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ORIGINAL RESEARCH

# Profile and Metabolic Risks for Non-Communicable Diseases Among Policemen in Northern Nigeria

**Olatunji Lawal K[1], Magaji Bello A[2], Abdulsalam Latifat B[3], Gafar Maryam K[4]**

[1]Department of Public Health, Iconic Open University Sokoto, Nigeria
[2]Department of Community Health, Faculty of Clinical Sciences, College of health Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria
[3]Department of Family Medicine, Usmanu Danfodiyo University Teaching of Hospital, Sokoto.
[4]Department of Chemistry, Faculty of Science, Federal University Gusau, Zamfara State, Nigeria

**Correspondence: Dr LK Olatunji, Department of Public Health, Iconic Open University, Sokoto, Nigeria.**
**E-mail: drlawalolatunji@gmail.com ; ORCID - https://orcid.org/0000-0002-1768-1098.**

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**Abstract**

**Background:** The burden of non-communicable diseases is rapidly increasing globally, especially in middle and low-income countries, including Nigeria, causing significant health, social, and economic consequences. The officers and men of the Nigeria Police Force are at risk of non-communicable diseases because of the stressful nature of their jobs, coupled with the increasing rise in insecurity in Northern Nigeria.
**Objectives:** To determine the risk factors for non-communicable diseases among the men and women of the Nigerian Police Force.
**Methods:** The study used a cross-sectional design. A modification of the World Health Organisation (WHO) STEPS methodology for non-communicable diseases was adopted; an interviewer-administered questionnaire was used along with anthropometric, blood pressure, fasting blood glucose, and fasting lipid profile measurements. The study was conducted in Sokoto, Northwest Nigeria, from November 2021 through September 2022.
**Results:** The response rate in this study was 83.8%, and the sample consisted of 299 (92.0%) males and 26 (8.0%) females. The ages ranged from 20 to 60 years, with a mean age of 38.47±9.5 years. The prevalence of metabolic risk factors—hypertension, diabetes, hypercholesterolaemia, and overweight/obesity — was 34.4%, 8.5%, 50.0%, and 21.1%, respectively. While hypertension and overweight/obesity showed a direct positive relationship with age, diabetes and hypercholesterolaemia showed no significant relationship with age.
**Conclusions:** The prevalence of metabolic risk factors for non-communicable diseases among police force personnel in Northern Nigeria is high. This calls for health promotional interventions such as providing and enforcing periodic medical examinations.

**Keywords: Diabetes mellitus, Hypercholesterolaemia, Hypertension, Non-communicable diseases, Obesity.**

## Introduction

Non-communicable diseases (NCDs), often called non-infectious or chronic diseases, are illnesses with a long duration that cannot be transmitted from one person to another. These diseases result from physiological, genetic, environmental, and/or behavioural factors. [1] These diseases have become a global health problem responsible for a tremendous proportion of disability and death in many countries, most notably the middle and low-income countries. In these countries, the burden of NCD is rapidly increasing and has some significant health, social, and economic consequences.

Non-communicable diseases affect people from all countries, regions, and continents, both sexes (male and female), and people of all age groups (i.e., Children, adults, and the elderly). Although these diseases are often associated with individuals in the older age groups, evidence shows that 37% of all NCD deaths occur between 30 and 69 years of age, with more than eight in ten of these deaths occurring in low- and middle-income countries. The risk factors contributing to the development of NCDs are mainly physical inactivity, unhealthy diets, harmful use of alcohol and exposure to tobacco smoke, compounded by globalisation of unhealthy lifestyles, population ageing and rapid unplanned urbanisation. Lack of physical activity and unhealthy diets may manifest as elevated blood pressure (BP), elevated blood lipid levels, elevated blood glucose levels, and obesity. These are referred to as metabolic risk factors of NCDs and can lead to cardiovascular disease (CVD), which is the world's number one killer disease and the leading NCD in terms of causing premature deaths. [1]

Over the past decades, the major causes of morbidity and mortality in Africa (containing most of the middle and low-income countries) are mainly infectious diseases and nutritional disorders. Still, with the rapid increase in the population and modernisation, traditional/cultural beliefs such as large family size, there is a tilt in the paradigm to non-communicable disease as a significant cause of morbidity and mortality in this region of the world. [2,3] Moreover, some infectious diseases have also been found to be associated with some NCDs. An example is the Human Papillomavirus, which is involved in the aetiology of cervical cancer.

Nigeria faces several security challenges from different perspectives, depending on the region. Criminality, militancy, and the Biafra separatists are often prevalent in the southwest, south-south and southeast, respectively. Farmer-herder and ethno-religious crises characterise the Middle Belt. The northeast faces Boko Haram Islamic extremists, while the northwest faces banditry that includes activities such as kidnapping for ransom, killing of innocent lives, gender-based and sexual violence, and cattle rustling, among other related human rights abuses. [4] All these tend to predispose them more to developing NCDs.

The personnel of the Nigeria Police Force are the primary security agency empowered to maintain law and order and protect lives and properties. They face many challenges as they stand at the forefront of the region's security issues. Thus, this study aimed to assess the health status of these personnel in terms of NCDs metabolic risk factors, as the epidemic keeps exploding.

*Operational definitions*

*Metabolic risk factors*

Metabolic risk factors include raised blood pressure (BP), elevated blood lipid levels,

elevated blood glucose levels, and obesity, which are often associated with or may lead to cardiovascular diseases.

*Raised blood pressure*

Hypertension, or high blood pressure, is usually defined as a systolic blood pressure ≥ 140 mmHg on two different days or a diastolic blood pressure ≥ 90 mmHg on two different days. Hypertension affects more than 1.13 billion people globally, with prevalence being higher in women than in men. Raised blood pressure is one of the major causes of premature death globally. Despite its high prevalence and its mortality in terms of premature death, only about 20% of individuals with hypertension have it under control. [5]

*Raised blood glucose (Hyperglycaemia)*

Diabetes is a chronic metabolic disease characterised by persistently raised blood glucose levels due to the inability of the pancreas to produce enough insulin, or the inability of the body to utilise the insulin produced effectively. Diabetes is a major cause of limb amputation, blindness, stroke, and kidney failure, and a major cause of premature death. The prevalence of diabetes is rapidly increasing, especially in low and middle-income countries.

*Raised blood lipids (Hyperlipidaemia)*

Abnormal blood lipid level (dyslipidaemia) is characterised by increased blood plasma levels of triglycerides and/or cholesterol or low levels of high-density lipoprotein (HDL), which may eventually lead to the development of atherosclerosis. Abnormal blood lipid levels have been implicated in many cardiovascular events, singly or combined with other metabolic risk factors.

*Obesity*

Obesity results from a chronic imbalance between energy/carbohydrate intake and expenditure[6]. According to the WHO Growth Reference for adolescents and school-aged children, overweight is a Z-score above one standard deviation (SD) of the body mass index (BMI) for age and sex, but less than two SD. In contrast, obesity is defined as a Z-score above 2 standard deviations of BMI for BMI-for-age and sex. For individuals aged 18 years and above, a BMI ≥ 30 kg/m² is defined as obesity. There is a high prevalence of obesity in all regions of the world, especially among children and youth. An unhealthy diet and inadequate physical activity may contribute to obesity.

Over the past three decades, there has been about a 25% increase in individuals with obesity, and this is closely related to high blood pressure, high blood glucose levels and high blood cholesterol levels. Obesity is a strong risk factor for other metabolic diseases such as type 2 diabetes mellitus, atherosclerosis, hyperlipidaemia, and non-alcoholic fatty liver disease. [6,7]

## Methods

*Study setting*

Sokoto State is located in the northwest of Nigeria. It has a land area of 28,232.37 km² and is located between longitudes 11° 30" to 13° 50" East and latitude 4° to 6° North. It is bordered to the North by the Niger Republic, Zamfara State to the East and Kebbi State to the South and West. The State is in the dry Sahel, surrounded by sandy savannah and isolated hills, with an annual average temperature of 28.3 °C (82.9 °F).

*Study design*

The study is a descriptive cross-sectional study

2.3 *Sample size estimation*

The sample size of surveyed police was determined using the formula

$n = z^2 p q / d^2$,

Where

n = desired sample size (where the population is greater than 10,000).

z =the standard normal deviation, usually set at 1.96, corresponding to the 95% confidence level.

p = is the proportion (prevalence) of the risk factors, which is set at 50% or 0.5. [8]

q = is the proportion of the respondents without the risk factor, i.e. q = 1 – p = 0.5
d = is the degree of accuracy (was set at 0.05).
Then n = $(1.96)^2 \times 0.5 \times 0.5 / 0.05^2$
n =384.
Since the population of police personnel in Sokoto State is less than 10,000, the formula nf = n/(1 + n/N) was used, where N is the target population size.
nf = 384/(1+384/4000)
nf = 350
Ten per cent (10%) non-response was anticipated, which was adjusted as $n_s$ = nf/R = 357/0.9 = 388.
388 police personnel were recruited for this study.

*Sampling technique*
A multistage sampling method was employed for the study
Four (4) LGs comprising the metropolis were selected for the first stage.
For the second stage, police headquarters/stations in each LGA were selected using a simple random sampling technique.
The third stage involves the selection of police personnel from each of the headquarters/stations using a simple random sampling, depending on the available number of personnel.

*Instrument of data collection*
Data were collected from respondents using a semi-structured interviewer-administered pre-validated version of the WHO STEPS questionnaire. The questionnaire was administered by a team of trained research assistants comprising one supervisor and four interviewers per team. The supervisors were medical doctors, while the interviewers were other health workers.

*Inclusion/exclusion criteria*
The respondents were actively serving Nigerian Police Force members residing in Sokoto State, while any police personnel who did not meet these criteria were excluded.

*Methods of Data Collection*
The respondent and the researcher or research assistants completed the questionnaire during the examination. The examination was carried out in a consulting room of the police hospital. Data was collected through November 2021 and September 2022.

*Anthropometric measurements*
The weight of the respondents was measured with a standardised digital bathroom weighing scale to the nearest 0.1 kilogram. Height was measured using a standardised stadiometer, with the respondent standing erect, shoes removed, and the reading recorded.
Blood pressure was measured with a sphygmomanometer (Dekamet MG3, England); two measurements were taken at least 10 to 15 minutes apart, and the average of the two readings was used in the analysis.
Sinocare Safe-Accu glucometer (Shanghai International Holding Corp. GmbH, Europe) was used for blood glucose analysis. Finger-prick capillary whole blood was obtained from participants early in the morning, after an overnight fast of at least 8 hours, for fasting blood glucose. About 3-5 mL of blood was withdrawn from the cubital fossa veins of the less dominant forearm and was analysed using the Rayto RT-9200 chemistry analyser (spectrophotometer) to measure fasting serum lipid.

*Operational terms definition*
Body mass index (BMI) was calculated as weight in kg divided by height in metres$^2$ (m$^2$), and it served as a marker of nutritional status. Underweight was defined as a BMI of less than 18.5 kg/m$^2$, normal weight was defined as a BMI of 18.5 to 24.9 kg/m$^2$, overweight was defined as a BMI of 25.0 to 29.9 kg/m$^2$, and obesity was defined as a BMI of 30.0 kg/m$^2$ and above. [9]

Dyslipidaemia/Hypercholesterolaemia was defined according to the Adult Treatment Panel III (ATP III) Guidelines: total cholesterol>200mg/dL. [10]

Diabetes was diagnosed with a fasting plasma glucose level ≥ 6.1 mmol/L (Capillary whole blood). Hypertension was also defined as systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg, or both, or self-reported use of antihypertensive drugs within the past week before the current blood pressure measurement. [11]

*Ethical Clearance*

Ethical clearance was obtained from the Sokoto State Health Research Ethics Committee (SKHREC/001/2022) and approval from the State Commissioner of Police (CB:3422/SKS/VOL.T3/99). In addition, written informed consent was obtained from the participants before administering the questionnaires.

*Data analysis*

Collected data was entered, cleaned, and analysed using Epi Info version 7.2.2.6 and Microsoft Excel 2013. Frequency distribution tables were constructed; cross-tabulations were done to examine the relationship between categorical variables, and the Chi-square test was used to compare differences between proportions. All statistical analysis was set at a 5% significance level ($p < 0.05$).

## Results

*Age and Sex distribution of the respondents*

From a total of 388 police personnel sampled, only 325 police personnel participated in the research. At the same time, 63 declined to participate (51 of them citing they were well and did not need further medical examination, and 12 because they were not comfortable with blood sample collection), giving a non-response rate of 16.2%. The personnel sampled population consisted of 299 (92.0%) men and 26 (8.0%) females. The ages of the participants ranged from 20 to 60 years, with a mean age of 38.47 ± 9.5 years for both male and female personnel, 37.68 ± 9.3 years for male police personnel, and 47.46 ± 6.7 years for female police personnel. Half of the respondents were between 30-44 years of age, followed by ages 45-59 years with a prevalence of 27.38%, then 18-29 years with a prevalence of 21.85%. One respondent was 60 years or older (Table I).

**Table I: Age and Sex distribution of the respondents**

| Age group (Years) | Men | | Women | | Both Sexes | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| 18-29 | 71 | 21.85 | 0 | 0.00 | 71 | 21.85 |
| 30-44 | 152 | 46.77 | 12 | 3.69 | 164 | 50.46 |
| 45-59 | 75 | 23.08 | 14 | 4.31 | 89 | 27.38 |
| 60 and above | 1 | 0.31 | 0 | 0.00 | 1 | 0.31 |
| 18-69 | 299 | 92 | 26 | 8 | 325 | 100.0 |

*Non-communicable diseases and the Metabolic risk factors*

Among the 325 respondents, 2 refused blood pressure measurement, and seven did not undergo anthropometric measurements (i.e., height and weight). Only 212 (65.2%) agreed and consented to phlebotomy and biochemical assessment.

*Prevalence of Diabetes mellitus, Hypertension and Obesity/Overweight*

None of the female respondents had diabetes mellitus. The prevalence of diabetes among male respondents was 9.2%, 8.5% overall. Over two-thirds of respondents with diabetes were in the 30-44 years age group. There was no significant association between the age and the prevalence of diabetes (p = 0.360). Six (23.1%) of the female respondents had hypertension, and they fell between the ages of 45 and 59 years. A similar trend was found in the male respondents, with about 85.0% of this age group presenting with hypertension. The prevalence of hypertension in the male respondents (35.4%) was found to be slightly higher than the prevalence of hypertension in both sexes of the respondents (34.4%). There is a significant increase in the rate of hypertension as the age increased (p = 0.016). Fifty-six (19.0%) male respondents and 11 (45.8%) of the female respondents were either overweight or obese (BMI ≥25kg/m$^2$). The prevalence of overweight/obesity among the respondents was 21.1%, and approximately half of the respondents aged between 45 and 59 years had a BMI ≥25kg/m$^2$. Overweight and obesity had a direct relationship with age (p = 0.001), as shown in Table II.

**Table IIa: Prevalence of diabetes, hypertension and overweight/obesity**

| Age (Years) | *Men* | | *Women* | | *Total* | | *p-value* |
|---|---|---|---|---|---|---|---|
| | *Present* | *Absent* | *Present* | *Absent* | *Present* | *Absent* | |
| 18-29 | 1 | 37 | | | 1 | 37 | 0.360** |
| 30-44 | 11 | 94 | 0 | 8 | 11 | 102 | |
| 45-59 | 6 | 47 | 0 | 8 | 6 | 55 | |
| ≥ 60 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 18-69 | 18 (9.2) | 178 (90.8) | 0 (0.0) | 16 (100.0) | 18 (8.5) | 194 (91.5) | |

***Fisher's Exact test; Figures in parentheses are percentages**

**Table IIb: Prevalence of diabetes, hypertension and overweight/obesity**

| Age (Years) | *Men* | | **Women** | | **Total** | | *p-value* |
|---|---|---|---|---|---|---|---|
| | *Present* | *Absent* | *Present* | *Absent* | *Present* | *Absent* | |
| 18-29 | 17 | 53 | 0 | 0 | 17 | 53 | 0.016** |
| 30-44 | 53 | 99 | 0 | 12 | 53 | 111 | |
| 45-59 | 34 | 40 | 6 | 8 | 40 | 48 | |
| ≥ 60 | 1 | 0 | 0 | 0 | 1 | 0 | |
| 18-69 | 105 (35.4) | 192 (64.6) | 6 (23.1) | 20 (76.9) | 111 (34.4) | 212 (65.6) | |

****Fisher's Exact test; Figures in parentheses are percentages**

**Table IIc: Prevalence of diabetes, hypertension and overweight/obesity**

| *Age (Years)* | *Men* | | *Women* | *Total* | | *p-value* | |
|---|---|---|---|---|---|---|---|
| | *Present* | *Absent* | *Present* | *Absent* | *Present* | *Absent* | |
| 18-29 | 5 | 65 | | | 5 | 65 | 0.001* |
| 30-44 | 27 | 124 | 7 | 4 | 34 | 128 | |
| 45-59 | 24 | 48 | 4 | 9 | 28 | 57 | |
| ≥ 60 | | 1 | | | | 1 | |
| 18-69 | 56 (19.0) | 238 (81.0) | 11 (45.8) | 13 (54.2) | 67 (21.1) | 25 (78.9) | |

***Chi-Square test; Figures in parentheses are percentages**

*Prevalence of dyslipidaemia*

The prevalence of hypercholesterolemia was 48.0% in males and 75.0% in females, with a male-to-female ratio of 1:1.5. The combined prevalence for both male and female respondents was 50.0%. There was no significant relationship between the age of the respondents and hypercholesterolaemia (p = 0.200). Half of the females and 17.9% of the males had hypertriglyceridaemia. Overall, one-fifth (i.e. 20.3%) of the study participants had hypertriglyceridaemia but there was no association between hypertriglyceridaemia and age (p = 0.436). The prevalence of low HDL was 13.2%, and the male-to-female ratio among those with low HDL was approximately 1:2. More than 85.0% of respondents with low HDL were aged 30-44 years. There was a significant positive relationship between low HDL and age (p = 0.001), as shown in Table III.

## Discussion

The Nigeria Police Force is challenged by their primary role as the frontline security apparatus in curtailing the security problems in the country. Thus, they are considered a high-risk occupation. This study's response rate was 83.8%, and some refused phlebotomy or anthropometric measurements. Some research involving police personnel has reported low response rates, [12,13] possibly due to fear and reduced trust between police personnel and the general public. The sampled population consists of 92.0% men and 8.0% females. Most studies reported the sampled female police population as less than 20% (4%-19%).[14,15] The low female police population composition of most regions/countries in the police might be because policing jobs are considered masculine. The ages of the participants ranged from 20 to 60 years, with a mean age of 38.47±9.5 years for both male and female personnel, in agreement with previous reports. [16–19] This is one of life's most active age groups.

The prevalence of hypertension among police personnel was 35.4%. This is similar to what was obtained in Asian countries such as India 34.5% by Ganesh *et al.* when assessing the prevalence and risk factors of hypertension among policemen in Puducherry, and in Japan, 36.6% by Shiozaki *et al.* when determining the Job stress and behavioural characteristics in relation to the risk for developing ischemic heart disease among Japanese police officers.[20,21] Canada and Germany reported a low prevalence of hypertension among policemen (14.4% in Canada and 16.0% in Germany), [18,22] which may be due to more robust health care systems that include periodic medical check-ups, among other factors.

The prevalence of hypertension in policewomen in this study was 23.1%. A similar report by Hartley from the USA found the prevalence of hypertension among policewomen to be 25.5%.[23] Gendron *et al.*, in an online survey of the cardiovascular health profile of Québec police in Canada, reported a 4.1% prevalence of hypertension in female police personnel. [18] Similarly, Fikenzer *et al.* conducted a cross-sectional study among 121 German police women whose ages averaged 28.4 ±10.8 years and found the prevalence of hypertension among them to be 11.6%. [22] The low prevalence in the German study might be due to German policewomen appearing younger than the female population in the present study. On the average, the prevalence of hypertension in male police personnel was higher than the prevalence of hypertension in their female counterparts.

**Table IIIa: Prevalence of dyslipidaemia**

| *Age (Years)* | *Men* | | *Women* | | *Total* | | *p-value* |
|---|---|---|---|---|---|---|---|
| | *Present* | *Absent* | *Present* | *Absent* | *Present* | *Absent* | |
| 18-29 | 17 | 21 | 0 | 0 | 17 | 21 | 0.200* |
| 30-44 | 55 | 50 | 8 | 0 | 63 | 50 | |
| 45-59 | 22 | 31 | 4 | 4 | 26 | 35 | |
| ≥ 60 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 18-69 | 94 (48.0) | 102 (52.0) | 12 (75.0) | 4 (25.0) | 106 (50.0) | 106 (50.0) | |

*** Fisher's Exact test; Figures in parentheses are percentages**

**Table IIIb: Prevalence of dyslipidaemia**

| *Age (Years)* | *Men* | | *Women* | | *Total* | | *p-value* |
|---|---|---|---|---|---|---|---|
| | *Present* | *Absent* | *Present* | *Absent* | *Present* | *Absent* | |
| 18-29 | 9 | 29 | 0 | 0 | 9 | 29 | 0.436* |
| 30-44 | 21 | 84 | 4 | 4 | 25 | 88 | |
| 45-59 | 5 | 48 | 4 | 4 | 9 | 52 | |
| ≥ 60 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 18-69 | 35 (17.9) | 161 (82.1) | 8 (50.0) | 8 (50.0) | 43 (20.3) | 169 (79.7) | |

*** Fisher's Exact test; Figures in parentheses are percentages**

**Table IIIc: Prevalence of dyslipidaemia**

| *Age (Years)* | *Men* | | *Women* | | *Total* | | *p-value* |
|---|---|---|---|---|---|---|---|
| | *Pres* | *Abs* | *Pres* | *Abs* | *Pres* | *Abs* | |
| 18-29 | 4 | 34 | 0 | 0 | 4 | 34 | 0.001** |
| 30-44 | 20 | 85 | 4 | 4 | 24 | 89 | |
| 45-59 | 0 | 53 | 0 | 8 | 0 | 61 | |
| ≥ 60 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 18-69 | 24 (12.2) | 172 (87.8) | 4 (25.0) | 12 (75.0) | 28 (13.2) | 184 (86.8) | |

****Fisher's Exact test; Figures in parentheses are percentage**

The prevalence of hypertension in both sexes was 34.4%, and it falls within the range of reported figures among police personnel in Africa (17.5%-44.7%). [16,19,24] The present study noted a significant increase in the rate of hypertension as the ages of the police personnel increased.In this study, none of the female police personnel had diabetes mellitus. Similar studies from Brazil and Germany reported no cases of diabetes mellitus among female police personnel. [25] Gendron *et al.*, in an online survey of the cardiovascular health profile of 756 Québec female police officers in Canada, reported the prevalence of diabetes as 0.8%. [18] The low prevalence of diabetes observed in police women may be due to the general fact that estrogen appears to be protective against Type 2 diabetes mellitus. The prevalence of diabetes among the male respondents is 9.2%. The prevalence of diabetes among all the subjects in this study is 8.5%, and over 2/3 of the respondents with diabetes are within the age group 30-44 years. This falls within the range of diabetes prevalence among police personnel in African countries (1.7%-9.8%). [19,26,27] This study showed no association between the age of the respondents and the prevalence of diabetes.

About 19.0% of the male and 45.8% of the female respondents were overweight or obese (BMI ≥25.0kg/m²). The prevalence of

overweight/obesity among the total respondents is 21.1%. Tesfaye reported that Ethiopian police personnel had a similar prevalence of 19.6%. [19] The prevalence in this study was lower than in most American studies [23,28], Asian countries [15,20,29,30], and European countries' studies.[31–33] The disparity in this study may be because most Asian and European countries and the USA have readily available food, "junk food" for consumption. In contrast, the standard of living in the study location is generally low. Approximately half of the respondents aged 45 to 59 years had a BMI ≥25.0kg/m². This might be because more than half of the respondents were police inspectors and above, who tend to have higher remuneration and are more sedentary. Overweight and obesity had a direct relationship with age in the present study; hence, the prevalence of overweight and obesity increases with age.

The prevalence of hypercholesterolaemia in this study is higher than the rate reported in other studies. [17,34] Half of the female respondents in this study present with hypertriglyceridaemia, while only about 17.9% of male respondents present with hypertriglyceridemia. One-fifth (i.e. 20.3%) of the study participants have hypertriglyceridaemia.

Although the sample size in the present study is one of the highest ever reported in Nigeria, one major limitation of this study is that not all the available police personnel were recruited at the time of sampling.

## Conclusion

The prevalence of metabolic risk factors for non-communicable diseases among police force personnel in Northern Nigeria is high. There is a positive trend between hypertension, overweight/obesity and age, while diabetes and hypercholesterolaemia do not show a significant relationship with age.

**Authors' Contributions:** OLK and MBA conceived and designed; All did literature review; OLK, ALB and GMK collected, analysed and interpreted; All drafted, revised and approved.
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