**Prevalence of Dyslipidemia among International Oil Company Workers: A Cross-Sectional Study in Lagos and Port Harcourt, Nigeria**

**Abstract**

**Background**: Dyslipidemia refers to an abnormal level of lipids (fats) in the blood, including high cholesterol, triglycerides, or both. Unhealthy diets, physical inactivity, mental & physical stress from job activities are all examples of work-related issues. According to a research investigating the link between job stress and dyslipidemia, reported that job stress was related to dyslipidaemia even after controlling the confounding factors.

**Aim**: This study aims to evaluate the Prevalence of dyslipidaemia and related variables among IOC (International Oil Company) workers in Lagos and Port Harcourt, Nigeria.

**Method**: This was a cross-sectional study among 300 IOC workers in Lagos and Port Harcourt, Nigeria.Out of the total 300 workers, 20% of them underwent biochemical tests. The participants were selected through multistage random sampling. Data were collected through a pre-structured questionnaire on the socio-economic, biochemical and other anthropometric measurements along with height & weight. Lipid profiles were measured from blood samples. Dyslipidaemia was classified and data were analyzed using SPSS version 25.0 with statistical significance set at p < 0.05.

**Results**: The average age of the staff was 40.5 years, with a significant gender difference (p < 0.001). Males had higher mean values for BMI, WC, SBP, and DBP compared to females (p < 0.01). Hypertension and diabetes affected 34.7% and 14.2% of the staff, respectively. Males had higher levels of TC and LDL, while females had slightly higher TG and HDL levels, though the gender differences were not statistically significant. About 78% of staff engaged in inadequate physical activity, while 21.3% had medium or adequate activity levels. Additionally, 15.3% of the staff were active smokers.

**Conclusion**: The study reported that IOC workers, particularly men, had significant rates of dyslipidemia, which was associated with cardiovascular risks and urban-related occupational health problems.

**Keywords**: Dyslipidemia, cholesterol, triglycerides, Unhealthy diets, physical inactivity, mental & physical stress

**Introduction.**

“Dyslipidemia is a state that occurs due to the abnormalities of lipids in the blood, such as elevated total cholesterol (TC), elevated triglycerides (TG), low level of high-density lipoprotein cholesterol (HDL-C) and elevated low-density lipoprotein cholesterol (LDL-C)” [1]. “These abnormalities can occur either single or combined, Bamba and Rader. Dyslipidemia, especially high levels of LDL-C, is a significant risk factor for cardiovascular disease (CVD), but other forms, such as hypertriglyceridemia, are related to acute pancreatitis and non-alcoholic fatty liver disease” [2]. “Hypercholesterolemia is the most prevalent form of dyslipidemia and is associated with an increased risk of CVD, with higher levels of LDL-C being the 8th leading risk factor for global death in 2019” [3]. “The identification of the risk factors relating to dyslipidemia can play an important role in the workers' health and, consequently, may increase industrial productivity. Most research carried out on dyslipidemia in Iran has been focused on specific age groups and patients and few studies have been conducted on the prevalence of dyslipidemia among worker populations, especially in Iran's industrial units” (Rashnoudi et al., 2022; Mannocci et al. 2015).

“A collection of metabolic disorders known as dyslipidemia is also characterized by elevated total cholesterol (TC), low-density lipoprotein cholesterol (LDL-c), triglycerides (TG), and low high-density lipoprotein cholesterol (HDL-c). These conditions frequently result in a persistent rise in the plasma concentration of triglycerides and cholesterol” [4,5].

“A third of ischemic heart disease worldwide is caused by elevated blood cholesterol, which also raises the risk of heart disease and stroke, according to WHO [6]. Low-density lipoprotein cholesterol (LDL-c) levels in the blood are a strong predictor of incident atherosclerotic cardiovascular disease, and LDL-c-lowering medication has been shown to minimize the risk of CVD in several populations” [7]. CVDs are a leading cause of death globally, accounting for more deaths annually than any other cause.

 [8].

Dyslipidemia have also been linked with the type of work and the environment [9]. “Unhealthy diets, physical inactivity, mental & physical stress from job activities are all examples of work-related issues. A research investigating the link between job stress and dyslipidemia, reported that job stress was related to dyslipidaemia even after controlling the confounding factors” [10]. “Dyslipidemia has also been documented in people from several occupational groups. High levels of low-density lipoprotein were linked to railroad work, especially for shift workers” [11]. Kang et al also observed that working in a company and related job mental stress, particularly in the context of decision-making, were associated with high levels of blood cholesterol and triglycerides among employees. Employed persons spend a quarter of their lives at work, and the pressures and expectations of the job can hurt their eating habits, lifestyle, and exercise patterns, resulting in major health consequences [12]

“Employees of multinational organizations (IOC) are susceptible to physical and psychological stress, and because of their sedentary lifestyle, they are at a heightened risk of developing dyslipidemia and, consequently, cardiovascular disease. According to Ezeukwu and Agwubike, sedentary lifestyles are associated with poor metabolic profiles, which are common in dyslipidemia. University employees may be more susceptible to dyslipidemia as a result of this, limited chances for other forms of exercise, and a high level of stress related to work and family responsibilities. According to Ezeukwu and Agwubike, sedentary lifestyle and physical inactivity, either separately or in combination, are known indicators of atherogenic risk, making them a useful prediction parameter for guiding early and efficient interventions” [13]

“Sedentary habits impact metabolic profiles, which are common in dyslipidemia. The rising incidence of dyslipidemia in young adults is concerning since it raises the risk of coronary heart disease later in life. Evaluating the prevalence of dyslipidaemia and atherogenic risk among IOC workers in Rivers and Lagos states is an essential step in the development of health promotion programs to avoid dyslipidaemia and its harmful clinical consequences” [14]. It was required to determine the prevalence of dyslipidemia and its associated characteristics among IOC personnel in Nigeria because little is known about the condition's frequency and determinants. A significant portion of the country's population consists of young adult IOC workers. Therefore, determining the prevalence of dyslipidemia and its risk factors in these particular demographic groups will be essential to raising awareness and preventing dyslipidemia and the health issues it causes. Determining the prevalence of dyslipidemia and associated factors among IOC workers in Rivers and Lagos was the aim of this study. This will provide vital information for the planning, implementation, and evaluation of interventions.

 **Material and method**

**Study Design**

The study adopted a cross-sectional descriptive survey design to generate data on the Prevalence of dyslipidaemia and associated factors. among IOC workers in Lagos and Port Harcourt, Nigeria The study was conducted between December and January at selected accredited medical facilities in Rivers State and Lagos State of Nigeria. The International Oil Companies (IOC) has many retainer medical centres, but 10 selected centres were used with millions of staff using multistage random sampling. The sample size for the study was 300 International Oil Companies (IOC) staff of both sexes obtained through a single population formula (Yamane’s formula) based on 95 % precision. 20 % of these formed the subsample on which biochemical tests were conducted.

**Inclusion and Exclusion Criteria**

i) Adult staff (age ≥18 years) who visited the Hospital for annual medical check-up with no changes in [drug therapy](https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/pharmacotherapy) in previous years, (ii) willingness to participate; (iii) both sexes were included in the study. However, changes in drug therapy in the previous 3 months, pregnant women, incomplete lipid profiles, and participants with mental problems were excluded from the study.

**Methods of data collection**

The questionnaire used for the study was constructed to elicit the socio-economic and lifestyle characteristics of the respondents. Participants with diabetes were identified by checking prescriptions provided by physicians and/or self-reported use of anti-diabetic medications. BMI was divided into normal (18.5–23.0 kg/m2), overweight (23.1–27.5 kg/m2), and obesity (≥ 27.5 kg/m2) according to WHO. Healthy individuals were defined as both non-hypertensive and non-diabetic. Physical activity was grouped as inadequate (comfortable office work and housework), medium (walking, swimming) and adequate (carrying, lifting, jogging, and/or sports). Smoking was classified as never smokers and current smokers.

Lipid profile measurement: Five milliliters of blood was obtained by a laboratory scientist from each respondent after 10 h post-absorptive fast. The blood was transferred into well-labelled plain specimen bottles and allowed to stand for 30 min at room temperature for complete clotting and clot retraction. Samples were centrifuged at 3500 revolutions/minute for 15 min for extraction of clear serum. The serum was used for the analysis of total cholesterol, high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), and triglyceride (TG) using a Randox kit.

**Diagnostic criteria**

Dyslipidaemia was classified according to the Executive summary of the third report of the National Cholesterol Education Programme/Adult Treatment Panel III (NCEP/ATP III) (2002) as the presence of any of the following: hypercholesterolemia (≥ 200 mg/dl), high LDL-c (≥ 130 mg/dl), low HDL-c (≤ 40 mg/dl in men; ≤50 mg/dl in women) and hypertriglyceridemia (≥ 150 mg/dl). The atherogenic index of plasma (AIP) was calculated and categorized as low risk (< 0.11), intermediate risk (0.11–0.21), and high risk [15].

**Statistical analyses**

Data analyses were performed using SPSS Version 25.0. Data were presented as mean, frequencies, and percentages. Independent sample t-test was used to compare the mean of two given samples and the chi-square test was used to compare categorical variables. Multivariable logistic regression was performed to determine the factors independently associated with lipid marker abnormalities. In regression models, elevated lipid profiles were dependent variables and anthro-demographics and behavioral factors were considered the independent variables. All p-values were two-sided and a p-value < 0.05 was considered statistically significant.

**Result**

**Characteristics of the staff participants**

Table [1](https://bmccardiovascdisord.biomedcentral.com/articles/10.1186/s12872-023-03399-1#Tab1) shows the general characteristics of the participants. Among 300 participants, 204 were males and 96 were females. The mean age of the staff was 40.5 ± 10.0 years and there was a significant difference between genders (p < 0.001). Among staff, the mean of BMI, WC, SBP and DBP were higher in males than in females (p < 0.01 at least for all cases). Based on blood pressure and blood glucose concentrations, 34.7% and 14.2% of the IOC staff were hypertensive and diabetic. Regarding biochemical parameters, the mean level of TC and LDL were higher in male staff; whereas mean TG and HDL were slightly higher in female staff but the differences were not statistically significant between the genders. About 78% of the IOC staff were used to Inadequate and 21.3% of the IOC were used to either medium or adequate physical activity. About 15.3% of the IOC staff were used to smoking.

Table 1: General characteristics of the participants.

| **Variables** | **IOC staff** |
| --- | --- |
|  | **Total****(N=300)** | **Male****(N=204)** | **Female****(N=96)** | **P-value** |
|  |  |  |  |   |
| Age (yr) | 40.5 ± 10.0 | 41.8 ± 10.0 | 38.3 ± 8.0 | 0.000 |
| Weight (kg) | 78.4 ± 9.4 | 70.2 ± 8.5 | 73.7 ± 10.0 | 0.000 |
| Height (cm) | 172.9 ± 8.2 | 176.6 ± 5.5 | 156.8 ± 6.3 | 0.000 |
| BMI (kg/m2) | 25.7 ± 3.12 | 25.26 ± 2.6 | 26.8 ± 3.8 | 0.000 |
| WC (cm) | 85.6 ± 8.1 | 87.3 ± 6.7 | 83.4 ± 9.4 | 0.005 |
| HC (cm) | 94.8 ± 7.8 | 95.0 ± 5.6 | 96.1 ± 9.8 | 0.117 |
| SBP (mmHg) | 121.9 ± 14.4 | 124.3 ± 13.1 | 116.2 ± 12.4 | 0.000 |
| DBP (mmHg) | 82.1 ± 10.2 | 83.8 ± 9.6 | 76.8 ± 10.4 | 0.000 |
| Glucose (mg/dL) | 100.8 ± 41.4 | 98.2 ± 34.2 | 105.4 ± 54.0 | 0.292 |
| TG (mg/dL) | 167.4 ± 81.2 | 160.4 ± 83.6 | 176.7 ± 74.0 | 0.119 |
| TC (mg/dL) | 167.3 ± 51.2 | 169.6 ± 52.1 | 162.9 ± 47.7 | 0.204 |
| LDL (mg/dL) | 102.3 ± 48.4 | 105.2 ± 48.4 | 91.6 ± 47.3 | 0.027 |
| HDL (mg/dL) | 35.2 ± 10.8 | 34.0 ± 10.4 | 34.7 ± 12.0 | 0.685 |
| Hypertensive (%) | 105 (35.7) | 85 (39.3) | 21 (23.3) | 0.008 |
| Diabetic (%) | 44 (14.2) | 33 (14.4) | 12 (14.0) | 0.929 |
| Physical activity (%) |
| Inadequate | 220 (79.4) | 162 (80.7) | 76 (76.8) | 0.482 |
| Medium/ Adequate | 80 (20.6) | 42 (19.3) | 20 (23.2) |
| Smoking status (%) |
| No | 268 (89.0) | 182 (84.7) | 86 (100) | 0.000 |
| Yes | 32 (11.0) | 34 (15.3) | 0 (0) |

Data are presented as mean ± SD or %. P-values are obtained from independent sample t-test for continuous variables and Chi-square test for categorical variables. TG: Triglyceride; TC: Total cholesterol; LDL: Low density lipoprotein; HDL: High density lipoprotein

**Discussion**

Our study has evaluated the prevalence of dyslipidaemia among IOC workers in Lagos and Port Harcourt, Nigeria and revealed the importance of health concerns as related to abnormal cholesterol levels among the workers. Though it was observed that the average age of the workers was 40.5 years, and there were notable gender differences where men had higher averages in body mass index (BMI), waist circumference (WC), and both systolic and diastolic blood pressure compared to women, highlighting a greater risk of cardiovascular disease among male workers. However, 34.7% of the workers were hypertensive, and 14.2% were diabetic, showing a significant presence of cardiovascular risk factors that could worsen complications linked to dyslipidemia.

Regarding cholesterol levels, men had higher average total cholesterol and low-density lipoprotein (LDL) cholesterol, which are linked to a higher risk of heart disease. Women, on the other hand, showed slightly higher average levels of triglycerides and high-density lipoprotein (HDL) cholesterol, although these differences were not statistically significant. The high LDL and total cholesterol levels in men suggest a greater risk of artery blockage and heart disease. However, 78% of the workers were not physically active enough, and 15.3% were smokers, both of which are known to worsen cholesterol issues and increase cardiovascular risks.

In comparison with previous studies Noubiap et al. [16] found “a high prevalence of elevated cholesterol and low HDL cholesterol in African adults, which aligns with the elevated LDL and total cholesterol levels observed in male IOC workers. However, the lack of significant gender differences in triglyceride and HDL levels in the IOC study suggests lifestyle and dietary differences between IOC workers and the general African population”. Similarly, Asiki et al. [17] reported “high rates of low HDL cholesterol but low total cholesterol in rural Uganda, contrasting with the higher total cholesterol and LDL levels found in IOC men. This highlights the impact of urban living on cholesterol levels, emphasizing the role of environmental and lifestyle factors across different populations”.

Mohamed et al. [18] stressed “the global need for targeted interventions to manage dyslipidemia, which the IOC study supports by highlighting the importance of workplace health programs to address high LDL and total cholesterol levels”. Zhao et al. [19] also noted “persistent high LDL cholesterol in Chinese patients despite treatment, similar to challenges faced by IOC workers, emphasizing the need for combined medication and lifestyle interventions”. Mahmoud and Sulaiman [20] reported “high dyslipidemia rates among Emirati adults, mirroring patterns in male IOC workers and underscoring the influence of gender, age, and lifestyle on cholesterol levels. These findings collectively highlight the need for tailored dyslipidemia management strategies that consider occupational, environmental, and lifestyle factors”.

**Conclusion**

The study shows a high prevalence of dyslipidemia among IOC workers, especially men, who are at greater risk of cardiovascular disease due to high blood pressure, diabetes, smoking, and lack of physical activity. The findings are consistent with global trends but also reveal specific occupational health risks linked to urban living and work environments.

**Ethical approval and informed consent**

Ethical approval was obtained from the Health Research Ethics Committee of the Hospitals. Informed consent was obtained from the respondents in writing after a detailed explanation of the study protocol before recruitment into the study. Confidentiality was assured and maintained.

**Disclaimer (Artificial intelligence)**

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