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***Journal of Scientific and Engineering Research*, 2016, 3(3):67-72**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

Investigation of Peak Expiratory Flow Rate of Female Bakers In Abeokuta, Ogun State, Nigeria

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Abstract The current cross-sectional study investigated the relationship between the Peak Expiratory Flow Rate (PEFR) and the anthropometrical parameters (body mass and height) among female bakers who are exposed to flour dust. A total of One hundred and twenty (120) participants were investigated, sixty (60) female bakers (study group) who are exposed to flour dust and sixty (60) control subjects. Peak Expiratory Flow Rate (PEFR) and the anthropometrical parameters were measured using the mini-Wright peak flow meter (PFM 20, OMRON) and Detector PD300MDHR (Cardinal Scale manufacturing company, USA) column scale with digital height rod to measure body mass (kg) and height (cm) of the subjects simultaneously. PEFR of the study and control groups were compared using descriptive statistics and T-test analysis. The results showed that the bakers has 158.17 ± 12.55 L/min PEFR which is lower than 267.5 ± 26.85 L/min of the control subject. The results showed that most of the bakers are at a risk of developing related pulmonary function impairments such as asthma and hence there is need to develop an effective intervention strategy, treatment seeking behaviour of individuals would also need to be improved through awareness programs.

Keywords Bakery, Flour, Dust, Peak Expiratory Flow Rate, Exposure, Asthma

Introduction

In recent years, bakery industries are one of the fastest growing agro industries creating impacts of daily life in Abeokuta metropolis. Bakery products are being used on large scale as daily food items in developing countries such as Nigeria. Bakers have one of the greater incidence rates of occupational asthma as reported and indicated by occupational and chest physicians. Ige and Awoyemi (2002) investigated the occupational induced long function impairment in bakery workers as a result of exposure to grain and flour dust. They reported that the mean values of peak expiratory flow rate (PEFR) in the bakery workers are significantly lower than those of the control subject [1]. Yach et al (1985) found that the grain mill workers had significant deteriorated lung function values compared to their matched control [2]. Essen (1997) demonstrated that the grain dust exposure is a common cause of respiratory symptoms and these workers developed obstructive change on pulmonary testing [3]. Zustin et al (1998) suggested that workers employed in the processing of flour may be at a risk in the development of respiratory impairment [4].

The respiratory effects of exposure to flour dust are influenced by the dose and duration of exposure [5-7], and these differ from one work environment to another. Therefore, it may not be correct to extrapolate the results of studies conducted in a different environment to our bakeries [8-10]. The most frequently reported clinical features among worker exposed to dust are respiratory symptoms and disorders such as rhinitis, chronic cough wheezing and lung function [11, 12]. In addition to this signs and symptoms, various methods have been employed to evaluate respiratory function. One of such method is the measurement of Peak Expiratory Flow Rate (PEFR), which is a measure of how fast a person can breathe out after taking a deep breath [13].

Different researches has been done to establish the physiological status of bakery workers like allergic condition, respiratory problem due to daily exposure to flour dust [14]. Abou Taleb et al, (1995) and Rafnsson et al, (1997) reported that the normal values for Peak expiratory flow rate for an healthy adult and non-exposed to

dust is between 300 – 600 L/min with variation for age, body mass, height, and gender [13,15] . Similarly Vestbo et al, (1991) also found that the most appropriate values for healthy and non-exposed to dust adult female are from 300 – 500 L/min respectively [16].
Elebute and Femi-Pearse (1971) performed a study to establish the standard values of Peak expiratory flow rate (PEFR) in Nigeria where they measure the anthropometric parameters and PEFR of 142 healthy subjects [17]. The study revealed that the mean values of male PEFR were 482.1L/min (±83.3) and 385.6L/min (±65.7) for female. Based on the study conducted by Elebute and Femi-Pearse (1971) that was taking as outdated, prompted the present research to revalidated their findings [17]. The aim of this present research is to of investigating the peak expiratory flow rate bakers with respect to their level of exposure to the flour dusts. The aim of the research is to determine the health risk and level of exposure of bakery workers to flour dust.

Materials And Methods
The study was conducted the Peak expiratory flow rate (PEFR) of One hundred and twenty (120) individuals were measured. Sixty (60) female bakers were investigated in traditional and modern bakeries in Abeokuta metropolis, Ogun State, Nigeria. Sixty percent (60%) of the participant were male while the remaining forty percent (40%) were female. Equal number and percentage of the control subject were considered.
These control subjects were of the same age group with the bakery workers mostly house wife and students recruited within Abeokuta metropolis. Both the bakery workers and the control subjects had no earlier report of systematic diseases. Subject suffering from any respiratory illness and smoking were exempted from the study.
The structured questionnaire was also used as a tool of data collection which includes the details demographic data of the subject such as age, marital status, education level, smoking habit, duration of flour dust exposure, working experience in the bakery industries and the occupational health hazards.
Detecto PD300MDHR (Cardinal Scale manufacturing company, USA) column scale with digital height rod was used to measure body mass (kg) and height (cm) of the subjects simultaneously. The peak expiratory flow rate (PEFR) was measured with Mini Wright peak flow meter, PFM 20 (OMRON). Three readings were taken from each subject in standing position and the best of the three were considered as peak expiratory flow meter reading for that subject.

Figure 1: Peak flow meter

Figure 2: Detecto PD300DHR column scale with digital height rod

Data collected were analysed statistically with the new version of SPSS 17.0 and Microsoft Excel (2010) programs [18-19].

Results and Discussions
The present study entitled "Investigation of Peak expiratory Flow rate among the female bakery Workers in Abeokuta, Ogun State, Nigeria" was conducted in Abeokuta metropolis. The results obtained were expressed as mean ± standard deviation statistical techniques like T-test for two group comparisons and correlations were considered.

Table 1 to Table 4 shows the descriptive statistics and T-tests analysis of participants (study and control) respectively.

Table 1: Descriptive statistics for Bakers

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Body mass (kg)	60	40.7	57.3	50.167	.5174	4.0078
Height (cm)	60	155.1	167.7	159.652	.3557	2.7555
PEFR (L/min)	60	150.0	220.0	158.167	1.6207	12.5538
Age (yrs)	60	19	27	23.02	.269	2.087
Yr of Exposure	60	1	4	2.38	.079	.613
Valid N (listwise)	60					

Table 2: Descriptive statistics for Control

	N	Range	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Body mass (kg)	60	14.9	44.8	59.7	51.718	.5651	4.3770
Height (cm)	60	16.4	149.4	165.8	157.520	.5796	4.4893
PEFR (L/min)	60	90.0	230.0	320.0	267.500	3.4659	26.8470
Age (yrs)	60	6	20	26	22.93	.215	1.666
Valid N (listwise)	60						

Table 3: T-test (one sample test) for Bakers

	Test Value = 0					
					99.99% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Body mass (kg)	96.959	59	.000	50.1667	48.007	52.326
Height (cm)	448.788	59	.000	159.6517	158.167	161.136
PEFR (L/min)	97.592	59	.000	158.1667	151.403	164.931
Age (yrs)	85.426	59	.000	23.017	21.89	24.14
Yr of Exposure	30.107	59	.000	2.383	2.05	2.71

Table 4: T-test (one sample test) for Control

	Test Value = 0					
					99.99% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Body mass (kg)	91.526	59	.000	51.7183	49.360	54.077
Height (cm)	271.787	59	.000	157.5200	155.101	159.939
PEFR (L/min)	77.180	59	.000	267.5000	253.035	281.965
Age (yrs)	106.635	59	.000	22.933	22.04	23.83

Table 5: Correlation coefficient for Bakers

		Body mass	Height	PEFR	Age	Years of Exposure
Body mass	Pearson Correlation	1	.319*	-.083	-.109	.245
	Sig. (2-tailed)		.013	.530	.406	.059
	N	60	60	60	60	60
Height	Pearson Correlation	.319*	1	-.109	.044	.141
	Sig. (2-tailed)	.013		.405	.737	.284
	N	60	60	60	60	60
PEFR	Pearson Correlation	-.083	-.109	1	.253	-.392**
	Sig. (2-tailed)	.530	.405		.051	.002
	N	60	60	60	60	60
Age	Pearson Correlation	-.109	.044	.253	1	-.032
	Sig. (2-tailed)	.406	.737	.051		.811
	N	60	60	60	60	60
Years of Exposure	Pearson Correlation	.245	.141	-.392**	-.032	1
	Sig. (2-tailed)	.059	.284	.002	.811	
	N	60	60	60	60	60

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlation coefficient for Control

		Body mass	Height	PEFR	Age
Body mass	Pearson Correlation	1	.247	.006	-.127
	Sig. (2-tailed)		.058	.964	.332
	N	60	60	60	60
Height	Pearson Correlation	.247	1	-.379**	-.029
	Sig. (2-tailed)	.058		.003	.827
	N	60	60	60	60
PEFR	Pearson Correlation	.006	-.379**	1	-.061
	Sig. (2-tailed)	.964	.003		.645
	N	60	60	60	60
Age	Pearson Correlation	-.127	-.029	-.061	1
	Sig. (2-tailed)	.332	.827	.645	
	N	60	60	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1 to Table 4 shows the descriptive statistic of the anthropometric parameters for the investigated individual. Table 1 show that the minimum and maximum peak expiratory flow rate (PEFR) was 160L/min and 220L/min for male bakers whose age was in the range of 25 – 34years with average mean of PEFR of 182.67±16.0L/min. The female bakers (table 2) has minimum and maximum PEFR of 150L/min and 220L/min with age range of 19 – 27years having average mean of 158±12.6L/min. Abou Taleb et al (1990) and Rafnsson et al (1997) presented in their research that the normal values of PEFR for healthy adults is between 300 - 600L/min [13,15]. Vestbo et al (1991) also presented that the normal values for healthy adults male and female is between 400 - 600L/min and 300-500L/min respectively [16].

In this present research, it was found that PEFR values for male and female bakers are less than the normal values [13,15-16] which shows that these bakers are not healthy which reveal that these bakers were adjudged to have some degree of airflow obstruction.

Control subject was also considered in Table 2 to Table 4. Similarly it was discovered that the average mean values of PEFR for male control subjects is 287.67±17.03L/min with 250L/min and 330L/min as the minimum and maximum peak expiratory flow rate (PEFR). Table 4 also reveal the average mean values of PEFR for

female control subjects is 267.5±26.85L/min with minimum and maximum PEFR as 230L/min and 320L/min respectively.

The values generated from the female control subjects were in line with Abou Taleb et al, (1990) and Rafnsson et al, (1997) values [13, 15]. This research found the difference in values of peak expiratory flow rate (PEFR) between the female bakers and female control subjects in relation to height, body mass and age, most especially in respect to height.

Peak expiratory flow rate (PEFR) values for female (bakers and control subjects) in relation to height were lower (Table 1 to Table 4). This difference of PEFR in female was also observed by Host et al, 1994. However, the factors that determine PEFR are predominantly expiratory muscle effort, lung elastic recoil pressure and airway size [20]. These muscle efforts depend on the physical strength activity. It is extremely possible that these lower values in females were due to physiological reason and better performance of the male.

The findings of lower PEFR values in the bakery workers compared to control subjects compares favourably with findings in similar studies in different industries for example Bamidele (2000) [21], Soap and detergent workers; Oleru (1984) [11], detergent workers; Jinadu (1998) [22] , Wood furniture workers and Sofola et al (2005), petrol workers [23]. These researchers drew their unexposed control subjects from outside their industries studied.

The positive coefficient of peak expiratory flow rate (PEFR) with body mass, height, age and years of exposure (where applicable) was observed in female (bakers and control subjects), this signifies that the values of PEFR increases with increased anthropometric parameters. The most significant was observed between PEFR and height of control ($P>0.01$). But the most highly significant occurs between the PEFR and year of exposure of female bakers ($P>0.01$). This reveals that the peak expiratory flow rate (PEFR) is practically dependent on the year of exposure.

Inem et al, (2010) research shows a similar inference in the present study as the level of exposure do affects the PEFR which affect the lung function and leading to the degree of airflow obstruction and reduction in the peak expiratory flow rate. Inem et al, (2010) also discovered that increase in PEFR also increases with the height of the workers in his study [24]. The correlation coefficient (Table 6) for female control subjects shows a significant correlation between the PEFR and the height of the control subject ($P>0.01$) with the female control subject has a negative correlation with height.

Ele (1992) presented that height is a good indicator of body build, hence, there is always a good correlation between height and ventilator function as it was found in this present study (table 6) [25]. There was no disagreement regarding positive correlation of PEFR with height as independent body parameters. Standing height is the best predictor of PEFR [26] and height should have the first preference for prediction of PEFR because of more accuracy, easy measurable at any palace and it's highly significant relationship with PEFR. The PEFR (L/min) values in relation to height interval in the present study were comparable to those obtained in other studies (Benjaponpitak et al, 1999; Host et al, 1994).

The study concluded that the prevalence of the occupational respiratory diseases among the bakers needs control of the allergens. The use of personal protective equipment should be employed and encourage as it has shown the significant reduction in the risk of lung function impairment. Thus, further study is required to understand the difference of PEFR between the flour dust exposed workers and other workers in the bakery.

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