Research Article

Respiratory Hazards of Bakery workers, El-Minia District

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Abstract
Background: The Bakery industry have many occupation health hazards, manly respiratory. Flour dust is a respiratory sensitizer and is known to cause occupational asthma. **Aim of the study:** The aim of this study is to assess the respiratory health hazards in in Bakery workers at El-Minia district. **Subjects and methods:** The study started at May ٢٠١٤ up to April ٢٠١٥, a total number of ٥٠ Bakery workers chosen randomly and ٥٠ matched controls. All subjects undergo inclusion and exclusion criteria with detailed history including occupational history and general physical examination. All respiratory symptoms were documented. Pulmonary function tests included forced vital capacity (FVC), forced expiratory volume in one second (FEV١), peak expiratory flow rate (PEFR), mean forced expiratory flow during the middle half of forced vital capacity (FEF ٢٥ - ٧٥) and maximum voluntary ventilation (MVV). **Results:** The study showed that all respiratory symptoms were significantly higher in Bakery workers. The pulmonary function tests showed a significant decline in Bakery workers compared to controls, the results also showed a clear impact of prolonged period of exposed > ٥ years with a highly significant (> ٠.٠٠١) decline in nearly all parameters measured. **Conclusion:** The results of our study supports the need to pay attention to working conditions in bakeries to reduce health hazards. **Recommendations:** It is advisable therefore, that flour mill managers, their workers and health officials should work together to adopt technical preventive measures, such as having well ventilated work areas, workplace hygiene, health education programs and wearing appropriate respiratory protective devices. It is also suggested that flour workers must undergo pre-employment and periodic medical surveillance tests spiromety and skin prick tests (SPT) examination. These tests will identify susceptible workers, so that they can take adequate preventive measures as well as medication.
Key words: Bakery workers, Respiratory hazards, Pulmonary function tests and El-Minia Bakeries.

Introduction

The Baking industry, like, most occupations is prone to occupational health challenges most of these hazards are preventable and arise from the neglect of occupational safety measures[١]. Bakery heat that radiates from ovens, harmful fumes, chemical ingredients and smoke, all affect the respiratory and cardio-vascular functions of the employees[٢]. There have been several reports of bakers that have to give up their work because they suffered persistent ill health and chronic respiratory disease[٣,٤].

Flour dust is a hazardous substance; it is a respiratory sensitizer and is known to cause allergic rhinitis and occupational asthma among bakers and millers[٥]. Asthma arising from workplace exposure to cereal flour (bakers' asthma) is one of the commonest types of occupational asthma[٦,٧]. Flour dust also an irritant and may give rise to short term respiratory, nasal and eye symptoms or it may provoke an asthmatic attack in individuals with pre-existing disease and also lead to chronic bronchitis[٨]. In addition, bakery workers have been reported to exhibit a variety of clinical manifestations including wheezing, febrile reactions, grain fever, lung fibrosis, allergic alveolitis, impairment of lung function and chronic obstructive pulmonary disease[٩,١٠]. In occupational respiratory disease, spirometry is one of the most important diagnostic tools[١١]. Measurement of dynamic lung functions is more important than of static lung volumes[١١,١٢].

Now it is well recognized that pulmonary function tests have been beneficial in the early recognition of pulmonary dysfunction in patient considered to be normal on the basis of clinical and radiological examination. A large number of workers are engaged in different types of bakeries widely distributed in urban and rural areas at El-Minia Governorate with or without safety regulations, so it is very important to evaluate and assess respiratory hazards in this group of workers, the main aim of this study is to evaluate the respiratory health hazards of Bakery workers at El-Minia district from May ٢٠١٤ to April ٢٠١٥.

Subjects and methods

A total number of ٥٠ Bakery workers, located in different urban and rural areas of El-Minia district, from May ٢٠١٤ to April ٢٠١٥, chosen randomly, non-smokers, all males and in age group of ١٣ to ٣٨ years (exposed group) and a total number of ٥٠ non-smokers, non-exposed (to Baking hazards) subjects of nearly the same age group and living near the selected bakeries. The study subjects (exposed and non-exposed) were evaluated for dynamic lung functions. In all subjects a detailed history including occupational history and general physical examination were done. Exclusion from the study was applied on any person who has asthma, chronic infection of the lungs, persistent cough and those treated recently from any respiratory illness. Occupational history was assessed through questions on previous and current job, daily working time, job description, working conditions, ventilation conditions, and protective measures used. Respiratory symptoms (cough, phlegm, dyspnea, wheezing, and chest tightness) were documented. Symptoms were considered to be work-related if they improved through rest or holiday or if employees reported them to be provoked by contact with flour.

The research protocol followed the regulations of the ethical committee of our institute and informed consent was obtained from each subject prior to inclusion in the study. The pulmonary function tests performed in this study include forced vital capacity (FVC), forced expiratory volume in one second (FEV١), peak expiratory flow rate (PEFR), mean forced expiratory flow during the middle half of forced vital capacity (FEF ٢٥ - ٧٥) and maximum voluntary ventilation (MVV), all done with spirometer.

A standard method for respiratory function test performance was used according to American Thoracic Society (ATS) recommendations[(١١)]. Using a portable spirometer (spiro ٥٠١- DIMEQ – Medizinelektronik GmbH Berlin – ART-NO٧ ٦٩٣ ٣٩١ ٠٠ ٣ – SER.NO. ٣٦٥١٨٢٧) for both exposed and non-exposed, a three trials were done with adequate rest in between for every one and the best one was taken as a percent of predicted normal values based on age, height and sex[(١١)].

Testing procedures were quite, simple, non-invasive and harmless to the examined person. The studied persons were familiarized with the instrument and the technique used. Statistical analysis was carried for all parameters using social package for social since (SPSS) version ٢٠. P-value was determined P>٠.٠٥, was considered as non-significant. Fisher exact test (calculated for cases and controls) were used for comparison between groups.

Results

Demographic: physical parameters, the mean age, height, weight and body surface area of both the control and Bakery workers showed no significant difference as shown in table (١).

Table (١): Anthropometric measurements of bakeries workers at El-Minia district, May ٢٠١٤ to April ٢٠١٥.

parameters	bakery workers	control	P-vale
Age (years)	٢٨.٥٦ ±٧.٥	٣٠.٢ ±٦.٥	>٠.٠٥
Height (cm)	١٥٨.٨١±٦.٨	١٦٢±٥.٢	>٠.٠٥
Weight (Kg)	٦٨±٧.٩	٦٩±٥.٢	>٠.٠٥
BSA (m٢)	١.٦٩±٠.٢١	١.٧١±٠.١٨	>٠.٠٥

BSA: body surface area

The educational level of the Bakery workers studied and showed illiterate in ٥٤٪ (٢٧ out of ٥٠), only primary school education in ٢٨٪ (١٤ out of ٥٠) and ١٨٪ (٩ out of ٥٠) workers had secondary school education. As regarding to the duration of occupation, the majority ٦٨٪ (٣٤ out of ٥٠) had a duration of occupation for more than ٥ years and only ٣٢٪ (١٦ out of ٥٠) had a duration of occupation less than ٥ years. As regard the working hours/day, ٧٦٪ (٣٨ out of ٥٠) worked from ٧ up to ١٢ hours / day, as shown in table (٢).

Table (٢): Education level and work duration of bakeries workers at El-Minia district, May ٢٠١٤ to April ٢٠١٥.

Variable	Frequency (n=٥٠)	%
Educational level		
Illiterate	٢٧	٥٤
Primary	١٤	٢٨
Secondary	٩	١٨
Total	٥٠	١٠٠
Duration of occupation		
Up to ٥ y.	١٦	٣٢
٦ – ١٥ y.	٢٦	٥٢
More than ١٥ y.	٨	١٦
Total	٥٠	١٠٠
No. of hours/day		
Up to ٦ h.	٦	١٢
٦ – ١٢ h.	٣٨	٧٦
١٢ – ١٨ h.	٦	١٢
Total	٥٠	١٠٠

The respiratory symptoms of bakery worker showed variable incidence with the most common one was cough ٦٤٪ (٣٢ out of ٥٠), sneezing ٥٦٪ (٢٨ out of ٥٠), catarrh ٤٢٪ (٢١ out of ٥٠), chest tightness ٣٦٪ (١٨ out of ٥٠), asthma ٢٨٪ (١٤ out of ٥٠) and breathlessness ١٠٪ (٥ out of ٥٠). It is clearly evident that all these symptoms are significantly higher in Bakery workers than in their control as shown in table (٣).

Table (٣): Respiratory symptoms of bakery worker at El-Minia district, May ٢٠١٤ to April ٢٠١٥.

Respiratory Symptoms	Bakery workers (n=٥٠)		Control (n=٥٠)		*P -value
	No.	%	No.	%	
Sneezing	٢٨	٥٦	٤	٨	
Catarrh	٢١	٤٢	٥	١٠	
cough	٣٢	٦٤	-	٠	<٠.٠٥
Chest tightness	١٨	٣٦	-	٠	
Asthma	١٤	٢٨	-	٠	
Breathlessness	٥	١٠	-	٠	

*= by Fisher exact test.

The analysis of the respiratory function parameters in bakery workers who worked for <٥ years and their controls showed a significant drop in the examined tests in the exposed group compared to the control group as shown in table (٤). The FVC, FEV١, PEFR and MVV, all showed a significant decline in Bakery workers when compared to their control group with a P-value <٠.٠٥ only the FEF (٢٥٪ - ٧٥٪) test showed a non-significant difference as shown in table (٤).

Table (٤): Respiratory functions parameters in bakery workers and controls at El-Minia district, with < ٥ years of exposure, May ٢٠١٤ to April ٢٠١٥.

parameter	unit	Bakery (n=١٦)	Control (n=١٦)	P- value
		Mean ± SD	Mean ± SD	
FVC	Liters	١.٥٨ ± ٠.٣٨	٢.٦٥ ± ٠.٥٢	<٠.٠٥
FEV١		١.٣٥ ± ٠,٢٧	٢.٥٢ ± ٠.٤٥	<٠.٠٥
PEFR	Liters/sec	٣.٥٨ ± ٠.٦٨	٥.٧ ± ١.٥٩	<٠.٠٥
FEF (٢٥-٧٥)		٣.٠٢ ± ٠.٦٧	٢.٩٨ ± ١.١٥	>٠.٠٥
MVV	Liters/min	٣٧.٨ ± ١٥.٩	٨٩.٨ ± ٢٥.٥	<٠.٠٥

FVC: Forced vital capacity.
FEV١: Forced expiratory volume in one second .
PEFR: Peak expiratory flow rate.
FEF (٢٥-٧٥): Forced expiratory flow (middle ١/٢ of FCV).
MVV: Maximum voluntary ventilation.

The impact of the prolonged period of exposure (> ٥years) was evident in the results of pulmonary function tests of the exposed bakery workers compered to their control subjects and is clearly shown in table (٥). The FVC showed a highly significant decline from ٢.٧ ± ٠.٧٤ liters in controls to ١.٥١ ± ٠.٠٦ in exposed workers (P < ٠.٠٠١), FEV١ also showed a highly significant (P < ٠.٠٠١) decline in exposed worker (١.٦٢ ± ٠.١٢ liters) compared to ٢.٣١ ± ٠.٥٩ liters in controls, the PEFR showed a highly significant decline (P < ٠.٠٠١) in exposed bakery workers ٣.٦٤ ± ٠.٦١ liters/sec. in exposed bakery workers compared to ٦.١٠ ± ١.١ liters/sec. in controls, however FEF (٢٥٪ - ٧٥٪) test showed a significant drop in exposed workers ٢.٢٨ ± ٠.٤٣ liters/sec. compared to ٣.١٠ ± ١.١٧ liters/sec of control (p < ٠.٠٥) and finally the MVV test showed a significant drop in exposed bakery workers ٥١.٠٧ ± ١٤.٨ liters/min. compared to ٨٣.٨ ± ٢٨.٨ liters/min. for controls with p-value < ٠.٠٥ as shown in table (٥).

Table (٥): Respiratory functions parameters in bakery workers and controls at El-Minia district, with > ٥ years of exposure, May ٢٠١٤ to April ٢٠١٥.

parameter	unit	Bakery (n=٣٤)	Controls (n=٣٤)	P- value
		Mean ± SD	Mean ± SD	
FVC	Liters	١.٥١ ± ٠.٠٦	٢.٧ ± ٠.٧٤	<٠.٠٠١
FEV١	Liters	١.٦٢ ± ٠.١٢	٢.٣١ ± ٠.٥٩	<٠.٠٠١
PEFR	Liters/sec	٣.٦٤ ± ٠,٦١	٦.١ ± ١.١	<٠.٠٠١
FEF (٢٥-٧٥)	Liters/sec	٢.٢٨ ± ٠.٤٣	٣.١٠ ± ١.١٧	<٠.٠٥
MVV	Liters/min	٥١.٠٧ ± ١٤.٨	٨٣.٨ ± ٢٨.٨	<٠.٠٥

FVC: Forced vital capacity. FEV١: Forced expiratory volume in one second .
PEFR: Peak expiratory flow rate.
FEF (٢٥-٧٥): Forced expiratory flow (middle ١/٢ of FCV).
MVV: Maximum voluntary ventilation.

Discussion

Exposure to flour dust occurs across a range of food industries including grain mills, flour mills and bakeries[١٣]. Flour dust is a heterogeneous substance with irritating properties and exposure to it in bakery operations (mixing and bakery operations) may induce acute or chronic respiratory diseases[١٤]. it contains particles from numerous cereal grains (wheat, barley, rye, oats, corn) and may contain a large number of contaminants including silica, fungi and their metabolites (aflatoxin), bacterial endotoxins, insects, mites, mammalian debris and various chemical additives such as pesticides and herbicides[١٥,١٦,١٧]. Bakery workers have been the victim of occupational disease, among which lung disease are most common[١٨]. Flour dust is an asthmagen and is known to cause sensitization, allergic rhinitis and occupational asthma among bakeries and millers[١٩].

In the current study bakery workers in El-Minia district, the education level hence the awareness of risks and hazards showed ٥٤% illiterate and ٢٨% of primary school level and similar results were reported in previous study (Impact of worker education on respiratory symptoms and sensitization in Bakeries) by FishwickJ et al.,[٢٠].

In this study all respiratory symptoms were more prevalent among bakery worker compared to controls and the differences were statistically highly significant and this is in agreement with many previous studies carried out on bakers and millers, as[٢١,٢٢,٢٣].

The results of present study showed a highly statistically significant (P < ٠.٠٠١) in the mean values of FVC, FEV١, PEFR and statistically signi-ficant reduction in FEF (٢٥٪ - ٧٥٪) and MVV (p < ٠.٠٥) in the bakery worker compared with their matched controls. Similarly many previous studies have shown that flour dust exposure causes respiratory symptoms and is associated with impairment of lung function[٢٤,٢٥]. The underlying mechanism of air way obstruction in workers involved in all activities in bakeries may be due to the formation of specific IgE leading to immunological reactions which can be immediate, late or dual or may be due to direct liberation of broncho constrictor substance[٢٦].

The decrease of FVC and FEV١ may be due to obstructive impairment which further increases with increase in number of years of exposure, in other words there is a dose exposure relationship[٢٧]. In this study a decrease in FEF(٢٥-٧٥) was clearly evident in bakery workers and several previous studies showed the same results as in[٢٨].

MVV is considered to be a good guideline of the mechanical efficiency of the lungs, so bakery environment on chronic bases causes decreased mechanical efficiency of lungs[٢٩], and results of the current study confirm this.

The results in our study support the need to pay attention to working conditions in bakeries to reduce harmful effects of air born particles in various bakery sections and spirometry should be an integral part of health care programme. Adequate control of exposure to flour, dust, heat and mechanical injuries should help to reduce the incidence of respiratory diseases and burns, cutaneous allergies and musculoskeletal injuries in bakeries and flour industry[٣٠,٣١,٣٢]. All this should be one of the objectives of occupational health and periodic health check are equally important.

Health hazards and risks in Bakeries as work place has been recognized several centuries ago, but it is a blemish that this is still prevalent today and that this serious problem has not been addressed to working safety. The employers are held responsible in providing and maintaining working environment which is safe for the employees and a workplace that will not be detrimental to their health. This responsibility will include providing instructions, supervision and training so that the workers in bakeries will not be exposed to these risks.

Recommendations

It is advisable therefore, that flour mill managers, their workers and health officials should work together to adopt technical preventive measures, such as having well ventilated work areas, workplace hygiene, health education programs and wearing appropriate respiratory protective devices. It is also suggested that flour workers must undergo pre-employment and periodic medical surveillance tests (spiromety and SPT examination). These tests will identify susceptible workers, so that they can take adequate preventive measures as well as medication.

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