Occupational Health Hazards and Work-Related Factors Among Grain Millers in North Central Nigeria

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ABSTRACT

Grain milling in Nigeria are usually at informal and small-scale in nature which exposes grain millers' occupational health hazard such as high concentrations of airborne particulate matter, noise, and ergonomic strain. These mills are often characterized with poorly ventilated environments and with limited use of personal protective equipment (PPE). A descriptive cross-sectional survey involving 165 workers across major milling hubs was conducted using structured, interviewer-administered questionnaires. Results revealed high prevalence rates of eye irritation (57.0%), phlegm (54.3%), fatigue (49.1%), cough (38.8%), and shortness of breath (30.9%). Statistical analysis showed significant associations between longer work experience and daily working hours with increased respiratory symptoms ($p<0.05$), while days worked per week had minimal impact. These findings underscore the urgent need for improved occupational safety practices, including enforced PPE use, ergonomic interventions, and policy-driven health protections to mitigate health risks in the grain milling sector.

Keywords: Occupational health; grain miller; respiratory symptom; Work Experience; Nigeria;

INTRODUCTION

Occupational health threats in the informal and small-scale industrial sectors, in fact, constitute a major public health issue in developing countries where regulation enforcement is poor [1]. The grain milling industry makes an important contribution to Nigeria's food supply, mostly comprises small-scale and labor-intensive production with outdated equipment, poor ventilation, and minimum use of protective devices [2]. In addition to these environmental and operational conditions that constitute an occupational risk, levels of noise, particulate matter (PM) from flour dust and diesel exhaust, and biological contaminants such as fungi and bacteria threaten the health of the grain millers [3],[4].

It is estimated that there are 2.9 million fatalities related to work globally every year, with occupational diseases accounting for 2.58 million, while injuries at the workplace accounted for 320,000 [5]. According to [6], such exposures contribute significantly toward non-communicable diseases; this include, hearing loss 16%, COPD 13%, asthma by 11%, and back pain 37%. In Nigeria, occupational health threats have been found to cause major concerns toward health and economic losses, with over 100 deaths annually and huge losses in productivity in naira [2].

Grain millers have been exposed to high levels of airborne particulate matter (PM10 and PM2.5), especially from flour dust, which acts as a respiratory sensitizer [4]. Reference [3] reported that PM2.5 concentrations in grain mills were above the 24-hour limit of 25 $\mu g/m^3$ set by WHO. These particulates were dust emissions from poorly maintained machinery, and the severity of exposure increases in environments with poor ventilation and a lack of personal protective equipment (PPE). Such particulate matter pollution, with longer

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exposure, has been reported to cause occupational asthma, chronic bronchitis, and Chronic Obstructive Pulmonary Disease (COPD) [7],[8].

The informal nature of most mills in Nigeria limits the enforcement of occupational health regulations and fosters work environment devoid of adequate safety practices. Studies have reported that workers are generally unaware of occupational hazards and either do not use personal protective equipment (PPE) or are rarely provided with such devices [9], [10]. Ergonomic risks, including prolonged standing, repetitive tasks, and manual handling of heavy loads, further increase the likelihood of developing musculoskeletal disorders [11].

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Though grain milling plays a significant role in the socio-economic development of North Central In Nigeria, there is a scarcity of empirical data on the occupational hazards prevalent in the industry. Consequently, the present study aims to assess self-reported diseases and symptoms among grain millers in North Central Nigeria. Recognizing the outcomes of this study is essential for informing targeted interventions, regulatory policies, and health promotion initiatives aimed at protecting this high-risk population [3].

MATERIALS AND METHODS

A. Study Area

This study was conducted in the North Central region of Nigeria, encompassing three significant grain trading markets. These include the Ago Saraki Market in Ilorin (Kwara State), the Kure Market in Minna (Niger State), and the Gwagwalada Market in Abuja (Federal Capital Territory). These markets were selected purposively based on their roles as primary hubs in the grain milling industry and their representative nature of the agricultural, occupational, and economic dynamics of the region. The Ago Saraki Market, located in Ilorin West Local Government Area of Kwara State, serves as a prominent center for the milling and distribution of maize, millet, sorghum, and rice. The Kure Market in Minna is situated within the Chanchaga Local Government Area and is noted for its extensive grain milling activities, often conducted under exposure to dust, machine noise, and exhaust emissions. The Gwagwalada Market, located in the semi-urban Gwagwalada LGA of Abuja, functions as a grain processing and redistribution hub serving the urban center of the capital.

B. Study Design and Sampling

Descriptive cross-sectional design was adopted for this study. A census sampling method was utilized to include all 165 eligible grain millers operating within the selected markets who met the inclusion criteria. The ages of the participants ranged from 15 to 60 years, with 141 (85.5%) males and 24 (14.5%) females

C. Questionnaire Design and Administration

Data were collected using a validated, structured, interviewer-administered questionnaire. The questionnaire was designed to assess self-reported respiratory symptoms (e.g., cough, phlegm, short breath), eye strain, and ergonomic issues common in grain milling environments. Demographic and occupational variables were also included.

The final questionnaire was administered in-person by trained interviewers fluent in local languages. Preliminary visits were made to all selected markets to engage with millers' associations and explain the purpose of the study. Participants were included based on the following inclusion criteria: engagement in grain milling for a minimum of two years, age between 15 – 60years, daily operational exposure of at least 5 hours for at least five days per week, and voluntary consent to participate in the study.

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D. Ethical Considerations

Ethical clearance for the study was obtained from the Ethical Review Board of the Department of Environmental Health Science, Kwara State University. Informed consent was secured from all participants prior to data collection.

RESULT

Table one (1) presents a descriptive summary of the prevalence of self-reported health symptoms among a sample of workers (N = 165). The most commonly reported conditions include eye irritation (57.0%), redness of the eye (57.6%), and phlegm production (54.3%), suggesting frequent exposure to irritants. Respiratory symptoms such as cough (38.8%), catarrh (36.4%), and shortness of breath (30.9%) were also reported at notable levels, indicating potential respiratory stress among workers. Fatigue was nearly evenly distributed (49.1%), while skin injuries (35.2%) and nose irritation/itching (33.3%) were moderately prevalent. In contrast, hypertension was rare, affecting only 1.2% of respondents. Overall, the data suggest a high burden of ocular and respiratory complaints in the working population, possibly reflecting occupational environmental exposures.

Table two (2) presents the analysis investigates the distribution of selected occupational health symptoms across workers categorized by years of experience (2–5 years, 6–10 years, and >10 years). The findings are based on cross-tabulated symptom frequencies and Pearson's Chi-square test of independence to assess statistical significance.

Notably, cough ($\chi^2 = 7.505$, $p = 0.023$), catarrh ($\chi^2 = 7.323$, $p = 0.026$), and shortness of breath ($\chi^2 = 18.177$, $p < 0.001$) demonstrated statistically significant associations with years of experience. Prevalence of these symptoms increased progressively with longer work exposure, with the highest proportions observed in individuals with more than 10 years of occupational experience 51.7% for cough, 48.3% for catarrh, and 51.7% for shortness of breath. These findings suggest a potential cumulative exposure effect or age-related vulnerability.

Conversely, other symptoms such as phlegm ($p = 0.471$), nose irritation/itching ($p = 0.934$), hypertension ($p = 0.660$), eye-related symptoms ($p > 0.24$), fatigue ($p = 0.695$), and skin injuries ($p = 0.194$) exhibited no statistically significant differences across experience categories, indicating a relatively uniform distribution irrespective of tenure.

Table three (3) relationship between daily working hours and the occurrence of selected occupational health symptoms among workers, categorized into three groups: ≤7 hours, 7–8 hours, and >8 hours per day. Using Pearson's Chi-square test, the study evaluated whether symptom prevalence significantly varied across these time categories.

Table 1 Prevalence of Self-Reported Occupational Health Symptoms Among Workers

		Count	Percentage
Cough	No	101	61.2
	Yes	64	38.8
	Total	165	100.0
Phlegm	No	75	45.7
	Yes	89	54.3
	Total	164	100.0

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Nose Irritation/Itching	No	110	66.7
	Yes	55	33.3
	Total	165	100.0
Catarrh	No	105	63.6
	Yes	60	36.4
	Total	165	100.0
Shortness in breathing	No	114	69.1
	Yes	51	30.9
	Total	165	100.0
Hypertension	No	163	98.8
	Yes	2	1.2
Redness of the eye	No	70	42.4
	Yes	95	57.6
Eye irritation	No	71	43.0
	Yes	94	57.0
Fatigue	No	84	50.9
	Yes	81	49.1
Cut Skin	No	107	64.8
	Yes	58	35.2

In contrast, other symptoms such as nose irritation/itching ($p = 1.000$), catarrh ($p = 0.182$), shortness of breath ($p = 0.787$), and hypertension ($p = 0.344$) did not exhibit significant differences across work duration categories. Similarly, symptoms related to the eyes (e.g., redness and irritation), fatigue, and skin injuries (cut skin) also showed no statistically significant association with the number of hours worked daily ($p > 0.05$).

Table four (4) association between the number of working days per week (≤6 vs. 7 days) and the prevalence of common occupational health symptoms using Pearson's Chi-square test for independence.

Among the ten health symptoms assessed, only cut skin injuries exhibited a statistically significant association with workweek length ($\chi^2 = 4.984$, $p = 0.026$). Workers who reported working 7 days per week had a higher incidence of skin injuries (39.5%) compared to those working ≤6 days (19.4%), indicating a potential cumulative risk of physical trauma with increased occupational exposure.

Other symptoms, including cough ($p = 0.125$), phlegm ($p = 0.861$), catarrh ($p = 0.972$), shortness of breath ($p = 0.386$), and eye or fatigue-related complaints ($p > 0.3$), did not demonstrate statistically significant variation between the two groups. While certain symptoms like cough and fatigue showed numerically higher prevalence in the 7-day group, these differences did not reach statistical significance.

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DISCUSSION

The present study examined the prevalence of self-reported occupational health symptoms among grain mill workers, revealing high rates of phlegm production (54.3%), eye irritation (57.0%), redness of the eyes (57.6%), fatigue (49.1%), and respiratory complaints such as cough (38.8%) and shortness of breath (30.9%). These findings are consistent with recent literature highlighting the respiratory and dermal health burden in flour and grain milling environments. For instance, [12] identified a strong association between grain dust exposure and the development of chronic respiratory symptoms, substantiated by skin test reactivity to grain-dust extracts. Their clinical validation of respiratory sensitization directly supports our observation of elevated cough and breathing difficulties. Similarly, Reference [13] documented frequent reports of eye strain, fatigue, and nasal congestion among workers in flour milling operations, attributing these symptoms to persistent exposure to fine flour particulates within poorly ventilated indoor environments, paralleling the elevated rates of eye irritation and fatigue observed in our study.

Reference [12] found that exposure to grain dust has been strongly correlated with characteristics of chronic respiratory alteration in clear association with skin test reactivity in grain-dust extracts. Respiratory sensitization validated clinically would support the observation made by the current study regarding increased cough and breathing difficulties. Similarly, [13] also reported eye irritation, fatigue, and nasal congestion symptoms that often occur among workers in flour milling operations; all of which are caused by the chronic exposure to fine flour particulates in poorly ventilated indoor environments, similar to the high rates of eye irritation and tiredness documented in our study.

The study results further show that 35.2% of grain mill workers develop cuts or bruises on their skin, whilst 49.1% suffer from occupational fatigue. These findings are typical of inherent occupational hazards occurring in high-risk industrial situations such as milling. Reference [14] also observed almost similar trends in their research conduction in Ebonyi State, Nigeria, where at least 88% of the workers had experienced industrial accidents, majority involving lacerations, abrasions, and bruises. The authors attributed these injuries to inadequate safety practices, such as the improper use or absence of personal protective equipment (PPE), insufficient machine guarding, and a lack of safety training.

Table 2 Symptom Distribution By Experience Level And Chi-Square Test

Symptom	2–5 Yrs. Yes (%)	6–10Yrs. Yes (%)	>10 Yrs. Yes (%)	Chi-square	Df	p-value
Cough	16 (27.1)	18 (37.5)	30 (51.7)	7.505	2	0.023
Phlegm	29 (49.2)	25 (53.2)	35 (60.3)	1.507	2	0.471
Nose Irritation/ Itching	19 (32.2)	17 (35.4)	19 (32.8)	0.136	2	0.934
Catarrh	21 (35.6)	11 (22.9)	28 (48.3)	7.323	2	0.026
Shortness in Breathing	12 (20.3)	9 (18.8)	30 (51.7)	18.177	2	0.000
Hypertension	1 (1.7)	0 (0.0)	1 (1.7)	0.831	2	0.660
Redness of the Eye	33 (55.9)	27 (56.2)	35 (60.3)	0.282	2	0.869
Eye Irritation	30 (50.8)	32 (66.7)	26 (44.8)	2.820	2	0.244
Fatigue	27 (45.8)	23 (47.9)	31 (53.4)	0.729	2	0.695
Cut Skin	16 (27.1)	17 (35.4)	25 (43.1)	3.281	2	0.194

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Table 3 Symptom Distribution By Daily Working Hours And Chi-Square Test

Symptom	≤7 Hrs. (Yes %)	7–8 Hrs. (Yes %)	>8 Hrs. (Yes %)	Chi-square	df	p-value
Cough	2 (11.1)	6 (25.0)	56 (45.5)	10.083	2	0.006
Phlegm	9 (52.9)	7 (29.2)	73 (59.3)	7.385	2	0.025
Nose Irritation/Itching	6 (33.3)	8 (33.3)	41 (33.3)	0.000	2	1.000
Catarrh	3 (16.7)	9 (37.5)	48 (39.0)	3.408	2	0.182
Shortness in Breathing	6 (33.3)	6 (25.0)	39 (31.7)	0.479	2	0.787
Hypertension	0 (0.0)	1 (4.2)	1 (0.8)	2.134	2	0.344
Redness of the Eye	12 (66.7)	14 (58.3)	69 (56.1)	0.725	2	0.696
Eye Irritation	11 (61.1)	11 (45.8)	70 (56.9)	0.203	2	0.903
Fatigue	11 (61.1)	15 (62.5)	55 (44.7)	3.710	2	0.156
Cut Skin	6 (33.3)	10 (41.7)	42 (34.1)	0.528	2	0.768

Similarly, occupational fatigue in our findings reflects cumulative physical stressors associated with repetitive manual tasks, prolonged standing, and suboptimal ergonomic conditions factors also noted in [14]'s analysis. [15], focused on wheat-derived mill, affirmed that flour milling by-products, such as wheat germ, can induce respiratory symptoms, highlighting potential health risks through airborne transmission or direct contact. These mechanistic insights lend further support to the plausibility of symptom occurrence in our occupational context. Based on current literature, the observed pattern in your chi-square analysis where years of experience and daily exposure hours showed significant associations with respiratory symptoms while days worked per week did not is well-supported by occupational health studies in similar contexts.

Workers in grain and flour milling industries are often exposed to high concentrations of particulate matter, flour dust, and diesel fumes, leading to chronic respiratory conditions. The current study corroborates a study by [3] and [16] who shown that long-term exposure, measured in years of experience, significantly correlates with declines in lung function and increased symptoms such as cough, catarrh, and shortness of breath. This cumulative exposure results in chronic inflammatory responses in the respiratory tract, particularly where protective equipment is lacking and engineering controls are absent.

Table 4: Symptom Distribution by Days Worked Per Week and Chi-Square Test Results

Symptom	≤6 Days (Yes %)	7 Days (Yes %)	Chi-square	df	p-value
Cough	10 (27.8)	54 (41.9)	2.351	1	0.125
Phlegm	20 (55.6)	69 (53.9)	0.031	1	0.861
Nose Irritation/Itching	14 (38.9)	41 (31.8)	0.640	1	0.424
Catarrh	13 (36.1)	47 (36.4)	0.001	1	0.972
Shortness in Breathing	9 (25.0)	42 (32.6)	0.753	1	0.386

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Hypertension	0 (0.0)	2 (1.6)	0.565	1	0.452
Redness of the Eye	19 (52.8)	76 (58.9)	0.434	1	0.510
Eye Irritation	18 (50.0)	76 (58.9)	0.912	1	0.339
Fatigue	17 (47.2)	64 (49.6)	0.064	1	0.800
Cut Skin/Bruises	7 (19.4)	51 (39.5)	4.984	1	0.026

In terms of hours worked per day, Reference [17] and [12] highlight that prolonged daily exposure to dust especially in poorly ventilated milling shops can trigger acute respiratory responses such as cough, nasal irritation, and phlegm production. The mechanism here involves both dose-dependent irritant effects and insufficient recovery time for airway clearance. Thus, workers with long shifts are more vulnerable, even if their total years in the job are limited.

However, number of days worked per week did not show a significant association, likely because the intensity of daily exposure and total duration of exposure over years play more dominant roles in disease progression than frequency alone. As supported by [18] and [19], even workers exposed only five days per week but for extended hours or over long careers face a higher burden of respiratory symptoms compared to those working more frequently but under safer or shorter conditions

CONCLUSION

This study has demonstrated a significant burden of occupational health symptoms among grain mill workers, with high prevalence rates of eye irritation (57.0%), phlegm production (54.3%), fatigue (49.1%), and skin cuts or bruises (35.2%). Respiratory complaints such as cough (38.8%) and shortness of breath (30.9%) were also notably present. The study affirmed that these health issues were due to prolonged exposure to occupational health risks associated with grain milling operations. The findings are consistent with existing literature, including recent studies among mill and processing workers, which highlight inadequate machine guarding, poor use of personal protective equipment (PPE), and physically demanding work conditions as major contributors to occupational morbidity. The elevated rates of fatigue in particular point to the dual impact of mechanical hazards and ergonomic strain, suggesting that grain milling environments require urgent occupational health interventions.

RECOMMENDATION

NESREA and Environmental Health Officers should enforce minimum occupational health standards in informal grain mills in the markets, including mandatory PPE usage, routine air quality inspections, and environmental noise monitoring and to Subsidize protective equipment (masks, earplugs, goggles) for small-scale millers through cooperative unions or local government interventions.

Millers' Associations and Trade Unions should advocate for better workplace conditions and legal recognition of health rights for informal workers and facilitate bulk purchasing of PPE and the creation of shared sanitation or health facilities within market clusters.

LIMITATION OF STUDY

This study relied on self-reported data, making it prone to recall and social desirability bias. Symptoms may have been under- or over-reported due to misunderstanding or stigma. Seasonal bias exists, as data were collected during a single climatic period. Exposure levels may vary across seasons, limiting generalizability. Clinical diagnostic tools were not used for confirmation. The study focused solely on informal mills, excluding formal industrial settings. Findings may not apply to mechanized sectors with different exposure profiles. Its cross-sectional design limits causal inference and long-term health tracking.

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