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Research Article

# Prevalence of Metabolic Syndrome and Cardiovascular Risk Profile in Cameroon: A Cross-Sectional Study in a Sub-Saharan African (SSA) Setting

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## Abstract

**Background:** Contrary to earlier thoughts, metabolic syndrome is no longer rare in Africa. The prevalence is increasing, and it tends to increase with age. This increase in the prevalence of metabolic syndrome in the continent is thought to be due to departure from traditional African to western lifestyles. Cardio-metabolic syndrome (MetS) is associated with a high cardiovascular risk and present an increasing prevalence in Africa, thereby, more attention has been brought to the topic recently. However, reports of MetS and the associated cardiovascular risk profile are still scarce in sub Saharan Africa context.

**Methodology:** We carried out a cross-sectional study in a population of adults ≥ 18 years, working in a local enterprise between October and November 2016. The WHO STEPwise approach for epidemiological surveillance of chronic non-communicable diseases was used to this end.

**Results:** A total of 236 participants were screened for MetS and assessed for cardiovascular risk profile. The study population consisted of 137 (58.1%, [95% CI: 51.5 - 64.4]) males. Their mean age was 45.5 ± 10.6 years ranging from 23 to 62 years. MetS was present in 97 (41.1%, [95% CI: 35 - 47.5) of the participants. The average number of risk factors per participant was 2.2 ± 1.2, and ranged from 0 to 5 risk factors. The average 10-year risk was 11.6 ± 9.8%, and this was significantly higher in men. The 10-year risk was very high in 116 (49.2%, [95% CI: 42.8 - 55.5]) participants.

**Conclusion:** Metabolic syndrome is frequent in professional milieu in our context with, and close to half of individuals present a very high 10-Year risk profile.

***Keywords:*** *Prevalence; Metabolic Syndrome; Cardiovascular Risk; Cameroon; Africa*

## Introduction

Metabolic Syndrome (MetS) is the clustering of interrelated risk factors of metabolic origin that are associated with the development of atherosclerosis [1]. This syndrome includes various combinations of central obesity, raised blood pressure, raised blood glucose, and dyslipidemia. MetS has reached epidemic proportions worldwide, with the greatest burden expected in low-and middle income settings such as sub Saharan Africa countries [2]. Evidence suggests that persons suffering from this condition are at increases risk of cardiovascular diseases and complications [3]. Therefore, patients at risk should be screened for metabolic syndrome and effective interventions must be carry out among patients with this conditions and/or its components in order to reduce their cardiovascular risk. To this end, some authors proposed the systematic screening of groups at risk, with organized individualized management and follow-up of diagnosed cases and its components [4]. On the other hand, Despite the increasing burden of cardiovascular and metabolic diseases in Africa, and the increasing interest of scientific society on metabolic syndrome and its consequences, awareness for these conditions remain still low in the general population as well as among healthcare practitioners [4]. Thereby, few studies have investigated the prevalence of metabolic syndrome in the general population in our context [2] especially in Cameroon where most of studies on the topic are hospital-based. We therefore aimed to investigate the prevalence of Mets, its components and the risk profile of a local corporation workers in an urban setting in sub-Saharan Africa (SSA).

## Methods

**Ethical statement:** This work was approved by the Ethical Committee of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I. We carried out this in accordance with the declarations of Helsinki. We report this work following the Standards for Reporting Epidemiological Studies (STROBE) checklist [10]. All high risk participants had individualized care and follow-up subsequently. The administration of the corporation initiated the annual health check of the workers, with the aim of improving their health. They authorized the use their data for research without restriction.

**Study design and setting**: We carried-out a cross-sectional study in a specialist Cardiology clinic in Yaoundé, the capital city of Cameroon, sub-Saharan Africa (SSA). The World Health Organisation (WHO) STEPwise approach for epidemiological surveillance of chronic non-communicable disease was used to this end [11]. This study was carried out between October and November 2016 in Yaoundé which has an estimated population of two million inhabitants of various origins.

**Participants:** These were consenting adults aged ≥ 18 years of both sexes, working in a local corporation. The corporation has a very high social standard with an estimated population of 250 workers including the directors.

**Variables:** Participants were expected to present to the clinic between eight and nine o'clock in the morning after an overnight fasting for at least eight hours. In the first STEP, we collected data on demographics (age, sex, function occupied), personal history (diabetes, hypertension alcohol use, tobacco use, dyslipidemia, drug use), lifestyle (low risk diet, physical activity), family history (diabetes, hypertension, stroke, myocardial infarction), symptoms of vascular diseases. In the second STEP anthropometric data were collected (height, weight, abdominal circumference, resting blood pressure and pulse, respiratory rate and pulse oximetry). At the third STEP, blood samples were drawn for biochemical measurements (glycaemia, HbA1c, renal function, lipid profile, serum uric acid, electrolytes, and full blood count). Participants also gave urine samples for dipstick analysis.

**Data sources and measurements**: Weight (w) was measured in kilograms (kg) with an electronic scale in light clothing and with no shoes and estimated at nearest 0.5 kg. Height (h) was measured with a stadiometer and expressed in meters (m). Body Mass Index (BMI) was calculated as $w/h^2$. Obesity was present if the BMI was ≥ 30 $kg/m^2$. Abdominal circumference was measured in cm with a tape in the standing position mid-way between the iliac crest and the inferior costal margin, mid-axillary line. Abdominal Obesity was present if this was > 94 cm in men and > 80 cm in women (IDF criteria). Blood pressure was measured twice on both arms after 10 minutes of rest in

the sitting position, with an electronic device (Omron®) using a standard adult cuff. The average of the highest recording was considered. Systolic Blood Pressure (SBP) readings > 140 mmHg and/or Diastolic Blood Pressure readings (DBP) > 90 mmHg or a participant on blood pressure lowering medications was considered as having hypertension. HbA1c was measured using High Performance Liquid Chromatography (HPLC), and glycemia (FBG) was measured using Glucose Oxidase method. Participants with HbA1c ≥ 6.5% and/or FBG ≥ 126 mg/dl or those on glucose lowering medication was considered as having diabetes. Other blood chemical panels were assessed using standard methods. Dyslipidemia was present if a participant has at least one of the following lipid anomaly: Total cholesterol > 2g/l, LDLc > 1g/l, Triglyceride > 1.5 g/l, and HDLc < 0.4 g/l for men and < 0.5 g/l for women. Hyperuricemia was present if serum uric acid was > 70 mg/l in men and > 60 mg/l in women. A participant was considered a smoker if he/she used tobacco or it products within the past three years. Alcohol consumption was limited to its use (dependence was not studied).

**Outcome data**: The main outcome was the presence of Metabolic Syndrome (MetS) using IDF criteria [12]. Other outcome variables were the prevalence of the components of the MetS and 10-year cardiovascular risks (risk estimated using the Framingham risk score calculator). The 10-year cardiovascular risk is the probability of having a heart attack, cerebrovascular accident, or other vascular events within 10 years. This risk depends on the age, sex, systolic blood pressure, diastolic blood pressure, cholesterol levels, diabetes, and smoking status. The risk is said to be low (< 1%), moderate (1 - 5%), high (5 - 10%), and very high (> 10%). We also looked at the prevalence of hyperuricemia and high risk life-style.

**Bias**: Participants were individuals with diverse activities in a high social profile enterprise. Thus, the prevalence rate does not necessarily represent that of the community, which might be over estimates.

**Study sample**: This was a descriptive study of a group of population from a community, with an estimated population of over two million inhabitants. For an expected prevalence of MetS of 20% [13] (worse acceptable prevalence of 15%), and an alpha error of 5%, we needed to screen 246 participants. However, since this was an annual health screening exercise for the workers, a convenient sample of all the workers was considered.

**Statistical methods**: Data were analyzed using Epi-Info version 7 and SPSS version 16. We assessed the distribution of the data by studying the Skewness of the age distribution. We present the baseline characteristics according to sex. We present discrete variables as frequencies and proportions with their 95% confidence intervals. Continuous variables are presented as means ± standard deviations. Differences between proportions were compared using Chi-square or Fischer exact tests where applicable. A p value < 0.05 was considered statistically significant.

## Results

General characteristics: A total of 236 participants (96% of expected population) were completely screened for cardiovascular risk factors. There were 137 (58.1%, [95% CI: 51.5 - 64.4]) males and 99 (41.9%, [95% CI: 35.6 - 48.5]) females. Their mean age was 45.5 ± 10.6 years (males 46.3 ± 10.2 years and females 44.1 ± 11 years), and ranged from 23 to 62 years. Most of the participants (37.7%, [95% CI: 31.5 - 44.2]) were between 50 to 59 years old (Figure 1).

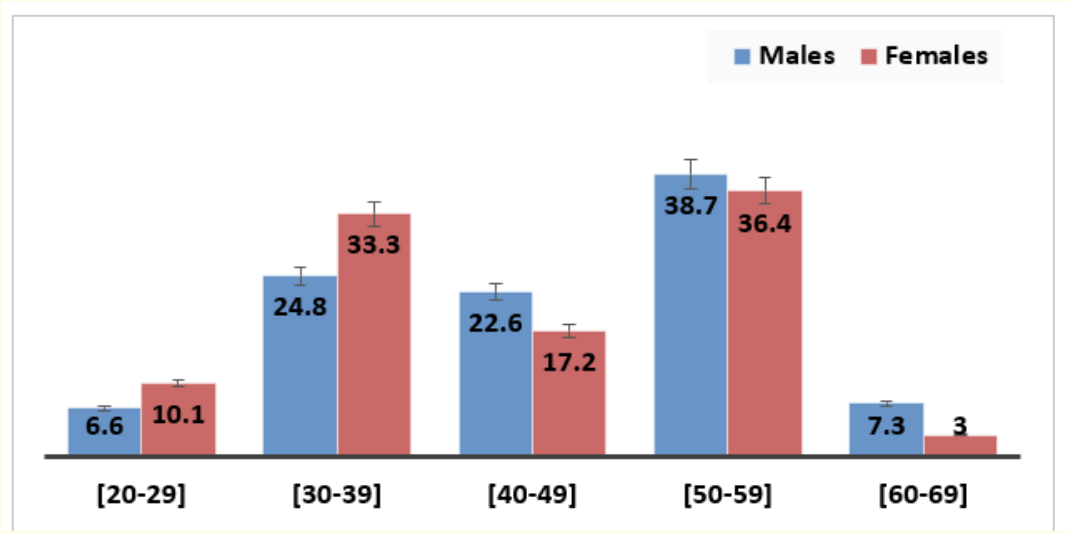


***Figure 1:*** *Age distribution (%) by sex.*

The socio-demographic, anthropometric, and biochemical characteristics are shown in table 1. More men used tobacco, consumed alcohol, and, engaged in physical activity (less than three times weekly) than women. The mean DBP was significantly higher in men. Men had significantly higher mean values of FBG, total cholesterol, triglycerides, serum uric acid, and 10-year cardiovascular risk. Women had significantly higher BMI and LDL-c levels.

| Characteristics | Overall (N = 236) | Male (n = 137) | Female (n = 99) | P value |
|---|---|---|---|---|
| **Personal History, % (95% CI)** | | | | |
| Hypertension | 21.2 (16.2 - 27) | 22.6 (15.9- 30.6) | 19.2 (12 - 28.3) | 0.529 |
| Diabetes | 5.9 (3.3 - 9.8) | 7.3 (3.6 - 13) | 4 (1.1 - 10) | 0.290 |
| Dyslipidemia | 8.1 (4.9 - 12.3) | 7.3 (3.6 - 13) | 9.1 (4.2 - 16.6) | 0.617 |
| Tobacco use | 11.4 (7.7 - 16.2) | 17.5 (11.6 - 24.9) | 3 (0.6 - 8.6) | 0.001 |
| Alcohol use | 58.1 (51.5 - 64.4) | 67.2 (58.6 - 74.9) | 45.5 (35.4 - 55.8) | 0.001 |
| **Physical activity** | | | | |
| None | 28 (22.3 - 34.2) | 19 (12.8 - 26.6) | 40.4 (30.7 - 50.7) | <0.001 |
| Less than 3 times/week | 55.1 (48.5 - 61.5) | 64.2 (55.6 - 72.2) | 42.4 (32.5 - 52.8) | 0.001 |
| More than 3 times/week | 16.9 (12.4 - 22.4) | 16.8 (11 - 24.1) | 17.2 (10.3 - 26.1) | 0.936 |
| No risk reducing diet | 89.2 (84.5 - 92.9) | 89.1 (82.6 - 93.7) | 89.5 (81.5 - 94.8) | 0.922 |
| **Family History, % (95% CI)** | | | | |
| Stroke | 17.8 (13.1 - 23.3) | 14.6 (9.2 - 21.6) | 22.2 (14.5 - 31.7) | 0.133 |
| Heart attack | 2.1 (0.7 - 4.9) | 1.5 (0.2 - 5.2) | 3 (0.6 - 8.6) | 0.432 |
| Hypertension | 39 (32.7 - 45.5) | 35 (27.1 - 43.6) | 44.4 (34.5 - 54.8) | 0.145 |
| Diabetes | 28.4 (22.7 - 34.6) | 30.7 (23.1 - 39.1) | 25.3 (17.1 - 35) | 0.365 |
| **Complaints, % (95% CI)** | | | | |
| Chest pain | 7.6 (4.6 - 11.8) | 9.5 (5.1 - 15.7) | 5.1 (1.7 - 11.4) | 0.211 |
| Palpitation | 14.4 (10.2 - 19.5) | 12.4 (7.4 - 19.1) | 17.2 (10.3 - 26.1) | 0.301 |
| Dyspnoea | 6.8 (3.9 - 10.8) | 2.2 (0.5 - 6.3) | 13.1 (7.2 - 21.4) | 0.001 |
| Orthopnea | 1.3 (0.3 - 3.7) | 0.7 (0 - 4) | 2 (0.2 - 7.1) | 0.375 |
| Snoring | 24.6 (19.2 - 30.6) | 28.5 (21.1 - 36.8) | 19.2 (12 - 28.3) | 0.102 |
| Headaches | 3.4 (1.5 - 6.6) | 3.6 (1.2 - 8.3) | 3 (0.6 - 8.6) | 0.801 |
| **Physical findings, Mean (SD) or % (CI)** | | | | |
| SBP (mmHg), Mean (SD) | 135 (21.8) | 137.2 (21.5) | 132 (21.9) | 0.070 |
| DBP (mmHg), Mean (SD) | 79.5 (13) | 81.4 (13.3) | 76.9 (12) | 0.008 |
| Pulse pressure (mmHg), Mean (SD) | 55.4 (14.4) | 55.7 (14.5) | 55 (14.3) | 0.688 |
| Heart rate, Mean (SD) | 71.3 (11) | 71.9 (11.4) | 70.4 (10.4) | 0.288 |
| BMI ($kg/m^2$), Mean (SD) | 28.6 (4.7) | 28.1 (4.2) | 29.3 (5.3) | 0.047 |
| Abdominal Circumference (cm), Mean (SD) | 93.9 (12.4) | 95.2 (12.1) | 92 (12.6) | 0.0543 |
| Heart Murmurs, % | 5.5 (3 - 9.2) | 5.1 (2.1 - 10.2) | 6.1 (2.3 - 12.7) | 0.740 |
| **Blood chemistry** | | | | |
| FBG (g/l), Mean (SD) | 0.86 (0.16) | 0.89 (0.18) | 0.83 (0.11) | 0.005 |
| HbA1c (%), Mean (SD) | 5.4 (1) | 5.4 (1) | 5.3 (0.9) | 0.271 |
| Total Cholesterol (g/l), Mean (SD) | 1.99 (0.4) | 1.96 (0.42) | 2.02 (0.4) | 0.202 |
| HDLc (g/l), Mean (SD) | 0.63 (0.2) | 0.55 (0.49) | 0.68 (0.18) | 0.001 |
| Triglycerides (g/l), Mean (SD) | 0.67 (0.8) | 0.93 (1.04) | 0.65 (0.27) | 0.012 |
| LDLc (g/l), Mean (SD) | 1.2 (0.4) | 1.19 (0.42) | 1.21 (0.37) | 0.698 |
| Total Cholesterol/HDLc Ratio | 3.4 (1.1) | 3.64 (1.2) | 3.1 (0.91) | < 0.001 |
| Serum Uric acid (mg/l), Mean (SD) | 59 (19) | 66.6 (19.4) | 48.4 (12.4) | < 0.001 |
| Serum Creatinine (mg/l), Mean (SD) | 9.5 (3) | 10.7 (3.2) | 7.7 (1.5) | < 0.001 |
| 10-Year Vascular Risk (%), Mean (SD) | 11.6 (9.8) | 13 (10) | 9.6 (9.2) | 0.010 |

***Table 1:*** *Baseline characteristics of the study population.*

### Prevalence of Metabolic Syndrome and 10-year Cardiovascular Risk

Metabolic syndrome (MetS) was seen in 97 (41.1%, [95% CI: 35 - 47.5) of the participants. with 54 (39.4%, [95% CI: 31.2 - 48.1]) males, and 43 (43.4%, [95% CI: 33.5 - 53.8]) females. The average number of risk factors per participant was 2.2 ± 1.2, and ranged from 0 to 5 risk factors. The average 10-year risk was 11.6 ± 9.8%, and this was significantly higher in men. The distribution of this risk is shown in figure 2. The 10-year risk was very high in 116 (49.2%, [95% CI: 42.8 - 55.5]) participants.

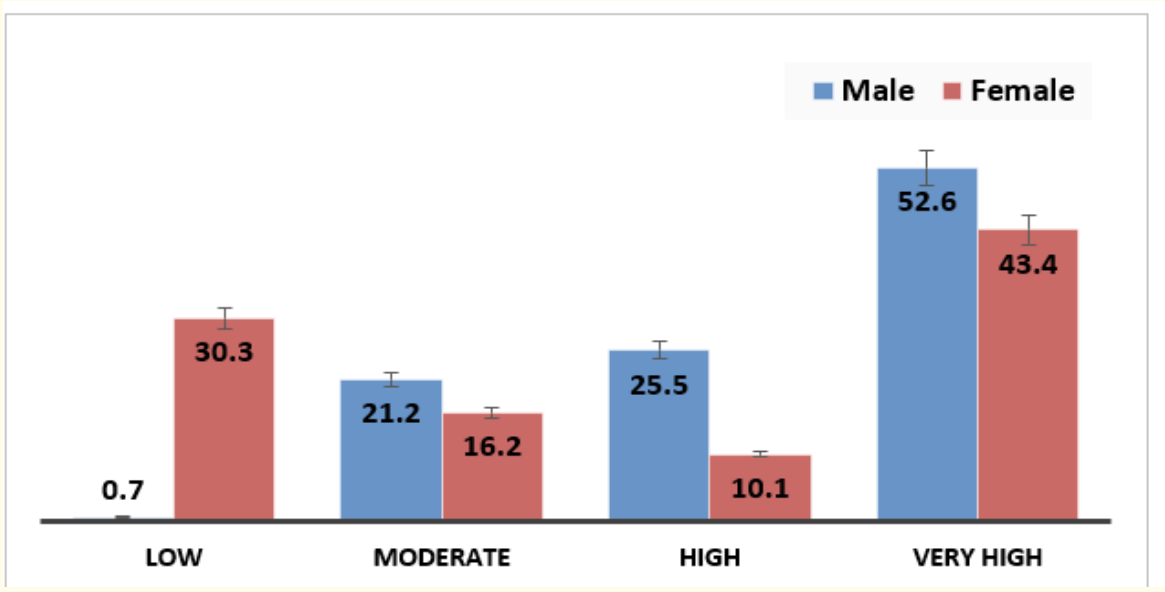


***Figure 2:*** *Distribution of 10-year risk (%) by sex.*

### Prevalence of elements that Contribute to the Cardiovascular Risk

**Hypertension**: The number of people with known hypertension (Blood pressure ≥ 140/90 mmHg) before screening was 50 (21.2%, [95% CI: 16.5 - 26.8]). The mean duration of hypertension was 9.1 ± 5.6 years and ranged from 1 to 22 years. After screening, the number of people with hypertension (old plus new) was 92 (39%, [95% CI: 33 - 45.3]). This shows that 42 (17.8%, [95% CI: 13.5 - 23.2) of the participants had newly diagnosed hypertension. Also, 42 (45.6%, [95% CI: 35.9 - 55.8]) of those with hypertension were not aware of their disease before screening. The distribution of blood pressure (known cases versus unknown cases) is shown in figure 3. Those who had hypertension were taking some medications continuously or intermittently. Blood pressure was under control in only 16 (32%) of those with known hypertension.

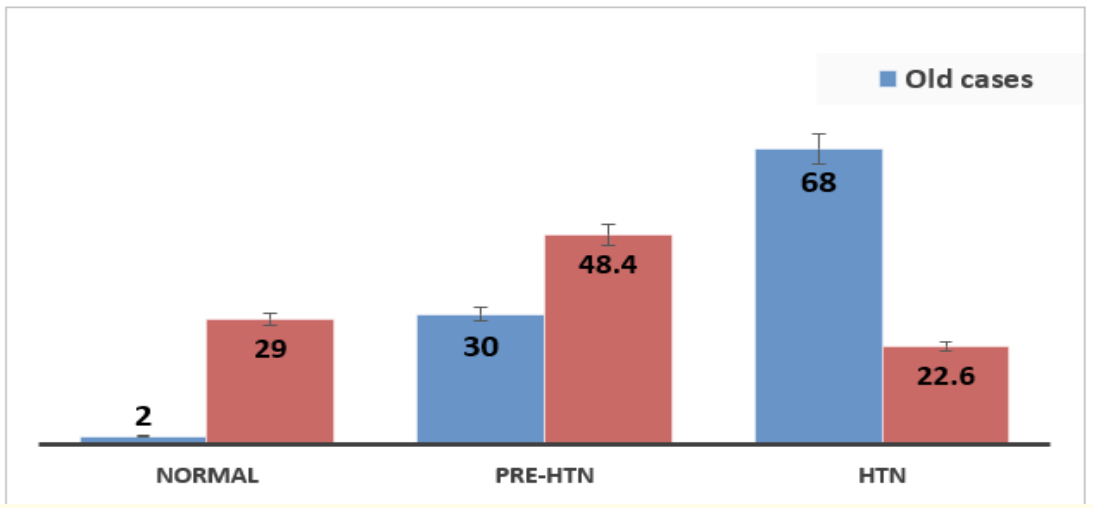


***Figure 3:*** *Distribution of Blood pressure (%) according to past history.*

**Diabetes**: The number of people with diabetes before screening was 14 (5.9%, [95% CI: 3.6 - 9.7). The mean duration of diabetes was 8.3 ± 8.8 years and ranged from 1 to 25 years. After screening, the number of people with diabetes (new plus old) was 20 (8.5%, [95% CI: 5.6 - 12.7]). This shows that 6 (2.5%, [95% CI: 1.2 - 5.4]) of the participants had newly diagnosed diabetes. Also, 6 (30%, [95% CI: 14.6 - 51.9]) of those with diabetes were not aware of their disease before screening. The number of people with newly diagnosed pre-diabetes (HbA1C: 5.7 - 6.4%) was 63 (26.7%, [95% CI: 21.5 - 32.7]) after screening. The distribution of HbA1c status for diabetes is shown in figure 4. Those with diabetes before screening were on any form of treatment. Of these, 6 (42.9%, [95% CI: 21.4 - 67.4]) had good control of their diabetes.

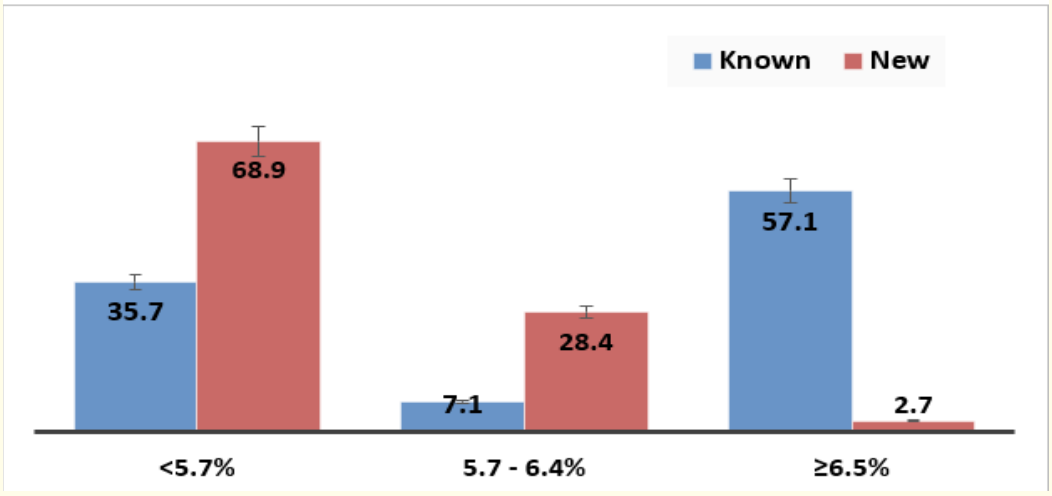


***Figure 4:*** *Distribution of HbA1c status (%) by Old vs New cases.*

**Dyslipidemia:** Raised blood cholesterol was reported by 19 (8.1%, [95% CI: 5.2 - 12.2]) of the participants before screening. At the end of the screening, 119 (50.4% [95% CI: 44.1 - 56.7]) had raised total blood cholesterol (Total cholesterol ≥ 2g/l). High levels of Low Density cholesterol (LDLc > 1 g/l), was seen in 163 (69.1%, [95% CI: 62.9 - 74.6]) of participants after screening. High Triglycerides (TG > 1.5 g/l) was seen in 16 (6.8%, [95% CI: 4.2 - 10.7) of participants. Low levels of High Density cholesterol (HDLc < 0.4 g/l in males and < 0.5 g/l in females), was seen in 32 (13.6%, [9.8 - 18.5]) of the workers. High atherogenicity index was seen in 39 (16.6%, [12.3 - 21.8]). The distribution of the different types of cholesterol is shown in figure 5.

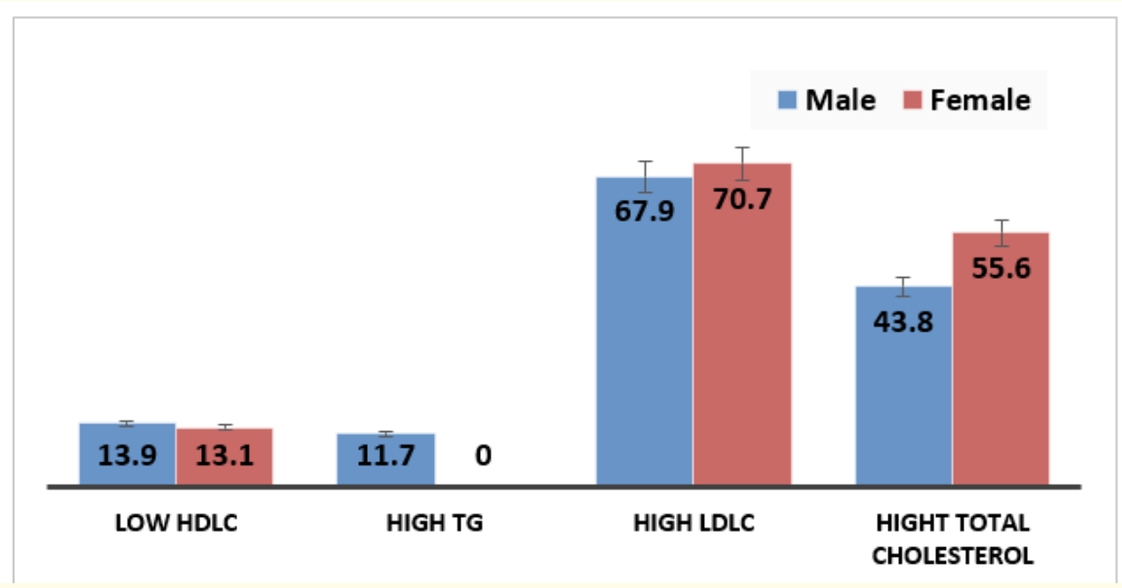


***Figure 5:*** *Lipid distribution (%) by sex.*

**Obesity and Overweight:** General obesity (BMI ≥ 30 kg/m$^2$) was seen in 92 (39%, [95% CI: 33 - 45.3]). Up to 150 (63.6%, [95% CI: 57.3 - 69.4]) of participants had abdominal obesity. The distribution of BMI is shown in figure 6.

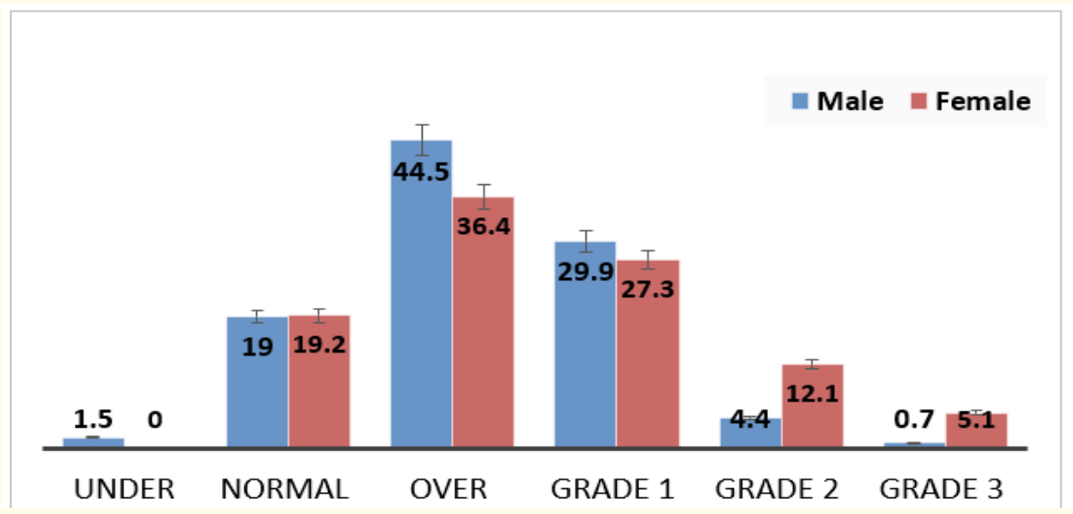


***Figure 6:*** *Distribution of BMI (%) according to sex.*

**Hyperuricemia**: High blood uric acid was seen in 66 (28%, [95% CI: 22.6 - 34]) of the participants.

## Discussion

This study was carried out in a group of workers in a high social profile enterprise in sub-Saharan Africa (SSA) in order to diagnose and describe metabolic syndrome (MetS) and its components. Compared to the general population, metabolic syndrome and its components were highly present in this group of workers, and close to half of them had very high 10-Year risk profile. This is coupled with low rates of physical activity, low risk diet, and tobacco use especially in men.

Few data exist on the prevalence of MetS in our setting in SSA, and the mostly focused on the urban-rural gradient and sex differences [2,9,14]. To the best of our knowledge, no report exist on the level of cardiovascular risk especially at the occupational level. The prevalence of MetS varied depending on the definition used, with conflicting results on the best definition to use in our setting [2,9]. Despite these differences, the prevalence of MetS varied across different settings. Compared to previous reports, the rate was highest in this study. This suggests that future epidemiological studies should also focus on occupational group reporting as suggested by Jingi., *et al* [4]. This might increase awareness, and diagnosed cases might benefit from an organized care. We found very high rates of 10-Years cardiovascular risk of more the ten percent. This was fuelled by the high rates of the components of the MetS. No local data exist to confront our findings. Inadequate physical activity and diet was very high in this group of people, thus fuelling the high rates of the components of the MetS.

The rate of Hypertension was comparable to that reported by other authors in similar settings [2,15-18]. Awareness rates of hypertension were better in this report, with comparable control rates. The rate of diabetes was higher in this study probably due to the method of diagnosis [17,18]. We used HbA1c for the screening of new cases of dysglycemia, which detected more cases than FBG. The awareness and control rates were comparable [17]. High HDLc and low TG levels were similarly reported by Fezeu., *et al.* [9] but with a lower proportion compared to this study. There is already an obesity epidemic in SSA [18], especially abdominal obesity that was seen in close to ¾ of the workers. This is attributed to the rapid urbanization facing countries in SSA [9]. It is the key ingredient of MetS [9] and is tightly associated with diabetes and hypertension [17].

Our findings should be interpreted in the light of its limitations. This was a high risk group in an urban setting, thus the findings cannot be extrapolated to the general population. The diagnosis of hypertension was made from a single day measurement of blood pressure as opposed to recommendations [19]. Thus, the prevalence of hypertension reported could be overestimates. Also, with this strategy the true control rate of hypertension cannot be ascertained. However, the participants had high rates of associated risk factors that are stable in the short term such as obesity that correlates well with blood pressure. We used HbA1, a more stable parameter than Fasting Blood Glucose (FBG) to ascertain dysglycemia. However, lack of norms in our setting might lead to spurious estimates of dysglycemia. Despite these limitations, we achieved the goal of creating awareness and implemented the screen and treat strategy.

## Conclusion

Compared to the general population, metabolic syndrome and its components were highly present in this group of workers, and close to half of them had very high 10-Year risk profile. Abdominal obesity was the most frequent risk component. This was coupled with low rates of physical activity, low risk diet, and tobacco use especially in men. Preventive strategies at the occupational level should target abdominal obesity, encourage regular physical activity, and improve on healthy eating.

## Authors' Contribution

Conception and design (LMK, AMJ,). Data collection (LMK, AMJ). Data analysis and Interpretation (LMK, AMJ, JJZN). Draft of manuscript (LMK, AMJ, JJZN). All authors read the final draft, and approved for publication.

## Disclosure

None to declare.

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## Bibliography

1. Kahn R., *et al*. "The metabolic syndrome: time for a critical appraisal". *Diabetologia* 48.9 (2005): 1684-1699.
2. Ntentie FR., *et al*. "Urbanization and Metabolic Syndrome in Cameroon: Alertness on Less Urbanised Areas". *Endocrinology and Metabolic Syndrome* 3 (2014): 137.
3. Ofori-Asenso R., *et al*. "Metabolic Syndrome in Apparently "Healthy" Ghanaian Adults: A Systematic Review and Meta-Analysis". *International Journal of Chronic Diseases* (2017): 2562374.
4. Jingi AM and Noubiap JJN. "Cardiovascular risk factors awareness and prevalence among primary care physicians: an insight from the West region Awareness Initiative Survey to fight cardiovascular disease (WAIT-CVD) in Cameroon". *BMC Research Notes* 8 (2015): 762.
5. Jingi AM., *et al*. "Primary care physicians' practice regarding diabetes mellitus diagnosis, evaluation and management in the West region of Cameroon". *BMC Endocrine Disorders* 15.1 (2015): 18.
6. Noubiap JJN., *et al*. "Approach to hypertension among primary care physicians in the West Region of Cameroon: substantial room for improvement". *Cardiovascular Diagnosis and Therapy* 4.5 (2014): 357-364.
7. Jingi AM., *et al*. "Access to diagnostic tests and essential medicines for cardiovascular diseases and diabetes care: cost, availability and affordability in the West Region of Cameroon". *PLoS One* 9.11 (2014): e111812.
8. Mbanya J-C and Sobngwi E. "Diabetes microvascular and macrovascular disease in Africa". *Journal of Cardiovascular Risk* 10.2 (2003): 97-102.
9. Fezeu L., *et al*. "Metabolic syndrome in a sub-Saharan African setting: central obesity may be the key determinant". *Atherosclerosis* 193.1 (2007): 70-76.
10. Von Elm E., *et al*. "The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies". *International Journal of Surgery* 12.12 (2014): 1495-1499.
11. Organization WH, others. WHO STEPS Stroke Manual: The WHO STEPwise approach to stroke surveillance (2005).

12. Alberti KGMM., *et al*. "Metabolic syndrome-a new world-wide definition. A Consensus Statement from the International Diabetes Federation". *Diabetic Medicine* 23.5 (2006): 469-480.

13. Enyegue DM., *et al*. "Prediction and Prevalence of Metabolic Syndrome in Overweight and Obese Subject in Cameroon". *International Journal of Biomedical and Pharmaceutical Sciences* 2.2 (2008): 117-121.

14. Lissock CNAA., *et al*. "Rural and urban differences in metabolic profiles in a Cameroonian population". *Pan African Medical Journal* 10 (2011): 1.

15. Kingue S., *et al*. "Prevalence and Risk Factors of Hypertension in Urban Areas of Cameroon: A Nationwide Population-Based Cross-Sectional Study". *Journal of Clinical Hypertension* 17.10 (2015): 819-824.

16. Dzudie A., *et al*. "Prevalence, awareness, treatment and control of hypertension in a self-selected sub-Saharan African urban population: a cross-sectional study". *BMJ Open* 2.4 (2012): e001217.

17. Katte J-C., *et al*. "Coincidence of diabetes mellitus and hypertension in a semi-urban Cameroonian population: a cross-sectional study". *BMC Public Health* 14 (2014): 696.

18. Kufe CN., *et al*. "Risk factors of impaired fasting glucose and type 2 diabetes in Yaoundé, Cameroon: a cross sectional study". *BMC Public Health* 15.1 (2015): 59.

19. Mancia G., *et al*. "ESH/ESC 2007 Guidelines for the management of arterial hypertension". *Revista Española de Cardiología* 60.9 (2007): 968.e1-94.

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