INTERNATIONAL JOURNAL OF RESEARCH AND SCIENTIFIC INNOVATION (IJRSI)
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Prevalence and Risk Factors of Diabetes and Hypertension Among Healthcare Workers in Public Hospitals of Sokoto, North-Western Nigeria

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DOI: https://doi.org/10.51244/IJRSI.2025.120800281

Received: 05 June 2025; Accepted: 06 September 2025; Published: 06 October 2025

ABSTRACT

Background

Diabetes mellitus and hypertension are major risk factors for cardio-cerebrovascular diseases (CVDs), coronary heart disease, stroke, and kidney failure. The study investigates diabetes, hyperglycemia, and hypertension prevalence among healthcare workers in Sokoto State, Nigeria, aiming to improve occupational health and targeted interventions.

Objectives

This study investigates the prevalence and risk factors of Diabetes, hyperglycemia, and Hypertension among healthcare workers in public hospitals in Sokoto State, North-Western Nigeria.

Methodology

This analytical, cross-sectional study involving healthcare workers aged 18 and above was conducted. Data were collected through the WHO STEPS Instrument, blood pressure measurement, Anthropometric assessment, and biochemical analysis. Descriptive statistics, Chi-square tests, and regression analysis were performed.

Results

Among 315 participants, 186 (59%) were female, with a mean age of 35.45 years, and 222 (70.5%) were married. Nurses constituted 209 (66.3%). This study found that hyperglycemia was present in 7.9% of participants, 4.4% had Diabetes, 17.8% had systolic and diastolic hypertension, and 12.1% of participants had dyslipidemia, with most having normal total cholesterol. Dietary habits indicated inadequate fruit and vegetable consumption, below the WHO recommendations. Additionally, 40.0 (12.7%) frequently added salt to their meals, and 134.0 (42.5%) engaged in physical activity, while 181.0 (57.5%) did not. Only 2.2% had LDL-C dyslipidemia, while 97.8% had normal LDL cholesterol. Triglyceride distribution was balanced, with 51.4% having dyslipidemia and 48.6% in the normal range.

Conclusion

This study underscores the need for interventions addressing modifiable risk factors, including physical activity and dietary habits, to mitigate NCDs among healthcare workers in public hospitals in Sokoto, Nigeria.

Recommendations

Future research should delve into the specific impact of these factors on distinct NCD outcomes within this population. Such interventions can play a crucial role in reducing the burden of NCDs in LMICs and improving the overall health of healthcare workers.

Keywords: Diabetes, hypertension, healthcare workers, prevalence, risk factors, Sokoto-Nigeria.

INTRODUCTION

The global prevalence of diabetes and hypertension is a significant public health challenge, with healthcare professionals (HCWs) often receiving less attention (1,2).

Understanding the prevalence of diabetes and hypertension among HCWs in Nigeria is crucial, as their health directly impacts their ability to provide quality care and promote healthy lifestyles within their communities (1). Cardiovascular diseases (CVDs), with hypertension as a major risk factor, are a leading cause of death worldwide, and Nigeria is experiencing an accelerated increase in CVD-related deaths (3). Lifestyle modifications are recognized as a critical first step in managing hypertension, requiring promotion by all healthcare professionals (1,2).

Prevalence of Diabetes among Healthcare Workers

Diabetes prevalence among HCWs varies across studies, influenced by factors like geographic location, study design, and demographics. Studies in West Central Illinois and India found that a significant proportion of HCWs in medically underserved regions exhibited cardiovascular risk factors and did not engage in regular physical activity (4). In India, a high prevalence of type 2 diabetes mellitus (34.6%) was found among healthcare professionals in tertiary care. Hospitals (5).

Diabetes mellitus, predominantly type 2 diabetes (T2DM), is another major chronic illness with a growing burden in Africa (6,7,8). The International Diabetes Federation estimates that approximately 19 million people in Africa are living with diabetes, and this number is projected to increase significantly (7). Effective management of diabetes requires a combination of pharmacological therapy and lifelong lifestyle interventions, including self-management education, medical nutrition therapy, physical activity, and smoking cessation counseling (6). Factors contributing to the potential vulnerability of HCWs to diabetes and hypertension include occupational stress, environmental factors, lifestyle factors, and patient care (6).

Prevalence of Hypertension among Healthcare Workers

Hypertension among healthcare workers (HCWs) is a significant cardiovascular risk factor, with a prevalence of 22.09% in India (5). Age is an important factor, with a correlation between HCWs' age and high blood pressure (4). During the COVID-19 pandemic, hypertension was a common comorbidity (32.3%) among physicians, with mild post-traumatic stress disorder (PTSD) significantly associated with comorbidities (9).

There is a significant lack of data specific to healthcare professionals in Nigeria, and understanding the unique challenges and risk factors faced by this population requires targeted research efforts. A study by Kehinde et al., (1) highlighted the need for more focus on the contribution of pharmacists to the promotion of lifestyle modification in the management of hypertension in Nigeria.

Context-specific research is essential, as the prevalence and associated factors of diabetes and hypertension can vary significantly across different populations and settings (Akalu, 2020). Tailoring research to the specific context of healthcare Workers in Nigeria can offer useful information about the unique challenges and experiences faced by healthcare Workers, ultimately leading to more effective interventions and support systems.

METHODOLOGY

This cross-sectional study was conducted among healthcare workers in public hospitals in Sokoto, northwestern Nigeria. The participants were government employees working at five secondary hospitals and one tertiary hospital. The study population consisted of doctors, nurses, pharmacists, pharmacy technicians, medical laboratory scientists, and medical laboratory technicians. The sample size was 330 participants, selected by systematic random sampling from the registers of the respective hospitals and departments. The calculations were derived from a cohort of 1,192 healthcare personnel, comprising medical doctors, nurses, pharmacists, pharmacy technicians, medical laboratory scientists, and medical laboratory technicians from six designated institutions, utilizing Taro Yamane's formula (1975), [(n=N/(1-Ne2)]. Where n represents the sample size, N denotes the population size, and e signifies the margin of error (5%). A 10% increase (31 participants) was incorporated to account for the anticipated participant attrition rate. The overall sample size was 332.

Data collection and measurements involved a modified form of the WHO STEPS questionnaire, version 2.1 (10), which used sequential steps to gather information about socio-demographic information, physical measurements, and biochemical tests. The main outcome variable was the prevalence of non-communicable diseases (NCDs) among the participants. Exposure variables included sociodemographic factors and lifestyle factors such as alcohol consumption, smoking status, and physical activity level.

The study adopted and modified the STEP-wise approach to the NCD Risk Factor Surveillance (STEPS) tool to explore variables related to NCD risks in the study participants. Socio-demographic characteristics, lifestyle factors, self-reported NCD status, and NCD risk factor assessment comprised the questionnaire categories.

The study received approval from the Sokoto State Ministry of Health Ethical Review Committee on Research Involving Human Subjects. Before enrollment, written informed consent was obtained from participants, who were informed about the voluntary nature of the study and the option to withdraw at any time without facing consequences. After completing two days of training before the research, six research assistants collected data while following aseptic procedures during sample collection.

Statistical analysis

We used the Statistical Package for Social Sciences (SPSS) Windows version 25.0 (SPSS, Inc., Chicago, IL, USA) to analyze the data. The unadjusted odds ratio was utilized to calculate the association between hypertension and socio-economic demographic factors.

Multivariate regression analysis was carried out between dependent variables (diabetes and hypertension) and independent variables (socioeconomic and demographic). Chi-square and Fisher's exact tests were used to test for association between Diabetes and Hypertension, socio-demographic characteristics, and risk factors. Significance was tested at 95%, and $p < 0.05$ was taken as significant.

Ethical approval

Ethical clearance was obtained from the Ethics and Research Committees of the Sokoto State Ministry of Health (MOH) and Specialist Hospital Sokoto (SHS), SKHREC/068/2022/15, and SHS/SUB/133/Vol. 1, 2022, respectively.

Informed consent was obtained in writing from each of the study participants. Non-disclosure of participant information was assured.

RESULTS

Socio-demographic characteristics

Among the 315 participants, the male-to-female ratio was 1:1.4, with a mean age of 35.4 years (±9.0). Of these, 222 (70.5%) were married, 91 (28.9%) were single, and 2 (0.6%) were divorced. 177 (56.2%) had a Diploma, a

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

57 (18.1%) had a higher diploma, 61 (21.6%) had a bachelor's degree, 11 (3.5%) had a Master's degree, and 2 (0.6%) had a PhD degree. See Table 1.

Table 1: The Socio-demographic characteristics of the study participants (n=315).

Variable	Category	N	%
Age	20-29	102	32.4
	30-39	119	37.8
	40-49	55	17.5
	>50	39	12.4
	Total	315	100
Sex	Male	129	41.0
	Female	186	59.0
	Total	315	100
Marital Status	Single	91	28.9
	Married	222	70.5
	Divorced	2	0.6
	Total	315	100
Education	BSc	68	21.6
	MSc	11	3.5
	PhD	2	0.6
	Diploma	177	56.2
	High Diploma	57	18.1
	Total	315	100

Percentage of study participants by Profession/cadre (n=315)

Nurses comprised 215 (68.2%), Medical Laboratory Scientists were 11 (3.5%), pharmacists were 10 (3.2%), and medical doctors were 18 (5.7%). Pharmacy technicians were 10 (3.2%), and medical laboratory technicians were 51 (16.2%). See Figure 1.

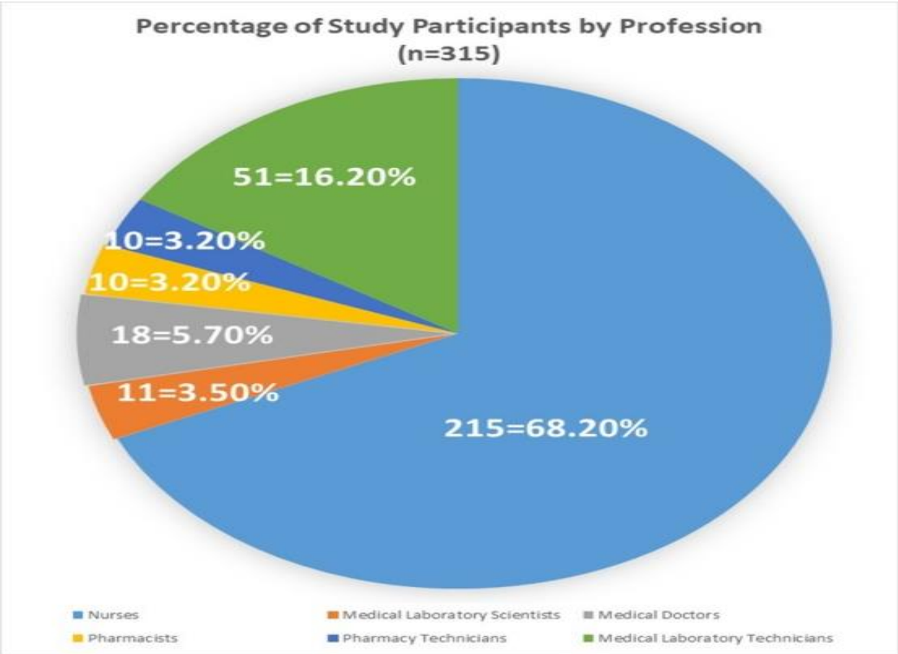

Figure 1: Showing the percentage of the study participants by profession.

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Relationship between socio-demographic characteristics and hypertension among study participants (n = 315).

Twelve participants (3.8%) in the 20-29 years age group had hypertension; the adjusted odds ratio (AOR) is 3.033 with a 95% confidence interval (CI) of 0.441 to 20.870 and a *p-v*alue of 0.260. The number of participants with hypertension among the 30-39, 40-49, and >50 years age groups were 12 (3.8%) (AOR=1.275, (CI: 0.207 to 7.854), *p*= 0.793), 7 (2.2%), AOR=1.545, (CI: 0.206 to 11.572), *p*-value 0.672, and 4 (1.3%), AOR=0.0, (CI: 0.0 to 0.0), *p*-value not available (NA), respectively. 35 (11.1%) of the participants received a diagnosis of hypertension. However, the relationship between these age groups and hypertension was not statistically significant ($\chi^2 = 0.346$).

6 (1.9%) of male participants had hypertension, while 29 (2.2%) of female participants had hypertension. 35 (11.1%) of the participants received a diagnosis of hypertension. Furthermore, the relationship between gender and hypertension was not statistically significant ($\chi^2 = 9.231$, AOR = 0.325 (CI: 0.098 to 1.072), $p = 0.065$).

2 (0.6%) of the unmarried participants had hypertension, 33 (10.5%) of the married participants had hypertension, and 0 (0%) of the divorced participants were hypertensive. There was a significant relationship between unmarried participants and hypertension ($\chi^2 = 10.737$, AOR = 3.533, CI: 13.222 to 51.095), $p = 0.000$; likewise, there was a significant relationship between married participants and hypertension (AOR = 3.699, CI: 5.699 to 6.699, p = 0.005).

7 (2.2%) of participants with bachelor's degrees had hypertension ($\chi^2 = 0.969$, AOR = 0.761 (CI: 0.125 to 4.634), $p = 0.767$). Participants with a master's degree, diploma, and higher diploma who had hypertension were 1 (0.3%) (AOR=2.053 (CI: 0.040 to 105.812), $p = 0.721$), 22 (7.0%) (AOR=2.769 (CI: 0.583 to 13.149), p=0.200), and 5 (1.6%) (AOR=3.086 (CI: 0.000 to 0.000), p=0.998), respectively. The relationship between educational attainment and hypertension was not statistically significant.

Significant associations were found with marital status (single and married) and hypertension. However, there is no significant association with age, sex, or education level in this dataset (Table 2).

Table 2: Relationship between sociodemographic characteristics and hypertension among participants (n=315).

Independent Variable	Category	Hypertension		χ^2/Fisher Exact test	Adjusted OR (CI 95)	*P* Value
		Yes n (%)	No n (%)			
Age	20-29	12 (3.8)	90 (28.6)	0.346	3.033 (0.441 to 20.870)	0.260
	30-39	12 (3.8)	107 (34.0)		1.275 (0.207 to 7.854)	0.793
	40-49	7 (2.2)	48 (15.2)		1.545 (0.206 to 11.572)	0.672
	>50	4 (1.3)	35 (11.1)		0.0(0.0 to 0.0)	NA
	Total	35 (11.1)	280 (88.9)			
Sex	Male	6 (1.9)	123 (39.0)	9.231	0.325 (0.098 to 1.072)	0.065
	Female	29 (9.2)	157 (49.8)			.

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	Total	35 (11.1)	280 (88.9)			
Marital Status	Single	2 (0.6)	89 (28.3)	10.737	3.533 (13.222 to 51.095)	0.000
	Married	33 (10.5)	189 (60.0)		3.699 (5.699 to 6.699)	0.005
	Divorced	0 (0)	2 (0.6)		NA	NA
	Total	35 (11.1)	280 (88.9)			
Education	BSc	7 (2.2)	61 (19.4)	0.969	0.761 (0.125 to 4.634)	0.767
	MSc	1 (0.3)	10 (3.2)		2.053 (0.040 to 105.812)	0.721
	PhD	0 (0)	2 (0.6)		NA	NA
	Diploma	22 (7.0)	155 (49.2)		2.769 (0.583 to 13.149)	0.200
	High Diploma	5 (1.6)	52 (16.5)		3.086 (0.000 to 0.000)	0.998
	Total	35 (11.1)	280 (88.9)			

Relationship between sociodemographic characteristics and diabetes

Table 3 examines the relationship between sociodemographic characteristics and hyperglycemia among the study participants.

4 (1.3%) of the male participants had diabetes, while 10 (3.2%) of the female participants had hyperglycemia. A total of 14 (4.4%) of the participants were diagnosed with diabetes. Furthermore, the relationship between gender and diabetes was not statistically significant ($\chi^2 = 0.929$, AOR = 2.108 (CI: 0.314 to 14.160), p = 0.443).

0 (0.0%) of unmarried participants had diabetes, 4 (1.3%) of married participants had diabetes, and 0 (0%) of the divorced participants were diabetic. There was a significant relationship between married participants and diabetes ($\chi^2 = 6.138$, AOR = 2.050 (CI: 2.050 to 2.050), $p = 0.002$).

3 (1.0%) of the participants with bachelor's degrees had diabetes ($\chi^2 = 7.606$, AOR = 0.282 (CI: 0.036 to 2.217), $p = 0.229$). Participants with a master's degree, PhD, diploma, and higher diploma who had diabetes were 1 (0.3%) (AOR=0.085 (CI: 3.779 to 10.014), p =0.531), 0 (0.0%) AOR=5.697 (CI: (0.000 to 0.000), $p = 1.000$), 4 (1.4%) (AOR=0.074, (CI: 0.009 to 0.597), p =0.015), and 6 (1.9%) (AOR=0.173 (CI: 0.020 to 0.296), p =0.000), respectively. We found statistically significant associations with marital status (married), education level (diploma and higher diploma), and diabetes (Table 3).

Table 3: Relationship between sociodemographic characteristics and Hyperglycemia among study participants (n=315).

Independent Variable	Category	Diabetes		χ^2/Fisher Exact test	Adjusted OR (CI 95)	*P* Value
		Yes n (%)	No n (%)			

Age	20-29	4 (1.3)	98 (31.1)	3.941	2.002 (0.184 to 21.758)	0.568
	30-39	3 (1.0)	116 (36.8)		0.342 (0.031 to 3.743)	0.379
	40-49	5 (1.6)	50 (15.9)		1.384 (0.140 to 13.664)	0.781
	>50	2 (0.6)	37 (11.7)		1.254 (0.134 to 3.55)	
	Total	14 (4.4)	301 (95.6)			
Sex	Male	4 (1.3)	125 (39.7)	0.929	2.108 (0.314 to 14.160)	0.443
	Female	10 (3.2)	176 (55.9)		.NA	.
	Total	14 (4.4)	301 (95.6)		NA	
Marital Status	Single	0 (0)	91 (28.9)	6.138	8.498 (0.000 to 0.022)	0.977
	Married	14 (4.4)	208 (66.0)		2.050 (2.050 to 2.050)	0.002
	Divorced	0 (0)	0 (0)		NA	.
	Total	14 (4.4)	301 (95.6)			
Education	BSc	3 (1.0)	65 (20.6)	7.606	0.282 (0.036 to 2.217)	0.229
	MSc	1 (0.3)	10 (3.2)		0.085 (3.779 to 10.014)	0.531
	PhD	0 (0)	2 (0.6)		5.697 (0.000 to 0.000)	1.000
	Diploma	4 (1.4)	173 (54.9)		0.074 (0.009 to 0.597)	0.015
	High Diploma	6 (1.9)	51 (16.2)		0.173 (0.020 to 0.296)	0.000
	Total	14 (4.4)	301 (95.6)			

Prevalence of Behavioral Risk Factors for NCD Among the Participants

Classification of study participants based on Body Mass Index (BMI)

Among the study participants, 176 (56%) were underweight; they comprised 84 (48%) males and 92 (52%) females. 85 (27%) were overweight, comprising 27 (32%) males and 58 (68%) females. 52 (16.5%) of them were obese (Figure 2).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

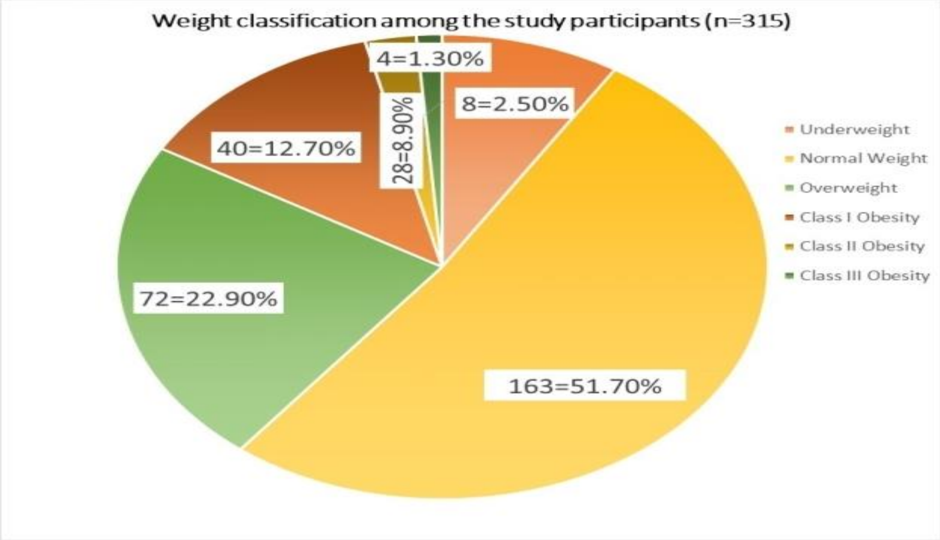

Figure 2: Percentage of the study population that is underweight, overweight, and obese.

Prevalence of behavioral risk factors for diabetes and hypertension among participants (n = 315).

Alcohol consumption among the study participants was 10 (3.2%), and the remaining 305 (96.8%) did not drink alcohol. Only 1 (0.3%) participant smokes a cigarette, while 314 (99.7%) do not. 134 (42.5%) of the participants were involved in physical exercise, while 181 (57.5%) were not. Only 75 (23.8%) of the participants consumed 5 portions (>40 g/day) of fruit and vegetables per day, while 240 (76.2%) did not. Additionally, 40 (12.7%) and 276 (87.6%) frequently added salt to their meals. See Table 4.

Table 4: Prevalence of the behavioral risk factors of NCDs among the study population, n=315

Variables	**Category**	**N**	**%**
Alcohol Consumption	Yes	10	3.2
	No	305	96.8
	Total	315	100
Smoke Cigarette	Yes	1	0.3
	No	314	99.7
	Total	315	100
Physical Exercise	Yes	134	42.5
	No	181	57.5
	Total	315	100
Fruit and Vegetable Intake	Yes	75	23.8
	No	240	76.2
	Total	315	100
Add Salt to Food	Yes	40	12.7

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	No	275	87.3
	Total	315	100

Relationship between diabetes and the behavioral risk factors of NCDs among the participants (n = 315).

This table explores the relationship between various behavioral risk factors for diabetes and hypertension within the study participants.

0 (0%) of the participants consumed alcohol, and 0 (0%) had diabetes, while 10 (3.2%) of them consumed alcohol but were not diabetic. However, 14 (4.4%) of them do not consume alcohol but have diabetes. 291 (92.4%) of them do not consume alcohol and do not have diabetes (χ^2=0.480, AOR=N/A, *p=0.070).* 4 participants (4.4%) had diabetes, and 301 (95.6%) did not have diabetes. A *p*-value of 0.999 indicates no significant association between alcohol consumption and diabetes.

0 (0%) of the participants smoked cigarettes, and 0 (0%) had diabetes. 1 (0.3%) of the participants smoked cigarettes but were not diabetic. c. 14 (4.4%) of the participants did not smoke cigarettes but had diabetes, and 300 (95.2%) did not smoke cigarettes and were not diabetic (χ^2=0.047, AOR= 0.000, CI:95): (0.000 to 0.000). A p-value of 0.999 indicates no significant association between smoking and diabetes.

7(2.2%) of the participants had diabetes and were engaged in physical exercise, compared to 127 (40.3%) who were not diabetic and were physically inactive. 14 (4.4%) of the participants had diabetes and did not engage in physical exercise, compared to 174 (55.2%) who were physically inactive and were not diabetic. 14 participants (4.4%) had diabetes, and 301 (95.6%) were not diabetic. (χ^2=0.334, AOR=1.430, (CI: 95): (0.487 to 4.200). A *p*-value of 0.515 indicates no statistically significant association between physical exercise and diabetes among the study participants.

13 (4.1%) of the participants ate fruit and vegetables according to WHO criteria but had diabetes, while 293 (93.0%) ate fruit and vegetables but had no diabetes, 1 (0.3%) of the participants who do not eat fruit and vegetables have diabetes, while 8 (2.5%) do not eat fruit and vegetables and do not have diabetes. 14 (4.4%) of the participants had diabetes, and 301 (95.6%) were not diabetic (χ^2 == 3.970, AOR == 0.336, CI: 95 (0.038 to 2.965). A *p*-value of 0.326 indicates no significant association between fruit and vegetable intake and diabetes.

1 (0.3%) of the participants added salt to cooked food and had diabetes, while 39 (12.4%) added salt to cooked food but were not diabetic. 13 (4.1%) of the participants did not add salt to cooked food and had diabetes. 262 (83.2%) participants did not add salt to cooked food and were not diabetic. 14 participants (4.4%) had diabetes, and 301 (95.6%) did not have diabetes. (χ^2= 0.408, AOR= 0.542, (CI: 95): (0.068 to 4.300). A *p*-value of 0.562 indicates no significant association between adding salt to cooked food and diabetes (Table 5).

Table 5: Relationship between diabetes and behavioral risk factors of NCDs among the study participants (n=315).

Independent Variable	Category	**Diabetes**		χ^2/Fisher Exact test	Adjusted OR (CI 95)	*P* Value
		Yes n (%)	No n (%)			
Alcohol Consumption	Yes	0 (0)	10 (3.2)	0.480		0.999
	No	14 (4.4)	291 (92.4)			
	Total	14 (4.4)	301 (95.6)			
	Yes	0 (0)	1 (0.3)	0.047	0.000	0.999

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ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Smoke Cigarette	No	14 (4.4)	300 (95.2)			
	Total	14 (4.4)	301 (95.6)			
Physical Exercise	Yes	7 (2.2)	127 (40.3)	0.334	1.430 (0.487 to 4.200)	0.515
	No	7 (2.2)	174 (55.2)			
	Total	14 (4.4)	301 (95.6)			
Fruits and Vegetables Intake	Yes	4(1.3)	71 (22.5)	3.970	0.336 (0.038 to 2.965)	0.326
	No	10 (3.2)	230 (73.0)			
	Total	14 (4.4)	301 (95.6)			
Add Salt to Food	Yes	1 (0.3)	39 (12.4)	0.408	0.542 (0.068 to 4.300)	0.562
	No	13 (4.1)	262 (83.2)			
	Total	14 (4.4)	301 (95.6)			

Relationship between hypertension and the behavioral risk factors of NCDs among the participants (n = 315).

This table explores the relationship between various behavioral risk factors for NCD and hypertension within the study participants.

3 (1.0%) of the participants had hypertension and consumed alcohol, while 7 (2.2%) consumed alcohol but were not hypertensive. However, 32 (10.2%) of them did not consume alcohol but had hypertension. 273 (86.7%) of them do not consume alcohol and do not have hypertension. (χ^2=3.731, AOR=3.565, *p=0.070)*. A *p*-value of 0.070 indicates no significant association between alcohol consumption and hypertension.

0 (0%) of the participants smoked cigarettes, and 0 (0%) were hypertensive. 1 (0.3%) of the participants smoked cigarettes but were not hypertensive. 35 (11.1%) of the participants had hypertension, and 279 (88.6%) were not hypertensive (χ^2=0.125, AOR=0.000, AOR=0.000, (CI: 95) (0.000 to 0.000). A *p*-value of 0.723 indicates no significant association between smoking and hypertension.

21 (6.7%) of the participants with hypertension engaged in physical exercise, compared to 113 (35.9%) who did not (physically inactive) and were not hypertensive. 14 (4.4%) of the participants with hypertension do not engage in physical exercise, compared to 167 (53.0%) who were physically inactive and were not hypertensive. 35 participants (11.1%) had hypertension, and 280 (88.9%) had no hypertension. (χ^2=4.911, AOR=2.217, (CI: 95): (1.082 to 4.541). A *p*-value of 0.030 indicates a significant association between physical exercise and hypertension.

34 (10.8%) of the participants ate fruit and vegetables according to WHO criteria and had hypertension, while 272 (86.3%) ate fruit and vegetables but were not hypertensive. 1 (0.3%) of the participants who did not eat fruit and vegetables had hypertension. 35 (11.1%) of the participants had hypertension, and 279 (88.6%) were not hypertensive (χ^2 = 0.000, AOR = 0.000, CI: 95 (0.121 to 8.242). A *p*-value of 1.000 indicates no significant association between fruit and vegetable intake and hypertension.

4 (1.3%) of the participants added salt to cooked food and had hypertension, while 36 (11.4%) added salt to cooked food but were not hypertensive. 31 (9.8%) of the participants had hypertension and did not add salt to

cooked food. 244 (77.5%) of the participants did not add salt to cooked food and were not hypertensive. 35 participants (11.1%) had hypertension, and 280 (88.9%) did not have hypertension. (χ^2= 0.057, AOR= 0.875, (CI: 95): (0.292 to 2.623). A *p*-value of 0.811 indicates no significant association between adding salt to cooked food and hypertension (Table 6).

Table 6: Relationship between hypertension and the behavioral risk factors of NCDs among the study participants (n=315).

Independent Variable	Category	Hypertension		χ^2/Fisher Exact test	Adjusted OR (CI: 95)	*P* Value
		Yes n (%)	No n (%)			
Alcohol Consumption	Yes	3 (1.0)	7 (2.2)	3.731	3.565 (0.901 to 14.845)	0.070
	No	32 (10.2)	273 (86.7)			.
	Total	35 (11.1)	280 (88.9)			
Smoke Cigarette	Yes	0 (0)	1 (0.3)	0.125	0.000 (0.000 to 0.000)	0.723
	No	35 (11.1)	279 (88.6)			
	Total	35 (11.1)	280 (88.9)			
Physical Exercise	Yes	21 (6.7)	113 (35.9)	4.911	2.217 (1.082 to 4.541)	0.030
	No	14 (4.4)	167 (53.0)			.
	Total	35 (11.1)	280 (88.9)			
Fruit and Vegetable Intake	Yes	3 (1.0)	72 (22.9)	0.000	0.000 (0.121 to 8.242)	1.000
	No	32(10.2)	208 (66.0)		2.539 (0.062 to 104.140)	
	Total	35 (11.1)	280 (88.9)			
Add Salt to Food	Yes	4 (1.3)	36 (11.4)	0.057	0.875 (0.292 to 2.623)	0.811
	No	31 (9.8)	244 (77.5)			
	Total	35 (11.1)	280 (88.9)			

Prevalence of Metabolic Risk Factors of NCD Among the Participants

Prevalence of Dyslipidemia among the study participants (n =315)

277 (87.9%) of the participants had normal total cholesterol (TC) levels, while 38 (12.1%) of them had TC dyslipidemia. 153 (48.6%) of the participants had normal triglyceride (TG) levels, while 162 (51.4%) of them had TG dyslipidemia. 313 (99.4%) of the participants had normal HDL-cholesterol (HDL-C) levels, while 2 (0.6%) of them had HDL-C dyslipidemia. 308 (97.8%) of the participants had normal LDL-cholesterol (LDL–a

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C) levels, while 7 (2.2%) of them had LDL–C dyslipidemia. 190 (60.3%) of the participants had normal VLDL-cholesterol (VLDL-C) levels, while 125 (39.7%) of them had VLDL-C dyslipidemia.

Thirty-eight (12.1%) of the participants had T-C dyslipidemia, 162 (51.4%) had T-G dyslipidemia, and 125 (39.7%) had VLDL-C Dyslipidemia (Table 7).

Table 7: Prevalence of Dyslipidemia among the study participants (n=315).

Lipid	Category	Frequency	Percent
Total Cholesterol	Normal	277	87.9
	TC-Dyslipidemia	38	12.1
	Total	315	100.0
Triglyceride	Normal	153	48.6
	TG-Dyslipidemia	162	51.4
	Total	315	100.0
HDL-Cholesterol	Normal	313	99.4
	HDL-Dyslipidemia	2	0.6
	Total	315	100.0
LDL-Cholesterol	Normal	308	97.8
	LDL-Dyslipidemia	7	2.2
	Total	315	100.0
VLDL-Cholesterol	Normal	190	60.3
	VLDL-Dyslipidemia	125	39.7
	Total	315	100.0

Prevalence of Dyslipidemia, hyperglycemia, and hypertension among the participants (n=315)

38 (12.1%) of participants had dyslipidemia, and the majority of participants had normal total cholesterol (277, 87.9%). Only 7 (2.2%) of participants had LDL-C dyslipidemia, while LDL cholesterol was 308 (97.8%). For VLDL cholesterol, 125 (39.7%) of participants had dyslipidemia, and 190 (60.3%) had values within the normal range. The distribution of triglycerides (TG) is roughly balanced; 162 (51.4%) of participants had dyslipidemia, with 153 (48.6%) in the normal range.

25 (7.9%) of participants had hyperglycemia, while 290 (92.1%) had normal blood glucose levels.

56 (17.8%) of participants had systolic blood pressure (SBP) hypertension, 63 (20.0%) had pre-hypertension, and 196 (62.2%) had normal systolic blood pressure (SBP). 120 (38.1%) of participants had diastolic blood pressure (DBP) hypertension, 41 (13.0%) had pre-hypertension, and 154 (48.9%) had normal diastolic blood pressure (DBP). See Table 8.

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Table 8: Distributions of Dyslipidemia, hyperglycemia, and hypertension among the study participants

Variables		**Frequency**	**Percent**
Total Cholesterol	Normal	277	**87.9**
	Dyslipidemia	38	**12.1**
	Total	315	**100.0**
LDL Cholesterol	Normal	308	**97.8**
	Dyslipidemia	7	**2.2**
	Total	315	**100.0**
VLDL Cholesterol	Normal	190	**60.3**
	Dyslipidemia	125	**39.7**
	Total	315	**100.0**
TG	Normal	153	**48.6**
	Dyslipidemia	162	**51.4**
	Total	315	**100.0**
Glycaemia	Normal	290	**92.1**
	Hyperglycemia	25	**7.9**
	Total	315	**100.0**
SBP Hypertension	Normal	196	**62.2**
	Pre-hypertension	63	**20.0**
	Hypertension	56	**17.8**
	Total	315	**100.0**
DBP Hypertension	Normal	154	**48.9**

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	Pre-hypertension	41	**13.0**
	Hypertension	120	**38.1**
	Total	315	**100.0**

Gender specific prevalence of hyperglycemia and hypertension among the participants (n=315).

The prevalence of hyperglycemia among male participants was 10 (3.2%), and that of females was 16 (5.1%), while that of hypertension among males was SBP 13 (4.1%)/DBP 44 (36.7%), and among females was SBP 43 (13.7%)/DBP 76 (63.3%. See Table 9.

Table 9: Prevalence of hyperglycemia and hypertension by gender among the study Participants (n=315)

Gender	Hyperglycemia	Hypertension
Male	10 (3.2)	SBP 13 (4.1)
		DBP 44 (36.7)
Female	16 (5.1)	SBP 43 (13.7)
		DBP 76 (63.3)

Prevalence of hyperglycemia and hypertension by profession among the study Participants (n=315).

The prevalence of hyperglycemia and hypertension (SBP/DBP) among nurses was 15 (4.8%) and SBP 35 (11.1%)/DBP 84 (26.7%), respectively. Among physicians, the prevalence of hypertension (SBP/DBP) was 10 (3.2%), and hyperglycemia (SBP/0.6%) was 2 (1.3%). Among pharmacists, the prevalence of hyperglycemia and hypertension (SBP/DBP) was 1 (0.3%) and 10 (3.2%), respectively. However, the prevalence of hyperglycemia and hypertension (SBP/DBP) among pharmacy technicians was 0 (0%) and SBP 3 (1.0%)/DBP 5 (1.6%), respectively. The prevalence of hyperglycemia and hypertension (SBP/DBP) among medical laboratory scientists was 2 (0.6%) and SBP 5 (1.6%)/DBP 5 (1.6%), respectively. The prevalence of hyperglycemia and hypertension (SBP/DBP) among medical laboratory technicians was 6 (1.9%) and SBP 8 (2.5%)/DBP 13 (4.1%), respectively. See Table 10.

Table 10: Prevalence of hyperglycemia and hypertension by Profession among the study Participants (n=315).

Profession	Hyperglycemia (%)	Hypertension n (%)
Nurses	15 (4.8)	SBP 35 (11.1)
		DBP 84 (26.7)
Medical Doctor	2 (0.6)	SBP 4 (1.3)
		DBP 10 (3.2)
Pharmacist	1 (0.3)	SBP 1 (0.3)
		DBP 3 (1.0)
Pharmacy Technician	0 (0.0)	SBP 3 (1.0)

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		DBP 5 (1.6)
Medical Laboratory Scientist	2 (0.6)	SBP 5 (1.6)
		DBP 5 (1.6)
Medical Laboratory Technician	6 (1.9)	SBP 8 (2.5)
		DBP 13 (4.1)

Prevalence of reported diabetes and hypertension, cardiovascular disease, family history of diabetes, and family history of hypertension among the participants (n=315).

35 (11.1%) of the study participants were already hypertensive, while 280 (88.9%) were not. 14 (4.4%) were already diabetic, while 301 (95.6%) were not. 5 (1.6%) of the participants had a diagnosis of cardiovascular diseases, while 310 (98.4%) did not.

50 (15.9%) of the participants had a paternal history of hypertension, 58 (18.4%) had a maternal history of hypertension, and 32 (10.2%) had both parents' histories of hypertension. 1 (0.2%) had other siblings with a history of hypertension. 174 (55.2%) participants were not aware of their parents' and siblings' hypertension status.

87 (27.6%) of the participants had a paternal history of diabetes, 173 (54.9%) had a maternal history of diabetes, and 32 (10.2%) had both parents with a history of diabetes. 1 (0.2%) had other siblings with a history of diabetes. 55 (17.5%) participants were not aware of their parents' and siblings' diabetes status.

28 (8.9%) of the participants were underweight, 164 (52.1%) had normal weight, and 71 (22.5%) were overweight. The prevalence of obesity class I, class II, and class III was 40 (12.7%), 8 (2.5%), and 4 (1.3%), respectively (Table 11).

Table 11: Prevalence of some clinical and metabolic risk factors of NCDs among the study population (n=315).

Variables	Category	N	%
Hypertension (reported)	Yes	35	11.1
	No	280	88.9
	Total	315	100
Diabetes Mellitus (reported)	Yes	14	4.4
	No	301	95.6
	Total	315	100
Cardiovascular Disease (reported)	Yes	5	1.6
	No	310	98.4
	Total	315	100
	Father	50	15.9

Family Member History of Hypertension	Mother	58	18.4
	Father & Mother	32	10.2
	Other Siblings	1	0.3
	Not aware	174	55.2
	Total	315	100
Family History of Hypertension	Yes	141	44.8
	No	118	37.5
	I do not know	56	17.8
	Total	315	100
Family History of Diabetes	Yes	87	27.6
	No	173	54.9
	I do not know	55	17.5
	Total	315	100
Body weight classification	Underweight	28	8.9
	Normal Weight	164	52.1
	Overweight	71	22.5
	Obesity Class I Obese	40	12.7
	Obesity Class II Obese	8	2.5
	Obesity Class III Obese	4	1.3
	Total	315	100

Relationship between diabetes and some clinical and metabolic risk factors for NCDs among the participants (n=315).

Table 12 examines the relationship between diabetes and some clinical and metabolic risk factors among the study population.

2 (0.6%) of the participants had diabetes and a family history of cardiovascular disease, and 3 (1.0%) of the participants did not have diabetes but had a family history of cardiovascular disease. 12 (3.8%) had diabetes but had no family history of cardiovascular disease; 298 (94.6%) did not have hyperglycemia and did not have a family history of cardiovascular disease. (χ^2= 0.162, p-value= 0.162, AOR= 0.162, (CI: 95): (11.751 to 0.372) for people who had a family history of cardiovascular disease, showing that there was no significant link with diabetes. P-value = 0.027; AOR = 1.463 (0.218 to 1.492) for those with no family history of cardiovascular disease, indicating a significant association with diabetes.

12 (3.8%) of the participants had diabetes and had a family history of diabetes; 75 (23.8%) of the participants did not have diabetes but had a family history of diabetes. 2 (0.6%) had hyperglycemia but had no family history of diabetes; 171 (54.3%) do not have high blood glucose and do not have a family history of diabetes. For participants with a family history of diabetes, the p-value was 0.980, the AOR was N/A, and the confidence interval (CI) ranged from 4.433 to 0.000, suggesting no significant association with diabetes. χ^2=24.867, p-value=0.015, AOR=0.985 (0.0032 to 1.582) for those with no family history of diabetes, indicating a significant association with diabetes.

10 (3.2%) of the participants had diabetes and a family history of hypertension. 131 (41.6%) of the participants did not have diabetes but had a family history of hypertension. 4 (3.2%) had diabetes but had no family history of hypertension. 114 (36.2%) do not have diabetes and do not have a family history of hypertension. (p-value = 0.981, χ^2 = 5.241, AOR = 0.981, (CI: 95): (9.690 to 0.000) for those with a family history of hypertension. For those without a family history of hypertension, the p-value is 0.981, and the AOR ranges from 4.689 to 0.000. There is no significant association with diabetes for both categories of participants (p = 0.981).

None of the participants were underweight and diabetic, while 28 (8.9%) of the participants were underweight but not diabetic. 7 (2.2%) of the participants had normal weight and were diabetic, while 157 (49.8%) of the participants had normal weight and were not diabetic (AOR=0.700, CI 95: (0.019 to 0.310).

2 (0.6%) of the participants were overweight and had diabetes, while 69 participants were overweight and had no diabetes (AOR=0.870, CI 95: (0.721 to 1.014). 3 (1.0%) of the participants had obesity class I and diabetes, while 37 (11.7%) had obesity class I but had no diabetes (AOR = 0.860, CI 95:0.454 to 1.022).

1 (0.3%) of the participants had obesity class II and diabetes, while 7 (2.2%) of the participants had obesity class II but had no diabetes. 1 (0.3%) of the participants had obesity class III and diabetes, and 3 (1.0%) of the participants had obesity class III but had no diabetes. χ^2=7.839, *p*-values of (0.017) for normal weight, (0.028) for overweight, and (0.016) for obesity class I indicate a statistically significant association with diabetes.

The table indicates significant associations between diabetes and the absence of a family history of cardiovascular disease, family history of diabetes, overweight, and obesity class I. The *p*-values suggest that these factors are statistically significant in diabetes (Table 12).

Table 12: Relationship between diabetes and some clinical and metabolic risk factors of NCDs among the study participants (n=315).

Independent Variables	Category	diabetes		χ^2/Fisher Exact test	Adjusted OR (CI 95)	*P* Value
		Yes n (%)	No n (%)			
Family history of Cardiovascular disease	Yes	2 (0.6)	3 (1.0)	15.124	0.162 (11.751 to 0.372)	0.162
	No	12 (3.8)	298 (94.6)		1.463 (0.218 to 1.492)	0.027
	Total	14 (4.4)	301 (95.6)			
Family history of hypertension	Yes	10 (3.2)	131 (41.6)	5.241	0.981 (9.690 to 0.000)	0.981
	No	4 (3.2)	114 (36.2)		0.981 (4.689 to 0.000)	0.981
	I do not know	0 (0)	56 (17.8)		NA	.

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	Total	14 (4.4)	301 (95.6)			
Family history of Diabetes	Yes	12 (3.8)	75 (23.8)		0.980 (4.433 to 0.000)	0.980
	No	2 (0.6)	171 (54.3)	24.867	0.985 (0.0032 to 1.582)	0.015
	I do not know	0 (0)	55 (17.5)		NA	.
	Total	14 (4.4)	301 (95.6)			
Weight classification	Underweight	0 (0)	28 (8.9)	7.839	N A	N A
	Normal Weight	7 (2.2)	157 (49.8)		0.154 (0.014 to 1.649)	0.122
	Overweight	2 (0.6)	69 (21.9)		0.435 (0.041 to 4.652)	0.492
	Class I Obese	3 (1.0)	37 (11.7)		1.444 (0.137 to 15.266)	0.760
	Class II Obese	1 (0.3)	7 (2.2)		3.000 (0.211 to 42.624)	0.657
	Class III Obese	1 (0.3)	3 (1.0)		NA	.N A
	Total	14 (4.4)	301 (95.6)			

Relationship between hypertension and some clinical and metabolic risk factors of NCDs among the study participants (n=315).

Table 13 examines the relationship between hypertension and some clinical and metabolic risk factors of non-communicable diseases (NCDs) among the study participants.

1 (0.3%) of the participants had hypertension and had a family history of cardiovascular disease, while 4 (1.3%) of the participants did not have hypertension but had a family history of cardiovascular disease. 34 (10.8%) had hypertension but had no family history of cardiovascular disease, and 276 (87.6%) did not have hypertension and did not have a family history of cardiovascular disease. (χ^2 = 0.406, p-value = 0.515, AOR = 2.029, (CI: 95): (0.220 to 18.687)). The result indicates no statistically significant association between hypertension and family history of cardiovascular disease in this dataset.

17 (5.4%) of the participants had hypertension and a family history of diabetes; 17 (5.4%) of the participants did not have hypertension but had a family history of diabetes. 70 (22.2%) had hypertension but had no family history of diabetes, and 156 (49.5%) did not have hypertension and did not have a family history of diabetes. (p-value = 0.013, χ^2 = 11.357, AOR = 5.164, (CI: 95): (0.554 to 48.159). This indicates a statistically significant association between hypertension and a family history of diabetes.

23 (7.3%) of the participants had hypertension and had a family history of hypertension; 118 (37.5%) of the participants did not have hypertension but had a family history of hypertension. 11 (3.5%) had hypertension but had no family history of hypertension, and 107 (34.0%) do not have hypertension and do not have a family history of hypertension. (p-value = 0.053, χ^2 = 9.175, AOR = 3.190, CI (95): (0.359 to 28.377). This indicates a borderline statistically significant association between hypertension and a family history of hypertension.

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None of the participants were underweight and hypertensive, while 28 (8.9%) of the participants were underweight but not hypertensive. 8 (2.5%) of the participants had normal weight and were hypertensive, while 156 (49.5%) of the participants had normal weight and were not hypertensive (χ^2= 41.687, *p*= 0.122, AOR=0.435, CI 95: (0.014 to 1.649).

99 (2.9%) of the participants were overweight and had hypertension, while 62 (19.7%) of the participants were overweight but had no hypertension (*p*=0.492, AOR=0.435, CI 95: 0.041 to 4.652). 13 (4.1%) of the participants had obesity class I and had hypertension, while 27 (8.6%) of the participants had obesity class I but had no hypertension (*p*=0.760, AOR=1.444 (0.137 to 15.266)).

4 (1.3%) of the participants had obesity class II and hypertension, while 4 (1.3%) of the participants had obesity class II but no hypertension (*p* = 0.417, AOR = 3.000, CI 95: (0.211 to 42.624)). One participant (0.3%) had obesity class III and hypertension, while three participants (1.0%) had obesity class III but did not have hypertension.

A family history of diabetes shows a significant association with hypertension (p-value = 0.013). See Table 13.

Table 13: Relationship between hypertension and some clinical and metabolic risk factors of NCDs among the study participants (n=315).

Independent Variable	Category	Hypertension		χ^2/Fisher Exact test	Adjusted OR (CI 95)	*p* Value
		Yes n (%)	No n (%)			
Family History of Cardiovascular Disease	Yes	1 (0.3)	4 (1.3)	0.406	2,029 (0.220 to 18.687)	0.532
	No	34 (10.8)	276 (87.6)			
	Total	35 (11.1)	280 (88.9)			
Family History of Hypertension	Yes	23 (7.3)	118 (37.5)	9.175	3.190 (0.359 to 28.377)	0.298
	No	11 (3.5)	107 (34)		2.160 (0.241 to 19.323)	0.491
	I do not know	1 (0.3)	55 (17.5)			
	Total	35 (11.1)	280 (88.9)			
Family History of Diabetes	Yes	17 (5.4)	70 (22.2)	11.357	7.322 (0.775 to 69.222)	0.082
	No	17 (5.4)	156 (49.5)		5.164 (0.554 to 48.159)	0.150
	I do not know	1 (0.3)	54 (17.1)			
	Total	35 (11.1)	280 (88.9)			

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Body weight classification	Underweight	0 (0)	28 (8.9)	41.687	N A	N A
	Normal Weight	8 (2.5)	156 (49.5)		0.154 (0.014 to 1.649)	0.122
	Overweight	9 (2.9)	62 (19.7)		0.435 (0.041 to 4.652)	0.492
	Obesity Class I	13 (4.1)	27(8.6)		1.444 (0.137 to 15.266)	0.760
	Obesity Class II	4 (1.3)	4 (1.3)		3.000 (0.211 to 42.624)	0.657
	Obesity Class III	1 (0.3)	3 (1.0)		N A	N A
	Total	35 (11.1)	280 (88.9)			

Prevalence of Dyslipidemia among the study participants (n =315)

277 (87.9%) of the participants had normal total cholesterol (TC) levels, while 38 (12.1%) of them had TC dyslipidemia. 153 (48.6%) of the participants had normal triglyceride (TG) levels, while 162 (51.4%) of them had TG dyslipidemia. 313 (99.4%) of the participants had normal HDL-cholesterol (HDL-C) levels, while 2 (0.6%) of them had HDL-C dyslipidemia. 308 (97.8%) of the participants had normal LDL-cholesterol (LDL–C) levels, while 7 (2.2%) of them had LDL–C dyslipidemia. 190 (60.3%) of the participants had normal VLDL-cholesterol (VLDL-C) levels, while 125 (39.7%) of them had VLDL-C dyslipidemia.

Thirty-eight (12.1%) of the participants had T-C dyslipidemia, 162 (51.4%) had T-G dyslipidemia, and 125 (39.7%) had VLDL-C Dyslipidemia (Table 14).

Table 14: Prevalence of Dyslipidemia among the study participants (n=315).

Lipid	Category	Frequency	Percent
Total Cholesterol	Normal	277	87.9
	TC-Dyslipidemia	38	12.1
	Total	315	100.0
Triglyceride	Normal	153	48.6
	TG-Dyslipidemia	162	51.4
	Total	315	100.0
HDL-Cholesterol	Normal	313	99.4
	HDL-Dyslipidemia	2	0.6
	Total	315	100.0
LDL-Cholesterol	Normal	308	97.8
	LDL-Dyslipidemia	7	2.2
	Total	315	100.0
VLDL-Cholesterol	Normal	190	60.3

	VLDL-Dyslipidemia	125	39.7
	Total	315	100.0

Relationship between Diabetes and Dyslipidemia among the study participants

Table 15 examines the association between diabetes and dyslipidemia among the study participants (n=315).

11 people (3.5%) had normal TC levels and diabetes, while 266 people (84.4%) had normal TC levels and no diabetes. 3 people (1.0%) had TC dyslipidemia and diabetes, while 35 people (11.1%) had TC dyslipidemia and no diabetes. The χ^2/Fisher Exact test value is 1.211, with an AOR of 1.418 (95% CI: 0.366 to 5.490) and a p-value of 0.613, which means there is no significant association.

2 (0.6%) of the participants had normal TG levels and diabetes, while 151 (47.9%) of them had normal TG levels and did not have diabetes. 12 (3.8%) of the participants had TTG dyslipidemia and had diabetes, while 150 (47.6%) of them had TG dyslipidemia and did not have diabetes.

The Theχ^2/Fisher Exact test value is 6.895, with an AOR of 8.212 (95% CI: 1.421 to 47.468) and a p-value of 0.019, indicating a significant association between diabetes and TG-Dyslipidemia.

14 (4.4%) of the participants had normal HDL-C levels and had diabetes, while 299 (94.9%) of them had normal HDL-C levels and did not have diabetes. 0 (0.0%) of the participants had HDL-C dyslipidemia and diabetes, while 2 (0.66%) of them had HDL-C dyslipidemia and did not have diabetes.

The χ^2/Fisher exact test value is 0.094, with no AOR analyzed, indicating no significant association.

14 (4.4%) of the participants had normal LDL-C levels and diabetes, while 294 (93.3%) of them had normal LDL-C levels and did not have diabetes. 0 (0.0%) of the participants had LDL-C dyslipidemia and diabetes, while 7 (2.22%) of them had LDL-C dyslipidemia and did not have diabetes.

The χ^2/Fisher exact test value is 0.333, with no AOR provided, indicating no significant association.

6 (1.9%) of the participants had normal VLDL-C levels and had diabetes, while 184 (58.1%) of them had normal VLDL-C levels and did not have diabetes. 8 (2.5%) of the participants had VLDL-C-C dyslipidemia and diabetes, while 117 (37.1%) of them had VLDL-C dyslipidemia and did not have hyperglycemia.

The χ^2/Fisher Exact test value is 1.866, with an AOR of 0.565 (95% CI: 0.160 to 1.995) and a p-value of 0.975, indicating no significant association.

For total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol (VLDL-C), there were no significant associations. However, there was a significant association between the two conditions.

Table 15: Association between Diabetes and dyslipidemia among the study participants (n=315).

Variables	**Category**	**Diabetes**		**χ^2/Fisher Exact test**	**AOR (CI: 95)**	***P* value**
		Yes n (%)	**No n (%)**			
Total Cholesterol	Normal	11 (3.5)	266 (84.4)	1.211	1.418 (0.366 to 5.490)	0.613
	TC Dyslipidemia	3 (1.0)	35 (11.1)			

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	Total	14 (4.4)	301 (95.6)			
Triglyceride	Normal	2 (0.6)	151 (47.9)	6.895	8.212 (1.421 to 47.468)	0.019
	TG Dyslipidemia	12 (3.8)	150 (47.6)			
	Total	14 (4.4)	301 (95.6)			
HDL-Cholesterol	Normal	14 (4.4)	299 (94.9)	0.094	N A	
	HDL-C Dyslipidemia	0 (0.0)	2 (0.6)			
	Total	14 (4.4)	301 (95.6)			
LDL-Cholesterol	Normal	14 (4.4)	294 (93.3)	0.333	N A	
	LDL-C Dyslipidemia	0 (0.0)	7 (2.2)			
	Total	14 (4.4)	301 (95.6)			
VLDL-Cholesterol	Normal	6 (1.9)	184 (58.1)	1.866	0.565 (0.160 to 1.995)	0.975
	VLDL-C Dyslipidemia	8 (2.5)	117 (37.1)			
	Total	14 (4.4)	301 (95.6)			

Relationship between Hypertension and Dyslipidemia among the study participants

28 (8.9%) of the participants had normal TC levels and had hypertension, while 249 (79.0%) of them had normal TC levels and did not have hypertension. 7 (2.2%) of the participants had TC dyslipidemia and hypertension, while 31 (9.8%) of them had TC dyslipidemia but did not have hypertension. The χ^2/Fisher Exact test value is 2338, the adjusted odds ratio (AOR) is 2.060 (95% CI: 0.802 to 5.295), and the p-value is 0.370. This means that there is no significant link between the two variables and high blood pressure.

16 (5.1%) of the participants had normal TG levels and hypertension, while 137 (43.5%) of them had normal TG levels and did not have hypertension. 19 (6.0%) of the participants had TG dyslipidemia and hypertension, while 143 (45.4%) of them had TG dyslipidemia and did not have hypertension.

The χ^2/Fisher Exact test value is 0.129, with an AOR of 0.626 (95% CI: 0.169 to 2.321) and a p-value of 0.483, indicating no significant association between hypertension and TG dyslipidemia.

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35 (11.1%) of the participants had normal HDL-C levels and hypertension, while 280 (88.9%) of them had normal HDL-C levels and did not have hypertension. 0 (0.0%) of the participants had HDL-C dyslipidemia and hypertension, while 2 (0.6%) of them had HDL-C dyslipidemia and did not have hypertension.

The χ^2/Fisher Exact test value is 0.252, with no AOR analyzed, indicating no significant association with hypertension.

35 (11.1%) of the participants had normal LDL-C levels and had hypertension, while 273 (88.9%) of them had normal LDL-C levels and did not have hypertension. 0 (0.0%) of the participants had LDL-C dyslipidemia and had hypertension, while 7 (2.2%) of them had LDL-C dyslipidemia and did not have hypertension.

The χ^2/Fisher Exact test value is 0.895, with no AOR analyzed, indicating no significant association.

19 (6.0%) of the participants had normal VLDL-C levels and had hypertension, while 171 (54.3%) of them had normal VLDL-C levels and did not have hypertension. 16 (5.1%) of the participants had VLDL-C-C dyslipidemia and hypertension, while 109 (34.6%) of them had VLDL-C dyslipidemia and did not have hypertension.

The χ^2/Fisher Exact test value is 0.599, with an AOR of 1.680 (95% CI: 0.459 to 6.149) and a p-value of 0.434, indicating no significant association.

None of the P values is less than 0.05, suggesting that there is no statistically significant association between hypertension and any type of dyslipidemia among the study participants. The AOR values also do not show strong associations (Table 16).

Table 16: Association between hypertension and dyslipidemia among the study participants (n=315).

Variables	**Category**	**Hypertension**		**χ^2/Fisher Exact test**	**AOR (CI: 95)**	***P* value**
		Yes n (%)	**No n (%)**			
Total Cholesterol	Normal	28 (8.9)	249 (79.0)	2.338	2.060 (0.802 to 5.295)	0.370
	TC Dyslipidemia	7 (2.2)	31 (9.8)			
	Total	35(11.1)	280 (88.9)			
Triglyceride	Normal	16 (5.1)	137 (43.5)	0.129	0.626 (0.169 to 2.321)	0.483
	TG Dyslipidemia	19 (6.0)	143 (45.4)			
	Total	35 (11.1)	280 (88.9)			
HDL-Cholesterol	Normal	35 (11.1)	278 (88.3)	0.252	N A	
	HDL-C Dyslipidemia	0 (0.0)	2 (0.6)			

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ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

	Total	35 (11.1)	280 (88.9)			
LDL-Cholesterol	Normal	35 11.1)	273 (86.7)	0.895	N A	
	LDL-C Dyslipidemia	0 (0.0)	7 (2.2)			
	Total	35 (11.1)	278 (88.3)			
VLDL-Cholesterol	Normal	19 (6.0)	171 (54.3)	0.599	1.680 (0.459 to 6.149)	0.434
	VLDL-C Dyslipidemia	16 (5.1)	109 (34.6)			
	Total	35 (11.1)	280 (88.9)			

Relationship between BMI and FBG among the participants (n=315)

Figure 3: Relationship between BMI and FBG

This figure likely illustrates a positive correlation between Body Mass Index (BMI) and Fasting Blood Glucose (FBG) levels. Studies indicate that higher BMI is associated with elevated FBG, particularly in overweight and obese individuals. Significant correlations have been observed across genders, with stronger associations in females and among those with obesity (Figure 3).

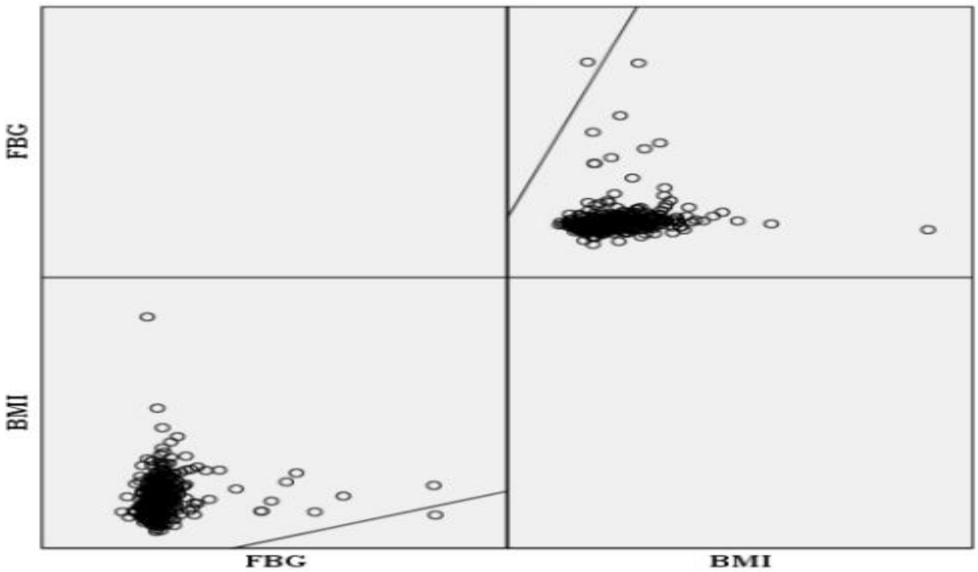

Figure 3: Relationship between the BMI and FBG of the study participants

Relationship between biochemical markers and health indicators

Figure 4: Relationship between Biochemical Markers

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This figure may depict interactions between various biochemical markers, such as FBG, body fat percentage, and waist circumference. It highlights how these markers correlate with metabolic health indicators, emphasizing the importance of monitoring these relationships for assessing diabetes risk and overall health (Figure 4).

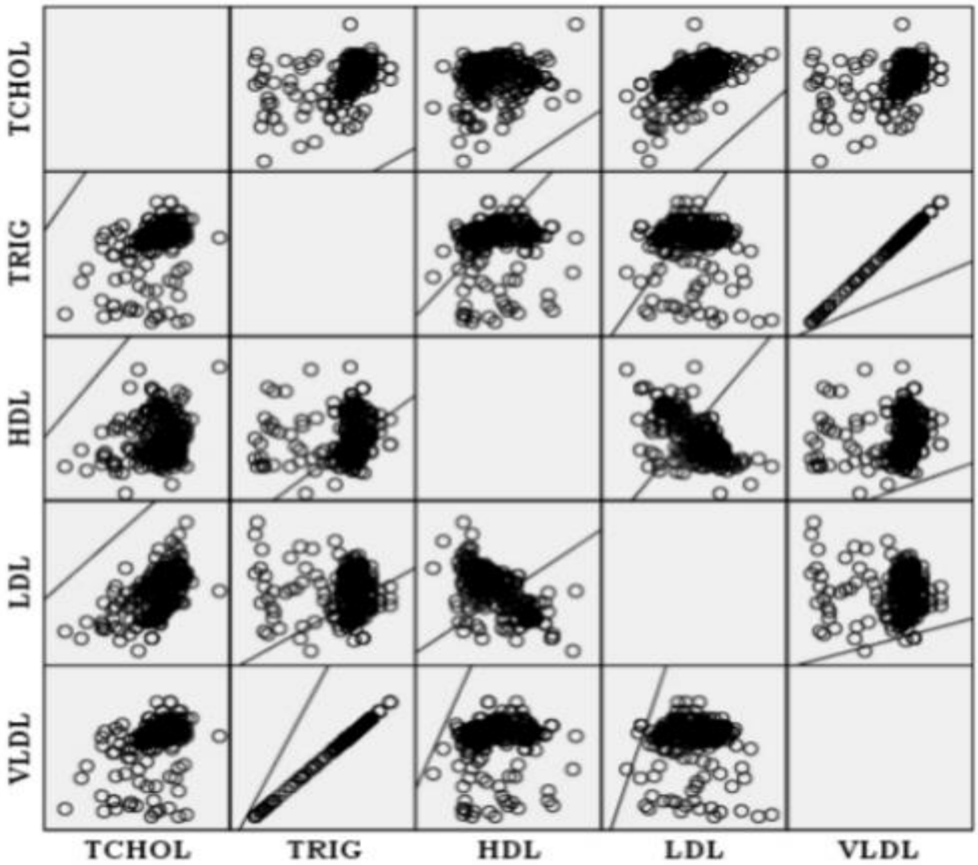

Figure 4: Relationship between the biochemical markers among the study participants.

DISCUSSION

Healthcare practitioners in Sokoto State, Nigeria, face challenges, including personnel shortages, inadequate resources, and heightened stress levels, which can negatively impact their well-being. This study examined the incidence of non-communicable diseases (NCDs) among healthcare professionals and identified risk factors that could guide healthcare policies and enhance the quality of medical care in public hospitals.

Healthcare professionals, seen as role models and trusted by the public, had a greater prevalence of risk factors for non-communicable diseases (such as diabetes and hypertension) than anticipated. Hypertension and diabetes were more common in females than in males (27.0% for females compared to 14.0% for males and 5.1% for females against 3.2% for males, respectively), potentially associated with overweight and obesity. Dyslipidemia was identified with an overall prevalence of 3.8%. These findings underscore the necessity of addressing cardiovascular health in both sexes.

Socio-demographic characteristics of participants

The principal demographic examined comprised nurses (68.2%), medical doctors (5.7%), pharmacists (3.2%), pharmacy technicians (3.2%), medical laboratory scientists (3.5%), and pharmacy technicians (16.2%).

Among the 315 participants, 186 (58.3%) were female and 129 (41.7%) were male, with a mean age of 35.45 years (± 9.9). A majority (72%) possessed a diploma in their respective disciplines. These findings align with other studies in India (Sharma et al., 2014), which reported that females comprised 60% and males comprised 40% (11). The disparity may be due to the smaller sample size of the study (the sample size was 100). Bangladeshi study by Khargekar, et al. (12) reported that 179 (33.90%) of their study participants were female a and 349 (66.09%) were male, with a mean age of 28.20 (±4.076) years and 33.77 (±8.82) years, respectively. The majority, i.e., 304 (57.57%) of the 528 participants, were below 30 years of age, with 319 (60.41%) being married and 209 (39.58%) being unmarried. This variation may be due to the larger sample size used in their study (the sample size used in their study was 528); more of them might be new employees.

This study found a male-to-female ratio of 1:1.4. The majority were nurses (68.3%), with a mean age of 35.45 (± 9.9) years. Ahmed et al., (13) reported that their study participants comprised 14 (11.7%) males and 106 (88.3%) females, with a mean age of 39.19 (±8.62) years; most of them were in the age group of 31–40 years. However, Khafaji, et al. (14) reported their study participants to be 63.55% females and 36.55% males. But Faruque et al. (15), in a study in Bangladesh, reported the mean age of their study participants to be 37.6 (9.5), and 87.6% of them had a diploma in their respective fields. Iwuala, et al. (16) reported their study participants to be 66.35% females with a mean age of 39.3 (±9.0) years. However, discrepancies in gender distribution and mean age were noted, primarily attributable to variances in sample numbers and research contexts.

The study identified the highest prevalence of hypertension and diabetes in the 28–37 (15.9% and (2.5%, respectively) and 38–47 age cohorts (11.4% and (2.5%, respectively. In contrast, research conducted in Bangladesh indicated elevated prevalence rates of hypertension (41.0%) and elevated blood glucose levels (19.2%), The highest prevalence was observed in the 28-37 age group, followed by the 36-47 age group, and the 48-57 age group (11) possibly due to factors such as central obesity, overweight, and physical inactivity. This implies that regional, lifestyle, and occupational variances may explain the discrepancies.

Behavioral and metabolic risk determinants

The study participants demonstrated a significant prevalence of behavioral risk factors for non-communicable diseases: physical inactivity 181 (57.5%), insufficient fruit and vegetable consumption 273 (73.0%), and excessive salt consumption 276 (73.0%). Overweight 77 (22.9%) and obesity 52 (16.5%) were also widespread.

These findings align with research conducted in Africa, Asia, and the Middle East, indicating low physical activity levels, inadequate diets, and elevated obesity prevalence among healthcare professionals. As was demonstrated by the works of:

Iwuala, et al. (16) reported a prevalence of physical inactivity and obesity among their study participants of 79.2% and 27.3%, respectively; this may be due to the regional difference between their study in Eastern Nigeria and the current study in North-western Nigeria.

Faruque, et al., (2021) reported that the prevalence of overweight, raised blood glucose, and raised BP among their study participants was 42.65%, 19.2%, and 12.8%, respectively. The most prevalent behavioral risk factors among them were physical inactivity (86.9%), inadequate fruit and vegetable intake (56.3%), and added salt intake (35.6%). Khargekar, et al., (12) reported a high intake of extra salt in their diet (461; 87.3%), less than 5 servings of fruit and vegetables (412; 78.03%), and a high level of physical inactivity (409; 77.4%) among their study participants. Ahmed, et al., (13) reported a prevalence of hypertension, overweight, obesity, and underweight of 9.2%, 33.5%, 8.3%, and 7%, respectively. Furthermore, fruit and vegetable intake was low. However, their sample size was small (120). Younis et al., (17) reported a high prevalence of overweight and obesity (65%) among healthcare workers in the Gaza Strip, Palestine. A study in Zimbabwe (18) reported a prevalence of elevated BP of 36% and elevated HbA1c of 12%. Gosadi, et al., (19) also reported similar findings. A study on physicians in Saudi Arabia reported that 70% of their study participants had a BMI >25, a high prevalence of overweight and obesity, a low level of physical activity, and low fruit intake. The prevalence of hypertension, diabetes, and Dyslipidemia among their study participants was 10.3%, 8.5%, and 3.4%, respectively. Iwuala, et al. (16) reported their study participants to be 66.35 females with a mean age of 39.3 (9.0). 44.7% of the study participants were overweight, while the prevalence of physical inactivity and obesity was 79.2% and 27.3%, respectively.

Metabolic risk variables

Metabolic risk variables were additionally noted. Pre-hypertension and hypertension were most common in the

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

18–27, 28–37, 38–47, 48–57, 58–67, and >68 age demographics. The 28–37 age group exhibited a greater prevalence of both Pre-hypertension (9.8%) and hypertension (6.0%). The total prevalence of overweight and obesity was 85 (27%) and 52 (16.5%), respectively. The correlation coefficients showed a minimal negative correlation between weight and height, while weight and height had a poor correlation. The correlation value for height and waist circumference was -0.118, suggesting a minor adverse association between height and waist circumference. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) revealed favorable connections with weight and waist circumference, while BMI showed a strong positive link with weight and a moderate positive correlation with waist circumference.

The waist-hip ratio was determined to be normal, indicating a balanced distribution of fat around the waist and hips, while abnormal ratios may signify an elevated risk of health concerns associated with central obesity. The incidence of non-communicable diseases (NCDs) in Bangladesh varies across age groups, with hypertension being the most frequent at 41.0%. The highest prevalence was recorded in the 28–37 age group, followed by the 36–47 age group and the 48–57 age group. The prevalence of diabetes was 8.3%, with the highest prevalence among the 28–37 and 38–47 age groups. The prevalence of elevated blood glucose among healthcare professionals in Bangladesh was 19.2%, presumably attributable to variables such as central obesity, overweight, and physical inactivity. Previous research indicated a lower prevalence, probably due to a smaller sample size and a lack of awareness among healthcare staff. The study indicated that hypertension and diabetes were more prevalent in females than males, presumably due to higher physical activity and a lower prevalence of overweight or obesity in the latter. Dyslipidemia was also widespread, with a total frequency of 3.8%.

Practical implications for policy

The results highlight the necessity for workplace-focused initiatives to mitigate NCD risk among healthcare professionals. Healthcare personnel can mitigate their non-communicable disease burden by consistent screening, improved dietary habits, and enhanced physical activity. Implementing workplace health promotion initiatives and monitoring risk factors for hypertension, diabetes, and obesity can successfully prevent and treat non-communicable diseases (NCDs).

In addition to broad measures, interventions targeted at the workplace are essential. Stress significantly contributes to detrimental behaviors and non-communicable diseases, especially in environments characterized by personnel shortages and excessive workloads. Implementing stress management initiatives, including mindfulness classes, peer support groups, and counseling, may mitigate burnout and decrease cardiovascular risk.

Routine in-house health screenings—comprising blood pressure, blood glucose, BMI, and lipid profile assessments—ought to be institutionalized within occupational health services. These checks facilitate early detection and promote a preventive culture among healthcare professionals, who serve as role models for patients.

Hospitals ought to implement institutional wellness programs that promote healthy habits as standard practice. This encompasses enhancing the nutritional content of meals in employee cafeterias, subsidizing fruits and vegetables, facilitating chances for physical activity during shifts, and promoting workplace wellness clubs or exercise groups. Integrating wellness into business culture would promote employee retention, decrease absenteeism, and improve patient care.

Integrating these interventions with overarching health system initiatives, such as the WHO Global Action Plan on NCDs, would enhance sustainability and establish healthcare institutions as frontrunners in workplace wellness.

CONCLUSION

This study identified a significant prevalence of main risk factors for non-communicable diseases—including obesity, insufficient fruit and vegetable consumption, inadequate physical exercise, excessive salt intake, and dyslipidemia—among healthcare professionals in Sokoto. These conditions render individuals particularly vulnerable to the onset of diabetes, hypertension, and other chronic diseases. There is an urgent need for awareness of healthy living behaviors, regular screenings, and supporting workplace policies.

This data highlights the necessity of addressing the health of healthcare professionals to protect their well-being and to maintain the sustainability and efficacy of healthcare service delivery in Nigeria.

RECOMMENDATIONS

The significant prevalence of non-communicable disease risk factors among healthcare professionals necessitates concerted efforts at both hospital management and governmental policy levels to promote supportive occupational health settings.

1. **Healthcare Administration**

Implement workplace wellness initiatives that incorporate routine health assessments (blood pressure, glucose, BMI, lipid profiles) into employee welfare services.

Implement stress management strategies, including counseling services, peer support groups, and flexible duty rotations, to mitigate burnout.

• Formulate robust workplace policies that encompass healthful cafeteria selections, meals with less sodium content, subsidies for fruits and vegetables, and initiatives promoting physical activity (e.g., wellness clubs, scheduled walking breaks).

Enhance occupational health units at hospitals to tackle work-related hazards and chronic disease risk factors.

Prioritize nurses and midwives, who constituted the majority in this study, in obesity prevention and wellness initiatives to protect their health and productivity.

2. **Government and Health Agencies**

Integrate occupational health and wellness standards into national health workforce strategies, formally recognizing the well-being of healthcare professionals as a public health priority.

• Offer financial and technical assistance for workplace-oriented non-communicable disease prevention programs, encompassing regular screenings and awareness initiatives.

Formulate national directives for workplace nutrition, physical activity enhancement, and stress alleviation initiatives specifically designed for healthcare personnel.

Enhance the implementation of workplace safety and health rules, rendering staff wellbeing a mandatory component of hospital accreditation.

• Facilitate research and monitoring of healthcare workers' health to consistently guide policy formulation and assess advancements.

By synchronizing hospital-level wellness efforts with national policy, management, and government, a conducive occupational health environment. This dual strategy will save healthcare workers from avoidable diseases while enhancing the health system's resilience and ability to provide quality care.

ACKNOWLEDGMENTS

We would like to extend our gratitude to the study participants, research assistants, and data analysts. We are grateful to the managements of the six public hospitals and the School of Medical Laboratory Science at Usmanu Danfodiyo University, Sokoto, for allowing us to utilize their equipment and facilities.

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