Original Research Article

Diabetes and Its Associated Factors among Oil and Gas Company Workers in Port Harcourt

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Abstract

The global burden of diabetes is becoming alarming; this has been aggravated by the change in lifestyle patterns which has encouraged the high prevalence of diabetes noticed today. The oil and gas company workers over the years have been predicted to have an increased prevalence of diabetes which has been attributed to the affluence of this population. The aim of this study is to determine the prevalence of diabetes and its associated factors among oil and gas company workers in Port Harcourt. The present study aim was to determine the prevalence of diabetes and its associated factors among oil and gas company workers in Port Harcourt. The study was carried out using a descriptive cross-sectional study and data's were collected using a questionnaire. A total of 376 questionnaires were administered and 318 questionnaires were retrieved from three oil and gas companies in Port Harcourt. Majority (51.9%) of the workers were above 40years of age. (72.01%) were married and Christianity (94.03%) was the main form of religion as recorded in the study. The study revealed that (56.1%) of the workers have poor dietary habit as against (43.9%) that have good dietary habit. The mean BMI of the workers (26.5) shows that majority (40.9%) of the workers are overweight, which depicts the nutritional status of the workers. The overall prevalence of diabetes in this study is (19.8%) and of all the risk factors predicted to be associated with the occurrence of diabetes, only women who have given birth to babies weighing more than 4kg at birth showed an association with an adjusted odd ratio of 4.79(1.34-17.11) 0.016. Therefore, there is a significant association between women who have given birth to babies weighing more than 4kg at birth and the occurrence of diabetes. Management of the oil companies, through the health education department should encourage exercise and diabetes management education to curtail the growing prevalence of diabetes.
Keywords: Diabetes, risk factors, oil, and gas company workers.

INTRODUCTION

Diabetes mellitus is a metabolic disorder of chronic hyperglycemia characterized by disturbances to carbohydrate, protein, and fat metabolism resulting from absolute or relative insulin deficiency with dysfunction in organ systems [1, 2]. Diabetes is a major, long-term disease that has a significant influence on the lives and well-being of people, families, and societies all over the world. It is one among the top ten causes of death in adults, with an estimated 4 million fatalities worldwide in 2017 [3].

A person with DM either does not produce enough insulin (deficiency of insulin) or has body cells that are unable to properly use insulin (insulin resistance) [4]. Insulin is a hormone produced in the pancreas and it aids in the transportation of glucose (blood sugar) from the bloodstream into cells so that it can be broken down and used by the body [5]. People cannot survive in the absence of insulin; DM can also be said as a condition in which the body does not properly process food for use as energy. The pancreas, which is an organ found near the stomach produces insulin. A diabetic patient's body either does not produce suitable amount of insulin or it does not use its own insulin as well as it should, causing sugars to accumulate in the blood. Insulin resistance is linked to genetic factors; obesity, sedentary lifestyle, and aging [4- 6]. Obesity and T2DM are strongly predicted by energy-dense food consumption and physical

inactivity [6, 7]. To achieve a normal glucose level, more insulin is produced at first However, this response is insufficient to overcome insulin insensitivity, particularly in obese individuals, resulting in increased glucose production by the liver [8, 9].

In Nigeria, the prevalence of diabetes mellitus (DM) among persons aged 20 to 69 years is estimated to be 1.7 percent [3]. Given that the estimated prevalence by the IDF are produced through extrapolation of data from other countries, it is commonly believed that they drastically under-report the true burden of DM in Nigeria. In years back, many researchers have found prevalence rates ranging from 2% to 12% across the country [10, 11]. The prevalence rate in Nigeria is predicted to double by 2040. Diabetics face a slew of health issues because the disease puts people at risk of different complications. Each year, the disease kills more people than breast cancer and AIDS combined. Reports have shown that everyone in the country is at risk of developing diabetes, particularly those who have abandoned active lifestyles in favor of sedentary ones (such as hiring others as labour in farming activities, use of machines, and replacement of walking and using bicycles, with using motorcycles and cars) as cited in [12].

Port Harcourt is a metropolitan metropolis in Nigeria's oil-rich Niger Delta area, as well as the state capital of Rivers State. The presence of global oil corporations helps the city's population's increasing affluence, particularly among Nigerians who work for these companies. Diabetes mellitus (DM) is said to be on the rise among Nigerian oil workers because of their 'westernized' and 'affluent' lifestyles, particularly in terms of nutrition and sedentary lifestyles, Hence the reason for conducting this study.

MATERIALS AND METHODS
Study Design
The study used a descriptive cross-sectional survey, with data obtained with a structured self-administered questionnaire. This is to enable the researcher discuss and explain the results in simple descriptive and explanatory approach.

Study Area
Port Harcourt is regarded as the Garden City of Nigeria because of its abundance greenery [13]. It is the capital of Rivers State and its largest city, It is situated in the Niger Delta and lies along the Bonny River as of 2016, the metropolitan area of Port Harcourt had an estimated population of 1,865,000 residents, up from 1,382592 as of 2016 [14]. In Rivers State, the Port Harcourt metropolis is located between Latitude 4°45'N and Latitude 4°55'N, and Longitude 6°55'E and Longitude 7°05'E. It is a city in the Niger Delta region of Nigeria [15]. The city is bounded to the north by the LGAs of Oyigbo and Etche, to the south by the LGA of Okrika, to the east by the LGAs of Okrika and Eleme,

and to the west by the LGA of Emohua [16]. Port Harcourt became the center of the Nigerian oil economy and benefited from its association with the industry through modernization and urbanization. Trans-Amadi is the city's main industrial area, with clusters of factories and oil companies that boast the state economy, while residential areas include Port Harcourt Township, also known as Town, Government Reserved Areas (GRA), Abuloma, Amadi-ama, Borokiri, Elekiah housing estates, Diobu, Rumuodara, Rumosi, and others. Etc [17]. According to the list published by petroleum technology association of Nigeria [18]. We have about 65 oil and gas companies in Port Harcourt, which are spread out across the city, but the majority of them are concentrated in the Trans Amadi industrial area. In Port Harcourt, Trans Amadi is a 1,000-hectare (2,500-acre) industrial area and diverse residential neighborhood. The neighborhood is known for its strong manufacturing sector and is a major industrial zone in Port Harcourt. It is at 4°48'53" north latitude and 7°2'14" east longitude. Glass bottles, tires, aluminum, and paper are among the materials produced in the area [19].

Study Population
The study was carried out among oil and gas company workers in Port Harcourt, Rivers State Nigeria. Lifestyle is linked to health and risk behaviors, and the two are intertwined in a clustered pattern. Risk factors are associated with disability, ill health, and death, whereas health and wellness are the result of a variety of factors. Individual risk factor perception exists, despite the fact that they do not exist independently in practice. They frequently coexist and interact in the same environment. Among the various classes of risk factors identified is a behavioral risk factor as cited by [20]. Because of the stress that comes with jobs in the oil and gas companies, some of the workers have poor stress coping mechanism that makes them indulge in different risk behaviors to help them to relieve stress, as a result, this health risk behaviors exposes them to the risk of having diabetes or diabetes for those having a family history of hyperglycemia Hence, the reason for choosing this study population is to uncover more facts that will help in the prevention and management of diabetes.

Inclusion Criteria
i. Workers in companies registered in Nigeria who are engaged in oil exploration and refining activities, with operational base in Port Harcourt
ii. Workers who have been employed for at least one year

Exclusion Criteria
i. Workers who are absent from work at the time the study
ii. Workers in offshore facilities of the various oil and gas companies

Study Tool

A structured questionnaire was used for the collection of data in this study

Sample Size

The sample size for this study was determined using (21) formula the sample size formula was used to estimate the sample size. Using a confidence interval of 95% with a marginal error of 5%, thus an alpha level of 0.05 with an equivalent z-value of 1.96.

The prevalence of Overweight and obesity among Kuwait oil company employee was found to be 75% (Al-Asi, 2003)75% will be used as the prevalence or attribute of interest in this study.

$$n = \frac{z^2pq}{e^2} \quad \text{or} \quad \frac{z^2 p (1-p)}{e^2}$$

n= sample size
Z= Z-score at 95% confidence interval =1.96
P= prevalence or the proportion of the attribute of interest. In this case it is the proportion of oil and gas company workers that are overweight and Obese
e = marginal error (5%) = 0.05

Therefore, substituting the values into the formula above, gives the following

$$n = \frac{1.96^2 \times 0.75 \times (0.25)}{0.05^2}$$
$$n = \frac{1.96^2 \times 0.75 \times (0.25)}{0.0025}$$
$$n = \frac{0.7203}{0.0025} = 289$$

Making 30% (86.7=87) provision for non-response rate in the study, the sample size then becomes =376

Sampling Techniques

A multistage sampling method was used to select the oil and gas companies from the 65 oil and gas companies in Port Harcourt according to the list published by petroleum technology association of Nigeria [18].

Multi-Stage Sampling

First Stage: Simple random sampling to select three oil companies from the 65 oil and gas companies in Port Harcourt, and they include: Nigerian National Petroleum Corporation (NNPC), Azienda Generale Italiana Petroli (AGIP) and The Shell Petroleum Development Company of Nigeria (SHELL)

Stage Two

Stratified sampling, to stratify the companies into the various departments, which are: Health, safety and Environment, human resources department, Security department, medical departments, engineering department and Production departments. And proportionate sampling applied to determine the number of respondents to be drawn from each stratum.
- NNPC was estimated to have 655 workers
- SHELL workers were estimated to be 700in number and
- An estimate of 500 workers was made for AGIP that guided us during the data collection process

The stratification into various departments was done using the formula below

No. of workers in each department × sample size (n)
Total number of workers in the company

For example, the proportionate sample size selected for study participants from the various oil companies and their departments using the above formula was done as follows

NNPC Medical department
$\frac{100 \times 318}{655}$ = 49, 49 participants were then drawn from the medical departments (see table 1)

Stage Three: Random sampling of respondents from the various departments

Table 1: Sampling of the oil and gas company workers

Company	Departments						Total
	Medical dept	HSE	Human Resources	Security	Engineering & Production	Other Department	Total
NNPC	$\frac{100 \times 376}{655}$ =57	$\frac{50 \times 376}{655}$ =29	$\frac{40 \times 376}{655}$ =23	$\frac{30 \times 376}{655}$ =17	$\frac{40 \times 376}{655}$ =23	$\frac{70 \times 376}{655}$ =40	189
SHELL	$\frac{80 \times 376}{700}$ =43	$\frac{30 \times 376}{700}$ =16	$\frac{20 \times 376}{700}$ =11	$\frac{20 \times 376}{700}$ =11		$\frac{25 \times 376}{700}$ =13	94
AGIP	$\frac{50 \times 376}{500}$ =38	$\frac{30 \times 376}{500}$ =22			$\frac{30 \times 376}{500}$ =22	$\frac{15 \times 376}{500}$ =11	93
Total							376

DATA COLLECTION

A self-administered questionnaire was used for data collection in the study. Consent and approval to carry out research in the oil companies was sort from the leadership of the companies and it was verbally approved after assessing the questionnaires. The questionnaire was distributed randomly to the workers in the various departments as seen in (table 1), a consent form was included in each questionnaire that was distributed, explaining the purpose of the research and assuring the participants that the information been sought for is for academic purposes only. The workers in the various departments were free to decline, if they do not want to participate in the study. Two Research assistants were trained prior to the data collection process to facilitate the distribution and collection of the filled questionnaires

Data Analysis

The data collected was analyzed using STATA version 16; descriptive statistics was presented in tables and charts in form of percentage, mean and standard deviation. Inferential statistics was used to measure the association between the dependent and independent variables. A P-Value less than 0.05 were considered statistically significant at 95% confidence interval. Chi-square test was used to test the relationship between the dependent and independent variables.

Multiple questions comprising of nine questions was used to assess the dietary habits. Each of the questions were rated and a composite score was generated those who scored five (5) and above were ranked to have good dietary habits and those who scored below that were rated to have poor dietary habits. BMI category was used to assess the nutritional status of the workers. Workers with BMI ($< 18.5 kg/m^2$) for underweight, normal BMI ($18.5 kg/m^2$ - $24.9 kg/m^2$), overweight BMI of ($25 kg/m2$ - $29.9 kg/m^2$) and BM1 of ($30 kg/m2$ and above) was considered as Obese.

Validity/Reliability of the Study Tool

Data collection tool was adopted from WHO STEPs Instrument and modified to suit the study and its objectives. In addition, random selection method ensured validity and reliability of the information obtained. The questionnaire was checked for completeness, and each question was assigned a serial number for easy identification and recall. A coding guide was created and used to enter the data from the questionnaire into a computer, after which the encoded data was analyzed.

Ethical Consideration

Ethical approval for this study was obtained from the school of public health and ethical committee of the University of Port Harcourt with approval number (UPH/CEREMAD/REC/079), and permission to carry out the study was obtained from the individual companies that were involved in the study. Informed consent was also obtained from the workers that participated in the study. Workers completed the self-administered questionnaire after being adequately informed about the purpose of the study and the contents of the questionnaire. Questions about the questionnaire were addressed. Confidentiality of the workers was taken into consideration as they were informed not to write their names on the questionnaire. The major benefit of the research to the respondents is the awareness and knowledge of the prevalence of diabetes in their companies, money or other incentives were not given. However, the respondents were duly acknowledged at the end of the research.

RESULTS

Socio-Demographic Characteristics of Respondents

A total of 318 questionnaires were retrieved out of 376 questionnaires that was shared among the oil and gas company workers which includes workers from NNPC, SHELL and AGIP were involved in the study. Majority of the workers were from NNPC (50.31). Also, majority (51.89%) of the workers were above 40 years of age with the mean age being 42.206 years (±11.753 standard deviation). Also, majority (65.72%) of the workers were males. Those who had attained tertiary level of education were the majority (84.28%). The workers were distributed across all departments of the companies with the higher proportion (36.10%) being The Medical officers. Majorities (72.01%) were married and Christianity (94.03%) was the main form of religious expression among the respondents. Among the Christians, more than half (58.53%) were Pentecostal by denomination see (table 2)

Table 2: Socio-Demographic Characteristics of Respondents

Attribute	Frequency	Percentage
Name of company		
AGIP	79	24.8
NNPC	160	50.3
SHELL	79	24.8
Age group of respondents		
25 years and below	15	4.7
26-30 years	36	11.3
31-35 years	45	14.2
36-40 years	57	17.9
41 years and above	165	51.9

Attribute	Frequency	Percentage
Sex		
Male	209	65.7
Female	109	34.3
Educational level		
Primary	1	0.3
Secondary	27	8.5
Technical	22	6.9
Tertiary	268	84.3
Department		
Human resource	28	8.8
HSE officers	57	17.9
Security/watchman	23	7.23
Engineering & production	38	11.9
Medical department	117	36.8
Other	55	17.3
Marital status		
Single	75	23.6
Married	229	72.0
Divorced/separated	4	1.3
Widow/widower	10	3.1
Religion		
Christianity	299	94.0
Islam	16	5.0
Traditional	3	0.9
If Christian, state the denomination		
Catholics	73	24.4
Protestants	42	14.0
Pentecostal	175	58.5
African churches	5	1.7
Other	4	1.3

Other departments mentioned were mainly Operations (11), Maintenance, and many others
**Other Christian denominations mentioned were Grail circle, Olumba, and Sabbatherian*

Dietary Habits of Respondents

A score was generated from the nine dietary habit questions; respondents who had less than five positive responses were coded to have poor dietary habits while those who scored five positive responses or more were coded to have good dietary habits. In Overall, only 43.9% of the respondents had good dietary habits (figure 1).
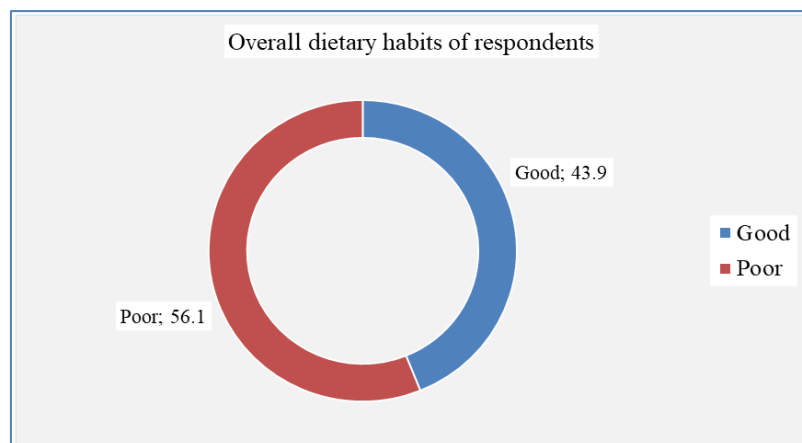

Figure 1: Overall dietary habit of respondents

Majority 287(90.3%) of the respondents indicated that they take fruits and vegetables every week. A higher proportion 88(30.7%) of those that take the fruits and vegetables take it twice weekly. A higher proportion 79(24.8%) said they sometimes add sugar to prepared meals and 263(82.7%) said they make

conscious effort to reduce salt intake. Only 148(46.5%) said they have never added salt to food at the dining table. 83.96% of the respondents said they often skip meals of which 53.18% said they often skip breakfast. Also, of those who skip meals, higher proportion 123(46.07%) often skip meals once a week. A higher proportion 146(45.9%) of the respondents said they rarely eat food that are not home-cooked. Only 125(39.3%) of respondents indicated they eat at an interval of four hours and beyond. A higher proportion 134(42.1%) said they eat their supper between 7pm to 8pm (table 3).

Table 3: Dietary habits of respondents

Dietary Habit Item	Frequency	Percentage
Take fruits and vegetables	287	90.3
Frequency of fruits and vegetables intake for those who take		
Once per week	37	12.9
Twice weekly	88	30.7
Thrice weekly	58	20.2
Four times weekly	44	15.3
Everyday	60	20.9
Frequency of adding sugar to meals		
Always	61	19.2
Often	44	13.8
Sometimes	79	24.8
Rarely	76	23.9
Never	54	16.9
Don't know	4	1.3
Conscious effort to reduce salt intake	263	82.7
Frequency of adding salt to meals at dining table		
Always	20	6.3
Often	37	11.6
Sometimes	48	15.0
Rarely	57	17.9
Never	148	46.5
Don't know	8	2.5
Skipping of meals	267	84
Meals often skipped		
Breakfast	142	53.2
Lunch	88	33
Supper	37	13.9
Frequency of skipping meals		
Rarely (once in two weeks)	43	16.1
Sometimes (once weekly)	123	46.1
Often (three times a week)	50	18.7
Very often (> three times a week)	51	19.1
Frequency of eating meals that are not home cooked		
Rarely (once in two weeks)	146	45.9
Sometimes (once weekly)	96	30.2
Often (three times a week)	38	12
Very often (> three times a week)	38	12
Interval between meals		
≥4 hours	125	39.3
< 4 hours	51	16.0
Don't know	142	44.7
Supper eating time		
4-5 pm	20	6.3
5-6 pm	31	9.8
6-7 pm	83	26.1
7-8 pm	134	42.1
After 8 pm	50	15.7

Nutritional Status of Respondents

The mean Body Mass Index of the respondents was $26.4695 Kg/M^2$ (± 4.07 standard deviation)

From figure 4.2, a higher proportion of the respondents (40.88%) had their Body Mass Index (BMI) being in the overweight range (from 25 to 29.9 Kg/M^2).

Table 4: BMI categories of respondents

BMI_category	Freq.	Percent	Cum.
Underweight (< 18.5 Kg/M2)	4	1.26	1.26
Normal (18.5 to 24.9 Kg/M2)	126	39.62	40.88
Overweight (25 to 29.9 Kg/M2)	130	40.88	81.76
Obese (? 30 Kg/M2)	58	18.24	100.00
Total	318	100.00	

Table 5 indicates that the possibility of delivering a baby with birth weight of 4kg increases with increasing BMI of the mother though it was not statistically significant (p=0.590).

Table 5: Association between BMI of mothers and delivery of 4kg babies

ATTRIBUTE	DELIVERED 4KG BABIES			Chi-Square (P.Value)
	No N (%)	Yes N (%)	Total	
Underweight (<18.5kg/m^2)	2 (100%)	0 (0%)	2 (100%)	1.9166 (0.590)
Normal (18.5 to 24.9kg/m^2)	37 (90.24%)	4 (9.76%)	41 (100%)	
Overweight (25 to 29.9kg/m^2)	36 (90%)	4 (10%)	40 (100%)	
Obese (≥30kg/m^2)	21 (80.77%)	5 (19.23%)	26 (100%)	

Diabetes Prevalence

63(20%) of the respondents said they have been told by a doctor or any health practitioner that they had diabetes (figure 2).
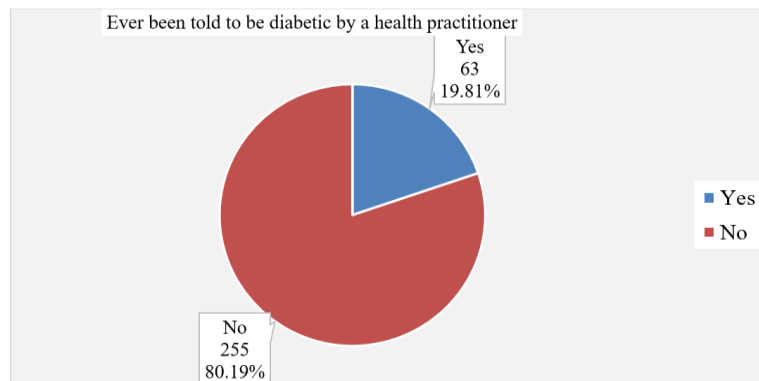

Figure 2: Known Diabetes

Diabetes prevalence was found to be high (21.25%) among workers of NNPC though it was not statistically significant (p=0.795) (table 6).

Table 6: Prevalence of diabetes among the Oil and Gas Companies

Company	Have diabetes		Chi-square (P-Value)
	No	Yes	
AGIP	64 (81.01%)	15 (18.99%)	04594 (0.795)
NNPC	126(78.75%)	34 (21.25%)	
SHELL	65 (82.28%)	14 ((17.72%)	

A higher proportion of the respondents (32.3%) got to know their diabetes status within one to five years ago (table 7).

Table 7: Duration of respondent awareness that they are diabetic

Duration of respondent's awareness of their diabetic state	Frequency	Percentage
Less than 3 months ago	9	14.5
3-to-1-year months ago	14	22.6
1 to 5 years ago	20	32.3
5 years and beyond	19	30.6
Total	62	100.00

More than half (67.2%) of the respondents who are known diabetics said they were on treatment (figure 3).
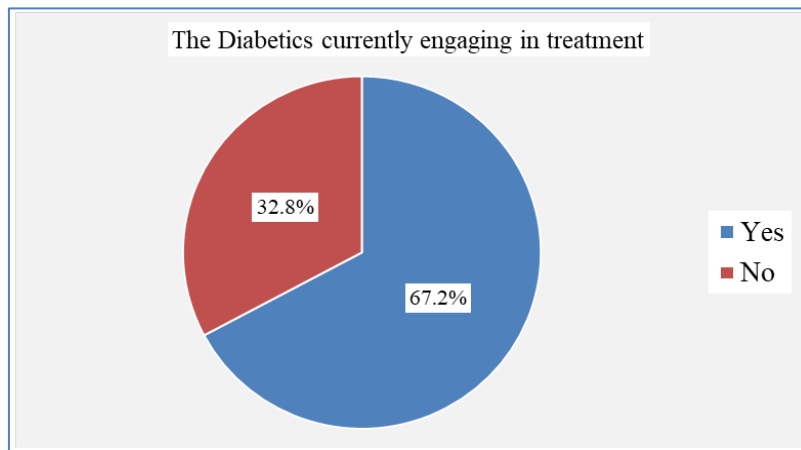

Figure 3: Treatment status of diabetic workers in the various companies

A higher proportion (34.48%) of the diabetic clients reported the use of both drugs and diet in the management of their conditions (figure 4)
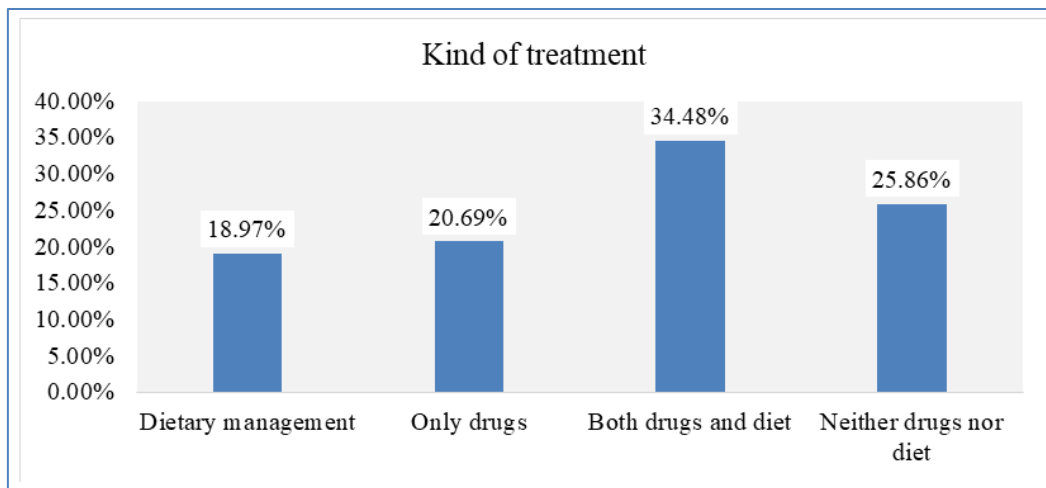

Figure 4: Showing the kind of treatments taken by the diabetic workers

Of all the respondents who reported of not been diabetics, majority (81.8%) indicated that they have had their blood sugar levels checked before (figure 5).
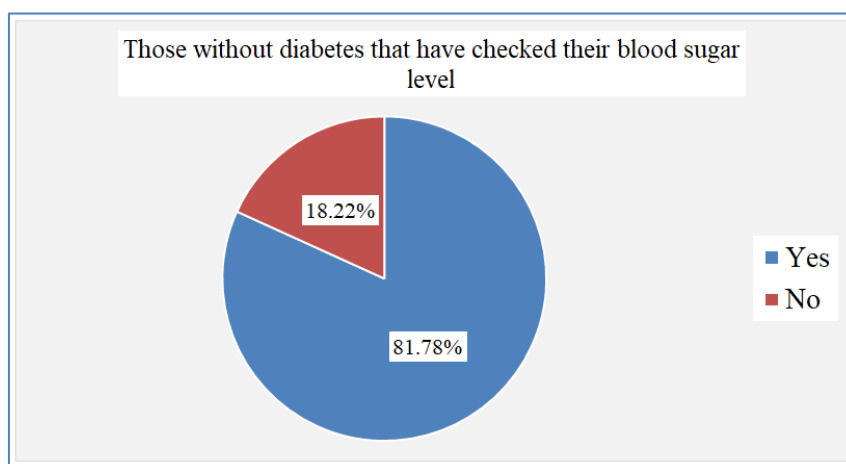

Figure 5: Screening status of respondents without diabetes/ with unknown diabetes

Among those who reported of having family members who are diabetic, a higher proportion (29.46%) said it were their mothers that were diabetics see (table 8).

Table 8: Showing number of respondents with diabetic family members

Diabetic family members	Freq.	Percent	Cum.
Father	28	25.00	25.00
Mother	33	29.46	54.46
Grand parents	17	15.18	69.64
Siblings	16	14.29	83.93
Other	18	16.07	100.00
Total	112	100.00	

Treatment Modalities Adopted by the Diabetic Workers

A higher proportion (34.43%) of the diabetic respondents uses a combination of drugs, diet, and physical activities in the management of their condition (table 9).

Table 9: Kind of treatment adopted by diabetic workers

Kind of treatment	Frequency	Percentage
Drugs	13	21.31
Diet	11	18.03
Physical activities	2	3.28
All the above	21	34.43
None of the above	14	22.95
Total	61	100.00

A greater percentage (80.56%) of the diabetic respondents who use drugs in the management of their condition indicated that they take oral diabetic drugs (figure 6).
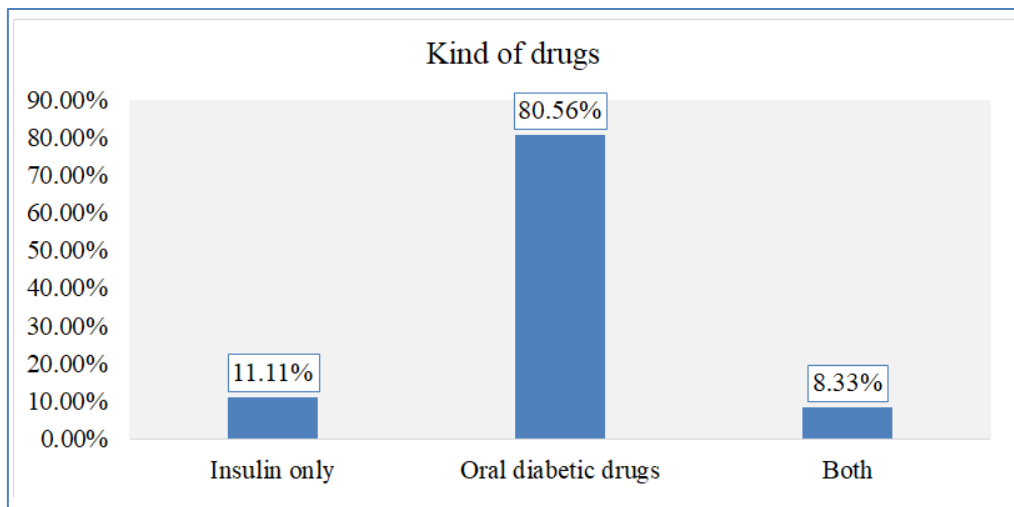

Figure 6: Kind of drugs taken by clients who use drugs for treatment

A higher proportion (44.07%) of the diabetic respondents said they engage in moderate to severe physical exercise once every week (figure 7).
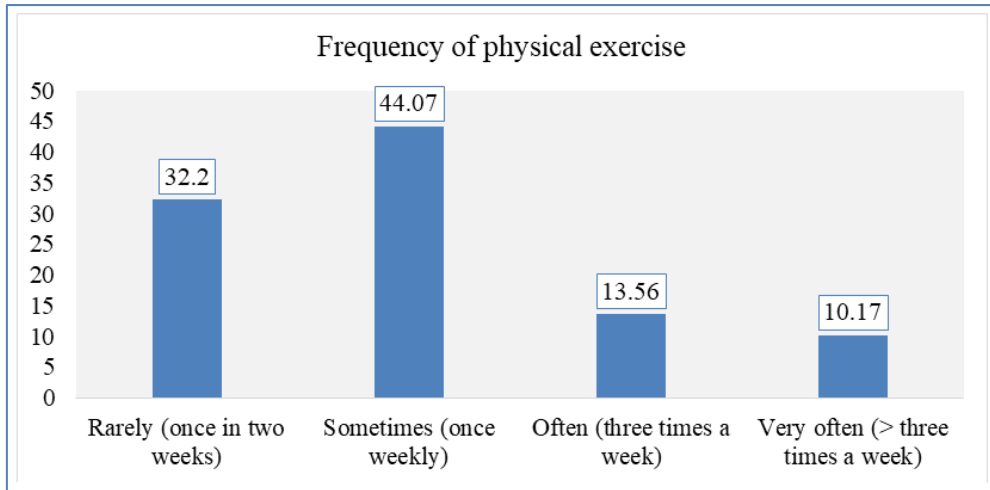
Figure 7: Frequency of physical exercise by diabetic respondents

Most (65.52%) of the diabetic respondents have not attended diabetic self-management education before (figure 8).
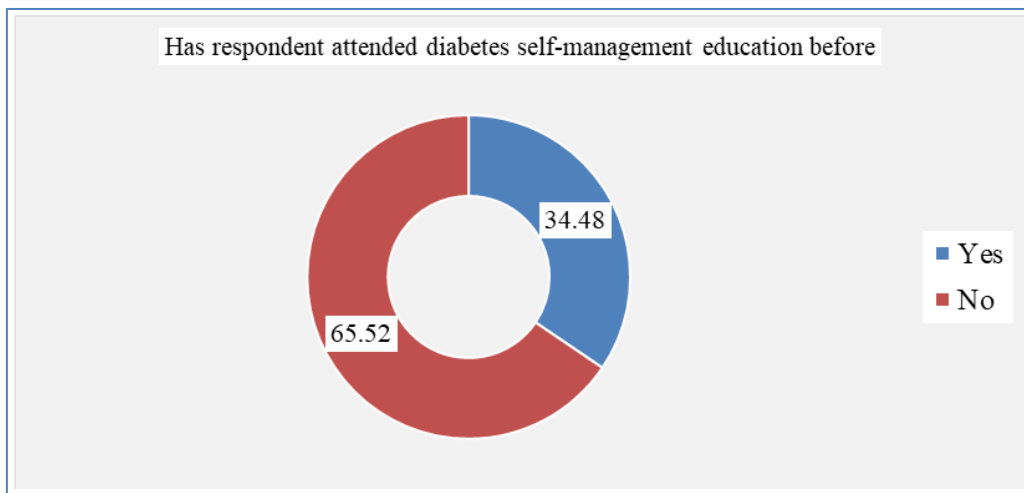

Figure 8: Diabetes self-management education

Risk Factors Associated with Diabetes among the Workers.

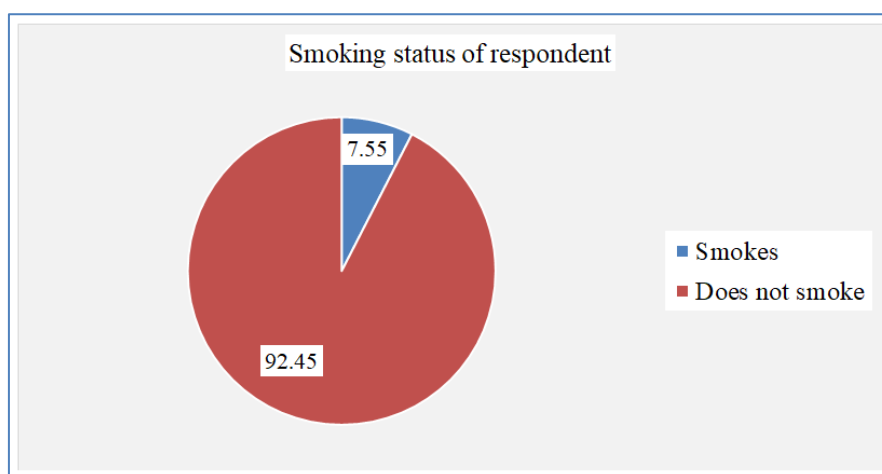7.55% of the respondents indicated that they smoke (figure 9).

Figure 9: Smoking status of respondents

Majority (58.33%) of the respondents who smoke said they often smoke between one and five sticks of the tobacco products per day (figure 10).
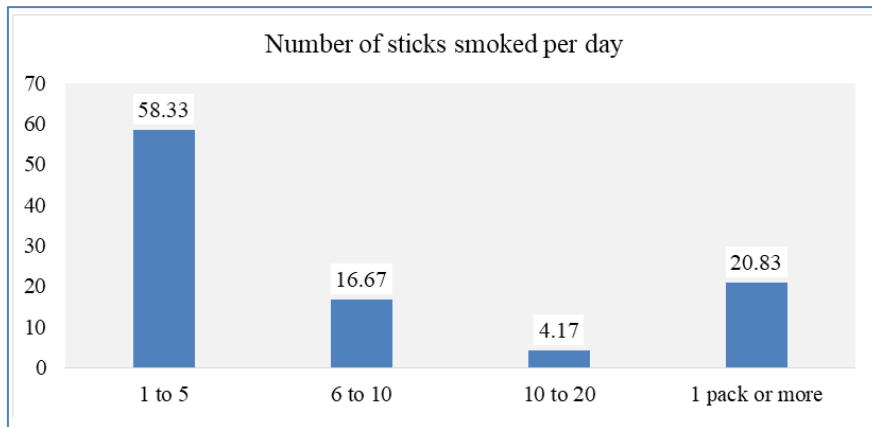

Figure 10: Number of sticks smoked by respondent smokers per day

Only 16.67% of the respondents who smoke have smoked for less than one year (figure 11).
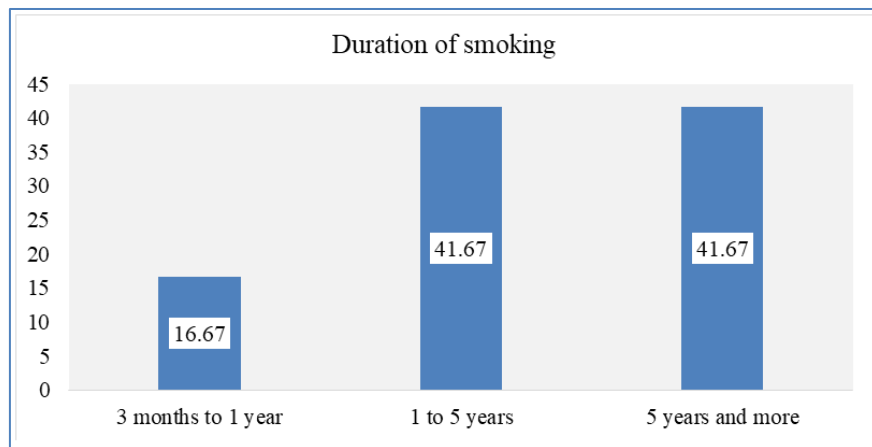

Figure 11: Duration within which respondent smokers have been smoking

A higher proportion (30.82%) of the respondents said they rarely take alcoholic drinks (figure12).
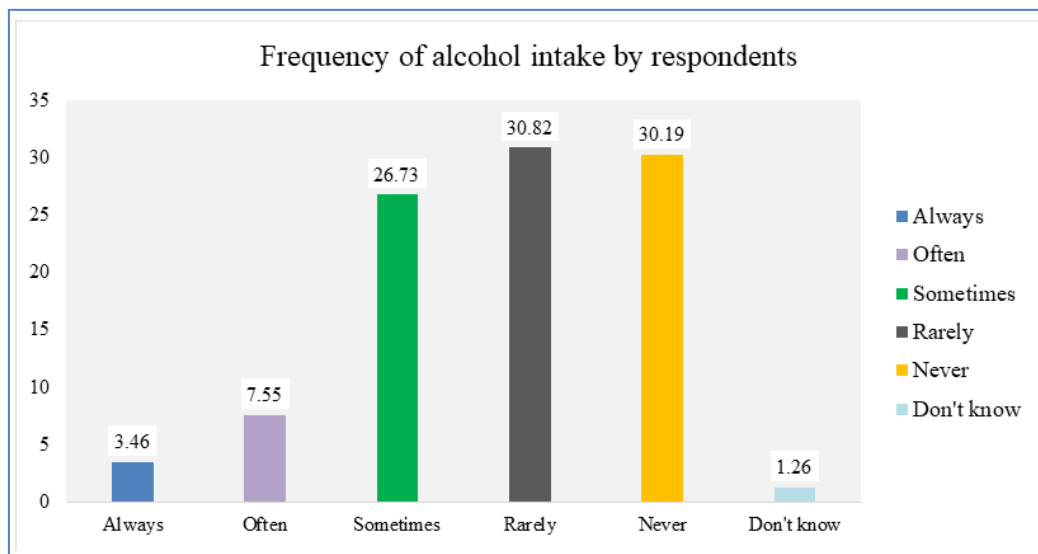

Figure 12: Frequency of alcohol intake by respondents

A higher proportion (48.21%) of the respondents who takes alcoholic drinks prefer wine (table 10)

Table 10: Preferred alcoholic drinks by respondents who take alcohol

Alcoholic Drink Preferred by Respondent	Frequency	Percentage
Beer	78	34.82
Wine	108	48.21
Vodka	9	4.02
Spirit	22	9.82
Other	7	3.13
Total	224	100.00

Other preferred alcoholic drinks mentioned were; Action bitter, Agbo, Brandy, and Whisky

Almost half (42.77%) of the respondents said their works involves sitting at a spot for long period of time (figure 13).
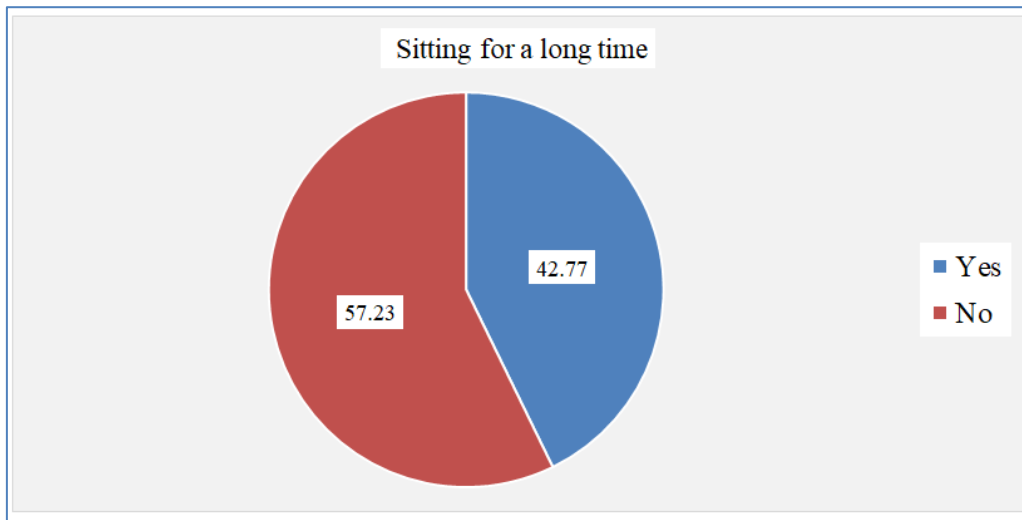

Figure 13 Duration of sitting by respondents.

11.93% of the female respondents said they have delivered babies with birth weight being 4kg or more (figure 14).
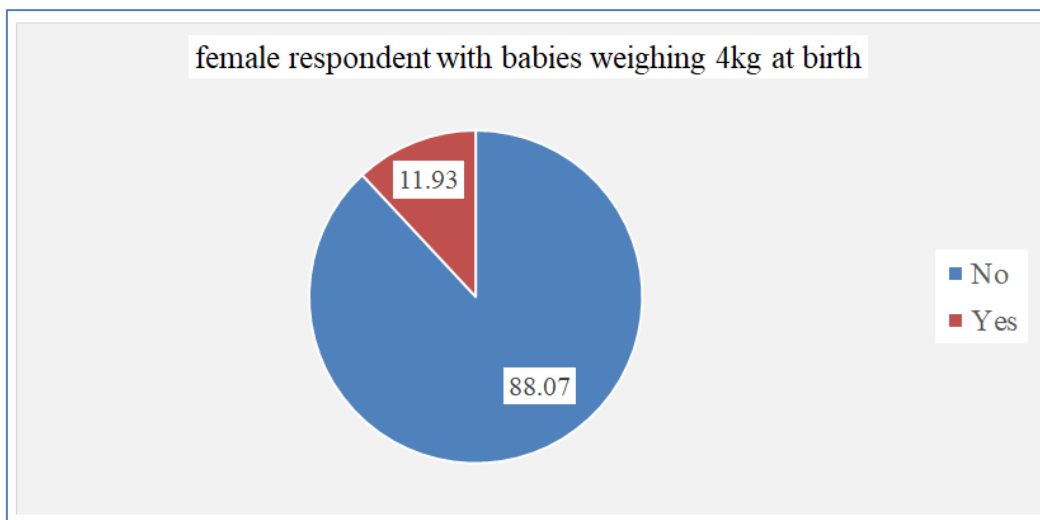

Figure 14: Proportion of female respondents who have delivered babies weighing more 4kg at birth or babies who are overweight at birth.

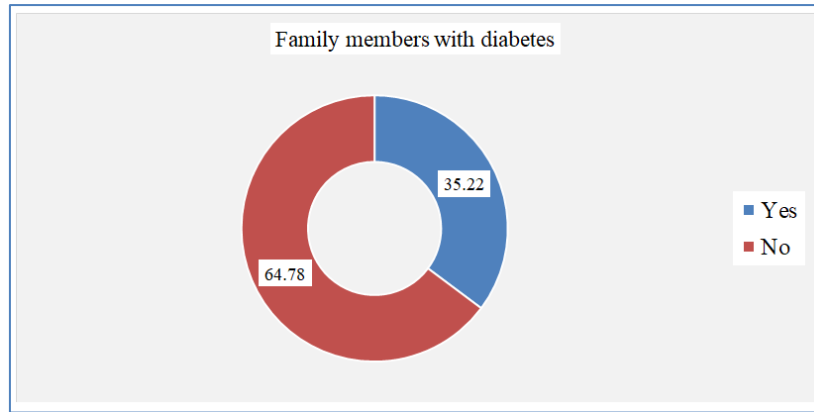About 35.22% of the respondents had diabetic family members (figure 15).

Figure 15: Family history of diabetes

Factors Associated with Occurrence of Diabetes

Association between Background Characteristics and Occurrence of Diabetes Of all the background characteristics of the respondents, none was statistically significantly associated with the occurrence of diabetes after those that showed significant association were adjusted for confounding variables. Chi-square test results indicated that there were significant association between age group of respondents as well as marital status and the occurrence of diabetes. They were further tested using binary logistic regression which showed similar result. But when they were adjusted for confounding variables, none was statistically significantly associated with the occurrence of diabetes (table 11).

Table 11: Association between background characteristics and the occurrence of diabetes

ATTRIBUTE	DIABETES STATUS		Chi-Square (P.Value)	COR (95% CI) P.Value	AOR (95% CI) P.Value
	Not Diabetic (%)	Diabetic (%)			
Age group of respondents					
25 years and below	100.00	0.00	20.2114	Base	Base
26 to 30 years	91.67	8.33	(**0.000**)	0.22(0.06-0.76)**0.016**	0.47(0.10-2.16)0.328
31 to 35 years	91.11	8.89		0.24(0.08-0.70)**0.009**	0.34(0.11-1.06)0.064
36 to 40 years	85.96	14.04		0.40(0.18-0.90)**0.028**	0.46(0.20-1.05)0.066
41 years and above	70.91	29.09		1.00	
Sex					
Male	78.95	21.05	0.5914	Base	
Female	82.57	17.43	(0.442)	0.79(0.44-1.44)0.442	
Educational level					
Primary	100	0.00	4.2945	Base	
Secondary	81.48	18.52	(0.231)	0.99(0.36-2.74)0.986	
Technical	63.64	36.36		2.49(0.99-6.26)0.052	
Tertiary	81.34	18.66		1.00	
Department					
Human resource	22 (78.57)	6 (21.43)	9.1758	Base	
HSE	49 (85.96)	8 (14.04)	(0.102)	0.60(0.19-1.93)0.391	
Security/watchman	18 (78.26)	5 (21.74)		1.02(0.27-3.89)0.979	
Engineering & production	24 (63.16)	14 (36.84)		2.14(0.70-6.54)0.182	
Medical	98 (80.00)	11 (20.00)		0.71(0.25-1.99)0.515	
Other	44 (80.00)	11 (20.00)		0.92(0.30-2.81)0.879	
Marital status					
Single	94.67	5.33	16.3572	Base	Base
Married	76.86	23.14	(**0.001**)	5.35(1.86-15.32)**0.002**	2.60(0.69-9.83)0.160
Divorced/separated	50.00	50.00		17.75(1.96-160.77)**0.011**	8.03(0.74-87.52)0.087
Widow/widower	60.00	40.00		11.83(2.35-59.62) **0.003**	5.10(0.84-30.83)0.076
Respondent's Religion					
Christianity	80.27	19.73	0.3578	Base	
Islam	81.25	18.75	(0.836)	0.94(0.26-3.40)0.923	
Traditional	66.67	33.33		2.03(0.18-22.81)0.565	

Association between Predicted Risk Factors and Occurrence of Diabetes Of all the predicted risk factors, women who have ever given birth to babies with birth weight being 4kg or more were found to most likely develop diabetes. Results of the multiple logistic regression revealed that, women who have delivered babies with birth weight of 4kg and beyond were 4.79 times more likely to develop diabetes compared to others who have not given birth to overweight babies before [AOR:4.79(CI:1.34-17.11) P=0.016] (table 12).

Table 12: Association between predicted risk factors and occurrence of diabetes

ATTRIBUTE	DIABETES STATUS		Chi-Square (P.Value)	COR (95% CI) P.Value	AOR (95% CI) P.Value
	Not Diabetic (%)	Diabetic (%)			
Dietary habits of respondents					
Poor habits	84.47	15.53	3.1293 (0.077)	Base	
Good habits	76.19	23.81		1.70(0.94-3.07)0.079	
BMI (Kg/M²)					
Underweight (<18.5)	100.00	0.00	1.0895 (0.780)	Base	
Normal (18.5 to 24.9)	80.16	19.84		1.06(0.48-2.33)0.889	
Overweight (25 to 29.9)	79.23	20.77		1.12(0.51-2.45)0.776	
Obese (≥30)	81.03	18.97		1.00	
Smoking					
No	80.27	19.73	0.0171 (0.0896)	Base	
Yes	79.17	20.83		1.07(0.38-2.99)0.896	
Frequency of alcohol consumption					
Always	72.73	27.27	10.8749 (0.054)	Base	
Often	79.17	20.83		0.70(0.13-3.66)0.674	
Sometimes	87.06	12.94		0.40(0.09-1.72)0.217	
Rarely	79.59	20.41		0.68(0.17-2.81)0.598	
Never	78.13	21.88		0.75(0.18-3.07)0.685	
Don't know	25.00	75.00		8.00(0.58-110.27) 0.120	
Does respondents sit for long					
No	79.67	20.33	0.0720 (0.788)	Base	
Yes	80.88	19.12		0.93(0.53-1.62)0.789	
Respondent delivering babies weighing 4kg at birth					
No	86.46	13.54	8.4607 (**0.004**)	Base	Base
Yes	53.85	46.15		5.47(1.59-18.86)**0.007**	4.79(1.34-17.11)**0.016**
Family history of diabetes					
No	84.47	15.53	6.7359 (**0.009**)	Base	Base
Yes	72.32	27.68		2.08(1.19-3.64)**0.010**	2.70(0.94-7.72)0.064

DISCUSSION

A thorough review of the literatures was done in this study as well as comparison of its findings on the concept of diabetes and its associated factors among oil and gas company workers in Port Harcourt. Diabetes has been studied not only as a disease, but also as a result of various modifiable and non-modifiable risk factors (age, ethnicity, gestational diabetes) that may have contributed to the occurrence of diabetes in the study population. According to the findings of this study, there are a higher percentage of those without diabetes than those with diabetes, and the majority of those with diabetes are already on diabetes treatment. However, there were a few exceptions, women who have given birth to babies weighing more than 4kg at birth. Also, almost all of the predicted factors that can likely lead to the occurrence of diabetes did not show any form of significance with the occurrence of diabetes. Furthermore, a higher percentage of the workers have poor dietary habits, and the majority of workers have a BMI in the overweight range. However, in our study, this was not associated with the occurrence of diabetes, which could have been due to a number of competing factors. However, those who are currently not diabetic may face a greater risk in the future.

The proportion of workers with good dietary habits, which include eating fruits and vegetables and making a conscious effort to eat breakfast, lunch, and supper at the appropriate times, was found to be 43.9%, while workers with poor dietary habits were found to be 55.1%, as shown in fig (1).Our findings are consistent with a cross- sectional study conducted by [22, 23], on the relationship between dietary patterns and risk factors for cardiovascular disease in patients with type 2 diabetes

mellitus. It was also noted that subjects with a higher score of dietary patterns that includes; eating seaweeds, vegetables, soy products, and mushrooms had a healthier lifestyle, with fewer depressive symptoms and increased physical activity after adjusting for confounding variables this was associated with lower use of diabetes medication.

This is in consonant with the findings of [24], who conducted a case control study in Yangon, Myammar on the association between dietary habits and type 2 diabetes mellitus, and he identified the risk in the dietary relationship of citizens of Myammar residents and discovered a poor dietary habit of daily intake of seasonings that is composed of salty foods, such as soy sauce, fish sauce, fish paste, and so on. Despite the fact that 56.1% of the participants in our study had poor dietary habits, it was not associated with the risk of diabetes in the study population [24]. In his study, he noted that salty seasonings or the addition of salt is associated with the risk developing diabetes. This study was contrary to the study in Lithuania by [25]. Variables showed that participants who added salt to prepared meals had about a twofold higher risk of developing T2DM compared to participants who never did. However, our study is consistent with the review carried out by [26], on the dietary intake and obesity in oil and gas workers, the result showed that a higher population of oil and gas workers from both developed and developing countries engage in poor dietary habits which causes the high prevalence of obesity, an important risk factor for the occurrence of diabetes.

Furthermore, a lot of research over the years has predicted that oil and gas company workers consume a lot of fats than fiber. A recent systematic review on shift workers and their eating habits concluded that shift workers have poor dietary quality due to altered meal plans such as skipping meals and eating at an unusual hour [27]. In all, none of the dietary habits accessed in our study is associated with the risk of occurrence of diabetes.

The nutritional status of the workers showed that a higher proportion (40.88%) of the workers have a body mass index in the overweight range from (25 to 29.9kg/m2. (39.62%) had normal BMI and (18.24%) were obese. The BMI of the workers be it normal (COR 1.06(0.48-2.33)0.889) or Overweight (COR 1.12(0.51-2.45)0.776) was not associated with the occurrence of diabetes in our study. A study conducted by [28], noted that obesity was associated with over nutrition and intake of foods rich in sodium but no association was shown with the occurrence of diabetes [26].A systematic review on the dietary intake and obesity in oil and gas workers also found out that, the majority of the population of oil and gas workers both from developed and developing countries have poor dietary habits and were obese, thereby increasing the prevalence of Obesity. Furthermore, a recent systematic review by [29], has

noted that been involved in shift work had a negative relationship or association with nutritional intake, it increases the possibility of being overweight/ obese and a higher chance of developing abdominal obesity. Although in our study BMI of respondent was not associated with the risk of diabetes, many factors would have affected this which could range from more awareness been on ground about the subject of obesity in recent times. Routine medical checkups has a significant improvement in total cholesterol systolic and diastolic blood pressure and their BMI has helped to reduce the incidence of diabetes especially in the high risk groups [30]. This might have contributed to the non-association recorded in our study. Our findings are consistent with the study conducted by (10) on type 2 diabetes in adults Nigerians in Port Harcourt, in which he discovered that BMI >=25kg/m2 and WHR >= 0.085 were associated with a significantly higher risk of developing type 2 diabetes. Other studies have shown that overweight and obesity [31], as cited in [10], emerged as a strong independent risk factor for diabetes, but BMI did not show any association. The study conducted by [22], on overweight and obesity among Kuwait oil company workers has also noted a high prevalence of overweight among the field workers than the office workers as against the initial hypothesized expectation of overweight being higher in the office worker than the field worker at the beginning of the study.

Diabetes is becoming more prevalent in Nigeria, owing to a variety of factors such as lifestyle changes, overweight, and obesity [32]. According to [33], the disease's prevalence is increasing as Nigeria modernizes and adopts Western lifestyles. Diabetes was found to be more prevalent in NNPC (21.25%) when compared to AGIP (18.99%) and SHELL (17.72%), respectively. In this study, though the prevalence was not statistically significant with a P- Value=0.087. Furthermore, our study found that (32.26%) of workers discovered they were diabetic 1-5 years ago, and more than 67.21% of diabetic workers reported being on treatment. However, the prevalence of diabetes in the current study is (19.81%) the oil and gas company workers have always recorded a high prevalence of diabetes from previous studies. A study conducted by [34], recorded a high prevalence of 23.4% among the oil industry workers which were the high social economic group chosen in his study when compared to the (16.9%) prevalence recorded in the low socio economic group. This suggests that Nigerians are prone to diabetes and explains the fact that modernization and the rise in Petroleum exploration to a large extent is responsible for the skyrocketing prevalence of diabetes recorded. There has been a varying prevalence of diabetes over the years in different populations. The study carried out by [35], showed a high prevalence of prediabetes and diabetes (19.4%) and (6%) respectively, other studies outside Nigeria has also shown a higher rates of diabetes prevalence too, such as studies from Ethiopia recorded (20.3%), Uganda (20.2%) and among Hispanic (47.4%).

Our study shows that, more than half of the workers who are diabetic (68.21%) are on treatment to control diabetes and (34.48%) of the diabetic workers use both drugs and diet in the management of their diabetes. Our study revealed that oil and gas company workers are aware of their diabetic condition, though the scope of this study did not cover the extent of knowing and how early they found out about their conditions in order to manage their diseases appropriately to avoid complications. Furthermore, early detection and management of diabetes mellitus reduces complications [32]. This is consistent with [33], who believes that people with undiagnosed diabetes mellitus suffer more from a variety of complications. Similarly, we also discovered that (27.68%) of diabetic workers have family histories of diabetes. This finding is similar to that obtained by [36], among civil servants in Oyo state, who discovered that (25.1%) of those with diabetes had a family history of diabetes. This is also consistent with the findings of a study conducted by [37], among civil servants in Onitsha, which found that 28.0 percent of those with diabetes have a family history of diabetes. It is worth noting that, family history can be a significant independent risk factor for diabetes [10], also opined that 40% of offspring developing diabetes have a family history of diabetes. Although, in our study the crude odd ratio (COR 2.08(1.19-3.64)0.010) showed an association of diabetes but after adjusting for confounding variable the Adjusted Odd Ratio (AOR 2.70(0.94- 7.72)0.064) showed no association, the reason for this could be the confounding variables in the study. Diabetes complications are reduced when diabetes is detected and treated early, so this is an important factor to consider [32]. Our study found that diabetic workers use drugs, diet, and physical activities to manage their condition, with a higher proportion of diabetic workers (34.34%) combining drugs, physical activities, and diet to manage their conditions, indicating that they have a good understanding of the treatments needed for their health. This is in contrast with the study carried out by [38], among community members of Bale zone in south east Ethiopia which revealed that diabetic participants had good knowledge of the treatment modalities for diabetes. The findings were supported by the finding of [39], which revealed that the respondent have good knowledge of insulin injection(57.32%) practicing healthy diet(56%) were proven ways of controlling and managing diabetes Factors associated with diabetes among the workers shows that 7.55% of the respondent's smoke and majority of the respondents that smoked started it about 1-5years ago. (20.83%) of the respondents that are diabetic smoked. Binary logistic regression showed that there was no statistically significant association between smoking and the occurrence of diabetes in our study. This study is consistent with the study of [10], in Port Harcourt among adults which also showed that there was no association between smoking and diabetes our findings contradict those of [40], in a cross- sectional study on the association of smoking and nicotine dependence with

prediabetes in young and healthy adults, who found an OR of 1.82 (95% CI 1.39;2.38) after adjusting for multiple confounders and potential mediators [41], in his study on smoking, smoking cessation, and the risk of type 2 diabetes mellitus. The reason for this association is unknown, but the study's small sample size and population must have played a role, as the study only included smokers. Heavy alcohol consumption has been linked to an increased risk of diabetes. This could be due to hepatic and/or pancreatic damage [42], as cited in [10]. Drinking alcohol moderately has been known to reduce the risk of diabetes as some studies suggest that it improves insulin sensitivity [43]. In [10], this and many more factor would have contributed to the non-association of alcohol with the risk of diabetes as seen in our study as (48.21%) of workers who indicated that they take alcohol prefers wine, a greater proportion of (30.82%) rarely takes alcohol and (30.19%) never takes alcohol. A cross sectional study by Ahmed on diabetes and hypertension among expatriate workers recorded a direct association between smoking and the occurrence of diabetes mellitus. A cross- sectional study conducted by [43], also found that moderate alcohol consumption has a 40% reduction in the risk of type 2 diabetes. He also discovered that drinking wine rather than beer or spirits was associated with a lower risk of diabetes. Because most workers who consumed alcohol in our study preferred wine, this must have necessitated the non- association of alcohol with the occurrence of diabetes as noted in our study.

Most studies have indicated an association between sedentary behaviours and the risk of the occurrence of diabetes. (44)In his study on reducing the risk of non-communicable disease in petroleum industry workers, he discovered a (36%) prevalence of sedentary behavior in the occurrence of diabetes mellitus after controlling for age, BMI, and exercise as confounding variables that would have affected this association. He also mentioned that breaking up long periods of sitting at work with active community participation stimulates cardiovascular function. This result is in line with what was obtained in our study as there was no significant relationship between sittings on a spot for long with the occurrence of diabetes as obtained in other studies. The reason for this is not known. Further research would prove valuable in this context. In our study, (35.22%) of workers have a diabetic family member, and 27.68 percent of the diabetic workers have a family history of diabetes. The crude odd ratio (COR 2.08(1.19-3.64)0.010) indicates that there is an association between family history and the occurrence of diabetes; however, after controlling for confounding variables, the (AOR 2.70(0.94-7.72)0.0641) does not show a significant association in the occurrence of diabetes. The reason for this non- association is not known, but, many factors which may include bias in the study might have necessitated the non- association in the adjusted odd ratio. Our study is in line with the study conducted by [36], that reported a (25.1%) of the respondents having

family members that Have suffered from diabetes [37], as he had (28%) of his respondents having family history of diabetes in a study he conducted among civil servants in Onitsha. Although these studies did not go further to investigate if having a diabetic family member is associated with the occurrence of diabetes as seen in the AOR of our study.(11.93%) female workers gave birth to babies weighing more than 4kg at birth and 27.68% of the women are diabetic. A P-value of (0.004) was gotten but after adjusting for potential confounding variables, the adjusted odd ratio became (AOR 4.79(1.34-17.11)0.016) which also proved to be significantly associated with the occurrence of diabetes mellitus. Our findings also revealed that women that gave birth or have given birth to babies weighing more than 4kg 4(9.76%) with a normal weight, 4(10%) overweight and 5(19.23%) were obese our study is related to a prospective cohort study conducted by [45], from eleven single institutional obstetric cohorts in Friuli Venezia Giulia a region of North Eastern Italy on the role of gestational diabetes, pre-pregnancy body mass index and gestational weight gain on the risk of newborn macrosomia. This study discovered that obese women are more likely to develop offspring macrosomia with a 1.7- fold risk increase when compared to women who are normal weight. Although, in their study overweight women did not show any form of increased risk of giving birth to microsomal. Also, another study by [46], in a retrospective review among Caucasian patient on the effect of pre-pregnancy body mass index and weight gain during pregnancy on perinatal outcome in glucose tolerant women also confirmed a greater frequency of microsomal in women with pre-pregnancy BMI$\geq$30kg/m2). It is clearly shown in our study that obese women 5(19.23%) gave birth to more babies weighing 4kg at birth, followed by the overweight women. Although this maternal BMI did not show any significant association in the occurrence of diabetes P(0.590) but other studies like that conducted by Alberico, have showed an association of Obese women giving birth to babies weighing more than 4kg at birth. This and many more factors might have brought about the significant association with women that has given birth to babies weighing more than 4kg at birth with the risk of the occurrence of diabetes, which could be obese or over weight and must have led to the birth of macrosomia and if they are obese it presents another risk of diabetes in the future. Although our study did not check the BMI of these women before pregnancy or while they were pregnant as it was beyond the scope of this current study, this would have given a clearly picture of why the relationship or significant association was noticed in our study. The post pregnancy BMI that was used to derive this association is not comprehensive enough to give the desired answer to answer all the questions that may arise as regard the significant association that was notice in women that have given birth to babies weighing more than 4kg at birth in which their BMI did not also show any significant association. More research in this area will better proffer answers to questions in the areas this present research could not cover.

CONCLUSIONS

Despite the limitations encountered in the course of this research on diabetes and its associated factors among oil and gas company workers in Port Harcourt. Diabetes has continued to be a burden in the general Nigerian population affecting almost all regions of the country [47]. Our study has pointed out a high prevalence of diabetes, a poor dietary habit, a poor nutritional status and poor treatment modalities adopted by the diabetic workers in the management of their conditions. Although some studies have recorded a relatively low prevalence and others have recorded a high prevalence which could be attributed to divergent factors. However, the prevalence of diabetes in similar population of oil company workers also showed a higher prevalence. This suggest that risk factors of diabetes, especially the modifiable risk like dietary habits, obesity, lack of physical inactivity can predispose the workers to diabetes and this risk factors should not be overlooked by the workers. The findings from this study sets the pace for future research that will be carried out in this population on diabetes and evidence from our research can further be researched and improved on.

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