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High Prevalence of Modifiable Cardiovascular Risk Factors Among Male Off-shore Workers in Nigeria-A Preliminary Study

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Abstract

Background: Internationally, Cardiovascular diseases (CVD) constitute a major cause of morbidity and mortality and it is estimated that by 2020 a majority of the global burden of CVD will be in developing countries. Offshore workers are often more prone to CVD due to unhealthy lifestyles however, the risk of CVD to this population is largely unknown in sub-Saharan Africa. Our study determined the prevalence of modifiable cardiovascular risk factors among off-shore workers in Nigeria.

Methodology A descriptive cross-sectional study was carried out amongst male off-shore workers in the Niger delta area of Nigeria from January to December 2012. Participants of the study were recruited consecutively during periodic medical fitness for work examinations where sociodemographic data, anthropometric measurements and blood pressure were obtained in a standardized manner.Venous blood samples were collected in the fasting state for glucose and lipid profile including total cholesterol, triglyceride, HDL and LDL, all of which were analaysed using dry chemistry technique (Reflotron® System, Roche Diagnostics, Germany).

Results This study looked at 375 male offshore workers with a mean age of 42.6 ± 7.1 years. Forty-one (10.9%) and 196 (52.3%) had a history of cigarette smoking and alcohol consumption respectively. The prevalence of modifiable cardiovascular risk factors screened for were: hypertension 139 (37.1%), diabetes mellitus 30 (8.0%), obesity 154 (41.1%), hypercholesterolaemia 80 (21.3%), lowHDL 30 (8.0%), highLDL 66 (17.6%), and hypertriglyceridaemia 53 (14.1%). Disorders that occurred more frequently in older patients were hypertension ($p=0.002$), diabetes ($p=0.002$), obesity ($p=0.02$) and hypercholesterolaemia ($p=0.04$). About 19 (63.3%) of subjects with diabetes mellitus and 52 (37.4%) with hypertension were unaware of the diagnosis prior to the on-site screening.

Conclusion The prevalence of modifiable cardiovaascular risk factors among off-shore workers in Nigeria is high. In order to prevent unwanted cardiovascular events in this group, a healthy lifestyle, frequent health screenings and other work place-based health promotion activities should be ensured.

Key Words: Cardiovascular · diabetes · hypertension · risk factors · dyslipidaemia · obesity

Introduction

Cardiovascular disease (CVD) remains a major cause of morbidity and mortality worldwide. In the past few decades, the global burden of CVD in developing countries has become quite significant. The World

Health Report estimated that in 1998, 78% of the burden of non-communicable diseases (NCDs) and 85% of the CVD burden arose from low and middle income countries[1]. The CVD burden afflicts both men and women, with CVD deaths accounting for 34% of all deaths in women and 28% in men in 1998.[2] It was estimated that 5.3 million deaths attributable to CVD occurred in developed countries in 1990, whereas the corresponding figure for the developing countries ranged between 8 to 9 million (ie, a relative excess of 70%).[3] In Nigeria, CVD is estmated to account for 11% of all deaths with over two hundred thousand projected deaths in 2005.[4] The burden of CVD in developing countries is on the increase for several reasons such as urbanization, westernized diet, unhealthy life styles, poor socio-economic status, poor access to healthcare, amongst others.[5]

Offshore activities expose the workforce to a risky lifestyle, hazards of the ocean environment, rigorous job schedule, regimented living and anxiety of travelling by air or sea to work location and eventual return to a time of sedentary life. Other risks inherent in such location include night shifts with altered sleep cycles, stress, isolation, exposure to noise and chemicals. There is also a growing body of evidence which suggests that noise pollution induces both temporary and permanent changes that can trigger endocrine and autonomic nervous system responses and thus may be a risk factor for CVD.[6] These risks are quite different from those experienced by onshore workers and may aggravate pre-existing conditions.[7] Therefore, with increasing industrialization of developing countries, such work place conditions that are likely to aggravate the burden of CVDs constitutea real threat to public heath. This is even truer in countries such as Nigeria where the health care expenditure per capita is less than 5% of the total Gross Domestic Product.[8]

Unfortunately, the emergence of CVD epidemic in developing countries during the past two to three decades has attracted little public health response in the work place, even within the affected countries.[9]

So far, the burden of CVD among offshore workers in sub-Saharan Africa is largely unknown. The additional cardiovascular risks posed by peculiar work place activities such as, offshore drilling, underscores the crucial need to optimize CVD prevention efforts in this population. The aim of this study was to determine the prevalence of modifiable cardiovascular risk factors among male offshore workers in Nigeria. It is hoped that the findings of this study will provide epidemiological basis for cardiovascular preventive strategies, work place advocacy and institution of health friendly policies.

Methods

Study design and population

A descriptive cross-sectional study was carried out among male offshore workers in the Niger delta area of Nigeria from January 1 to December 31 2012. We hypothesized that offshore workers will have a high prevalence of modifiable cardiovascular risk factors. The Niger delta area of Nigeria comprises oil mineral producing communities located in eight States including, Rivers, Bayelsa, Cross River, Akwa Ibom, Delta, Abia, Imo and Ondo States. The study was conducted at a dedicated occupational health centre in Port Harcourt, Rivers State where these participants undergo periodic and pre-employment medicals. The occupational health centre is equipped to international standards for work place clinical and laboratory assessments. At the centre, clinical evaluations are carried out by doctors specially trained in occupational health while certified laboratory scientists man the laboratory sections.

Participants were recruited consecutively during periodic medical fitness for work examinations. The inclusion criteria were all Nigerian male offshore workers, 18 years or more, whose work locations are within the Niger Delta area of Nigeria. Females were understandably excluded considering that they usually constitute less than 3% of the offshore workforce in Nigeria. For the purposes of this research, an offshore worker was defined as a person employed in the oil and gas industry that works solely at offshore locations or visits such locations for a greater portion of his working time.

Ethical considerations

Permission to use the data from the occupational health centre was sought and approval was received.

As obtainable in the offshore health system in the area, the participants already gave consent for their data to be used for research by the occupational centre and their affiliates provided anonymity was ensured. All data obtained from the participants were therefore anonymised. Individual participants were offered necessary medical education based on findings during their examination. Those who required further medical evaluation or treatment were referred to their general practitioner or specialist as applicable. Confidentiality was maintained through out the study, each candidate was assigned a number code.

Data collection

Data was extracted unto an anonymised sheet from medical questionnaires completed by the participants during their periodic and pre-employment medical fitness examinations. The health professionals that conducted the assessments were duly trained in their areas of involvement.

The protocol used for the examination included structured questionnaires consisting of socio-dermographic characteristics, history of alcohol consumption and cigarette smoking, past medical history, drug treatment history. Anthropometric measurements (weight (kg), height (m) were measured using calibrated equipment and in a standardized manner.[10]Body Mass Index (BMI) was determines as weight (kg)/height(m)^2. Blood pressure (BP) was measured using a Zoll Mseries cardiac monitor with the subject seated, relaxed in a chair, back supported and arm at heart level. Measurement was repeated for those with initial BP elevation at interval of one hour from the first.

Venous blood was collected after an overnight fast for blood glucose and lipid profile (total cholesterol-TC, high density lipoprotein cholesterol-HDL-C and triglyceride-TG. Fasting state was defined as no calorie intake for at least 8 hours. Samples were analysed within 10 minutes using dry reagent chemistry technique (Reflotron® System, Roche Diagnostics, Germany). Low-density lipoprotein cholesterol (LDL-C) was estimated using the Friedewald formula.[11]

Case definitions

Study parameters were defined as follows:

- Hypertension: systolic BP ≥140 and/or diastolic BP ≥90 mmHg on two separate measurements.
- Diabetes Mellitus and impaired fasting glucose were diagnosed based on World Health Organization (WHO) and International Federation of Diabetes definitions[12]:
  Diabetes: fasting plasma glucose (FPG) ≥7.0mmol/l
  Impaired Fasting Glucose (IFG): FPG of 6.1–6.9mmol/l.
- Dyslipidaemia was defined as derangement in any of the lipid profile fractions according to the World health organization (WHO) criteria thus hypercholesterolaemia (Total cholesterol(TC) >5.2mmol/L), hypertriglyceridaemia(Triglyceride(TG) >1.7mmol/L), low high density lipoprotein-Cholesterol([HDL-C]<0.9mmol/L for men and <1.0mmol/L for women), high low density lipoprotein-cholesterol([LDL-C]>3.5mmol/L) and (high atherogenic index = TC/HDL-C ratio >5).[13]
- Obesity was defined as BMI ≥ 30kg/m^2.

Statistical analysis

Epi info version 3.5.3 (CDC Atlanta, Georgia, USA) was used for data analysis. Occurrence of cardiovascular risk factors was presented as percentages. Continuous variables were reported as means (± standard deviation, SD) if they were normally distributed or median (interquartile range, IQR) if non-normally distributed. Categorical variables were compared by using the chi square test or Fisher's exact test. All reported p-values less than 0.05 were considered statistically significant.

Table 1—Clinical and laboratory characteristics of the study population

	N=375
Age (years)	42.6 ± 7.1
Age (years)	
20–29	15 (4.0)
30–39	105 (28.0)
40–49	190 (50.7)
≥50	65 (17.3)
Known diabetic persons, *n (%)*	11 (2.9)
Known hypertensive persons, *n (%)*	87 (23.2)
Individuals on antihypertensives, *n (%)*	61 (16.3)
Current smokers, *n (%)*	41 (10.9)
Alcohol use, *n (%)*	196 (52.3)
SBP (mmHg)	131.5 ± 16.1
DBP (mmHg)	82.9 ± 10.6
BMI (Kg/m^2)	29.7 ± 4.1
Total cholesterol (mmol/l)	4.5 ± 1.0
HDL cholesterol (mmol/l)	1.4 ± 0.5
LDL cholesterol (mmol/l), *median (IQR)*	2.6 (2.0–3.2)
Triglyceride (mmol/l)	1.2 ± 0.6
Creatinine (μmol/l)	80.1 ± 17.2
Uric acid (mmol/l)	316.9 ± 90.5

Except otherwise stated, values are mean± SD

Table 2—Prevalence of modifiable cardiovascular risk factors in the study population

	N=375
	n (%)
Hypertension	139 (37.1)
Diabetes	30 (8.0)
Impaired fasting glucose (N=345)	32 (9.3)
Obesity	154 (41.1)
Hypercholesterolaemia	80 (21.3)
Low HDL-C	30 (8.0)
High LDL-C	66 (17.6)
Hypertriglyceridaemia	53 (14.1)
Raised atherogenic index (TC/HDL >5)	29 (7.7)

Results

In this study, 375 participants were consecutively recruited. The clinical characteristics of the study population are shown in Table 1. The ages of the participants ranged from 24 to 63 with a mean of 42.6 ± 7.1years. Half (50.7%) of the participants belonged to the 40–49 years age group while the age group 20–29 years was the least frequent with only 15 people (4%). There were 41 (10.9%) current smokers while 196 (52.3%) reported current alcohol use. Eighty seven (23.2%) individuals were known hypertensive patients but only 61 (16.3%) were on antihypertensives at the time of the study. Eleven individuals (2.9%) were known diabetic patients. The mean values of the laboratory parameters are also shown in Table 1.

The prevalence of cardiovascular risk factors is presented in Table 2. Obesity was the most common cardiovascular risk factor and occurred in 154 individuals (41.1%). Hypertension was present in 139 patients (37.1%) and this included both previously known hypertensive patients (87 people) and those diagnosed during the study (52 people). Diabetes mellitus was diagnosed in 30 patients (8.0%) and this

Table 3—Prevalence of modifiable cardiovascular risk factors according to age

	Age (years)				
CV risk factor	20–29	30–39	40–49	≥50	p-value
Hypertension	3 (20.0)	25 (23.8)	80 (41.9)	31 (48.4)	0.002
Diabetes	0 (0.0)	3 (2.8)	15 (8.2)	12 (21.4)	0.002
Impaired fasting glucose (N=345)	0 (0.0)	6 (6.1)	18 (11.2)	1 (1.9)	0.11
Obesity	3 (20.0)	33 (31.4)	90 (47.1)	28 (43.8)	0.02
Hypercholesterolaemia	3 (20.0)	18 (17.1)	37 (10.4)	22 (34.4)	0.04
Low HDL-C	0 (0.0)	9 (8.6)	18 (9.4)	3 (4.7)	0.42
High LDL-C	2 (13.3)	22 (21.0)	27 (14.1)	15 (23.4)	0.25
Hypertriglyceridaemia	1 (6.7)	14 (13.3)	28 (14.7)	10 (15.6)	0.82
Raised atherogenic index (TC/HDL >5)	0 (0.0)	9 (8.6)	15 (7.9)	5 (7.8)	0.70

comprised of both previously known diabetic patients (11) and those diagnosed during the study (19). Of the remaining 345 patients who did not have diabetes, 32 (9.3%) had impaired fasting glucose. Overall, dyslipidaemia as previously defined was present in 154 participants (41.1%). The commonest lipid disorder was hypercholesterolaemia 80 (21.3%) followed by high LDL-C 66 (17.6%), hypertriglyceridaemia 53 (14.1%) and low HDL-C 30 (8.0%). High atherogenic index was documented in 19 people (7.7%).

We further analysed the prevalence of modifiable cardiovascular risk factors according to age (Table 3). The prevalence of hypertension progressively increased from the 20–29 years to the ≥ 50 years age group and the difference was statistically significant (p=0.002). Diabetes was absent in individuals less than 30 years but the prevalence steadily increased from the 30–39 years (2.8%) to the ≥ 50 years (21.4%) age group (p=0.002). Although there was statistically significant differences in the prevalence of obesity (p=0.02), the highest rate of 47.1% occurred in the 40–49 years age group. Hypercholesterolaemia also showed a statistically significant difference across the age groups with the highest rate in individuals who were ≥ 50 years (34.4%) while the lowest rate occurred in the 40–49 years age group (p=0.04). There was no statistically significant difference in the frequency of the other cardiovascular risk factors according to age as shown in Table 3.

Discussion

This study corroborates our hypothesis that offshore workers in Nigeria have a high prevalence of modifiable cardiovascular risk factors. Generally, the prevalence of cardiovascular risk factors has been shown to be on the increase both in Western and African countries, particularly in urban areas.[14] According to Nwankwo et al (2008), a common explanation for the rising tide of CVD world-wide is the adoption of the western lifestyle with resultant increase in the prevalence rates of diabetes and hypertension.[15]

Previous studies in Nigeria focused on cardiovascular risk factors in specific populations, such as those with hypertension, diabetes or within certain age groups, while others focused on the general population. Bearing in mind the peculiar work place-related risks faced by our study's population and their tendency to aggravate CV disorders, we investigated the burden of CV risk factors in this largely unexplored group so as to compare their CVD profile with findings in the general population and other sub-populations. Considering that there is documented evidence of a high prevalence of cardiovascular risk factors amongst apparently healthy adult Nigerians,[16] we anticipated that the situation would be higher among offshore workers.

The participants in this study were predominantly in the 40–49 age group. This is not surprising as this group represents the most experienced workforce in the offshore sector. The low frequency of individuals who were 20–29 years is understandable considering that most individuals of this age in Nigeria are recent

graduates who may be seeking employment. In Nigeria, the general opinion is that the average offshore worker is affluent, likely to belong to at least the middle socioeconomic class, and have at least secondary level of education.

In this study, obesity was found to be the most prevalent cardiovascular risk factor, occurring in 41.1% of the population. This is substantially higher than the prevalence of 8–22% reported in a systematic review of prevalence of obesity in adult Nigerians.[17] In agreement with our observation, Katherine Parkes in her study of offshore workers in the Northsea found a high prevalence of obesity in this group relative to the general population.[18] Such a finding is not surprising as obesity is often linked to unhealthy diet, high in sugar and saturated fats and low in fruits and vegetable. The availability of unhealthy free food and sugar rich drinks in offshore locations create a tendency towards dietary indiscretion.Obesity is seen as a precursor to other antecedents of artherosclerosis (hypertension, diabetes and dyslipidaemia.).[19] In line with our finding of increasing prevalence of obesity with age, documented evidence exists that age and day-night shift patterns of work interact significantly to predict BMI in offshore workers, though day-night shift pattern was thought to play more of a role than age.[20]

Hypertension was the second most prevalent cardiovascular risk factor, with 37.1% of the population diagnosed as hypertensives. This is higher than the prevalence of 25.7% found in a cross-sectional study of healthy Nigerian adults.[21] A systematic review of the prevalence of hypertension in adult Africans reported 8–46%.[22] The prevalence of hypertension showed a statistically significant association with increasing age. This is similar to findings in earlier reports on age and hypertension in the rural population.[23] An important observation is the 20% prevalence of hypertension in subjects less than 30 years. The danger in this emerging trend is that this age group are the least likely to consider regular blood pressure screening or treatment. This will create room for late diagnosis and earlier onset of complications. Other studies identified hypertension as the most threatening cardiovascular risk factor with prevalence ranging between 15 and 30% in adults.[24] This underscores the need for increased screening for hypertension combined with other health promotion activities.

Dyslipidaemia as previously defined was present in 41.1% of our participants. Hypercholestolaemia was the most prevalent of all the spectrum of dyslipidaemia followed by high LDL-C. Unlike the other fractions, hypercholesterolaemia showed a statistically significant trend with age. The overall prevalence of dyslipidaemia in this study is lower than value of . . .60%. . .. . reported by Oguejiofor et al.[25] No immediate explanation could be given for the relatively lower rate of dyslipidaemia observed in our offshore population. It is possible that the level of physical activity involved in offshore work may have a beneficial role with respect to lipid abnormalities. Another plausible reason for this difference may be that, what we found is a reflection of previous dietary restriction advice offered during past medicals since majority of the participants have had medicals in the centre within the last two years. Future research in the trend of these risk factors may lend more support to this explanation.

Oguejiofor O.C and Onwukwe C. H in their study on “Dyslipidemia in Nigeria Prevalence and Pattern” noted dyslipidaemia as highly prevalent in all the geopolitical zones of Nigeria with the consistent pattern being low HDL-C and high LDL-C. Overall, the prevalence of dyslipidemia ranged from 60% among apparently healthy Nigerians to 89% among diabetic Nigerians.[26]

The prevalence of diabetes Mellitus was 8% (30). 2.9% (11) of the participants were known diabetics, 45% (5) of whom had fasting blood sugar of 7mmol/L and above. Amongst the known diabetics, 45% (5) were on oral hypoglycemic agents. It is not surprising that none of them was on insulin, since use of insulin may be a contra indication for offshore work.[27] 63.3% (19) of those diagnosed with diabetes were not aware of their deranged glycaemic status prior to the test. This underscores the benefit of including laboratory parameters as part of medical fitness for work examination in the developing countries where access and attitude to general preventive health check may be poor. 63.3% of previously undiagnosed diabetes is comparable with previous studies in Africa which noted that about 80% of Africans with diabetes are undiagnosed[28]

Previous literatures documented concerns and projection about rising trend of diabetes globally[29]

The observed prevalence of diabetes in this study (8%) is lower than the 8.5% global prevalence estimated by International Diabetic Federation (IDF) [30], it is higher than figures reported in previous studies of the general population in Nigeria. In their study of young healthy Nigerian adults, Mahmoud Sani et al (2010) observed prevalence 0f 5.3% which was noted to be equally higher than 2.2%–2.8% found by other workers in the country.[31]

Apart from challenges with diet restriction in an offshore location, the diabetic offshore worker may find drug compliance more difficult than onshore workers. Refill of prescriptions and a rigorous job schedule may pose serious hinderance to drug compliance making glycaemic control more difficult to achieve in the diabetic offshore worker.

There is therefore a need to educate this group on ways to achieve drug compliance with respect to medication treatable cardiovascular risk factors.

Alcohol consumption was recorded in 52.3% of offshore workers. It is important to note that work place drug and alcohol policies forbid the offshore worker from use of alcohol while offshore. The trend is usually a reactionary over-indulgence in alcohol from the moment they disembark from the rig. In addition to above reason, relative affluence of the average offshore worker makes alcohol very affordable.

Cigarette smoking was observed in 10.9% of the participants. This is comparable to reports of current smoking status in a population based study by Adepoju et al. [32]Though one would have expected a much higher prevalence of smoking in this group

Limitations

A majority of the participants were offshore workers who have had past medical fitness examinations at the occupational health centre. This sample population may already be beneficiaries of the salutatory effect of such medical surveillance. It is possible that the finding in the general offshore population may be more severe than what we reported in this study.

Information available did not allow calculation of smoking in pack years and alcohol use in terms of units. As such we were not able to correlate how the quantity of cigarettes smoked or alcohol consumed impacted on other cardiovascular risk factors.

There was no measurement of abdominal circumference. This parameter would have been useful in extimation of metabolic syndrome in this population.

Conclusion: There is a high prevalence of modifiable cardiovaascular risk factors among off-shore workers in Nigeria. In order to prevent unwanted cardiovascular events in this group, a healthy lifestyle and frequent screening should be ensured. Work place health promotion activities should also focus on these areas. There is also need for further studies on the trend of these risk factors. This will help to align health promotion activities and appreciate the benefits of fitness for work examination in this population.

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