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Original Research Article

Evaluation of the Cardiopulmonary Profile of Bakery Workers in Port Harcourt

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Abstract: Heart attacks, strokes, and sudden cardiac death can be avoided by routinely evaluating the cardiopulmonary profile, which includes the integrated function of the heart, lungs, and vascular system. Thus, the present study evaluated the cardiopulmonary profiles of traditional and industrial bread bakers resident in Port Harcourt. The present study adopted the survey-based cross-sectional approach to evaluate the cardiopulmonary profiles of traditional and industrial bread bakers resident in Port Harcourt. The quantitative data obtained from the study were statistically analysed using version 25.0 of the IBM Statistical Product and Service Solutions (SPSS) software. The present found that the age of the bakers and their non-baker counterparts ranged from 36.8 to 39.70 years; thus, implying a relatively young set of people make up the workforce in the bread baking industry. On BMI changes, the stud noted that the industrial bakers had significantly (p<0.05) elevated level when compared to those of non-bakers and traditional bakers. Only On the blood pressure profile, systolic blood pressure (SBP) of the bakers did not vary significantly (p>0.05), it was recorded here that, the value for the traditional bakers was the most marginally raised. The ECG findings on the bakers in the present study revealed that 60% of each of the traditional and industrial bakers presenting with sinus rhythm with abnormal findings ranging from left axis deviation, left/ or ventricular hypertrophy, incomplete right bundle branch block, left axis, deviation to clockwise QRS rotation. On the pulmonary profile screening, the mean FVC, FEV1 and FEV6 levels showed significant (p<0.05) reduced in the bakers. The traditional bakers even had much more significantly (p<0.05) lower levels of the parameters when compared to those of the industrial bakers. Thus, the bakers may need health education on the use of personal protective equipment and good health seeking behaviours to avert cardiopulmonary crisis.
Keywords: Occupational Health Risk, Blood Pressure, Bread Bakery Workers, Cardiopulmonary.

INTRODUCTION

In order to detect underlying heart conditions that may cause sudden cardiac death (SCD) and other related incidences, it is essential to regularly assess the cardiopulmonary profile (Sen-Chowdhry & McKenna, 2006; Yousuf *et al.,* 2015), which includes electrocardiography (ECG), echocardiogram, and, in unique cases, exercise testing or cardiac Magnetic Resonance Imaging (MRI) (Santoro *et al*., 2019; Del Punta *et al*., 2023). Regular heart check-ups are especially important for individuals with risk factors for heart disease, such as high blood pressure, high cholesterol, diabetes, obesity, smoking, or a family history of heart disease (Park *et al*., 2021). Indeed, these individuals may benefit from more frequent screenings and interventions to prevent or manage heart disease (Laukkanen *et al.,* 2004; Berger *et al*., 2010).

Now, considering the business of bread baking, it is understood that the process of mixing bread dough comes with a chemical hazard caused by metal-contaminated materials (Maher & Nowak, 2022; Magnattack, 2024). This risk is accompanied by another which in the process of receiving cheese, sausage where biological hazards in the form of *Escherichia coli* bacteria is involved and lastly, in the cooling process of the baked bread before packaging is associated with physical hazards in the form of dust and dirt (Henroid Jr, & Sneed, 2004).

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Further, the degree of automation, production scale, and regulatory monitoring all play a major role in the huge differences in baking hazards between industrial and local (artisanal) contexts (Aguwa *et al.,* 2014; Bonsu *et al.*, 2020). Although fire, heat, and flour dust are common hazards in both settings, industrial settings are more dangerous due to sophisticated machinery, while local bakeries are more dangerous due to poor infrastructure, manual handling, and poor sanitation (Aguwa *et al.*, 2014; Bonsu *et al.*, 2020).

Consequently, the present study evaluated the cardiopulmonary profiles of traditional and industrial bread bakers resident in Port Harcourt.

MATERIALS AND METHODS

Study Design
The present study adopted the survey-based cross-sectional approach to evaluate the cardiopulmonary profiles of traditional and industrial bread bakers resident in Port Harcourt.

Study Area
Port Harcourt is the capital and largest city in Rivers State and it is a bustling metropolis in Nigeria's Niger Delta. The city, which has a rich cultural history and a fast-expanding population, is situated along the Bonny River (Archibong, *et al.,* 2004; Encyclopædia Britannica, 2026). The population of Port Harcourt's urban area increased from 1.38 million in 2006 to 1.87 million in 2016, according to the National Population Commission. The city ranks as Nigeria's fifth-largest metropolis after Lagos, Kano, Ibadan, and Kaduna.

Study Population
The population of this study included 60 adults within the age range of 20 and 55 years. They were made up of non-bakers, traditional bakers and industrial: 20 traditional bread bakers, 20 industrial bread bakers, who are resident in Port Harcourt Metropolis for not less than 24 months.

Sample Size and Sampling Methods
The population of this study included 60 adults within the age range of 20 and 55 years: 20 traditional bread bakers, 20 industrial bread bakers and 20 non-bread bakers who were resident within the Port Harcourt Metropolis for not less than 24 months.

Multi-stage non-probability sampling tools-- purposive and snowball sampling techniques were used for this study. This decision was made in light of the participants' availability, time limits, and other obvious limitations. A realistic approach to participant recruiting was made possible by the tools that helped easy accessibility following occupational ties.

Eligibility Criteria
The inclusion criteria for participating in the study included subjects within the age range of 18 and <60 years who gave their consent. The exclusion criteria included subjects with known history of cardiovascular/respiratory diseases, individuals with other underlying health conditions or with chronic illnesses (e.g., cancer, kidney disease) that could negatively affect the outcome of the study.

Methods of Data Collection
The data were collated with the help of well-structured proforma and the use of standard procedures. The health status, duration of exposure, and other demographic data were taken into account in the investigation. The proforma was administered to study participants, and measurements and samples were taken by qualified and experienced research assistants after the study participants gave their consent.

Methods of Data Analysis
All quantitative data obtained from the study participants were statistically analysed using version 25.0 of the IBM Statistical Product and Service Solutions (SPSS) software. Statistical significance was determined using one-way analysis of variance (ANOVA) and then followed by Post-Hoc LSD multiple comparison test. A P-value less than 0.05 were taken to be statistically significant.

Ethical Consideration/Informed Consent
Ethical approval for the present study was obtained from the Research Ethics unit of the Department of Human Physiology, Faculty of Basic Medical Sciences, Rivers State University, Nigeria. Likewise, correctly filled consent letter were received from the study participants before being included in the study.

RESULTS
Figure 1 showed the distribution of mean age of bakers and non-bakers resident in Port Harcourt.

All sub-groups of the study subjects (non-bakers, traditional bakers and industrial bakers) had their mean age ranging from 36.8 to 39.70 years. There were no significant (p>0.05) variations when the mean ages of all subgroups were compared to themselves.

Figure 2 is showing the outcome on the variations of body mass index (BMI) (Kg/m2) across Bakers and Non-Bakers Resident in Port Harcourt.

Only the mean BMI of the industrial bakers was seen to be significant (p<0.05) higher when respectively compared to those of non-bakers and traditional bakers.
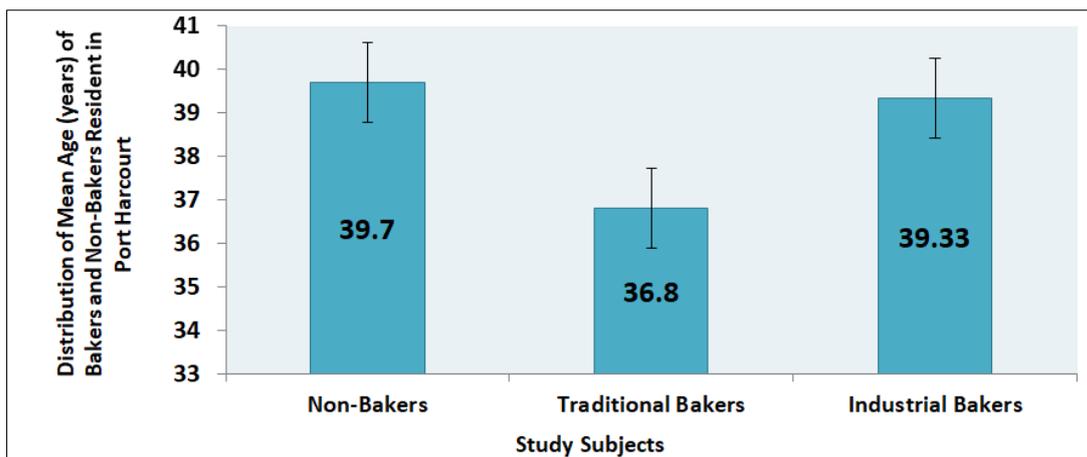
Figure 1: Distribution of Mean Age of Bakers and Non-Bakers Resident in Port Harcourt

Values are expressed as Mean ± Standard Deviation (SD); n =20. [a] Significant at $p<0.05$ when compared to the mean value of Non-Bakers; [b] Significant at $p<0.05$ when compared to the mean value of Traditional Bakers.
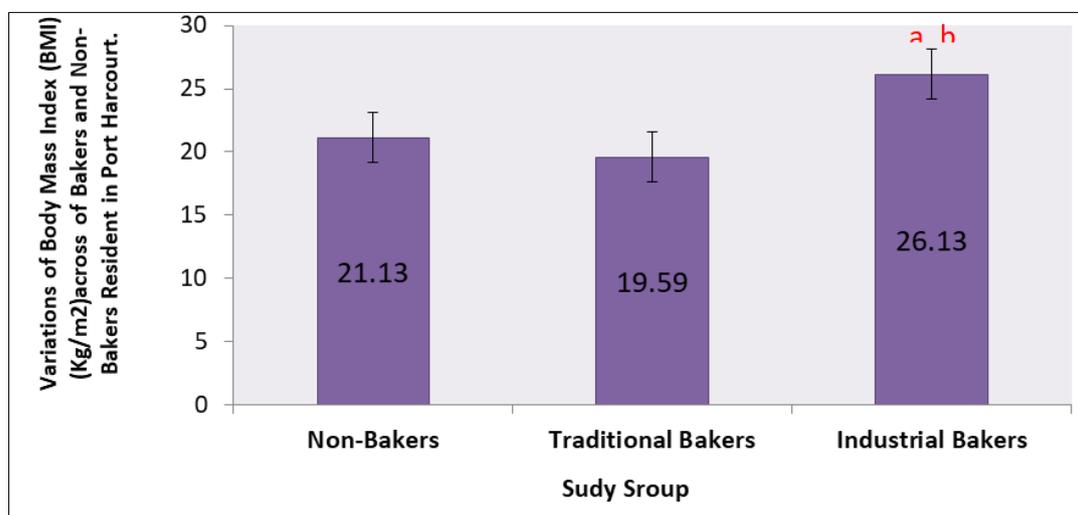

Figure 2: Variations of Body Mass Index (BMI) (Kg/m2) across of Bakers and Non- Bakers Resident in Port Harcourt

Values are expressed as Mean ± Standard Deviation (SD); n =20. [a] Significant at $p<0.05$ when compared to the mean value of Non-Bakers; [b] Significant at $p<0.05$ when compared to the mean value of Traditional Bakers.

Table 1: Comparison of Blood Pressure Parameters of Bakers and Non-Bakers Resident in Port Harcourt

S/N	Parameters	Study Groups		
		Non-Bakers	Traditional Bakers	Industrial Bakers
1.	SBP (mmHg)	128.62 ± 13.57	129.00 ± 12.87	127.27 ± 4.94
2.	DBP (mmHg)	87.44 ± 11.63	83.00 ± 9.49	80.09 ± 1.92
3.	MAP (mmHg)	101.15 ± 11.61	98.10 ± 9.57	95.73 ± 2.10

Values are expressed as Mean ± Standard Deviation (SD); n =20. [a] Significant at $p<0.05$ when compared to the mean value of Non-Bakers; [b] Significant at $p<0.05$ when compared to the mean value of Traditional Bakers.

Table 1 represents the outcome on comparison of blood pressure parameters of Bakers and Non-Bakers Resident in Port Harcourt.

The systolic blood pressure (SBP) of the bakers did not vary significantly (p>0.05), only that, the value for the traditional bakers was seen to be the highest.

The diastolic blood pressure (DBP) and mean arterial pressure of the bakers were also found to be non-significantly (p>0.05) variant with those of the non-bakers.

Table 2: Electrocardiographic Changes Bakers and Non-Bakers Resident in Port Harcourt

S/N	ECG Findings on Heart Rhythm	Study Groups		
		Non-Bakers [Frequency (%)]	Traditional Bakers [Frequency (%)]	Industrial Bakers [Frequency (%)]
1.	Normal sinus rhythm	30(100)	-	4(20)
2.	Sinus Bradycardia		4(20)	4(20)
3.	Sinus Tachycardia	-	4(20)	-
4.	Sinus rhythm with abnormal findings	-	12(60)	12(60)

(**Source:** Field Research Data by Researcher).

Table 2 shows the electrocardiographic changes in bakers and non-bakers resident in Port Harcourt.

All of the non-bakers indicated sinus rhythm with normal electrocardiographic (ECG) findings. Considering the ECG changes amongst the Traditional Bakers, 60% of them indicated sinus rhythm with abnormal findings ranging from left axis deviation, ventricular hypertrophy, incomplete right bundle branch block, left axis, deviation to clockwise QRS rotation. Sinus bradycardia (20%) and tachycardia (20%) were as well noticed for this set of bakers.

For the industrial bakers also, 60% of them showed sinus rhythm with abnormal findings ranging from left axis deviation, left/ or ventricular hypertrophy, incomplete right bundle branch block, left axis, deviation to clockwise QRS rotation. Further, this 20% sub-population presented with sinus rhythm with no abnormal ECG findings while another 20% indicated sinus tachycardia.

Table 3: Comparison of some Lung Function Indices between Bakers and Non-Bakers Resident in Port Harcourt

S/N	Parameters	Study Groups		
		Non-Bakers	Traditional Bakers	Industrial Bakers
1.	FVC (%)	92.24 ± 4.82	51.29 ± 27.69 [a]	71.40 ± 21.31 [a, b]
2.	FEV1 (%)	88.80 ± 6.11	48.08 ± 22.69 [a]	76.00 ± 23.86 [a, b]
3.	FEV6	92.85 ± 5.20	51.29 ± 27.69 [a]	71.40 ± 21.31 [a, b]
4.	FEV1/FVC	95.68 ± 4.54	101.05 ± 24.15	106.36 ± 7.07 [a]

Values are expressed as Mean ± Standard Deviation (SD); n =20. [a] Significant at $p<0.05$ when compared to the mean value of Non-Bakers; [b] Significant at $p<0.05$ when compared to the mean value of Traditional Bakers.
Note: FVC = forced vital capacity, FEV1 = forced expiratory volume in 1 second, FEV6 = forced expiratory volume in 6 seconds and FEV1/FVC = FEV1/FVC ratio.

Table 3 represent result on comparison of some Lung Function Indices between Bakers and Non-Bakers Resident in Port Harcourt.

Considering the changes in the levels of FVC, FEV1 and FEV6, it was observed that the bakers' mean values were all significantly ($p<0.05$) reduced when respectively compared to those of the non-bakers. Also worthy of note is that, the FVC, FEV1 and FEV6 levels of the traditional bakers were all significantly ($p<0.05$) lower when compared to those of the industrial bakers.

Concerning the FEV1/FVC ratio of the bakers, their men levels were respectively higher than that of the non—bakers, but only that of the industrial bakers was significantly ($p<0.0.0$) higher.

DISCUSSION

It is indeed important to state that, the essence of regular evaluation of the pulmonary, cardiovascular and even renal functions is because they are veritable tools in identifying risk factors for heart, lungs and renal conditions and detect early signs of associated diseases (Tamimi & Lynch, 2024). By detecting these risk factors and warning signs, healthcare providers can intervene early with lifestyle modifications, medical treatments, or preventive interventions to reduce the risk of heart disease and its complications (Wang *et al.*, 2021).

Considering the possible hazards in bread production, first, in the process of mixing bread dough, there is a chemical hazard caused by metal-contaminated materials. Second, the process of receiving cheese, sausage has biological hazards in the form of Escherichia coli bacteria. Third, the cooling process before packaging has physical hazards in the form of dust and dirt (Henroid Jr, & Sneed, 2004).

In the light of the foregoing, the present study evaluated the pulmonary functions and some renal function investigation amongst bread bakers and non-bread bakers resident in Port Harcourt. In the following paragraphs are presented the main findings of the present study.

The current student noted that, the age of the bakers and their non-baker counterparts ranged from 36.8 to 39.70 years and there were no significant variations when the mean ages of all subgroups were compared to themselves. From the outcome of the

present study it can be seen that the bread making industry relies relatively on young workforce.

One advantage of hiring younger workers is that they may be able to accept lower pay than more seasoned ones, making them a more cost-effective choice for businesses (Hoeschler & Backes-Gellner, 2017). Another reason for this group of workers is that they are more likely to be able to adjust to new technologies, stress, and techniques, which is important in industries that are always changing and fast-paced. Most employers of such workforce categories tend to overlook the risks and their impact on these workers (Protection, 2006).

The outcome of the present study on BMI revealed that the industrial bakers had significantly raised level when compared to those of non-bakers and traditional bakers. This is suggestive of the fact that, the industrial bakers may be using mechanized equipment, thus resulting in less movements and encouraging of sedentary life style and by implication higher tendencies to becoming obese than the traditional bakers (Torbeyns *et al.*, 2014). This outcome has thus revealed that the industrial have higher tendencies to becoming obese than their traditional baker colleagues.

While the systolic blood pressure (SBP) of the bakers did not vary significantly, it was recorded here that, the value for the traditional bakers was the most marginally raised. Thus pointing at a possible disposition to hypertension when compared to the others.

The ECG findings on the bakers in the present study revealed that 60% of each of the traditional and industrial bakers presented with sinus rhythm with abnormal findings ranging from left axis deviation, left/ or ventricular hypertrophy, incomplete right bundle branch block, left axis, deviation to clockwise QRS rotation. Further, this 20% sub-population presented with sinus rhythm with no abnormal ECG findings while another 20% indicated sinus tachycardia.

Although it is known that, the above stated conditions on their own, like a right bundle branch block are not usually serious; however, in people with heart disease and a previous heart attack or heart failure, RBBB increases the risk of premature death ((Xiong *et al.*, 2015). An incomplete or partial block means that electrical signals are partly disrupted (Xiong *et al.*, 2015); but care and follow-up must be done to prevent against adverse CVD conditions. Again, it has been said that just the persistent and untreated sinus tachycardia and other related conditions can result in complications; for instance, the formation of a blood clot could lead to a heart attack or stroke. Subsequently, if the heart cannot pump enough blood, this result in heart failure (Tutwiler *et al.*, 2017). Thus, the above finding has shown that the bread bakers may have the tendencies of presenting with abnormal ECG finding and this may be attributed to some possible workplace or work-condition hazards.

Further investigation on the specific hazards that may be responsible for this outcome may be helpful.

The findings on the cardiovascular system corroborate with that ECG findings of this same study. While there was no significant variation between the blood pressure parameters of the bakers and non-bakers, the bakers must put their cardiovascular indices to regular checks as to prevent any possible derangement.

The present study also found that mean FVC, FEV1 and FEV6 levels of in the bakers were remarkable reduced in the bakers compare to those of the non-bakers. The traditional bakers even had much more significantly lower levels of the parameters when compared to those of the industrial bakers. On the other hand, the FEV1/FVC ratio levels in the bakers were elevated when compared to that of the non-bakers, the value was significantly higher in the industrial bakers group. Of course, the pulmonary function test is known to measure how much air an individual can breathe in, how much that can be breathe out and how fast this can occur (Gold & Koth, 2015). Healthcare professionals use spirometry to diagnose asthma, chronic obstructive pulmonary disease (COPD) and other conditions that affect the ability to breathe (Wilt *et al.*, 2005).

Usually decreases in FVC, FEV1 and FEV6 levels are indicative of possible bronchospasm, inflammation, or increased secretions in the airways; and more often than not, such will in turn result in the obstruction of breathing (MR & YL 2011; Kaminsky, 2012). The diminished levels of the parameters can suggest signs of several conditions, including: Chronic obstructive pulmonary disease (COPD), including chronic bronchitis, emphysema, and bronchiectasis. Juxtaposing this notion with the above outcome of the present study could mean exposure of the bread bakers to such factors like smoke and heat. This is so because; significant exposure to smoke has been connected to incidence of reduced pulmonary indices (Sethi & Rochester, 2000). Smoke is known to damaging the lungs in several ways, including: narrowing airways, swelling, excess mucus secretion, reduced blood flow to the lungs and destruction of air sacs in the lungs (Sethi & Rochester, 2000; Yoshida & Tuder, 2007). Smoking can also lead to nonneoplastic respiratory diseases, such as chronic obstructive pulmonary disease (COPD), asthma, and respiratory infections (Madan *et al.*, 2016).

The increment in the level of FEV1/FVC ratio may be imply either normal spirometry test or indicate the presence of a restrictive defect (Low *et al.*, 2015). Considering the overall outcome of the spirometry finding of the study, the bakers must put their pulmonary health to check as to avert any possible respiratory condition.

CONCLUSION

The present found that the age of the bakers and their non-baker counterparts ranged from 36.8 to 39.70 years; thus implying a relatively young set of people make up the workforce in the bread baking industry. On BMI changes, the stud noted that the industrial bakers had significantly elevated level when compared to those of non-bakers and traditional bakers. It portends that the industrial bakers may be more prone to obesity than their other counterparts.

The ECG findings on the bakers in the present study revealed that 60% of each of the traditional and industrial bakers presented with sinus rhythm with abnormal findings ranging from left axis deviation, left/ or ventricular hypertrophy, incomplete right bundle branch block, left axis, deviation to clockwise QRS rotation.

On the pulmonary profile screening, the mean FVC, FEV1 and FEV6 levels were seen to be comparatively remarkably reduced in the bakers. The traditional bakers even had much more significantly lower levels of the parameters when compared to those of the industrial bakers. And lastly, the FEV1/FVC ratio levels in the bakers were raised when compared to that of the non-bakers, the value was significantly higher in the industrial bakers group.

Health education, use of personal protective equipment and good health seeking behaviours are recommended for the bakers.

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