

**International Journal of TROPICAL DISEASE
& Health**

16(4): 1-11, 2016, Article no.IJTDH.25873
ISSN: 2278-1005, NLM ID: 101632866

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Workplace Assessment of Hypertension: Prevalence and Awareness in a Food Processing Industry in Owerri Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author CCO designed the study, carried out site visits, computational aspects, wrote the protocol and the first draft of the manuscript. Author ILN served as main supervisor of the study, provided guidance on data collection, analysis and modeling, confirmed the accuracy of the results and documentation. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2016/25873

Editor(s):

- (1) Akihiro Asakawa, Kagoshima University Graduate School of Medical and Dental Sciences, Kagoshima, Japan.
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(2) Anonymous, Hamdard University, Karachi, Pakistan.
Complete Peer review History: <http://sciencedomain.org/review-history/14565>

Original Research Article

Received 22nd March 2016
Accepted 2nd May 2016
Published 11th May 2016

ABSTRACT

Workplace health assessment is the process of gathering information about the factors that support or hinder the health of employees at particular opportunities to improve or address them. It helps to identify the current picture of health at a company as well as improve potentials to increase productivity, decrease absenteeism and health cost for both employees and the organisation. This study was designed to determine the prevalence and awareness of hypertension among food processing industry workers. The prevalence was determined as a rate and reported in percentage as 48.6%. The awareness among workers was determined using the Kendall's W coefficient of concordance. A total of 107 workers were physically and anthropometrically assessed with respect to blood pressure, fasting blood sugar, waist circumference, weight, height, and body mass index. Data on sex, age, etc, were equally obtained. The Kendall's W Statistic was 0.5235 (52.35%) on awareness of hypertension. This implies that there was an agreement of about 52.35% on awareness of hypertension. The high prevalence of hypertension with a relatively average

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awareness among food processing industry workers strongly suggest that there is paucity of Occupational health services in the manufacturing industry.

Keywords: Workplace, hypertension, prevalence, awareness, kendall's statistic, food industry.

1. INTRODUCTION

The process of gathering information about the factors that support or hinder the health of employees may be taken as workplace health assessment [1]. This process helps to identify the state of health of employees and increase the potential for productivity, decrease absenteeism, and health care cost for the organisation. Definitely, health assessment of employees, results in higher productivity and reduced number of missed work days, thus, a savings in organisational healthcare. The following steps, allocation of resources, adoption of strategies, implementation of intervention(s) and measurement of outcomes may be necessary before goals are developed.

Hypertension is the most common cardiovascular disorder posing a major clinical and public health challenges worldwide because of its high prevalence and concomitant increase risk of diseases [2]. It is the most important risk factor for cardiovascular, cerebrovascular and renal diseases. It remains a public health epidemic and appropriately 4 in 10 adults [3]. Hypertension is the cause of estimated 9.4 million deaths and the cause of 50% of heart diseases and renal failure [3]. There is a double burden of communicable and chronic non-communicable diseases due to epidemiological transition. Nigeria and other Sub-Saharan African countries are undergoing epidemiological transition [4]. Globalization, the changing demographic dynamics, affluence and the pattern of food consumption are responsible for the trend. There is also a global inertia to curtail the rising trend as seen by the lack of establishment of occupational health services in the industries [5].

Many workers with hypertension are unaware of their condition and among those with hypertension medical adherence is lacking. The prevalence of hypertension varies around the world with the lowest prevalence in rural India (3.8% in men and 6.8% in women) and the highest prevalence in Poland (68.9% in men & 72.5% in women). Hypertension may cause prolonged employee absence, compromised concentration and work performance due to its accompanying symptoms. Employee's health directly affects the company's productivity. It is

very important for employers to have a proactive approach in keeping their workers blood pressure regulated. Researchers have shown that employees that suffer from chronic diseases like hypertension always experience unscheduled absences from their job. Unscheduled absences are disruptive to the business and result in increased indirect costs of absenteeism. Companies lose approximately 2.8 million workdays a year because of injuries and illnesses in the United States. This leads to decreased productivity, burden on society and a social cost of enormous productions [6]. Other manipulations of absenteeism include loss of productivity, high - cost of replacement of workers, excess staffing, higher turnover, poor quality of goods and services, excess manager time and safety issues.

The trend is that there is a paradigm shift to prevent, protect, promote and maintain health in the work place. Occupational health has shifted in bringing the well being of workforce as this will impact positively to both employees and employers [7]. Workplace is not only a setting to practice health promotion but a key determinant of health. This necessitates the need for a comprehensive workplace health promotion (CWHP) which is an approach to protecting and enhancing the health of employees. It relies and builds upon the efforts of employers to create a supportive management via the efforts of employees to care for their own wellbeing.

1.1 Justification of the Study

In 2008, globally 40% of adult aged 25 years and above had been diagnosed with hypertension. The number of people with the condition rose from 600 million in 1980 to 1 billion in 2008. The WHO Health Report 2002 indicates that hypertension caused 7.1 million premature deaths worldwide and 4.5% of the disease burden. (i.e. 64 million disability adjusted life years (DALYS)). In the United States, about 77.9 million (1 out of 3) adult Americans have high blood pressure, 69% of people who are hypertensive have heart attack, 77% have stroke and 4% have congestive heart failure. High blood pressure was listed in death certificates as the primary cause of death of 61,762 Americans in 2009 [8].

The prevalence of hypertension is highest in the African region at 46% of adults aged 25 years and above. While lower prevalence of 35% was found in the Americans. High income countries have a lower prevalence of hypertension, 35% than other groups at 40%. Furthermore, because of weak health systems, the numbers of people with hypertension who are undiagnosed, untreated and uncontrolled are also higher in low and middle income countries compared to high income countries. Hypertension shows an increasing prevalence worldwide with increasing predisposing obesity and physical inactivity. Hypertension constitutes 25% of emergency medical admissions in Nigeria. It is the medical condition most frequently diagnosed in elderly Nigerians [9]. It is also the most common condition in senior executives and army recruits Autopsy reports reveal that hypertension is the most common cause of sudden death.

Studies in Nigeria gave a prevalence rate of 11.5% using the then recommended cut off of 160/95 mm hg. By extrapolation using the current WHO/ISH cut off of (140/90 mm hg) this would give a prevalence of about 20%. Emerging data appear to confirm an upward trend [3]. Only about a third Nigerians who have hypertension are aware of their conditions. The awareness appears to be higher in female than male and of those that are aware that they are hypertensive only two-thirds are on treatment.

Premature death, disability, personal and family disruption, loss of incurred health care expenditures due to hypertension takes a toll on

families, communities and national finances. Families face huge health care expenditures, which is often long term in the case of hypertension complications, pushing tens of millions of people into poverty. More so, the loss of family income from death or disability can be devastating. In certain low- and middle- income countries, current health expenditure on cardiovascular diseases alone accounts for 20% of total health expenditure.

2. METHODOLOGY

2.1 Study Area

The study area is Owerri, the capital of Imo State, Nigeria. Situated at latitude 5.48°, longitude 7.03°. The city is located in South-East of Nigeria and it is a part of the Niger-Delta, home of oil and gas activities in Nigeria (see Fig. 1). It has an estimated population of about 400,000 people as at 2006 census. It is approximately 100 km² in area [10]. The Otamiri River surrounds Owerri by the east while Nworie River is to the south [11].

2.2 Study Site

The study site was Rapido Foods, a subsidiary of Rapido Ventures Limited located at km 5, Uratta/MCC Road, Umuoba, Owerri. It was established in 2011 with the purpose of investing in processed food production and agriculture. The processed food production focuses on quality products meeting accepted international standards with hygienic processes as priority.

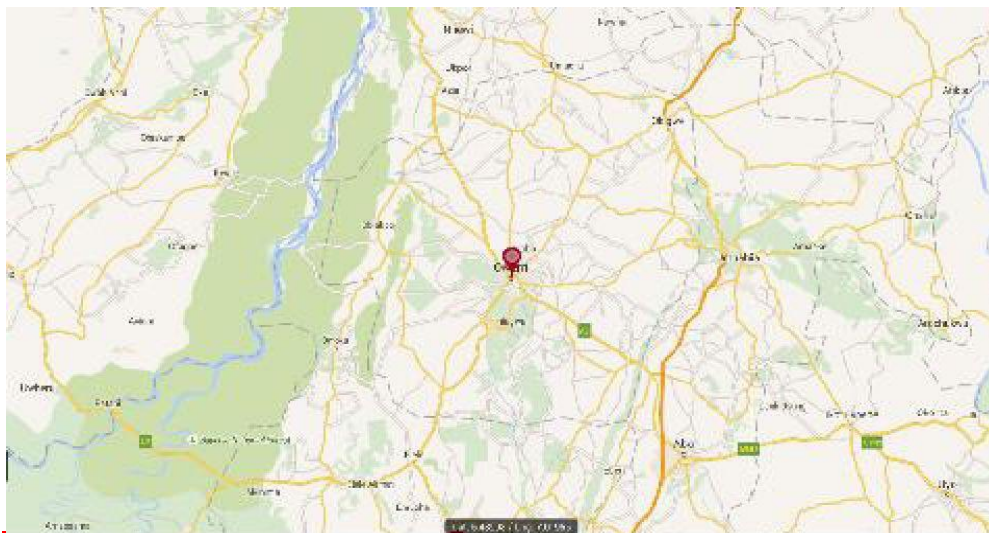


Fig. 1. Map of study area, Owerri Nigeria
Source: Google map, 2015.

The Rapido Foods has several departments including Quality Assurance, Administrative, Accounts, Business Development, and Production. They are the makers of Fibi beef roll. It is known for excellence and best industry practice. They employ the principles of Hazard Analysis and Critical Control Points (HACCP) System in which products are monitored from production processes in all factories for compliance to Good Manufacturing Practices (GMP). They ensure good management of the interface between the customers/consumers during handling, distribution and storage with respect to product quality issue. Rapido Foods employs the use of high-tech, strongly built, elegant and high degree reliable ISO 9001-2000 certified standard Baking Oven B – 2200 and industrial ovens with sophisticated, computerized and programmable controller. Their brand of beef sausage is Fibi and is set to bring a whole new excitement in taste to consumers. The management of Rapido Foods believes that Fibi sausage roll is well articulated initiative to satisfy the yearnings of millions of Nigerians who consistently seek value in the consumption of packaged foods. They maintained that Fibi beef sausage roll comes with a distinctive blend of natural beef, yummy texture and nourishing ingredients with pure Nigerian spices that distinguishes Fibi from other brands of beef sausage roll in the market.

2.3 Population for the Study

The study population comprised of employees in the selected industry who met with the inclusion criteria. The company's registers were used to determine the population/sampling frame.

2.4 Inclusion Criteria

The criterion includes employees of Rapido Food (of Rapido Ventures Limited) who are aged 18 years and above, who gave their informed written consent for the study.

2.5 Exclusion Criteria

The criteria excluded pregnant employees and those with physical deformities affecting the spine and/or deformities that could not stand for height and weight anthropometric measurements.

2.6 Sample size Estimation

The sample size estimation was made using the prevalence formula:

$$N = \frac{Z^2 P(1-P)}{T^2} \quad (1)$$

Where T = tolerance error (0.05); P = prevalence from a previous study [12]; and; z= 1.96, that is the level of significance (standard normal deviate) which corresponds to 95% confidence level.

Substituting the applicable parameters to Equation (1):

$$N = \frac{1.96^2 \times 0.07(1 - 0.07)}{0.05^2} = 100.03$$

The sample size was obtained as 100, and given attrition rate of 10% a sample of 110 workers was obtained.

2.7 Sample Techniques

A Stratified random method was used to obtain a representative sample based on the inclusion criteria; each job description in the organization was regarded as a stratum.

2.8 Methods of Data Collection

2.8.1 Training of research assistants

Health care professionals (5) were recruited for the purpose of data collection. They were tested and certified for data collection.

2.8.2 Participants

A total of one hundred and ten questionnaires were distributed and one hundred and seven were properly filled and returned giving a response rate of 97.3%. The reason for default may have been due to apathy on the side of the defaulters. Age distribution and gender of participants are as summarised in Table 1.

2.8.3 Questionnaire

Two types of questionnaires were designed. The first part addresses the background information of the participants with respect to age, gender, job title and address. Part 2 of the questionnaire is of ten questions designed to assess the level of awareness amongst workers on hypertension. The questionnaire is of interviewer– administered and has five options, namely: Strongly Agree, Agree, and Disagree or strongly disagree.

Table 1. Employees' age distribution for rapido food industry

Age group	Male		Female		Total
	Respondents	Proportion (%)	Respondents	Proportion (%)	
15 - 24	0	0	1	2	1
25 - 34	12	22	6	11	18
35 - 44	29	53	27	52	56
45 - 54	12	22	14	27	26
55 - 64	2	3	4	8	6
Total	55	100.0	52	100.0	107

The pretesting of the questionnaire was done internally at the Centre for Occupational Health, Safety & Environment, University of Port Harcourt, Rivers State (COHSE) and externally at the Rapido Foods Limited, Owerri. Five staff of the COHSE, Port Harcourt was randomly selected for pretesting of the questionnaire and five workers from the Rapido Foods Limited, Owerri were equally used. The pretesting was done to assess the applicability of the Questionnaire tool internally and externally. All the participants used for pretesting of the Questionnaire instrument gave valid and reliable responses, confirming the clarity and applicability of the questionnaire tool, and questions were interpreted with the same meaning as intended. The questionnaires were administered by the recruited and trained five Research Assistants. The basic demographic variables of age, and gender were also documented and the physical anthropometric measurements were also recorded.

2.8.4 Blood pressure measurements

Blood pressure readings were based on the Seventh Report of the Joint Committee on Prevention, Detection, Evaluation and Treatment of high Blood Pressure, Classification and Guidelines [13].

2.8.5 Operational definitions

The authors defined hypertension as a systolic and/or diastolic blood pressure ≥ 140 per 90 mmHg or documented use of antihypertensive medications in previously diagnosed individuals with hypertension [13].

2.9 Data Analysis

The prevalence of hypertension was determined as a rate and expressed in percentage. The Blood Pressure measurements were based on the Seventh Report of the Joint Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, Classification and

Guidelines. The level of awareness was determined using the Kendall's test of concordance, a non-parametric statistic (*W*). It is a normalization of the statistic of Friedman test and can be used for assessing agreement among raters [14]. Its value ranges from zero (no agreement) to unity (complete agreement). In other words, if *W* is 1.0, then the survey respondents have unanimous response. If *W* is zero, there is no overall trend of agreement among respondents and their responses can be regarded as random.

However intermediate values of *W* indicate high or low degree of unanimity among the various responses [14].

Consider an object *i* given a rank r_{ij} , if by respondent member *j*; and we further assume that there were a total of *n* objects and *m* respondents. Then the total rank given to object *i* is:

$$R_i = \sum_{j=1}^m r_{ij} \tag{2}$$

and the mean value of these total ranks is:

$$\bar{R} = \frac{1}{2} m(n+1) \tag{3}$$

The sum of squared deviation, S_d is given as:

$$S_d = \sum_i^n (R_i - \bar{R})^2 \tag{4}$$

Kendall's *W* statistic is defined as:

$$W = \frac{12S_d}{m^2(n^2 - 1)} \quad 0 \leq W \leq 1 \tag{5}$$

Computing Kendall's *W* coefficient/statistic for workers in the Study group

Given that *m*=107, *n*= 10, thus Equation (2) gives:

$$\bar{R} = \frac{1}{2} m(n + 1) = 0.5 \times 107 (10 + 1) = 588.5$$

Table 2. Kendall’s parameters on workers awareness on hypertension in the industry

Parameters	R _i	Mean	(R _i - \bar{R}) ²
AW – HYP -1	395	3.6916	37442.25
AW – HYP – 2	323	3.0187	70490.25
AW – HYP – 3	355	3.3178	54522.25
AW – HYP – 4	341	3.1869	61256.25
AW – HYP – 5	370	3.4579	47742.25
AW – HYP – 6	392	3.6636	38612.25
AW – HYP – 7	396	3.7009	37056.25
AW – HYP – 8	401	3.7477	35156.25
AW – HYP – 9	309	2.8879	78120.25
AW – HYP – 10	404	3.7757	34040.25
			\sum 494438.5

The sum of the squared deviation (see Equation 3) becomes:

$S_d = \sum_i^n (R_i - \bar{R})^2 = 494438.5$ (see Table 2 above), and Kendall’s W statistic becomes:

$$W = \frac{12 \times S_d}{m^2 n(n^2 - 1)} = \frac{12 \times 494438.5}{107^2 \times 10(10^2 - 1)} = 0.5235 = 52.35\%$$

The Kendall’s W statistics was 0.5235 (52.35%) among the number of sampled workers in industry under study. This implies that there was an agreement of about 52.35% on the awareness of hypertension. The range distribution for systolic blood pressure was from 100 to 260 mmhg, diastolic blood pressure was from 40 to 220 mm Hg, fasting blood sugar was from 73 to 144 mg/dl, waist circumference was from 51 to 106 kg, height was from 1.5 to 1.87 m and BMI was from 19.59 to 3.6.26 kg/m², respectively.

3. RESULTS AND DISCUSSION

3.1 Results

One hundred and seven (107) employees who scaled through the inclusion criteria were physically examined, and subsequently, questionnaires were administered to them. The distribution of the measured variables for the employees and the control group are as presented in Tables 3 & 4. The mean waist circumference (WC), Systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood sugar (FBS), Height (H), body mass index (BMI) and Weight (W) of the respondents are as

shown in Table 3. The mean and modal distributions of measured variables (SBP, DBP, FBS, WC, W,H and BMI.)

3.1.1 Risk factor analysis

The under study were subjected to risk of hypertension, diabetes and obesity analyses. The result showed that 14 out of 107 workers representing 13.1%, fifty two workers representing 23.4%. 25 respondents representing 23.4% sampled population were at risk of developing hypertension, diabetes and obesity, respectively (see Fig. 4).

The systolic blood pressure of the workers in the company were compared with the control group. The systolic blood pressure of the control group were in correspondence with those of the respondents (Figs. 5 & 6)

The prevalence of hypertension among study population was 48.6%. The level of awareness on hypertension was 52.35%. The modal age of workers in the food processing industry was 35 – 44 years while the modal age of the control group was 25 – 34 years.

3.2 Discussion

The modal age bracket in the study group was 35 – 44 years, whereas that of the control group was 25 – 34 years. Thus, there are younger workers in the control group. This is in conformity with risk factor analysis because epidemiologically, age is a risk factor for the development of hypertension. According to [2], who used multivariate logistic regression analysis

on pooled data from five cities, after adjustment for age, showed that age was strongly associated with hypertension. Both the systolic and diastolic blood pressure measurements of the workers were in correspondence with those of the control. The prevalence of hypertension is highest in the African region at 46% of adults aged 25 years and above. While lower

prevalence of 35% was found in the Americans. High income countries have a lower prevalence of hypertension, 35% than other groups. Furthermore, because of weak health systems, the number of people with hypertension who are undiagnosed, untreated and uncontrolled are also higher in low and middle income countries compared to high income countries.

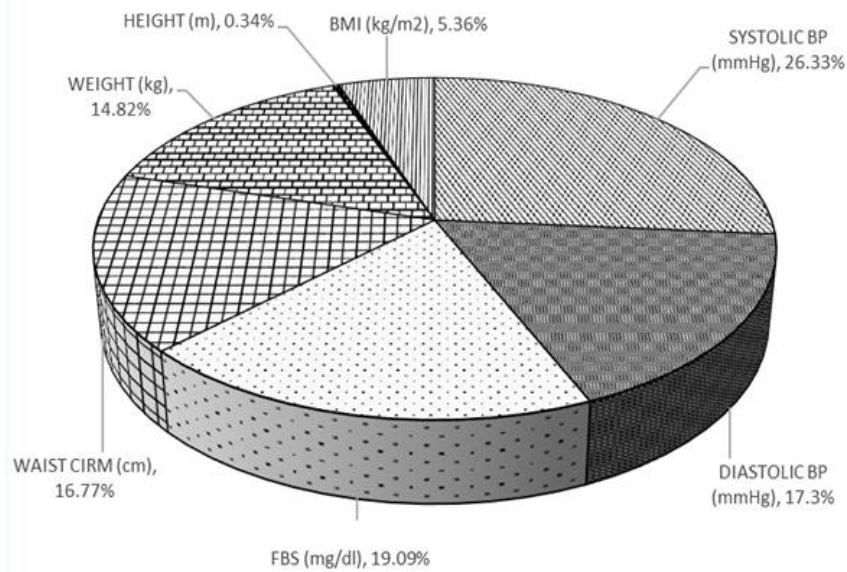


Fig. 2. Mean distribution of measured variables

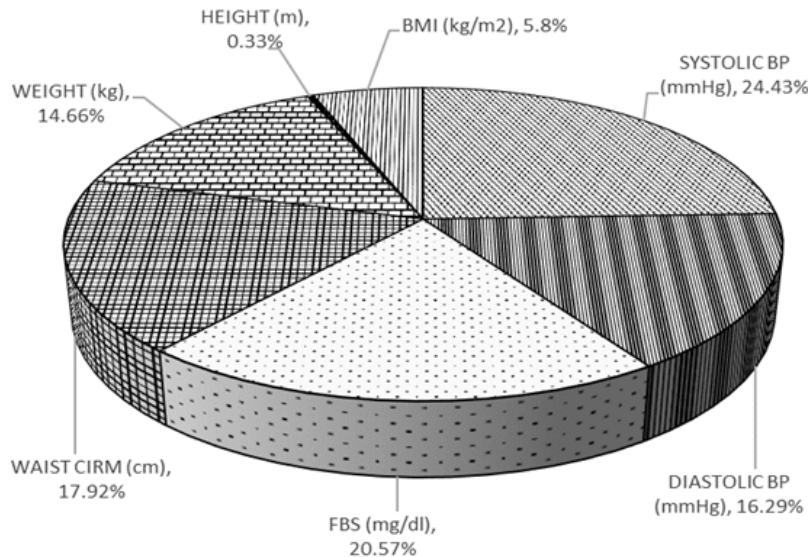


Fig. 3. Modal distribution values for measured variables

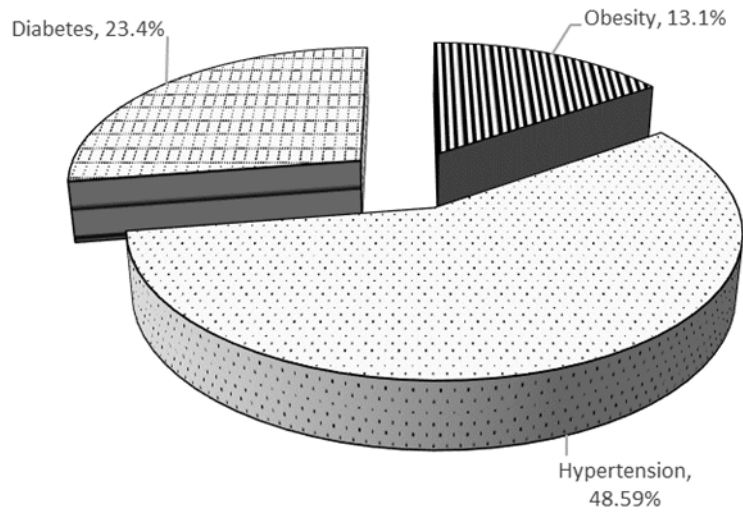


Fig. 4. Risk factor analysis

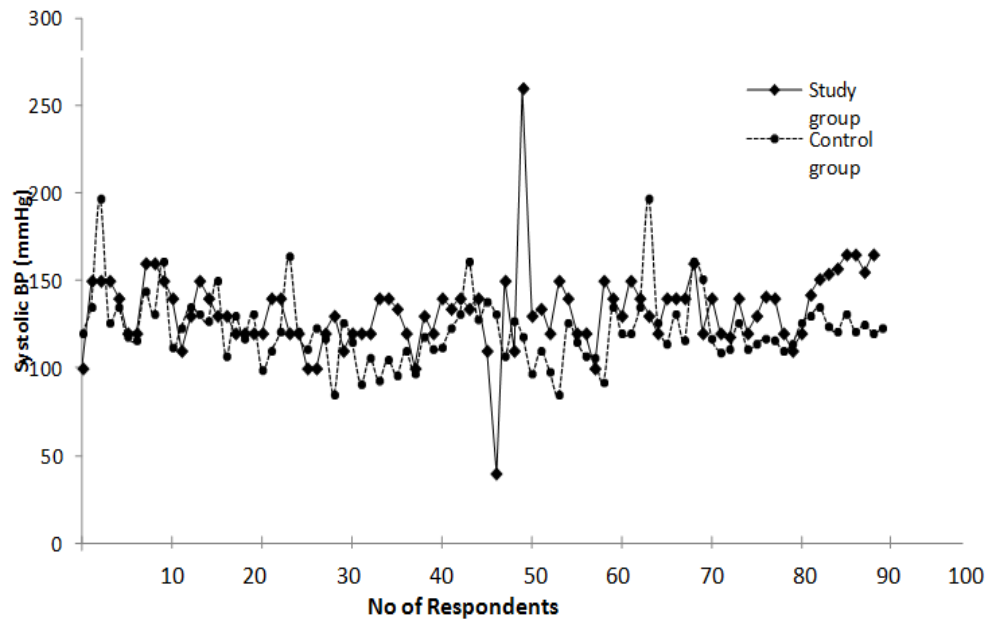


Fig. 5. Systolic blood pressures against the respondents in industry

Hypertension shows an increasing prevalence worldwide with increasing predisposing obesity and physical inactivity [15]. The prevalence of hypertension among the study population was 48.6%. This is higher than 12.4% reported among bankers in Owerri [16], A prevalence of hypertension of 32.5% was reported among middle-aged adults in Ahiazu Mbaise local government area of Imo State, Nigeria [17]. In a study carried out in Nsukka, Enugu State, the

prevalence of hypertension was reported to be 21.1% [18]. Hypertension shows an increasing prevalence worldwide with increasing predisposing obesity and physical inactivity. The high prevalence of hypertension reported in this study implies a high cardiovascular risk factors and carries a lot of morbidity at workplace. This could impact negatively on work performance, increase absenteeism and poor productivity.

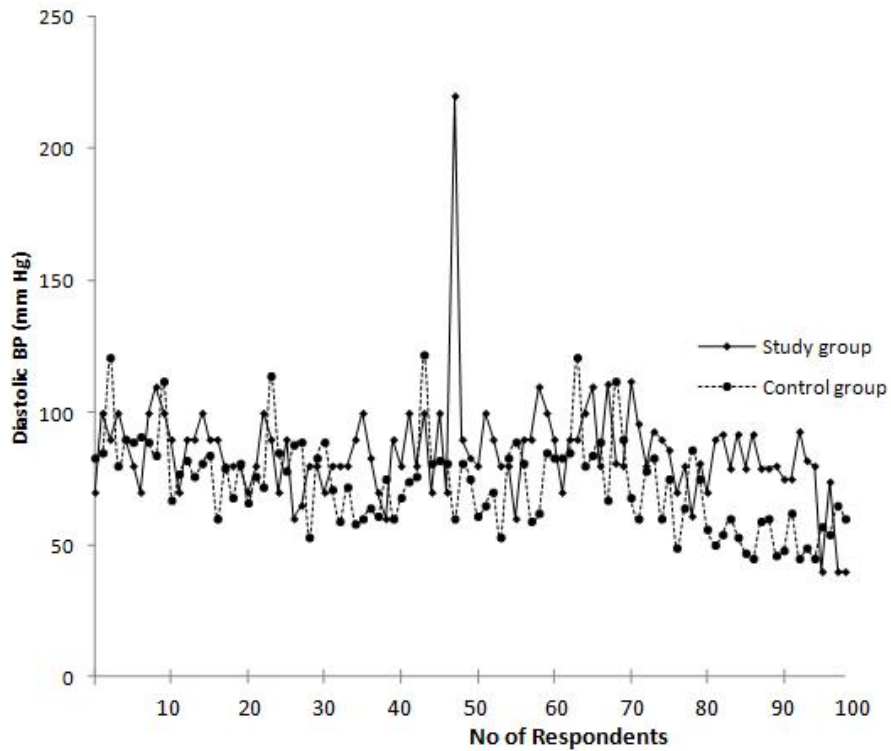


Fig. 6. Diastolic blood pressures against the respondents in industry-1 & 2

Table 3. Descriptive statistics for respondents in the study group

Descriptive statistics	Systolic BP (mmHg)	Diastolic BP (mmHg)	FBS (mg/dl)	Waist cirm (cm)	Weight (kg)	Height (m)	BMI (kg/m ²)
Mean	130.1	86	94	83	73	1.7	26.5
Median	130	82	91	86	72	1.7	26.4
Mode	120	80	101	88	72	1.6	28.5
Standard deviation	20	20	16	16	11	0.1	3.4
Standard error	2.0	2	2	2	1	0.01	0.3
Standard variance	380.6	381	260	251	118	0.01	11.8
Kurtosis	17	21	3	3	1	-0.3	0.50
Skewness	2.7	3	2	-1	0.30	-0.05	0.65
Range	160	180	71	106	55	0.4	16.67
Minimum	100	40	73	9	51	1.5	19.6
Maximum	260	220	144	115	106	1.9	36.23
Sum	13922	9149	10092	8865	7833	177.8	2833.77
Count	107	107	107	107	107	107	107

The awareness of hypertension among population using the Kendall's coefficient of concordance was found to be 52.35%. This is an improvement to the 33.33% reported by

WHL/ISH [3]. In a study carried out among staff and students of a tertiary institution in Nigeria, an awareness of 21.6% was reported [19; 20].

Table 4. Descriptive statistics for workers in the control group

Descriptive statistics	Systolic BP(mmHg)	Diastolic BP(mmHg)	FBS (mg/dl)	Waist cirm(cm)	Weight (kg)	Height (m)	BMI (kg/m²)
Mean	123.8	79.8	81.4	76.8	67.8	1.7	23.3
Median	120	81	81	76	69	1.7	23.1
Mode	131	83	72	85	71	1.73	21.3
Standard deviation	22.3	15.3	10.5	10.1	12.6	0.09	3.7
Standard error	2.2	1.5	1.0	1.00	1.2	0.01	0.4
Standard variance	497.8	232.9	109.2	101.7	159.0	0.01	13.8
Kurtosis	2.8	1.3	-0.7	1.1	0.2	-0.2	0.12
Skewness	1.3	0.9	0.4	-0.3	0.4	0.2	0.31
Range	11	69	43	55	62	0.4	18.9
Minimum	85	53	61	49	42	1.5	15.8
Maximum	197	122	104	104	104	2	34.8
Sum	12871	8299	8463	7988	7055	177.3	2424.9
Count	104	104	104	104	104	104	104

4. CONCLUSION

This study has demonstrated a high prevalence of hypertension. Unexpectedly, there is a relatively high level of awareness of hypertension among the food processing industry workers. The underlying explanation for this phenomenon is paucity of occupational health services in the food processing industry. There are virtually non-existent health protection, promotion, preventing, rehabilitating program in the industry. The following are the summary of major findings:

- i) The prevalence of hypertension in Owerri population is 48.6%;
- ii) The level of awareness of hypertension among the food processing industry workers is 52.35%; and
- iii) The risk factor of developing hypertension amongst industry workers examined is 23.4%.

5. RECOMMENDATION

As a result of this study, the following recommendations are made:

- i) There is need to provide effective occupational health services through the provision of a well-articulated company policy. For good occupational services to be realized, top management must show leadership and commitment;
- ii) Occupational Health Programme must be instituted. It has the potential of preventing and controlling hypertension, thus promoting a healthy workplace and consequently increased productivity;
- iii) The Occupational Health Services (OHS) should be able to maintain health

surveillance which enables the identification of those employees likely to be at risk from occupational ill-health; and
iv) The Dietary Approach to Stop Hypertension (DASH) diet plan and the Medical Nutrition Therapy are advocated as they help in control of hypertension.

ETHICAL APPROVAL

Ethical certificate was obtained from the Ethics Committee of the industries. Informed written consent was also obtained from the workers who participated in the study.

ACKNOWLEDGEMENT

This work is supported by TETFund for the MSc/PhD programme of Charles C. Onoh. This is a kind of scholarship for academic staff development as approved by the Vice Chancellor, Federal University of Technology, Owerri, Nigeria. The authors are delighted and will ever remain grateful.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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