

## Prevalence and Determinant of Respiratory Symptoms Among Rice Mill Workers in Sokoto State, Northwest Nigeria

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### ABSTRACT

**Introduction:** Rice milling provides a means of livelihood to many in Northwest Nigeria, but like any other profession, it is not without risks. Workers in rice mills are exposed to hazards which has deleterious effects on many systems in the body, one of them is the respiratory system. This study aimed to determine the prevalence and factors that are associated with respiratory problems among rice millers in Sokoto State, Northwest Nigeria.

**Methods:** A cross-sectional study was conducted between June 2019 and July 2019. An interviewer-administered questionnaire was used to obtain responses from the participants.

**Results:** A total of 398 workers participated in the study, and 230(57.8%) of them had at least one symptom of respiratory morbidity. Morning cough 184(46.2%) had the highest prevalence, followed by chest tightness 157(39.4%). Cigarette smoking, involvement in de-husking and paddy separation were factors that increase the likelihood of having respiratory symptoms among the workers.

**Conclusion:** The prevalence of respiratory symptoms is high among rice mill workers, and the factors that were found to determine the presence of respiratory symptoms were cigarette smoking, and involvement in de-husking and paddy separation.

**Key words:** Chest pain, Cough, Respiratory symptoms, Rice mill workers.

### INTRODUCTION

Rice is arguably the most important source of calories for humans, it accounts for 21% of per capita caloric intake globally and 27% in developing countries.<sup>1</sup> Rice has fed more people over a longer period than any other crop, however, workers in rice mills in developing countries work in a hazardous work environment that poses danger to their respiratory

health.<sup>2-4</sup> Dust produced during grain processing has long been associated with diseases affecting several organs including the lungs, eyes, nose, skin, and airways.<sup>5-7</sup> Occupational respiratory disease has been described as an acute or chronic disorder that arises from the inhalation of airborne agents in the workplace.<sup>8</sup> Studies among rice mill workers have shown distinctive clinical, haematological, and radiological findings described as "Rice Millers' Syndrome".<sup>9</sup> Workers in rice mills are potentially exposed to organic and inorganic dust which adversely affect health.<sup>5</sup> Residents living close to these mills are also not spared from the dust as more often than not, in developing countries, these mills are within residential areas.<sup>10</sup> The rice husk is covered with small needle-like hairs that project outwards as sharp elongated spines when viewed under an electron microscope.<sup>9</sup> Rice husk is high in silica and may cause pulmonary disease with characteristic

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pleural thickening and fibrosis.<sup>5</sup> Dust exposure in rice mills causes inflammatory reactions of the pulmonary tissues, eosinophilia, and asthma-related disease.<sup>9</sup>

Rice husk dust causes damage to bronchial passages along with damage to the elastic component of alveolar walls.<sup>11</sup> Respiratory system diseases induced by occupational dust are influenced by the type of dust and duration of exposure.<sup>12</sup> Cross-sectional studies conducted among workers exposed to dust from flour, cotton, wood, barley, and other grains have all demonstrated respiratory abnormalities similar to those found among rice mill workers.<sup>13-15</sup> The common respiratory symptoms that have been reported among workers exposed to rice dust include cough, breathlessness, chest tightness, wheezing, cough on exertion, phlegm expectoration, etc.<sup>2,8,16-22</sup>

This study aimed to determine the prevalence and factors that may be associated with respiratory problems among rice millers in Sokoto State, Northwest Nigeria.

## METHODS

This was a descriptive cross-sectional study carried out between June and July 2019 in Sokoto State, Northwest Nigeria. Sokoto state is about 649km from Abuja (the nation's capital) and 470km from Kano (the economic capital of Northern Nigeria). The study population comprised workers who were at least 18 years old and had worked for a minimum of one year in the rice mills, while those who are sick, those not fully involved in rice milling activities, and administrative staff were excluded from the study.

A total of 398 participants were recruited for the study based on a prevalence of cough of 64.4 % obtained in a previous study in Ebonyi state<sup>2</sup> and using the Fisher's formula<sup>23</sup> for cross-sectional studies, and a 10% adjustment for non-response.<sup>24</sup>

A multi-stage sampling technique was employed in selecting the respondents. First, two Local Government Areas (LGAs) were selected from the three LGAs majorly involved in rice milling using simple random sampling by balloting, then a line list of all the rice mills operating within the LGAs was obtained from their respective rice miller's associations. Based on the average number of workers in each rice mill during the preliminary survey, 60 rice mills were selected from the two LGAs by simple random sampling using a table of random numbers, thereafter, a systematic sampling

technique was used to select 398 study participants. This was done by obtaining the line list of all workers in each of the selected rice mills. These lists were used as the sampling frame for the selected mills. Proportionate allocation (PA) of the number of workers to be enrolled in each of the selected rice mills was done, and the sampling interval was calculated for all rice mills. The first study subject in each mill was chosen by balloting, then subsequent study subjects were enrolled by adding the value of the sampling interval to the serial number of previously enrolled study subjects.

Data were collected using an interviewer-administered questionnaire adapted from the Medical Research Council Questionnaire on respiratory symptoms.<sup>25</sup>

Data analysis was done using IBM® SPSS version 23. Socio-demographic variables were summarised using mean with standard deviation and frequencies with percentages. A Chi-square test was performed to assess the association between independent socio-demographic/work profiles and the outcome variable, while binary logistic regression was used in determining the predictors of respiratory symptoms among the workers. Ethical approval was obtained from the Ethics Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto.

## RESULTS

The respondents' ages range between 18 and 65years, with a mean of  $26.2 \pm 7.5$  years. The majority of the respondents, 235(59.0%) were in the 20 – 29 years age group, and 31(7.8%) of them were above 40years of age. All of the respondents were males and Muslims. Less than half 145(36.4%) of them were currently married, and only a few 4(1.0%) had tertiary education. Only 63(15.8%) of the 398 respondents smoked cigarettes, and most 297(74.6%) had worked for less than 10 years (Table 1)

The majority of the respondents 230(57.8%) had at least one symptom of respiratory morbidity. Morning cough was the predominant symptom as nearly half of the respondents (46.2%) reported having morning cough, followed by chest tightness which had a prevalence of 39.4%, while another 149(37.4%) reported phlegm expectoration. Nearly a quarter of the respondents 99(24.9%) had dyspnoea. About one-fifth (19.8%) of the respondents had attacks of wheezing or whistling in the last twelve months preceding the onset of the study. Only a few 31(7.8%) of the 398 respondents

have had a chest illness which kept them from usual activities for up to a week (Table 2).

There was a significant association ( $p < 0.05$ ) between smoking and symptoms of respiratory morbidity. The proportion of respondents with symptoms of respiratory morbidity was significantly higher among cigarette smokers compared to the non-smokers, ( $p = 0.002$ ). Only de-husking and paddy separation were the work variables significantly associated ( $p < 0.05$ ) with respondents' reports of symptoms of respiratory morbidity. Respondents that were involved in de-husking had a significantly higher ( $p < 0.05$ ) prevalence of respiratory morbidity (66.2%), as compared to those that were not (54.3%), while respondents involved in paddy separation had a significantly higher prevalence of symptoms of respiratory morbidity compared to those who were not ( $p = 0.018$ ). The proportions of respondents with symptoms of respiratory morbidity did not differ significantly by their age, marital status, and education status (Table 3).

Smoking, involvement in de-husking, and paddy separation were factors that predict having symptoms of respiratory morbidity. Respondents who smoke cigarettes were almost three times more likely to have symptoms of respiratory morbidity as compared to non-cigarette smokers (aOR 2.830, CI 1.512-5.297,  $p = 0.001$ ). Respondents involved in de-husking had approximately twice more odds of having symptoms of respiratory morbidity compared to those not involved (aOR 1.851, CI 1.183-2.896,  $p = 0.007$ ). The odds of having symptoms of respiratory morbidity were 1.8 times more among respondents involved in paddy separation compared to those that were not (aOR 1.779, CI 1.173-2.697,  $p = 0.007$ ). (Table 4)

A little above one-third 145 (36.4%) of the respondents used one form of protective device or another. Hand gloves 139 (95.9%) were the most commonly used protective device among respondents who reported the use of PPE, followed by safety boots (22.8%), while only 4.9% of them used a face cover (Table 5).

**Table 1:** Respondents' socio-demographic characteristics

Variables	Number of respondents (n=398)	Percentage (%)
<b>Age group (years)</b>		
≤ 19	52	13.1
20 – 29	235	59.0
30 – 39	80	20.1
40 – 49	27	6.8
≥ 50	4	1.0
<b>Sex</b>		
Male	398	100
<b>Religion</b>		
Islam	398	100
<b>Marital status</b>		
Unmarried	253	63.6
Married	145	36.4
<b>Educational status</b>		
Informal	244	61.3
Primary	86	21.6
Secondary	64	16.1
Tertiary	4	1.0
<b>History of cigarette smoking</b>		
Yes	63	15.8
No	335	84.2
<b>Duration of working experience (years)</b>		
<10	297	74.6
10-19	72	18.1
≥ 20	29	7.3

**Table 2:** Symptoms of respiratory morbidity among the respondents

*Symptoms	Number of respondents (n=398)	Percentage (%)
Reported at least one symptom	250	57.8
Morning cough	184	46.2
Chest tightness	157	39.4
Phlegm	149	37.4
Cough on exertion	128	32.2
Dyspnoea	99	24.9
Attack of wheezing or whistling in the last twelve months	79	19.8
Had chest illness which kept him from usual activities for as much as one week in the past three years	31	7.8
Produced more phlegm than usual in any of the illnesses (n = 31)	30	96.7
Had more than one episode of such illness in the past three years (n = 31)	26	83.9

\*Multiple responses allowed

**Table 3:** Factors associated with symptoms of respiratory morbidity

Socio-demographic variables n = 398	Symptoms of respiratory morbidity		<sup>a</sup> Odds ratio, (p-value)
	Yes n = 232, n (%)	No n = 166, n (%)	
<b>Age (years)</b>			
< 30	170 (59.2)	117 (40.8)	0.87, (p = 0.540)
≥30	62 (55.9)	49 (44.1)	
<b>Marital status</b>			
Unmarried*	149 (58.9)	104 (41.1)	0.93, (p = 0.748)
Married	83 (57.2)	62 (42.8)	
<b>Educational status</b>			
Informal	137 (56.1)	107 (43.9)	1.26, (p = 0.275)
Formal	95 (61.7)	59 (38.3)	
<b>Smoking</b>			
No	184 (54.9)	151 (45.1)	2.63, (p = 0.002)
Yes	48 (76.2)	15 (23.8)	
<b>Pre-cleaning</b>			
No	143 (58.6)	101 (41.4)	0.97 (p = 0.873)
Yes	89 (57.8)	65 (42.2)	
<b>Parboiling</b>			
No	127 (59.6)	86 (40.4)	0.89, (p = 0.563)
Yes	105 (56.8)	80 (43.2)	
<b>Drying</b>			
No	109 (55.1)	89 (44.9)	1.30, (p = 0.192)
Yes	123 (61.5)	77 (38.5)	
<b>De-husking</b>			
No	144 (54.3)	121 (45.7)	1.64, (p = 0.024)
Yes	88 (66.2)	45 (33.8)	
<b>Paddy separation</b>			
No	98 (52.1)	90 (47.9)	1.62, (p = 0.018)
Yes	134 (63.8)	76 (36.2)	

<b>Number of working days per week</b>			
≤ 5	186 (56.9)	141 (43.1)	1.40, (p = 0.221)
>5	46 (64.8)	25 (35.2)	
<b>Number of working hours per day</b>			
≤ 8	169 (61.5)	106 (38.5)	0.66, (p = 0.056)
>8	63 (51.2)	60 (48.8)	
<b>Length of working experience (years)</b>			
<10	176 (59.3)	121 (40.7)	0.86, (p = 0.502)
≥10	56 (55.4)	45 (44.6)	

<sup>a</sup>Crude Odds ratio;      \*(single, divorced, and separated)

**Table 4:** Predictors of symptoms of respiratory morbidity among respondents

<b>Variables</b>	<b>aOR</b>	<b>95% Confidence Interval</b>		<b>p-value</b>
		<b>Lower</b>	<b>Upper</b>	
Smoking (non-smokers* vs smokers)	2.830	1.512	5.297	0.001
De-husking (No* vs Yes)	1.851	1.183	2.896	0.007
Paddy separation (No* vs Yes)	1.779	1.173	2.697	0.007

\*reference value;      aOR- adjusted odds ratio

**Table 5:** Use of personal protective equipment among respondents

<b>Variables</b>	<b>Number of respondents</b>	<b>Percentage (%)</b>
<b>Use of PPE (n=398)</b>		
Yes	145	36.4
No	253	63.6
<b>*Type of PPE used (n=145)</b>		
Use hand gloves	139	95.9
Use safety boots	33	22.8
Use face masks	7	4.9
Others**	6	4.1

\*Multiple responses allowed,      \*\*(helmets, and aprons)

## DISCUSSION

Rice milling provides a means of livelihood to many in Northwest Nigeria, but like any other profession, it is not without risk. Rice mill workers suffer from myriads of respiratory health problems as demonstrated from previous studies from around the world, and also highlighted in this study.<sup>2,8,18,19</sup> This study found a high prevalence of respiratory symptoms among rice mill workers with about six out of every ten workers reporting at least one respiratory symptom. A study conducted by Ratnaprabha in India reported a similarly high prevalence of respiratory symptoms among rice mill workers.<sup>8</sup> In our study, morning cough was the most prevalent (46.2%) of all the respiratory symptoms reported by the workers. Other studies in Asia and Africa have also reported morning cough to be the commonest respiratory symptom among rice mill workers.<sup>2,8,22</sup> However, in a study in Malaysia, chest

tightness was the most prevalent respiratory symptom.<sup>5</sup> Cough frequently reported among workers in rice mills has been attributed to the effect of rice husk and other contaminants in the rice dust which include silica, fungi, aflatoxins, and bacterial endotoxins.<sup>26</sup> The prevalence of morning cough reported in this study is higher than the 32.83% reported in India.<sup>8</sup> It was much lower than the 64.35% and 62.9% reported among rice millers in Ebonyi and Ekiti states of Nigeria respectively.<sup>2,22</sup> The differences observed may be a result of the differences in the age of workers and the duration of exposure. The high prevalence of cough in these studies is a pointer to the poor use of personal protective equipment among the workers and calls for prompt action by the regulatory agencies involved before more serious problems develop.

Aside from cough which was the most prevalent respiratory symptom, chest tightness (39.4%), phlegm

(37.4%), and cough on exertion (32.2%) were the other respiratory symptoms reported by workers in this study. These findings align with reports in other studies among workers involved in rice processing in Asia and Africa.<sup>5,9,19,22</sup> The proportion of workers with chest tightness in this study is higher than the 20.7% reported in Ekiti, 34.9% reported in Malaysia, and 29.5% reported in India.<sup>5,20,22</sup> About a quarter (24.9%) of the workers in our study experienced dyspnoea, this could negatively impact the productivity of the mills as more workers will be away from work due to ill health. Studies in India reported similarly high levels of dyspnoea among rice mill workers.<sup>8, 19, 20</sup> Respiratory symptoms seen in rice mill workers have been attributed to repeated irritation of the airways from exposure to dust, this implies that with adequate use of PPE and environmental control measures, the symptoms are largely preventable.<sup>9</sup> Sadly, the use of protective devices by these workers is abysmally low and this may be responsible for the high prevalence of respiratory symptoms reported among them. The low usage of protective devices is not peculiar to rice mill workers alone as this only reflects what happens in most informal workplaces in Nigeria.<sup>22,27</sup> Similar findings have been reported in other studies, meaning that this ugly trend is not peculiar to Nigeria rice mills alone and calls for urgent action globally to address this problem.<sup>8,28</sup>

This study shows that workers exposed to higher dust levels report respiratory symptoms more frequently demonstrating the dose-response effect of rice dust. Workers involved in de-husking (aOR 1.9, CI 1.2-2.9), and paddy separation (aOR 1.8, CI 1.2-2.7), were more at risk of having respiratory symptoms compared to those that work at the other stages of rice milling. Similar effects have been demonstrated in other studies.<sup>19,29</sup> Also, our study showed that cigarette smoking significantly increases the risk of respiratory symptoms among rice mill workers (aOR 2.8, CI 1.5-5.3). The

hazardous effect of smoking on the lungs has long been documented, and cigarette smoking has been shown to have a positive multiplicative effect on occupational lung disease which explains the association seen in this study.<sup>30</sup> A similar finding was reported among rice mill workers in Malaysia.<sup>5</sup> However, our study did not demonstrate significant associations between age, marital status, educational status, duration of exposure, and workers having respiratory symptoms, unlike in other studies in Malaysia and India where age and duration of work were significantly associated with respiratory symptoms.<sup>5,31</sup> The predominantly younger age and shorter duration of exposure to dust among workers in our study might be responsible for this difference.

## CONCLUSION

The prevalence of respiratory symptoms is high among the workers, with cough being the most prevalent. Workers who smoked cigarettes as well as those involved in de-husking and paddy separation were found to have an increased risk of having respiratory symptoms. The use of personal protective devices by the workers was abysmally low as only about 5% of them used face masks at work. Therefore, we recommend that both the workers and the rice mill owners should be educated on the dangers rice dust poses to health. Also, workers were counselled on the proper use of face masks during working hours as well as quitting cigarette smoking.

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