

# Exposure to occupational hazards among bakers and their coping mechanisms in the Kumasi Metropolis of Ghana

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## Research

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# Abstract

**Background:** Despite the contribution of the baking industry to employment creation and income generation in low-and middle-income countries, the sector is also prone to occupational health and safety challenges which could undermine the quality of life and wellbeing of bakers within the industry. However, studies on the exposure to occupational hazards among bakers and the strategies they employ to control their exposure to occupational hazards are still lacking in Ghana. In this study, we aimed at examining the exposure to occupational hazards among bakers in the Kumasi Metropolis of Ghana and further explore their coping mechanisms.

**Methods:** By employing a cross-sectional design, the study was conducted among 172 bakers in the Kumasi Metropolis of Ghana. A questionnaire consisting of both closed and open-ended questions was used to take data from the respondents. Descriptive statistics such as frequencies and percentages were adopted to analyze the data.

**Results:** We found that the participants were exposed to different types of occupational hazards including physical (noise, flour dust/smoke, fire, and high temperature), biological (mosquitoes, insects and rodents), psychosocial (stress, verbal abuse, and poor interpersonal relationship), chemical (chemicals in the local soap used to clean and wash napkins after baking), and ergonomic hazards (standing, sitting and bending repetitively). Some of the coping mechanisms employed to reduce exposure to the various types of occupational hazards comprise the use of a wooden and metallic peel to place and remove bread from the oven, removing excess fire from the oven with a peel, use of mosquito repellent and coil, rest breaks and staying hydrated.

**Conclusion:** The findings from this study are therefore critical to informing policymakers in implementing occupational health and safety policies to safeguard the health of bakers in Ghana and other low-and middle-income countries. We suggest that there should be participatory and action-oriented programs organized for bakers at their weekly meetings to discuss relevant occupational health and safety issues. Union executives should carry out worksite inspection accompanied by a checklist to monitor the progress of the sessions held during meetings.

## Introduction

As the attention of development actors turn towards safety and health at the workplace, international bodies such as the WHO and the International Labour Organisation (ILO) are increasingly advocating for the implementation of occupational health and safety standards to ensure health and safety among workers. This is because the work environment and its varied circumstances have both negative and positive effects on the health and safety of its workers. For instance, harmful work environment accounts for significant causes of morbidity, mortality, and disability [1–2].

Globally, workplace accidents lead to over 2.3 million death annually, with 2 million and 300,000 ascribed to be work-related diseases and injuries, respectively [3–4]. Occupational injuries and diseases that result from harmful work environments account for about 4 percent loss of the world's Gross Domestic Product (GDP)

[5]. This suggests that occupational health and reduced working capacity of workers causes an economic loss of about 10–20 percent of the Gross National Product of a country [6]. Thus, safety and health at the workplace cannot be seen solely as a sound economic policy but also as a basic human right [7]. About 75 percent of the world's labor force live in developing countries, with only 5–10 percent having access to occupational health services [8].

In Ghana, the baking industry is an essential sub-sector of the economy. The sector plays a vital role in employment creation and income generation. This implies that bakers contribute to their livelihoods, their communities and the country at large (Amponsah-Tawiah and Dartey-Baah, 2011). Despite the enormous contribution, the baking industry, like other occupations is prone to occupational health and safety challenges. Doaa et al. [9] highlighted that bakery poses several hazards to the health of its workers. Baking as an economic activity exposes workers to work injuries and diseases that affect production and productivity which translates into low incomes [10–11]. Occupational injuries and diseases among workers result in absenteeism, reduces the ability of households to earn income and affect the local and national economy [9].

Even though studies have reported that informal sector workers are exposed to occupational hazards [9–11], literature is lacking in the specific occupational hazards bakers are exposed to in the Kumasi Metropolis of Ghana. Understanding the exposure to occupational hazards among bakers is therefore critical to informing policymakers in the formulation and implementation of occupational health and safety policies to safeguard the health of bakers in Ghana and other low-and middle-income countries. Findings from the study will inform occupational health and safety policies, procedures, Acts and legislation established in the country towards the achievement of the Sustainable Development Goal 8. Target 8.8 indicates the need “to protect labor rights and promote safe and secure working environments for all workers, including migrant workers and those in precarious employment of which bakery is no exception. The purpose of this descriptive study is to examine exposure to occupational hazards among bakers in the Kumasi Metropolis of Ghana.

## Methods

### Setting and Research Design

The study was conducted in the Kumasi Metropolis of Ghana. The metropolis is the second most populous settlement in the country with an annual growth rate of 2.7 percent [12]. The increase in population growth rate is due to the attractiveness (tourism, and employment opportunities) of the metropolis [12]. About 91.2 percent of the labor force is employed in the private sector, with 79.2 percent of the employed population working in the private informal sector. Small/medium scale manufacturing industries employ 13.6 percent of the labor force. The use of modern production methods to produce both traditional and modern product dominate this sub-sector. Notable among the activities carried out include brewery and food processing, which creates and promotes job opportunities for the youth. Most of the baking industries are located in Asafo and Fanti New Town. Asafo and Fanti New Town are one of the well-patronized baking centers in the Kumasi Metropolis. Asafo and Fanti New Town. Fanti New Town is a hub for informal bakery units that produce baked foods to serve the metropolis and beyond. The bakery units operating within the enclave are composed of flour processors, bread makers and pasteries.

This study used a cross-sectional survey to examine exposure to occupational hazards among bakers in the Kumasi Metropolis. A cross-sectional survey was used because data were gathered from the participants at one specific point in time [13-16]. As a result of the fact that the study falls within the domain of public health research, it was appropriate to use a cross-sectional survey.

## **Sampling frame and technique**

We first undertook a headcount of the bakers to determine the sampling frame; this was necessitated by the absence of data on the population of bakers. The headcount covered the employers and employees working as bakers within the study area. The criterion for the selection of the bakers was based on those who are actively engaged in baking and those who had employees. A census was conducted because the study group was small and easy to be identified in the study area. Hence, a census was conducted to cover all bakers. This implied that the results obtained from respondents were generalized based on the sampling technique employed. With the detailed information on the location and contacts, respondents were easily located and interviewed.

After the headcount/ preliminary census, each bakery unit had different activities being carried out. An average of four groups of employees, which comprised pan cleaners, slicers, oven bakers and mixers. The headcount identified 39 employers at Fanti New Town and Asafo. Each employer was selected together with three employees for an interview. The study identified 16 mixers who were actively involved in mixing the flour. Interviewing the employees ensured the triangulation of the information provided by the employers. A total sample frame for the study was 172 representing both employers and employees.

The study adopted a purposive sampling technique in selecting the bakers because they were the main unit of analysis of the study. Also, bakers were purposively interviewed because of their knowledge and experience in the baking profession.

## **Data Collection Instruments and procedure**

Data from a cross-sectional survey were collected using a questionnaire. This was designed and administered to bakers. The questionnaire was made up of both closed and open-ended questionnaire which helped to collect comprehensive data. Closed-ended questions were mostly used to enhance high response to sensitive questions. Also, open-ended questions such, as "others please specify" were used to allow respondents' to be actively involved in the survey by giving their opinions concerning the subject matter. Data gathered included socio-demographic and economic information (sex, education status, age of respondents, working experience, among others), and exposure to occupational hazards (biological, ergonomic, psychosocial, and physical hazards) and strategies adopted to curb the effects. The questionnaire was designed in English but was translated into the Twi (the local language of the study participants). Three research assistants who have knowledge on occupational hazards were recruited from the Kwame Nkrumah University of Science and Technology to help administer the data collection instrument. However, the first author monitored the data collection process to ensure quality control. In all, each administered questionnaire lasted 40 minutes on the average.

## Ethical Consideration

A letter of introduction was obtained from the head of the Department of Planning and sent to the head of the Bread Union before the data collection exercise began. The respondents were also informed of the purposes and procedures involved in the study and the time needed to complete each questionnaire. They were also reassured that all information provided would be treated with the required confidentiality and anonymity. Further, informed and verbal consents were sought from the respondents before the data collection exercise began.

## Data Analysis

The primary data were collated, edited and harmonized after the field survey. This was to ensure quality control. The quantitative data was collected using Kobo Collect Software and exported using the Statistical Package for Social Sciences Version (SPSS) 21 to organize the data into categories that were useful to the study. The application of the software made it possible for the enumeration of data in percentages, charts/graphs, and tabular representations. Descriptive deductions (cross-tabulation, frequencies, and percentages) were adopted and used to provide a detailed explanation of the tables and charts produced from the quantitative analysis.

## Results

### Demographic and Socio-Economic Characteristics of the respondents

The majority (59.3%) of the respondents were females. The female dominance could be explained by the traditional role of women, as household managers hence are responsible for the day-to-day administration/management of processing food. The study revealed that 41.3% of the respondents had no level of formal education. This demonstrates a low educational background among the respondents. The likely explanation for this is that the informal sector is characterized by free entry and exit hence allow people with low educational levels to engage in informal economic activities. This in a way affects their understanding of vital occupational health and safety issues.

### Table 1: Demographic and Socio-economic characteristics of the respondents

Variables	Category	n=172	Percentage
Gender	Male	70	40.7
	Female	102	59.3
Education	None	71	41.3
	Basic School	68	39.5
	Secondary/Vocational	28	16.3
	Tertiary	5	2.9
Work Experience (years)	Below 2	3	1.6
	2-4	32	18.6
	5-7	31	18.0
	8-10	10	5.8
	Above 11	96	55.8
Total Income (GHS)	Below 500	11	6.4
	500-1000	161	93.6

The majority (55.8%) of the respondents indicated they had worked in the bakery industry for more than 11 years. The higher work experience of the respondents could have implications on the study as most of them would be able to bring to light their exposure to occupational hazards. The study revealed that the majority of the respondents earned between 500 and 1,000 Ghana Cedis (1 USD = 4.97 GHS as at 31 January 2019) on monthly basis (see Table 1).

## Exposure to Occupational Hazards

Bakers are exposed to biological, physical, ergonomic, chemical and psychosocial hazards. Bakers' provided information on their exposure to occupational health and safety hazards, the sources of the hazards and strategies adopted to minimize the effects.

### Exposure to Physical Hazards

Physical hazards discussed are grouped into noise, smoke/dust, temperature (heat from the oven) and fire.

#### *Noise*

The bakery environment involves flour milling and mixing by using machines such as a dough-kneading machine, turbo sifters, mixer, roll plant and hand tray for shaping the edible dough. This shows that dough

mixers are always exposed to noise once they start kneading the flour. From the survey, all dough mixers were exposed to noise because of their activity.

The dough mixers disclosed that they did not feel comfortable wearing ear protective devices. However, further discussions with them revealed that they did not know the importance of using ear protective devices during their operation. When asked to rate their noise exposure, 75 percent of mixers rated their exposure as very high (above 85Db) (Figure 1).

Figure 1: Rating of noise by dough mixers

### Strategies against the Noise

In preventing the effects associated with noise, none of the employees had a structural or mechanical modification such as earplugs, mufflers, and noise protection enclosures, which provide a noise reduction.

### *Dust/Smoke*

Flour dust is associated with employees who are engaged in mixing the dough. It appeared from the survey that, all dough mixers were exposed to flour dust. Among the dough mixers; runny nose, excessive cough, wheezing, irritation of the eye and respiratory problems were some effects resulting from flour dust. This implies that dough mixers are likely to suffer from chronic pulmonary diseases such as bronchial asthma in the long term.

Table 2: Effects of flour dust reported by dough mixers

<b>*Effects</b>	<b>No.</b>	<b>%</b>
Runny nose	16	25
Excessive cough	16	25
Wheezing	16	25
Irritation of the eye	16	25
<b>Total</b>	<b>64</b>	<b>100</b>

\*Multiple responses

Figure 2: Control measures adopted against inhalation of flour dust

Control measures adopted by bakers to protect themselves from the effect of the flour dust included: having active ventilation (88%) and the use of handkerchief (12 percent) (Figure 2). The dough mixers did not use

the nose mask because it was uncomfortable during breathing. Others indicated that it was difficult to see when wearing the nose mask, which could result in an injury.

The survey revealed that 92 percent of the employers used traditional ovens to bake bread and pastries because it was cheaper to purchase fuelwood. All oven bakers and 97 percent of pan cleaners were exposed to smoke because of the fuelwood. Materials such as metal or wood slates and sacks were used to cover the oven during the burning of the fuelwood. The oven bakers checked on frequently to ensure that all the logs placed in the oven were burnt. Notwithstanding, pan cleaners were exposed to smoke because they were required to clean, grease and pack the baking pans at the same compound. From the survey, two percent of the employers had created chimneys to direct the smoke away from the baking space.

Table 3: Exposure to Smoke by Bakers

Variable	Employers		Employees				Total for employees	
	No.	%	Pan cleaners		Oven bakers		No.	%
			No.	%	No.	%		
Exposed to smoke								
Yes	19	49	38	97	39	100	77	99
No	20	51	1	3	0	0	1	1
<b>Sub-total</b>	<b>39</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>78</b>	<b>100</b>
*Effects of smoke								
Itching of the eye	18	33	38	27	39	25	77	26
Excessive cough	14	26	38	27	38	24	76	26
Wheezing	12	22	38	27	38	24	76	25
Stuffy nose	10	19	25	19	42	27	67	23
<b>Sub-total</b>	<b>54</b>	<b>100</b>	<b>139</b>	<b>100</b>	<b>157</b>	<b>100</b>	<b>296</b>	<b>100</b>
*Measures adopted								
Staying away from fire	16	35	33	46	36	43	69	45
Frequent break	2	4	3	4	23	27	26	17
Adjustment of ovens	4	9	0	0	12	14	12	8
Working in an open space	16	35	31	44	9	11	40	25
Active ventilation	4	9	3	4	2	3	5	3
Nothing is done	2	4	1	2	1	1	2	1
Chimney provided for the oven	2	4	0	0	1	1	1	1
<b>Sub-total</b>	<b>46</b>	<b>100</b>	<b>71</b>	<b>100</b>	<b>84</b>	<b>100</b>	<b>155</b>	<b>100</b>

\*Multiple responses

Exposure to smoke resulted in occupational diseases such as rhinitis, excessive cough and wheezing resulting in breathlessness. The smoke also results in residential hazards since the activities are carried out in a residential environment where people live. The smoky environment was seen as a normal issue since they use fuelwood.

### Strategies Adopted Against Smoke

The strategies respondents have adopted against smoke include staying away from fire, frequent break, working in an open space, active ventilation and adjustments of ovens (Table 3).

### *Fire hazard*

The use of fire is predominate in the baking environment since fuelwood is the main source of energy for the baking of bread and pastries. All oven bakers interviewed disclosed that they were exposed to fire hazards. Employers (63 percent) and employees (74 percent) rated exposure to fire hazards as very high. About 41 percent of employers indicated that they did get close to the fire when they wanted to check if the ovens were hot and whether the bread had been well baked. Both employers and oven bakers sustained burns because they used their hands in lifting hot baking pans from the oven.

Figure 3: Measures adopted against fire hazard

### **Measures Adopted Against Fire Hazards**

The most frequent measure adopted by employers and employees to fight against fire hazard was the use of a wooden and metallic peel to place and remove bread from the oven as well as regulate the fire in the oven. Surprisingly, some employers used hand gloves to hold the wooden and metallic peel to prevent burns from the hot oven (Figure 3). Employees, on the other hand, commented that the use of hand gloves made it difficult to work with the peels since they had to remove the baked bread from the oven.

Notwithstanding the effects of fire, out of the 12 employers who are members of Ghana Flour Users Association, eight of them had purchased fire extinguishers at their workplaces. Employers indicated that the process for acquiring them was cumbersome and expensive.

### *High Temperature*

The high temperature indicated was related to fire from the oven. About 53 percent and 59 percent of employers and employees claimed their exposure to high temperature from the ovens as very uncomfortable. According to Avula et al. [17], the standard temperature at the baking premises should be between 55<sup>0</sup>C - 60<sup>0</sup>C. Among the effects reported by employees were burns, scalds, fainting, and dizziness that recorded 33 percent, 23 percent, five percent, and 39 percent respectively. Employers also sustained burns (80 percent), (seven percent) scalds because of their exposure to the hot ovens.

### ***Strategies employed to control high temperature***

Strategies were however adopted to help curb the exposure of bakers to the effects of high temperature. Strategies ranged from physical barriers (use of metallic or wood sacks to cover the oven), manual regulation (by removing excess fire from the oven with a peel), rest breaks and staying hydrated were adopted by both employers and employees (Table 4).

Table 4: Effects and strategies adopted against high temperature

Variables	Employer		Employees	
	No.	%	No.	%
*Exposure to effects of high temperature				
Burns	36	80	28	33
Fainting	0	0	4	5
Scalds	3	7	20	23
Dizziness	6	13	34	39
<b>Sub-total</b>	<b>45</b>	<b>100</b>	<b>86</b>	<b>100</b>
*Strategies				
	No.	%	No.	%
Physical barriers	34	47	39	28
Rest breaks	31	42	39	28
Manual regulations	0	0	39	28
Staying hydrated	8	11	24	16
<b>Total</b>	<b>73</b>	<b>100</b>	<b>141</b>	<b>100</b>

\*Multiple responses

## Exposure to Biological Hazard

All dough mixers complained of being exposed to mosquitoes (34 percent), insects (34 percent) and rodents (32 percent), this is because ingredients such as flour, wheat, margarine, and sugar were kept in their working room. Oven bakers were least (21 percent) exposed to mosquito bites because of the extreme temperature from the oven. However, slicers who mostly started their work between the hours of 4 pm to 10 pm were exposed to mosquito bites (95 percent) (see Table 5).

Table 5: Exposure of Bakers to Biological hazard and Control Measures Adopted

Variable	Employer		Employees								Total for employees	
	No.	%	Pan Cleaners		Slicers		Oven bakers		Mixers		No.	%
			No.	%	No.	%	No.	%	No.	%		
<b>*Exposure</b>												
Mosquitoes	25	83.0	39	87.0	37	80.0	8	89.0	16	34.0	100	69.0
Insects	5	17.0	6	13.0	6	13.0	1	11.0	16	34.0	29	20.0
Rodents	0	0.0	0	0.0	0	0.0	0	0.0	15	32.0	15	11.0
<b>Subtotal</b>	<b>30</b>	<b>100</b>	<b>45</b>	<b>100</b>	<b>43</b>	<b>100</b>	<b>9</b>	<b>100</b>	<b>47</b>	<b>100</b>	<b>144</b>	<b>100</b>
<b>*Effects of exposure</b>												
Malaria	27	75.0	42	89.0	38	95.0	8	100.0	17	51.5	105	82.0
Physical weakness	9	25.0	5	11.0	2	5.0	0	0.0	16	48.5	23	18.0
<b>Subtotal</b>	<b>36</b>	<b>100</b>	<b>47</b>	<b>100</b>	<b>40</b>	<b>100</b>	<b>8</b>	<b>100</b>	<b>33</b>	<b>100</b>	<b>128</b>	<b>100</b>
<b>*Control measures</b>												
Wearing long-sleeved clothes	21	48.8	39	50.0	39	50.0	8	50.0	16	61.5	102	52.0
Use of mosquito repellents, coil	22	51.0	39	50.0	39	50.0	8	50.0	10	38.4	96	48.0
<b>Subtotal</b>	<b>43</b>	<b>100</b>	<b>78</b>	<b>100</b>	<b>78</b>	<b>100</b>	<b>16</b>	<b>100</b>	<b>26</b>	<b>100</b>	<b>198</b>	<b>100</b>

\*Multiple responses

The predominant effect of bakers' exposure to biological hazards was malaria (Table 7).

### Strategies employed to control their exposure to Biological Hazards

To protect themselves from mosquito bites bakers resulted in wearing long-sleeved clothes and the use of mosquito repellent and coil. Another method adopted by bakers was the use of burning orange peels gathered from an orange seller, others also resorted to drinking "Dr. Ceaser Lina Energy Tea" as a remedy to prevent malaria.

## Exposure to Psychosocial Hazard

Stress (workload), verbal abuse and poor interpersonal relationship are some types of psychosocial hazards reported. About 90 percent of employers indicated that their work was stressful since they worked more than

12 hours daily. These results in injuries, low productivity, absenteeism and poor concentration at work (Table 6). This contributes to a stressful and an unfriendly work environment.

Table 6: Exposure of Bakers to Psychosocial hazard

Variable	Employers		Employees								Total for employees	
	No.	%	Pan cleaners		Slicers		Oven bakers		Mixers		No.	%
<b>*Types</b>												
Stress	39	100.0	39	41.0	39	54.9	39	38.0	16	100.0	133	47.0
Poor interpersonal relationship	0	0.0	34	36.0	24	33.8	31	31.0	0	0	89	31.0
Verbal abuse	0	0.0	22	23.0	8	11.3	31	31.0	0	0	61	22.0
<b>Sub-total</b>	<b>39</b>	<b>100</b>	<b>95</b>	<b>100</b>	<b>71</b>	<b>100</b>	<b>101</b>	<b>100</b>	<b>16</b>	<b>100</b>	<b>283</b>	<b>100</b>
<b>*Effects</b>												
Low productivity	33	58	31	49.0	33	63.5	28	33.7	16	100	108	50.0
Poor concentration	12	21	14	22.0	7	13.5	20	24.0	0	0	41	19.0
Injuries	0	0	9	14.0	2	3.8	28	33.7	0	0	39	18.0
Absenteeism	8	14	7	11.0	5	9.6	3	3.6	0	0	15	7.0
Presenteeism	4	7	2	4.0	5	9.6	4	5.0	0	0	11	6.0
<b>Sub-total</b>	<b>57</b>	<b>100</b>	<b>63</b>	<b>100</b>	<b>52</b>	<b>100</b>	<b>83</b>	<b>100</b>	<b>16</b>	<b>100</b>	<b>214</b>	<b>100</b>
<b>*Strategies adopted</b>												
Showing respect	39	39.0	39	41.0	39	35.0	39	37.0	16	34.0	133	37
Report of dispute	39	39.0	39	41.0	39	35.0	39	37.0	16	34.0	133	37
Reduce work hours	23	22.0	18	18.0	33	30.0	28	26.0	15	32.0	94	26
<b>Sub-total</b>	<b>101</b>	<b>100</b>	<b>96</b>	<b>100</b>	<b>111</b>	<b>100</b>	<b>106</b>	<b>100</b>	<b>47</b>	<b>100</b>	<b>360</b>	<b>100</b>

\*Multiple responses

These psychosocial hazards affect workers and their families as well as their jobs since sickness is related to loss of productivity and hence low incomes.

## Strategies against Psychosocial Hazard

Employers adopted strategies such as showing respect at the workplace (39 percent), reduction in work hours (22 percent) and settling of dispute among employees (39 percent) to reduce psychosocial hazards at the workplace (Table 8).

## Exposure to Chemical Hazard

About 72 percent of pan cleaners were exposed to chemical hazards because they used bleach and “Azuma blow” to clean and wash napkins after baking. The perceived effects of the chemical hazard were mainly whitlow (44 percent) and irritation of the eye (56 percent) (Table 7).

Table 7: Exposure of Pan Cleaners to Chemical hazard

Variable	Employees (Pan cleaners)	
	No.	%
*Effects		
Irritation of the eye	28	56.0
Whitlow	22	44.0
<b>Subtotal</b>	<b>50</b>	<b>100</b>
Rating of exposure		
Very High	25	89.0
High	3	11.0
<b>Subtotal</b>	<b>28</b>	<b>100</b>

\*Multiple responses

Due to the chemicals used in the preparation of the local soap “Azuma blow” cleaners, develop whitlow and parts of their skin peel off.

## Exposure to Ergonomic Hazard

Bakers assumed working postures such as standing, sitting and bending which were done repetitively. Pan cleaners (100 percent), slicers (100 percent) stood for less than two hours because their activity required them to sit for close to seven hours each day. Sitting, standing, bending and lifting of heavy equipment for a longer period led to musculoskeletal disorders such as lower back pain, shoulder pain, and pain in the hand (see Table 8).

Table 8: Exposure of Bakers to Ergonomic hazard

Variable	Employers		Employees								Total for employees	
			Pan cleaners		Slicers		Oven bakers		Mixers			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>*Effects</b>												
Lower back pain	39	20	39	26	39	24	39	20	16	20	133	23
Shoulder pain	39	20	39	27	39	24	39	20	16	20	133	23
Neck pain	39	20	39	27	39	24	39	20	16	20	133	23
Pain in the hand	39	20	14	10	39	24	39	20	16	20	108	19
Muscle spasm and pain in the leg	39	20	14	10	7	4	39	20	16	20	76	12
<b>Subtotal</b>	<b>195</b>	<b>100</b>	<b>145</b>	<b>100</b>	<b>163</b>	<b>100</b>	<b>195</b>	<b>100</b>	<b>80</b>	<b>100</b>	<b>583</b>	<b>100</b>
<b>Rating of exposure</b>												
Very high	39	100	20	51.2	25	64.1	31	79.5	14	87.5	90	68
High	0	0	19	48.8	14	35.9	8	20.5	2	12.5	43	32
<b>Subtotal</b>	<b>39</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>16</b>	<b>100</b>	<b>133</b>	<b>100</b>
<b>*Control measures</b>												
Proper lifting			20	20.4	0	0	31	28.4	16	34	67	23
Continuous change in work posture			39	39.8	0	0	39	35.8	16	34	94	32
	N/A											
Mini breaks	39	100	39	39.8	39	100	39	35.8	15	32.0	132	45
<b>Sub-total</b>	<b>39</b>	<b>100</b>	<b>98</b>	<b>100</b>	<b>39</b>	<b>100</b>	<b>109</b>	<b>100</b>	<b>47</b>	<b>100</b>	<b>293</b>	<b>100</b>

\*Multiple responses

The muscles around the joints are subjected to tension. These could lead to low productivity among bakers and hence reduced incomes and profits on the side of employers.

### Strategies Adopted Against Ergonomic Hazard

The prevalence of ergonomic hazard was controlled by ensuring proper lifting, continuous change in work posture and adhering to mini-breaks (Table 8). Moving large baking trays and tins of flour dough from the mixer room to the bakery poses many health risks. They are usually heavy and bulky.

## Discussion

This study examines the exposure to occupational hazards among bakers in the Kumasi Metropolis of Ghana. The study found that the participants were exposed to various forms of occupational hazards such as physical, chemical, ergonomic, psycho-social and biological hazards. This finding was consistent with a previous study that found that bakers are exposed to biological, physical, ergonomic, chemical and psycho-social hazards [11]. It could be inferred that the exposure to occupational hazards may further expose the respondents to economic and social consequences through the payment of medical bills, absence from work and loss of productivity which could go a long way to undermine the quality of life and wellbeing of bakers in Ghana and other low and middle-income countries. To this end, specific interventions such as the formulation and implementation of occupational health and safety policy which incorporates frequent education and sensitization exercise on occupational hazards may help to scale down the exposure to hazards among bakers in Ghana.

The study revealed that the specific physical hazards the participants were exposed to include noise, smoke/dust, temperature (heat from the oven) and fire which is consistent with previous studies [9]. Exposure to noise, for instance, could cause hearing difficult among the participants and may result in pain in the ear (discharge), deafness and psychosocial hazards (stress, anxiety) [11, 18–19]. Apart from their exposure to noise, the majority of the respondents were exposed to smoke and flour dust which resulted from the use of traditional ovens to bake bread and pastries and inhalation of flour dust respectively. Higher exposure to smoke could also result in health and safety problems among the bakers as evident in the Giza Governorate [9]. Similar to previous studies, this study found health outcomes of exposure to smoke to include rhinitis, excessive cough and wheezing which could result in breathlessness [20–21], which could result in death in the long run [22]. The inhalation of flour dust which may contain fungi, silica, and bacterial endotoxins are considered to be harmful to human health [23]. In line with Avula et al. [17], the major health problems associated with flour dust were irritation of the eye, excessive cough, and wheezing. This implies that bakers are likely to suffer from chronic pulmonary diseases such as bronchial asthma in the long term.

The study further found that the majority of the respondents were exposed to fire because most of them predominantly use fuelwood as their main source of energy for baking of bread and pastries. To this end, the participants sustained burns because they used their hands in lifting hot baking pans from the oven. This finding agrees with Yossif and Abd Elaal [11] who indicated that 14 percent of bakers were exposed to burns in Benha City. Besides their exposure to fire hazards, the study also revealed that the participants were exposed to a high temperature which resulted in burns, scalds, fainting, and dizziness. These confirm studies by Yossif and Abd Elaal [11], Aguwa and Arinze-Onyia [24] and Ahmed et al. [25] who state that fainting, scalds, and burns are common effects of high temperature at the bakery industries. Heat stress leads to heat cramps, heat stroke and long-term death [26].

The study revealed that the specific biological hazards the participants were exposed to include mosquitoes, insects, and rodents because ingredients such as flour, wheat, margarine, and sugar were kept in their working room. Malaria was noted as the predominant effect of biological hazard participants were exposed to. Besides the biological hazards, the study reported that the participants were exposed to stress (workload), verbal abuse and poor interpersonal relationship as the types of psychosocial hazards. These psychological hazards resulted in injuries, low productivity, absenteeism and poor concentration at work. Employers refuse to increase their staff because the informal sector is geared towards profit maximization [27]. This contributes to a stressful and an unfriendly working environment. These psychosocial hazards affect workers and their families as well as their jobs since sickness is related to loss of productivity and hence low incomes. Besides, stress reduces workers' productivity, which causes an economic loss of about 4–5 percent of the Gross National Product of many countries [28]. These also have physical, mental and social health implications detrimental to bakers as suggested by Greenland et al. [28]. In this study, participants were exposed to chemical hazards. Bakers especially pan cleaners used sodium hydroxide, bleach and other chemicals for cleaning the baking environment which causes skin infection and irritation to the eye [24, 29]. Due to the chemicals used in the preparation of the local soap “Azuma blow” cleaners, develop whitlow and parts of their skin peel off.

This study revealed that bakers assumed working postures such as standing, sitting and bending. However, occupational activities such as weight lifting, poor work posture, repetitive movements and operating of the dough mixer led to an ergonomic hazard [30]. According to Yossif and Abd Elaal [11], exposure to musculoskeletal disorders increase when work duration increases. Sitting, standing, bending and lifting of heavy equipment for a longer period led to musculoskeletal disorders such as lower back pain, shoulder pain, and pain in the hand. Per a study conducted by Ghamari et al. [30], Yossif and Abd Elaal [11] indicated that awkward and repetitive work posture led to pain in the back and shoulder which are common in most developing countries. This can be attributed to the muscles around the joints being subjected to tension. These could lead to low productivity among bakers and hence reduced incomes and profits on the side of employers.

The study found that the participants employed varied strategies to control their exposure to the occupational hazards they were exposed to. Because different occupational hazards may require different strategies, participants have employed different strategies to control their exposure to each type of occupational hazard. Whereas operating in open spaces and the use of handkerchiefs have been employed against flour dust, the use of a wooden and metallic peel to place and remove bread from the oven as well as regulate the fire in the oven have been adopted against fire hazards. Regarding the high-temperature exposure, the study revealed that strategies employed ranged from physical barriers (use of metallic or wood sacks to cover the oven), manual regulation (by removing excess fire from the oven with a peel), rest breaks and staying hydrated. The prevalence of biological hazards was controlled through wearing long-sleeved clothes and the use of mosquito repellent and coil, whilst psychological hazards were reduced by showing respect at the workplace, reduction in work hours and settling of dispute and ergonomic hazards were controlled by ensuring proper lifting, continuous change in work posture and adhering to mini-breaks. This implies that the strategies employed by the participants could help to lessen their exposure to occupational hazards. It was, however, a surprise to note that in preventing the effects associated with noise, none of the employees had a structural

or mechanical modification such as earplugs, mufflers, and noise protection enclosures, which provide a noise reduction of 85 Db [18]. This could be a result of poor knowledge of the importance of using ear protective devices during their operation to reduce the noise-induced. This implies that the participants need to be sensitized or educated to deepen their knowledge of the importance of using ear protective devices to control noise.

The study has both strengths and weaknesses that should be remarked upon. In the first place, this is one of the first studies in Ghana to have examined the perceived exposure to occupational hazards among bakers and their strategies employed against their exposure to occupational hazards. The findings from this study have implications for informing appropriate policy and decision making to safeguard the health and safety as well as the quality of lives of bakers in the Kumasi metropolis and Ghana in particular. The findings are also critical to suggest the need for formulation and implementation of occupational health and safety policies, procedures, acts and legislation to reduce the exposure of bakers to occupational hazards. This study is essential to contributing partly to the realization of the Sustainable Development goal 8 and target 8.8 which seeks to protect labor rights and promote safe and secure working environments for all workers. The major limitations are that the authors were not able to get adequate literature to support our findings on the strategies employed against exposure to occupational hazards. This is because studies on coping strategies adopted by bakers to reduce their exposure to occupational hazards are scarce. We encourage more studies to be conducted in Ghana and other low-and middle-income countries to validate our findings or otherwise. Also, this study was purely descriptive and so were not able to establish a relationship and association between the socio-economic and demographic characteristics of the respondents and their exposure to occupational hazards. To this end, we recommend that future studies should examine the contribution of demographic and socio-economic factors in explaining perceived exposure to different types of occupational hazards among bakers to inform policy direction.

## **Conclusion**

This study examined perceived exposure to occupational hazards among bakers and their strategies employed to control or reduce their exposure to occupational hazards. The study found that participants were exposed to different types of occupational hazards such as physical hazards (fire, noise, smoke/flour dust, and high temperature), chemical hazards, ergonomic hazards, psycho-social and biological hazards. We argue that frequent exposure to occupational hazards among the participants could undermine their quality of life and wellbeing. It was however revealed that the participants had employed different coping strategies to control or reduce their exposure to occupational hazards. One key finding was that each type of occupational hazard requires a different coping strategy.

We suggest that there should be participatory and action-oriented programs organized for bakers at their weekly meetings to discuss topics on clear walkways, work posture, machine guards and safe handling of hazardous substances. Union executives should carry out worksite inspection accompanied by a checklist to monitor the progress of the sessions held during meetings. International Organisations should serve as facilitators in strengthening local efforts to improve health and safety among bakers. Properly constructed preventive programs will help reduce or eliminate occupational injuries and disease. The employees should

avail themselves for training, obey all safety rules and regulations and also use the appropriate PPE's to protect themselves against occupational hazards, injuries, and diseases.

## **Abbreviations**

GDP- Gross Domestic Product

SPSS- Statistical Package for the Social Sciences

ILO- International Labour Organization

## **Declarations**

# **Ethics Approval and Consent to Participate**

A letter of introduction was obtained from the head of the Department of Planning and sent to the heads of the Kumasi Metropolitan Labour Department, Bread Union, Environmental Health Department, and the Factories Inspectorate before the data collection exercise began. The respondents were also informed of the purposes and procedures involved in the study and the time needed to complete each questionnaire. They were also reassured that all information provided would be treated with the required confidentiality and anonymity. Further, informed and verbal consents were sought from the respondents before the data collection exercise began. They were further assured that their participation in the study was voluntary and that they were free to opt-out at any time.

## **Consent for Publication**

Not Applicable

## **Data and Material Availability**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## **Competing Interests**

The authors declare that they have no competing interests.

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## Authors' Contributions

WSB conceived the study, DA and WA-D contributed to the design, WSB collected the data, WSB, DA and WA-D analyzed the data and drafted the manuscript, DA and WA-D reviewed the draft. All authors read and approved the final draft. .

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## References

1. Bhuiyan, M.S.I. (2016). Pattern of occupational skin diseases among construction workers in Dhaka city. *Bangladesh Medical Journal*, 44(1),11-20
2. World Health Organization (2006). Declaration of workers health. WHO collaborating centres of occupational health: Stresa, Italy.
3. Takala, J., Hämmäläinen, P., Saarela, K. L., Yun, L. Y., Manickam, K., Jin, T. W. and Lin, G. S. (2014). Global estimates of the burden of injury and illness at work in 2012. *Journal of Occupational and Environmental Hygiene*, 11(5), 326–337.
4. International Labour Organization (2005). Facts on safety at work. International Labour Office: Geneva, Switzerland.
5. Machida, S. (2010). Strategic approach to occupational safety and health. A presentation at the 5<sup>th</sup> China international forum on work safety, Beijing. 31 August – 2 September 2010. Safe Work & ILO: Geneva.
6. World Health Organization (1994). Global Strategy on occupational health for all, the way to health at work. Geneva, Switzerland. Available: [who.org](http://who.org). [Accessed on 18<sup>th</sup> August 2018].
7. Amponsah-Tawiah, K. and Dartey-Baah, K. (2011). Occupational health and safety: Key issues and concerns in Ghana. *International Journal of Business and Social Science*, 2(14), 119-126.
8. Kumar, C. R., Verma, K. C., and Neetika, A. (2016). An assessment of the knowledge, attitudes and practices about the prevention of occupational hazards and utilization of safety measures among meat workers in a city of Haryana state of India. *Indian Journal of Applied Research* 6 (3), 40-48.
9. Doaa, M. A., Nagah, M. A., and Heba M. S. (2017). Common health problems and safety measures among workers intraditional bakeries at Giza Governorate. *Med. J. Cairo Univ.* 85 (3): 993-1001.
10. Stoia, M. and Oancea, S. (2008). Occupational risk assessment in a bakery unit from the district of Sibiu. Research Paper.

11. Yossif, H. A and Abd Elaal E. M. (2012) Occupational hazards: Prevention of health problems among bakery workers in Benha City. *J Am Sci*, 8 (3), 99-108.
12. Ghana Statistical Service (GSS) (2014). 2010 Population and housing census: District analytical report, Kumasi Metropolitan. Ghana Statistical Service. Available: statsghana.gov.gh. [Accessed on 20<sup>th</sup> October 2018].
13. Hall J. (2008). Encyclopedia of survey research methods; Cross-sectional survey design edited by Paul J. Lavrakas. Available: <http://dx.doi.org/10.4135/9781412963947.n120>. [Accessed on 20<sup>th</sup> February 2019].
14. Oslen, C. and George, D. M. (2004) Cross-sectional study design and data analysis under the young epidemiology scholars program (YES) supported by the Robert Wood Johnson Foundation and administered by the College Board.
15. Dillman, D. A. (2000). Mail and internet surveys: The tailored design method, (2nd ed.), New York: John Wiley.
16. Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, 7(1), 24–25.
17. Avula, I. J., Stanley, O.N. and Samuel, N.K. (2015). Assessment of safety measures used by staff in bakeries in Yenagoa, Bayelsa State, Nigeria. *J Health All. Res*, 2(1), 7-15.
18. Wachira, W.B. (2016). Status of occupational safety and health in flour milling companies in Nairobi, Kenya. Unpublished M.Sc. (Occupational Safety and Health) Special Study Submitted to the Department of Occupational Safety and Health, Jomo Kenyata University of Agriculture and Technology.
19. Mellor, N., and Webster, J. (2013). Enablers and challenges in implementing a comprehensive workplace health and well-being approach. *International Journal of Workplace Health Management*, 6(2), 129-142.
20. Po, J.Y.T, FitzGerald, J.M. and Carlsten, C. (2011). Respiratory disease associated with solid biomass fuel exposure in rural women and children: Systematic review and meta-analysis, *PubMed*, 66(3), 232-239.
21. Smoke, H.W. (2012). How wood smoke harms your health. Available: <https://fortress.wa.gov/ecy/publications/publications/91br023.pdf>. [Accessed on 8<sup>th</sup> May 2019].
22. World Health Organization [WHO] (2013). Declaration on occupational health for all. WHO, Beijing.
23. Rushtan, L. (2007). Occupational causes of chronic obstructive pulmonary diseases. *Rev Environ Health*, 22(3), 195- 212.
24. Aguwa, E. N., and Arinze-Onyia Sussan, U. (2014). Assessment of baking industries in a developing country: The common hazards, health challenges, control measures and association to asthma. *Int Res J Med Sci*, 15(20), 21-25.
25. Ahmed, A., Bilal, L., and Merghani, T. (2009): Effects of exposure to flour dust on respiratory symptoms and lung function of bakery workers: A case control Sudanese Journal of Public Health, 4, 1-8
26. Commission on Health, Safety, and Workers' Compensation (2010). The Whole Worker: Guidelines for Integrating Occupational Health and Safety with Workplace Wellness Programs. Available: <http://lohp.org/whole-worker/>. [Accessed on 18<sup>th</sup> January 2019].
27. De Bruin, G.P. and Taylor, N. (2005) Development of the sources of work stress inventory. *South African Journal of Psychology*, 35, 748-765.

- 28. Greenlund, K., Liu, K., Knox, S., McCreath, H., Dyer, A. and Gardin, J. (1995). Psychosocial work characteristics and cardiovascular disease risk factors in young adults: The CARDIA Study. *Social Science & Medicine*, 41, 717-723.
- 29. Arrandale, V., Meijster, T. and Pronk, A. (2013). Skin symptoms in bakery and auto body shop workers: associations with exposure and respiratory symptoms. *Int Arch Occup Environ Health*, 86(2), 167-75
- 30. Ghamari, F., Mohammad, B.A. and Tajik, R. (2009). Ergonomic assessment of working postures in Arak bakery workers by the OWAS method, *Journal of School of Public Health and Institute of Public Health Research*, 7(1), 47-55.

## Figures

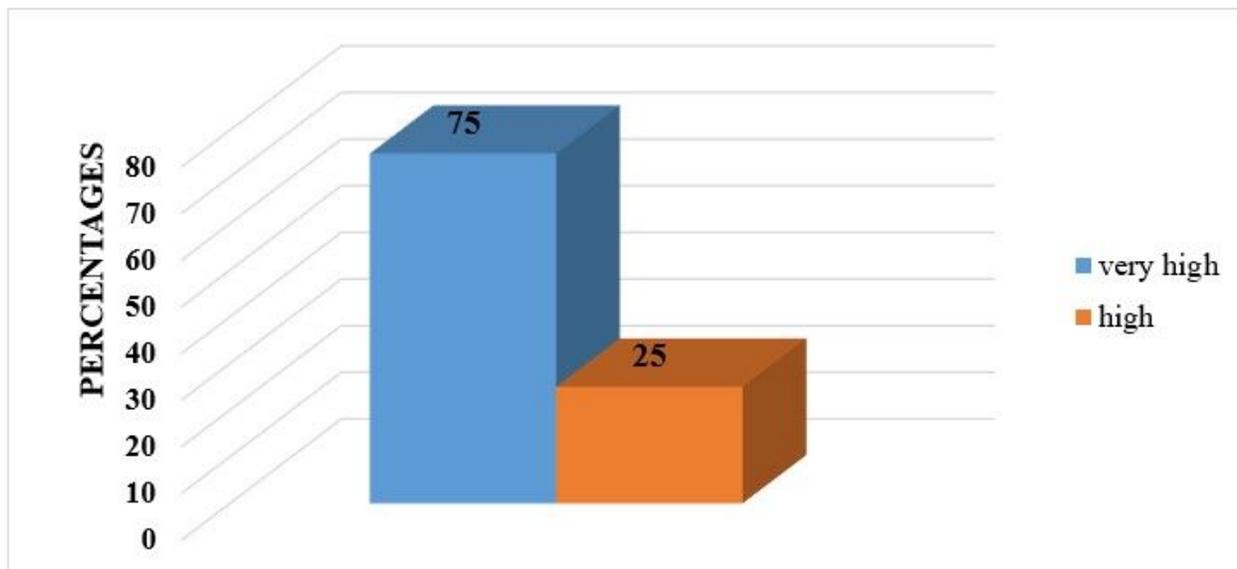
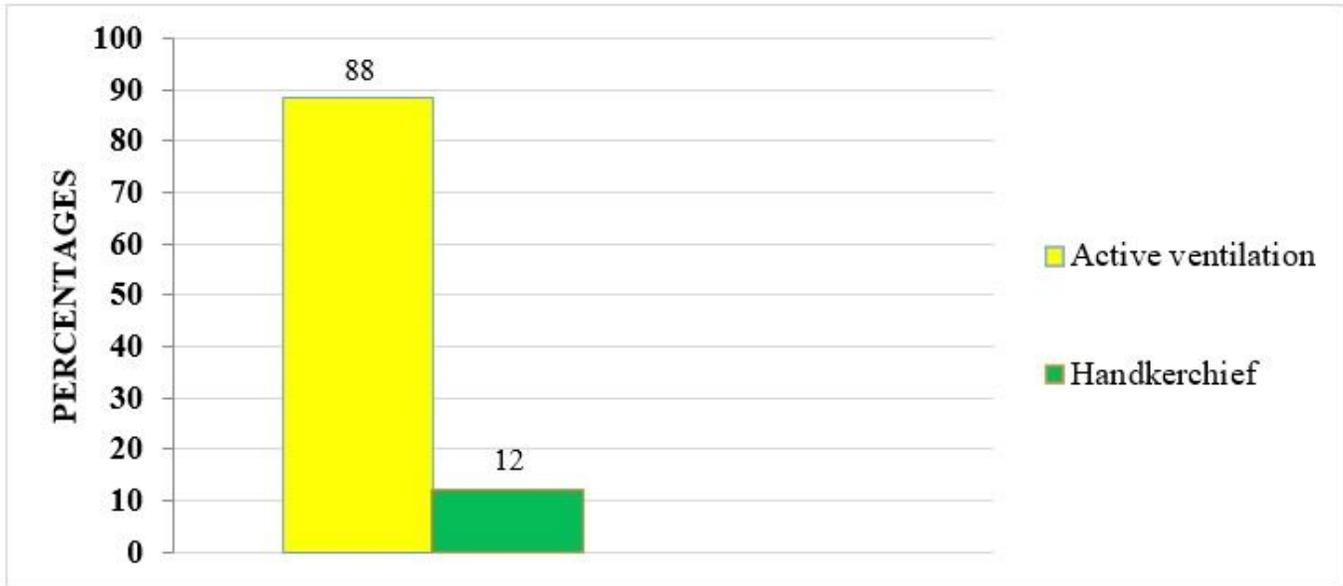


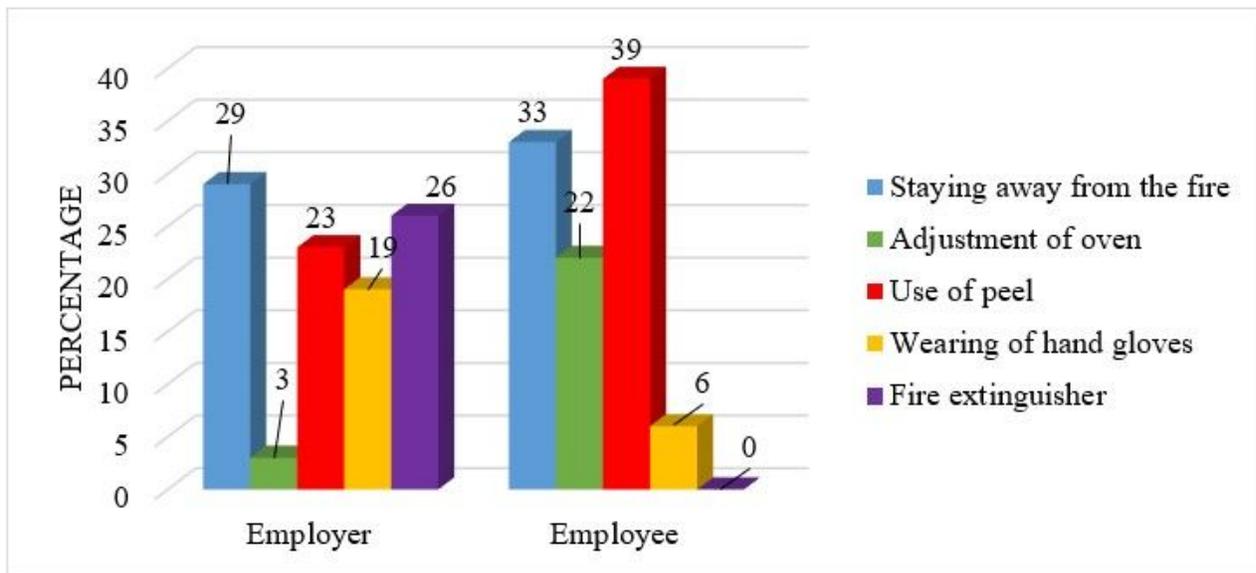
Figure 2

Rating of noise by dough mixers



**Figure 4**

Control measures adopted against inhalation of flour dust



**Figure 5**

Measures adopted against fire hazard