Original Article

Prevalence and Risk Factors of Obesity among Workers in the Oil and Gas Industry of the Niger Delta Region

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Abstract

Background: Obesity prevalence among oil and gas industry workers over the past decade globally has been on the increase, adversely affecting workers' well-being and productivity. Therefore necessitates the increased need for both occupational, and public health policymakers to take action. Data on obesity prevalence rates among workers in the oil and gas industry of the Niger-Delta region needed to drive public and occupational health policies regarding obesity is scarce. Therefore, this study aimed to determine the prevalence of obesity and its risk factors among oil and gas industry workers in the Niger Delta Region of Nigeria.
Methodology: A cross-sectional study of 280 oil and gas industry workers in the Niger Delta region of Nigeria aged 29 -to 61 years, from November - to - December 2017 was done. A structured survey data of Body Mass Index (BMI) measurements and socio-demographics was collected. Statistical analysis with Chi-Square and Multinomial Logistic Regression tests was used.
Results: Results indicated that the Obesity prevalence rate among the oil and gas industry workers of the Niger Delta region was 49.6% (p=0.002). Obesity was significantly associated with a family history of cardiovascular diseases (OR=2.761, p=0.001, 95%CI=1.491-5.112).
Conclusion: The Obesity prevalence of 49.6% (p=0.002)among oil and gas industry workers in the Niger-Delta region, is statistically significantly high. Therefore, concretive preventive measures are needed to reduce obesity prevalence among workers.
Keywords: Obesity Prevalence; Oil and Gas Workers; Niger Delta Region; Occupational health, Nigeria.

Introduction

Obesity is fast becoming a global public and occupational health challenge, evident by the increase in its prevalence, especially among adults of the working-age population, from 300 million in 1980 to 650 million in 2016.[1-3] Since the 1990s, obesity has increased in sub-Saharan Africa, with prevalence rates as high as 43% in 2010.[4, 5]

With pressure and work demands, employed adults spend more than half of their lives at work, affecting their eating and activity lifestyles predisposing them to become overweight or obese [6]. The World Health Organization (WHO) defines obesity as an excessive accumulation of body fat.[1] Any individual with a body mass index (BMI) of ≥ 30kg/m^2 is defined as being obese. The BMI is a one of the most widely used measures that uses an individual's height and weight to determine

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How to cite this article: Onigbogi CB, Banerjee S, McKinney ZJ. Prevalence and Risk Factors of Obesity among Workers in the Oil and Gas Industry of the Niger Delta Region. Niger Med J 2022;63(4):288-294

how healthy the weight is. BMI is calculated by dividing an individual's weight in kilograms by their height in metres squared. BMI is further categorized as follows: <18 – underweight, 18.5-24.9 – normal weight, 25-29.9 – overweight, 30-34.9 – obesity class I, 35-39.9 – obesity class II, >40 – obesity class III. BMI is the globally accepted public health tool for measuring obesity.[2] Obesity is a well-studied and significant risk factor for cardiovascular diseases (CVD) and diabetes.[7]

Obesity in the past three decades in the oil and gas industry globally has witnessed a steady increase in its prevalence, associated with increases in lost workdays.[8]

Ninety per cent of Nigeria's oil and gas reserves[9,10] are derived from the Niger-Delta region. Unfortunately, data needed to drive both occupational and public health policies regarding obesity among oil and gas industry workers in the Niger-Delta region is limited.[11]

The primary objective of this study is to establish the prevailing obesity rates and risk factors among workers in the oil and gas industry of the Niger Delta region of Nigeria, using standard B.M.I. classifications.[12] The study hopes to close the existing knowledge gap and generate data in advancing prospective studies on obesity. The study also evaluates the current age- and sex-specific obesity prevalence rates among the workers. This study also aimed to identify whether age, sex, and a family history of CVD are associated with or are predictors of obesity, with the intent to inform preventive efforts and control strategic decisions.

Materials and Methods

A cross-sectional study of randomly selected oil and gas industry workers from one of Africa's largest producers and exporters of oil and gas, a petrochemical and hydrocarbon company with five (three refining and two petrochemicals) out of seven of its plants in West Africa, and extensive operational bases located in the Niger Delta region. At the commencement of this cross-sectional study, there were 1030 employees under permanent employment in the company, manning the petrochemical and refining plants in the region. This research was carried out from November to December 2017, the peak operational season for the plants. Only the company's permanent staff stationed in the Niger Delta region were included for participation, irrespective of their sex. Participants that could not stand for their weight and height measurements were excluded. There were no pregnant women among the sample participants.

Ethical approval was obtained from the University of Roehampton Ethics Committee and local ethics approval was also obtained from company during data collection. The study is non-interventional, under the auspices of improving employee health and safety. The study did not collect identifiable employee data, and the Principles outlined in the Declaration of Helsinki were upheld.

The survey data instrument specially designed for this study was tested in a pilot study for accuracy, reliability, and clarity and certified as suitable for this purpose. Body composition measures of height, weight, and BMI were collected using a standardized and validated Stadiometer and weighing scale for reliability. Individual data were collected on a paper survey instrument on-site. Completed paper survey data instruments were coded, then manually verified and cleaned for data entry errors, before transfer into a company-secured computer, stored in a Microsoft Excel (Microsoft, Redmond, WA, United States) spreadsheet.

The calculated sample size for this study population was 280. The Epi Info software (7.2.1.0. C.D.C., Atlanta, Georgia, USA) was used to calculate the sample size for this study representative of the target population. The software eliminates sampling error, with the expected margin of error and frequency each at 5%, and design effect calculated at 1.0, using 95% Confidence level. Participants were selected using Stat Trek online random number generator application (Fama Dr NE, Atlanta, Atlanta, GA 30329, USA) from workers who initially expressed interest to participate. All of the participants selected to participate underwent an informed consent process. Data collection was conducted using structured survey data of body mass index (BMI) measurements and socio-demographics collected at the workstations. The socio-demographics obtained also included among others, the work category (whether field work location,

with some level of physical activity, or office work location, with more sedentary lifestyle), skill pool (whether skilled professional with post graduate degree, or unskilled with only high school leaving and technical certificates).

An initial 420 of 1030 workers expressed interest to participate, from which 280 participants were randomly selected based on the required sample size calculated for this study population. All the 280 selected subjects fully participated in the study with a 100% participation rate established.

Data Analysis

Collected data elements included age (years), sex (male or female), height (m), weight (kg), and whether the worker has a known family history of CVD (yes or no). Additionally, data on work category and skill pool of the participants were collected. B.M.I. (kg/m^2) was computed from weight and height. Obesity as a binary classifier of B.M.I. $\geq$ 30 kg/m^2 was stored. Age was converted to a categorical variable representing three groups primarily by decade and aligned with the age range of participants in the study, as categories of 29-39 years, 40-50 years, and 51- 61 years.

The continuous variables in the study (age, height, weight, BMI) are characterized in terms of mean and standard deviation. The age range distribution of obesity across each sex and both sexes is described as the percentage of the total participants in each age category.

Association of obesity and study variables was evaluated using a multivariate logistic regression analysis of obesity as a dependent variable of family history of CVD, skill pool, work category, age group category, and sex. The analysis was performed using R (R Project for Statistical Computing, Vienna, Austria). Similar multivariate logistic regression for each sex individually was performed for obesity associated with family history of CVD, work category, skill pool and age group categories. Paired *t*-test and chi-square test was also performed for both continuous and categorical variables respectively. Model variables were considered statistically significant at a level of $p < 0.05$.

Results

The 280 selected subjects' ages ranged from 29-61 years, 26.4% were females, and 73.6% were males. The Age-group 51-61 years formed the largest group among the participants at 40.7%. Participant continuous demographics from the primary survey collection are shown in Table 1, with the mean participants' BMI at 30.14±5.36 kg/m^2.

In Table 2, about 139 out of the 280 participants had a BMI > 30kg/m^2. Sixty-eight percent (68%) of the subjects fell under the obesity class I category (30-34.9 kg/m^2), while 21% were in the obesity class II category (35-39.9 kg/m^2). Only 11% of the subjects fell into the obesity class III category (>40 kg/m^2).The study population age group 40-50 years accounted for the highest prevalence of obesity class II category at 48.3%, while the study population age group 51-61 years accounted for the highest prevalence of obesity class I and III, at 41.05% and 60.0% respectively [Table 2].

Only fifty-eight subjects (20.7%) in this study, had a family history of CVD, while 57.5% of the study subjects were field workers, and 42.5% were stationed in the offices. Among the subjects used for this study, 52.9% were unskilled, while 47.1% were skilled workers with post graduate degrees [Table 2].

A logistic regression test was carried out to establish the statistical relationship between having a family history of cardiovascular disease (CVD), age-group, skill pool, work category, and gender with obesity prevalence and determining if they are predictors and determinants for obesity prevalence [Table 3, 4, 5]. In Table 3, Mean age for obese subjects was established at 47.18±8.16, with paired *t*–test value of -1.666, p=0.097 [Table 4]. Gender variable for obesity prevalence was derived at X^2 = 2.883, p=0.090 [Table 3].To determine if differences in mean happened by chance, the paired *t*-test for other variables like BMI was also derived at -3.151, with p=0.002, weight (*t*-test=-.735, p=0.463), and height (*t*-test=-5.883, p=0.000). Among the one- hundred and thirty-nine obese subjects, 69.0% (n=40), had a family history of CVD, with X^2=10.926, OR=2.761, 95%CI: 1.491-5.112, and p=0.001 [Table 3, 4, 5].

About 46.0% of the obese subjects were field workers, while 54% were office desk workers. The logistic regression for work category, showed X^2=2.052, p=0.152 [Table 3]. Unskilled workers, accounted for 50.8% of the obese subjects, while 49.2% of the obese study subjects, were skilled workers with post graduate degrees. The logistic regression for skill pool, showed X^2=0.016, p=0.899 [Table 3].

The prevalence of obesity among the oil and gas industry workers of the Niger Delta region was derived at 49.6% (n=139), with a mean BMI of 30.14±5.36 kg/m^2 [Tables 1 and 2], and p=0.002 [Table 4].

Table 1: Descriptive Anthropometric and Demographic Characteristics of Participants

	Frequency (n=280)	Percentage (%)
Age (years)		
29-39	79	28.2
40-50	87	31.1
51-61	114	40.7
Mean Age = 46.41±8.43		
Gender		
Female	74	26.4
Male	206	73.6
Anthropometric variable	**mean±SD**	
Height (m)	1.66±0.07	
Weight (kg)	83.20±14.02	
BMI (kg/m2)	30.14±5.36	

Table 2: BMI, Obesity, and Socio-demographic Distributions among Participants

Age group (years)	Gender	BMI Category (kg/m^2)					
		<18 underweight	18.5-24.9 normal	25-29.9 overweight	30-34.9 obesity class I	35-39.9 obesity class II	>40 obesity class III
29-39	Female	0	0	5	3	3	3
	Male	0	16	15	19	4	0
40-50	Female	0	2	11	9	5	2
	Male	0	4	20	25	9	1
51-61	Female	0	3	11	11	3	3
	Male	0	11	33	28	5	6
Total					95 (68%)	29 (21%)	15 (11%)

	Frequency (n=280)	Percentage (%)
Obesity status (>30kg/m^2)		
Yes	139	49.6
No	141	50.4
Family History of CVD		
Yes	58	20.7 (30:70 Female: Male ratio)
No	222	79.3
Work Category		
Field	161	57.5
Office	119	42.5
Skill Pool		
Skilled	132	47.1
Unskilled	148	52.9

Table 3: Logistic Regression Test for Predictors and Determinants of Obesity in study

Variable	Obesity Status			
	Yes (n=139)	No (n=141)	X^2	*p*value
Age Group (years)				
29-39	32(40.5%)	47(59.5%)	5.455	0.065
40-50	51(58.6%)	36(41.4%)		
51-61	56(49.1%)	58(50.9%)		
Mean age (Mean±SD)	47.18±8.16	45.66±8.66	*t*=1.512	0.132
Gender				
Female	43(58.1%)	31(41.9%)	2.883	0.090
Male	96(46.6%)	110(53.4%)		
Family History of CVD				
Yes	40(69.0%)	18(31.0%)	10.926	0.001*
No	99(44.6%)	123(55.4%)		
Work Category				
Field	74(46.0%)	87(54.0%)	2.052	0.152
Office	65(54.6%)	54(45.4%)		
Skill Pool				
Skilled	65(49.2%)	67(50.8%)	0.016	0.899
Unskilled	74(50.0%)	74(50.0%)		

*Statistically significant

Table 4: T-test with p value on Anthropometric and Demographic Characteristics of Participants

Variable	Gender			
	Male (n=206)	No (n=74)	*t*-test	*p*value
Age (years)	45.91±8.74	47.81±7.44	-1.666	0.097
Height (m)	1.68±0.07	1.62±0.06	5.883	0.000*
Weight (kg)	82.83±13.35	84.23±15.78	-.735	0.463
BMI (kg/m^2)	29.55±4.95	31.80±6.10	-3.151	0.002*

*Statistically significant

Table 5: Odds Ratio for Family history of CVD Vs Obesity

	p value	Odd ratio	95% CI	
			Lower	Upper
Family History of CVD				
Yes	0.001	2.761	1.491	5.112
No		1.000		

Discussion

In this cross-sectional study, the overall prevalence of obesity among the oil and gas industry workers of the Niger Delta Region was 49.6 %, with a p = 0.002,which is statistically significant, and also higher than the general obesity prevalence rate of 5.50%, observed for the general Niger Delta region population [13], with the average B.M.I. of 23.02 ±4.42.

The high obesity prevalence rate among the oil and gas industry workers could probably be attributed to reduced physical activity and unhealthy dietary regimes consequence of the long off-duty shift (four weeks off, two weeks on- duty roster) and sedentary

nature of their work resulting in weight gain, as observed in similar studies.[14]

This study finding is nevertheless consistent with global industry negative trends of progressive increase of obesity among oil and gas industry workers in keeping with similar studies with an obesity prevalence rate of 42%, observed during a longitudinal study among Shell oil and gas employees, as extracted from Shell Health Surveillance System.[8] A similar study conducted among on-shore oil and gas industry workers in the East Kalimantan region of Indonesia reported an overall prevalence of obesity of 49.5%.[14]

Physiologically, obesity can occur at any age. However, hormonal changes leading to decreased metabolism with advanced age and concomitant reduced physical activity and muscle mass result in relative adipose tissue increase with associated increased risk for obesity in the older age groups. This study demonstrated this finding consistently in both sexes of workers and each sex individually [Table 3], although these findings were not statistically significant (p=0.132). These findings are however consistent with similar studies and conclusions [15, 16], where the older the workforce, the higher the likelihood for obesity. The statistical insignificance of associations between obesity and age categories in this study suggests that regarding the oil and gas industry of the Niger Delta region, age is not a significant contributory factor of obesity risk. This finding is a cause for concern as it suggests that the workplace may affect obesity more than aging.

The female subjects, accounted for 30.2%, while male subjects accounted for 69.8% of the obese workers in this study, but however, gender showed no statistical significance (p=0.090) for obesity prevalence in this study. These statistically insignificant data suggest that the smaller worker sample size (n=280) is most likely not large enough to demonstrate this effect. These data are interestingly in keeping though with similar studies carried out at the same period[17], where higher prevalence rates for obesity were recorded among the male working population.

Fifty percent (50.8%) of the obese subjects in this study were unskilled, while 49.2% were skilled workers. However, logistic regression for skill pool with X^2=0.016, and p= 0.899, showed no statistical significance, implying that skill pool of the subjects in this study, is not a determinant of obesity prevalence. Similarly, 46.7% of the obese subjects in this study were working in the fields, while 54.6% were office workers. The logistic regression for work category, revealed X^2=2.052, and p=0.152, which showed no statistical significance. Hence, work category, in terms of field or office location, is not a determinant of obesity prevalence in this study.

The family history of CVD with the odds ratio (OR) of 2.761, 95% CI: 1-491-5.112, and the p=0.001,is statistically strongly significant, implying a higher likelihood of obesity development with those with a positive family history of CVD. Childhood obesity is closely linked with a family history of CVD, explaining why 69.0% of the obese subjects in this study had a family history of CVD. This effect has been demonstrated to increase with age. [18]This study showed a strong statistically significant association of a family history of CVD (p =0.001) among oil and gas industry workers of the Niger Delta Region with obesity prevalence, in keeping with global trends.[16,17]

The relatively high obesity prevalence rate in this study can negatively impact the health and productivity levels of the workers, resulting in poor health and reduced quality of life, and lost work time as described in similar studies.[8,16] This imminent epidemic problem supports and requires urgent attention and action by occupational health professionals, policymakers, and executives of the oil and gas industry of the region. Additionally, it is now more apparent that a family history of CVD among the oil and gas industry workers of the Niger Delta region is a statistical independent factor that significantly and negatively affects the prevalence of obesity in this study.

Conclusion

Obesity is a multifaceted global public and occupational health issue and exist in Nigeria and even so among the oil and gas industry workers of the Niger Delta region.[13]It is common knowledge that obesity results from eating excessive high calorie meals more than expended. According to

available literature, obesity is a risk factor for many chronic diseases, and undoubtedly an undesirable outcome of poor lifestyle and unhealthy behavior.[1] The findings thus emphasize the need to design and implement strategic approaches focusing on healthy lifestyle and work-shift pattern modifications aimed at improving the general well-being of the workers and curbing obesity with a particular emphasis on high-risk individuals, especially workers with a family history of cardiovascular disease (CVD).

Strengths and Limitations

The primary strength of this study is that it is the first of its kind conducted in oil and gas industry workers, specifically of the Niger Delta region of Nigeria, an area in which obesity rates are gradually increasing in the general populace. The strength of this generalization is enhanced with data derived from a representative sample size computed with epidemiologic calculations.

The primary limitation of this study is its cross-sectional design. This inhibits follow-up studies of ongoing obesity trends and the temporal relationships. This study also did not capture and measure other cardiovascular risk factors like blood pressure, cholesterol and blood sugar levels in the cohort. Additionally, this study did not carry out waist circumference and waist-hip ratio obesity measurements for further obesity prevalence clarity. Lastly, other socio-demographical variables such as religion, exercise patterns, dietary heterogeneity, and detailed ethnicity, all of which can also account for the high obesity rates in this study, were not included and assessed.[13,16]

Key Points

What is already know?

- Obesity is undoubted, a major public and now an occupational health issue in the oil and gas industry,
- It is by far a significant risk factor for cardiovascular and other non-communicable diseases.[1]

What this study adds:

1. Due to the vital link between obesity and cardiovascular diseases, the consequences of this study's findings are fundamental for the health and safety of oil and gas industry workers, who face additional occupational hazards such as shift work, sedentary lifestyle, and suboptimal diet.
2. The operational implications of the increased risk for health complications are the potentials for declines in productivity.[19]

- The high obesity prevalence among the workers should stimulate urgent preventive measures by the oil and gas industry management, stakeholders, and policymakers that will positively impact the worker's well-being and productivity.
- In alignment with the tenets of Total Worker Health, integrated workplace strategies based on scientific findings aimed at weight reduction, healthy lifestyle, and behavioural changes focused on exercise and diet are needed in this population of workers.[19]

Acknowledgment

The author acknowledges the top management and all members of staff of the African Petrochemical and Hydrocarbon Company in the Niger Delta Region, who participated in the studies.

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