

Boiled yam	8 (3.1)	109 (45.8)	87 (36.6)	26 (10.9)	6 (2.5)	2 (0.8)	-
Pounded yam	10 (4.2)	83 (34.9)	74 (31.1)	47 (19.7)	19 (8.0)	5 (2.1)	-
Amala	7 (2.9)	49 (20.6)	71 (29.8)	63 (26.5)	31 (13.0)	11 (4.6)	6 (2.5)
Garri	25 (10.5)	104 (43.7)	67 (28.2)	29 (12.2)	8 (3.4)	-	5 (2.1)
Eba	12 (5.0)	114 (47.9)	69 (29.0)	32 (13.4)	7 (2.9)	1 (0.4)	3 (1.3)
Yam pottage	26 (11.0)	165 (69.3)	34 (14.3)	10 (4.2)	2 (0.8)	1 (0.4)	-
Cocoyam	60 (25.2)	155 (65.2)	13 (5.5)	7 (2.9)	3 (1.3)	=	=
Potatoes	22 (9.2)	184 (76.3)	21 (8.8)	99 (3.8)		2 (0.8)-	-
Fufu	42 (17.2)	163 (67.5)	19 (8.0)	11 (4.6)	2 (0.8)	-	2 (0.8)
Legumes							
Beans	4 (1.7)	57 (23.9)	94 (38.5)	67 (28.2)	10 (4.2)	5 (2.1)	1 (0.4)
Groundnut	6 (2.5)	98 (41.2)	85 (35.7)	37 (15.5)	8 (3.4)	3 (1.3)	1 (0.4)
Moimoi	4 (1.6)	73 (30.7)	98 (41.2)	53 (22.3)	8 (3.4)	-	2 (0.8)
Akara	6 (2.5)	176 (74.0)	98 (41.2)	53 (22.3)	8 (3.4)	-	2 (0.8)
Egusi	4 (1.7)	69 (28.9)	85 (35.7)	67 (28.2)	10 (4.2)	1 (0.4)	2 (0.8)
Ekuru	68 (28.6)	145 (61.0)	14 (5.9)	8 (3.4)	1 (0.4)		2 (0.8)
Fruits and vegetables							
Orange	6 (2.5)	113 (47.5)	81 (34.0)	28 (11.8)	7 (2.9)	1 (0.4)	2 (0.8)
Pawpaw	14 (5.9)	117 (49.2)	66 (27.7)	32 (13.4)	4 (1.7)	4 (1.7)	1 (0.4)
Pineapple	8 (3.4)	106 (44.5)	77 (32.4)	32 (13.4)	8 (3.4)	5 (2.1)	2 (0.8)
Water melon	4 (1.6)	63 (26.5)	90 (37.8)	44 (18.5)	31 (13.0)	5 (2.1)	1 (0.4)
Ewedu	7 (3.0)	47 (19.8)	85 (35.7)	60 (25.2)	26 (10.9)	8 (3.4)	5 (2.1)
Okro	9 (3.7)	53 (22.3)	79 (33.2)	63 (26.5)	29 (12.2)	4 (1.7)	1 (0.4)
Green (Shoko)	4 (1.7)	59 (24.8)	101 (42.4)	47 (19.7)	21 (8.8)	4 (1.7)	2 (0.8)
Bitter leaf	20 (8.4)	132 (55.5)	56 (23.5)	22 (9.2)	6 (2.5)	1 (0.4)	1 (0.4)
Tomatoes	1 (0.4)	7 (3.0)	9 (3.8)	27 (11.3)	74 (31.1)	85 (35.7)	35 (14.7)

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Pepper	-	5 (2.1)	7 (2.9)	17 (7.1)	75 (31.5)	93 (39.1)	41 (17.2)
Onion	-	4 (1.7)	8 (3.4)	14 (5.9)	65 (27.3)	100 (42.0)	47 (19.7)
Dairy products							
Milk and its products	4 (1.7)	49 (20.6)	82 (34.5)	50 (21.0)	23 (9.7)	25 (10.5)	5 (2.1)
Eggs	-	33 (13.9)	88 (37.0)	63 (26.5)	30 (12.6)	19 (8.0)	5 (2.1)
Oils							
Palm oil	-	14 (5.9)	32 (13.4)	62 (26.1)	67 (28.2)	49 (20.6)	14 (5.9)
Groundnut oil	3 (1.2)	16 (6.7)	22 (9.2)	53 (22.3)	68 (28.6)	54 (22.7)	22 (9.2)
Meat	3 (1.3)	12 (5.0)	31 (13.0)	49 (20.6)	58 (24.4)	58 (24.4)	27 (11.3)
Fish	1 (0.4)	16 (6.7)	26 (10.9)	57 (23.9)	70 (29.4)	46 (19.3)	22 (9.2)
Others							
Beverages	15 (6.3)	62 (26.1)	81 (34.0)	45 (18.9)	20 (8.4)	12 (5.0)	3 (1.3)
Alcoholic drinks	202 (84.9)	29 (12.1)	5 (2.1)	1 (0.5)	-	1 (0.4)	-
Soft drinks	8 (3.1)	74 (31.1)	74 (31.1)	47 (19.7)	19 (8.0)	14 (5.9)	2 (0.8)
Snacks	4 (1.7)	76 (31.9)	71 (29.8)	43 (18.1)	26 (10.9)	13 (5.5)	5 (2.1)

Here, 35.3% eat boiled rice 3-4 times a week, 21.0% eat it 5-6 times a week and 16.0% eat it once a day. Also, two-thirds (68.1%) rarely eat roasted maize while 33.2% rarely take boiled maize. Less than half (42.0%) eat bread 1-2 times per week while 39.1% eat semolina rarely. Less than half (45.8%) rarely eat boiled yam, 34.9% rarely eat pounded yam 28.2% take garri 1-2 times per week. Two-thirds (69.3%, 65.2%) rarely eat cocoyam and potatoes respectively. As regards their legume consumption, 38.5% eat beans 1-2 times weekly and 23.9% eat it rarely. Less than half (41.2%) rarely eats Groundnut, 41.2% eats moimoi and akara 1-2 times weekly respectively. As regards fruits and vegetables, few (11.8%) take orange 3-4 times weekly, 49.2% rarely take pawpaw, 44.5% rarely takes pineapple, 35.7% takes ewedu 1-2 times weekly while 26.5% take okro 3-4 times weekly. As regards dairy products, 34.5% take milk 1-2 times weekly, 37.0% take eggs 1-2 times weekly. The majority of the respondents (84.9%), never take alcohol, 31.1% were 1-2 times weekly.

Table 4: Anthropometric status of the respondents

Classifications	Frequency	Percentage
Underweight	11	4.6
Normal	111	46.6
Overweight	80	33.6
Obese	36	15.1
Total	238	100.0

The majority (46.6%) were normal, 33.6% were overweight, 15.1% were obese and a lesser percentage of the respondents (4.6%) were underweight.

Table 5: Blood pressure of the respondents

Systolic BP classification	F (%)
Normal	130 (54.8)
Prehypertension	72 (30.3)
Stage 1	27 (11.3)
Stage 2	9 (3.8)
Total	238 (100.0)

More than half (54.8%) have normal blood pressure (BP) while 0.8% have normal blood pressure. Also, 30.3% have pre-hypertension concerning blood pressure. 15.1% were hypertensive and the majority (99.2%) were hypertensive.

Table 6: Association between lifestyle practice and anthropometric Status

Variables	Underweight	Normal	Overweight	Obese	Total	p-value
I engage in physical activities (PA) 30 min three times or more per week						
Yes	2 (18.2)	27 (24.3)	13 (16.2)	2 (5.6)	44 (18.5)	.080
No						
I engage in PA 30 min less than three times per week						
Yes	-	29 (26.1)	16 (20.0)	13 (36.1)	58 (24.4)	.064
No	11 (100.0)	82 (73.9)	64 (80.0)	23 (63.9)	180 (75.6)	
I don't engage in any PA except for work and domestic activities						

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Yes	10 (90.9)	67 (60.4)	58 (72.5)	21 (58.3)	156 (65.5)	.072
No	1 (9.1)	44 (39.6)	22 (27.5)	15 (41.7)	82 (34.5)	
I spend most of my time at work sitting						
Yes	8 (72.7)	63 (56.8)	47 (58.8)	28 (77.8)	146 (61.3)	.116
No	3 (27.3)	48 (43.2)	33 (41.2)	8 (22.2)	92 (38.7)	
Do you consume alcohol						
Yes	3 (27.3)	20 (18.0)	13 (16.2)	2 (5.6)	38 (16.0)	.230
No	8 (72.7)	91 (82.0)	67 (83.8)	34 (94.4)	200 (84.0)	
No of alcoholic drinks per day						
1 – 2	3 (27.3)	15 (13.5)	12 (15.0)	1 (2.8)	31 (13.0)	.270
3 – 4	-	5 (4.5)	1 (1.2)	1 (2.8)	7 (2.9)	
Never	8 (72.7)	91 (82.0)	67 (83.8)	34 (94.4)	200 (84.0)	
How often you drink alcoholic drink						
Never	8 (72.7)	91 (82.0)	67 (83.8)	34 (94.4)	200 (84.0)	
Less than 1 month	-	4 (3.6)	5 (6.2)	-	9 (3.8)	
Monthly	3 (27.3)	13 (11.7)	7 (8.8)	1 (2.8)	24 (10.1)	.450
Weekly	-	2 (1.8)	-	1 (2.8)	3 (1.3)	
Daily or almost daily	-	1 (0.9)	1 (1.2)	-	2 (0.8)	

* Significant at P<0.05

The above table shows that there is no association between the respondents' lifestyle practices and anthropometric status.

DISCUSSION

A study (**Kumma and Loha., 2023**) reported that 27.1% of the participants were in the age group of 35 - 44, which is not in agreement to this study as a little above average of the respondents (55%) were in the age group of 30 - 40. The population of females was more than that of males. Previous studies also had similar findings of higher response rates from females than males (**Kebede et al, 2020**). A majority of the respondents were Christians because the study location is Bowen University, a faith-based institution. The majority of the respondents in this study were married which is similar to the study conducted in Arba Minch Town (**Haftu et al., 2017**).

The lifestyle practices of the respondents in this study were shown to be inappropriate. The majority of the respondents did not engage in physical exercises 30 minutes three times or more per week and in physical exercises 30 minutes less than three times per week. The physical exercises considered by the respondents were domestic activities and work activities. A previous study that was conducted in Southern Ethiopia reported that a minority of the respondents had regular physical activity, similar to the report of this study (**Tekalegn et al., 2022**). A previous study was conducted in Nigeria where it was reported that a few of the respondents consumed alcohol (**Adeloye et al., 2019**) which is also similar to this current study where a majority of respondents do not consume alcohol.

Slightly above average (66.7%) of the respondents in a study that was conducted in Sokoto, Nigeria, reported consumption of fatty foods (**Awosan et al., 2014**) which is not in agreement to this study where less than half (41.2%) of respondents rarely eat groundnut, 34.5% takes milk 1-2 times weekly and 37.0% takes eggs 1-2 times weekly.

Based on BMI classification, it was revealed that less than average (46.6%) of the respondents in this study were normal in weight (18.5-25kg/m²), which is slightly similar to the study conducted in Southern Ethiopia (**Kebede et al, 2020**) where it showed that 42.0% of respondents also had a BMI of <25kg/m². **Chukwuonye et al., (2013)**, conducted a study that showed that the prevalence of overweight and obesity in Nigeria, 35.1%, and 22.2%, respectively, which is similar to this current study that reported 33.6% of respondents to be overweight and 15.1% of respondents to be obese.

A previous study conducted in the rural part of Osun state, Nigeria revealed that 13.16% of the respondents were hypertensive (**Asekun-Olarinmoye et al., 2013**), which is in agreement to this current study where 15.1% were hypertensive.

CONCLUSION

This research shows that the lifestyle practices of the respondents can be considered inappropriate, due to the fact that the majority of the respondents do not participate in physical activities, as majority of them practice sedentary lifestyle. An average of the respondents consumes fruits and vegetables at least 3-4 times per week. Majority of the respondents never take alcohol. Less than half of the respondents consume fatty foods. The research revealed that majority of the respondents have a normal weight. The blood pressure status of the respondents also revealed that majority of them have normal blood pressure.

REFERENCES

- Adeloye, D., Olawole-Isaac, A., Auta, A., Dewan, M. T., Omoyele, C., Ezeigwe, N., Jacobs, W., Mpazanje, R. G., Harhay, M. O., Alemu, W., & Adewole, I. F. (2019).** Epidemiology of harmful use of alcohol in Nigeria: a systematic review and meta-analysis. *The American Journal of Drug and Alcohol Abuse*, 45(5), 438–450.
- American Heart Association. (2023).** What is cardiovascular disease? Retrieved December 26, 2023, from <https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease>

- Asekun-Olarinmoye, E., Akinwusi, P., Adebimpe, W., Isawumi, M., Hassan, M., Olowe, O., Makanjuola, O., Alebiosu, C., & Adewole, T. (2013).** Prevalence of hypertension in the rural adult population of Osun State, southwestern Nigeria. *International journal of general medicine*, 6, 317–322. <https://doi.org/10.2147/IJGM.S42905>
- Awosan, K. J., Ibrahim, M. T. O., Essien, E., Yusuf, A. A., & Okolo, A.C. (2014).** Dietary pattern, lifestyle, nutrition status and prevalence of hypertension among traders in Sokoto Central market, Sokoto, Nigeria. *International Journal of Nutrition and Metabolism*, 6(1), 9-17. <https://doi.org/10.5897/IJNAM2013.0158>
- Chukwuonye, I. I., Chuku, A., John, C., Ohagwu, K. A., Imoh, M. E., Isa, S. E., Ogah, O. S., & Oviasu, E. (2013).** Prevalence of overweight and obesity in adult Nigerians - a systematic review. *Diabetes, metabolic syndrome and obesity : targets and therapy*, 6, 43–47. <https://doi.org/10.2147/DMSO.S38626>
- Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Redondo-Flórez, L., Martín-Rodríguez, A., & Tornero-Aguilera, J. F. (2023).** Global Impacts of Western Diet and Its Effects on Metabolism and Health: A Narrative Review. *Nutrients*, 15(12), 2749. <https://doi.org/10.3390/nu15122749>
- Francula-Zaninovic, S., & Nola, I. A. (2018).** Management of Measurable Variable Cardiovascular Disease' Risk Factors. *Current cardiology reviews*, 14(3), 153–163. <https://doi.org/10.2174/1573403X14666180222102312>
- Haftu, Desta & Meles, Gebrekiros & Berbada, Dessalegn & Gedamu, Genet & Getehun, Eskezyiaw. (2017).** Water, sanitation and hygiene practice and associated factors among HIV infected people in Arba Minch town, Southern Ethiopia. *Journal of Water and Health*. 15. wh2017373. 10.2166/wh.2017.373.
- Kebede, B., Ayele, G., Haftu, D., & Gebremichael, G. (2020).** The Prevalence and Associated Factors of Hypertension among Adults in Southern Ethiopia. *International Journal of Chronic Diseases*, 2020, 1–7. <https://doi.org/10.1155/2020/8020129>
- Kumma, W. P., & Loha, E. (2023).** Dietary patterns and their association with cardiovascular risk factors in Ethiopia: A community-based cross-sectional study. *Frontiers in nutrition*, 10, 1074296. <https://doi.org/10.3389/fnut.2023.1074296>
- Mensah, G. A., Roth, G. A., & Fuster, V. (2019).** The Global Burden of Cardiovascular Diseases and Risk Factors. *Journal of the American College of Cardiology*, 74(20), 2529–2532. <https://doi.org/10.1016/j.jacc.2019.10.009>
- Nnate, D. A., Eleazu, C. O., & Abaraogu, U. O. (2021).** Ischemic Heart Disease in Nigeria: Exploring the Challenges, Current Status, and Impact of Lifestyle Interventions on Its Primary Healthcare System. *International journal of environmental research and public health*, 19(1), 211. <https://doi.org/10.3390/ijerph19010211>

- Sharifi-Rad, J., Rodrigues, C. F., Sharopov, F., Docea, A. O., Can Karaca, A., Sharifi-Rad, M., Kahveci Karıncaoglu, D., Gülseren, G., Şenol, E., Demircan, E., Taheri, Y., Suleria, H. A. R., Özçelik, B., Nur Kasapoğlu, K., Gültekin-Özgüven, M., Daşkaya-Dikmen, C., Cho, W. C., Martins, N., & Calina, D. (2020).** Diet, Lifestyle and Cardiovascular Diseases: Linking Pathophysiology to Cardioprotective Effects of Natural Bioactive Compounds. *International journal of environmental research and public health*, 17(7), 2326. <https://doi.org/10.3390/ijerph17072326>
- Tekalegn, Y., Solomon, D., Sahiledengle, B., Beressa, G., Desta, F., Tolcha, F., Rogers, H. L., Petrucka, P. P., & Mwanri, L. (2022).** Level of physical activity and its associated factors among adults in southeast Ethiopia: a community-based cross-sectional study. *BMJ open*, 12(11), e063333. <https://doi.org/10.1136/bmjopen-2022-063333>
- Thiriet, M. (2018).** Cardiovascular Disease: An Introduction. *Biomathematical and Biomechanical Modeling of the Circulatory and Ventilatory Systems*, 1–90. https://doi.org/10.1007/978-3-319-89315-0_1
- World Health Organization. (2021).** Cardiovascular diseases (CVDs). Retrieved from [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)773-777](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)773-777).