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.1 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.2-4 Dust produced during grain processing has long been associated with diseases affecting several organs including the lungs, eyes, nose, skin, and airways.5-7 Occupational respiratory disease has been described as an acute or chronic disorder that arises from the inhalation of airborne agents in the workplace.8 Studies among rice mill workers have shown distinctive clinical, haematological, and radiological findings described as “Rice Millers’ Syndrome”.9 Workers in rice mills are potentially exposed to organic and inorganic dust which adversely affect health.5 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.10 The rice husk is covered with small needle-like hairs that project outwards as sharp elongated spines when viewed under an electron microscope.9 Rice husk is high in silica and may cause pulmonary disease with characteristic...
Dust exposure in rice mills causes inflammatory reactions of the pulmonary tissues, eosinophilia, and asthma-related disease. Rice husk dust causes damage to bronchial passages along with damage to the elastic component of alveolar walls. Respiratory system diseases induced by occupational dust are influenced by the type of dust and duration of exposure. 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. 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. 

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 and using the Fisher’s formula for cross-sectional studies, and a 10% adjustment for non-response. 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. 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 65 years, with a mean of 26.2 ± 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 40 years 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).

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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 (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 (%) |
|----------------------------|-------------------------------|----------------|
| Age group (years)          |                               |                |
| ≤ 19                       | 52                            | 13.1           |
| 20 – 29                    | 235                           | 59.0           |
| 30 – 39                    | 80                            | 20.1           |
| 40 – 49                    | 27                            | 6.8            |
| ≥ 50                       | 4                             | 1.0            |
| Sex                        |                               |                |
| Male                       | 398                           | 100            |
| Religion                   |                               |                |
| Islam                      | 398                           | 100            |
| Marital status             |                               |                |
| Unmarried                  | 253                           | 63.6           |
| Married                    | 145                           | 36.4           |
| Educational status         |                               |                |
| Informal                   | 244                           | 61.3           |
| Primary                    | 86                            | 21.6           |
| Secondary                  | 64                            | 16.1           |
| Tertiary                   | 4                             | 1.0            |
| History of cigarette smoking|                               |                |
| Yes                        | 63                            | 15.8           |
| No                         | 335                           | 84.2           |
| Duration of working experience (years) |   |                |
| <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 |  |
|-------------------------------------|----------------------------------|---|
|  | Yes n = 232, n (%) | No n = 166, n (%) | Odds ratio, (p-value) |
| Age (years) | | | |
| < 30 | 170 (59.2) | 117 (40.8) | 0.87, (p = 0.540) |
| ≥30 | 62 (55.9) | 49 (44.1) | |
| Marital status | | | |
| Unmarried* | 149 (58.9) | 104 (41.1) | 0.93, (p = 0.748) |
| Married | 83 (57.2) | 62 (42.8) | |
| Educational status | | | |
| Informal | 137 (56.1) | 107 (43.9) | 1.26, (p = 0.275) |
| Formal | 95 (61.7) | 59 (38.3) | |
| Smoking | | | |
| No | 184 (54.9) | 151 (45.1) | 2.63, (p = 0.002) |
| Yes | 48 (76.2) | 15 (23.8) | |
| Pre-cleaning | | | |
| No | 143 (58.6) | 101 (41.4) | 0.97 (p = 0.873) |
| Yes | 89 (57.8) | 65 (42.2) | |
| Parboiling | | | |
| No | 127 (59.6) | 86 (40.4) | 0.89, (p = 0.563) |
| Yes | 105 (56.8) | 80 (43.2) | |
| Drying | | | |
| No | 109 (55.1) | 89 (44.9) | 1.30, (p = 0.192) |
| Yes | 123 (61.5) | 77 (38.5) | |
| De-husking | | | |
| No | 144 (54.3) | 121 (45.7) | 1.64, (p = 0.024) |
| Yes | 88 (66.2) | 45 (33.8) | |
| Paddy separation | | | |
| No | 98 (52.1) | 90 (47.9) | 1.62, (p = 0.018) |
| Yes | 134 (63.8) | 76 (36.2) | |
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| Number of working days per week | ≤ 5     | >5     | Odds Ratio | p-value  |
|-------------------------------|---------|--------|------------|----------|
| ≤ 5                           | 186 (56.9) | 141 (43.1) | 1.40       | 0.221    |
| >5                            | 46 (64.8)  | 25 (35.2)   |            |          |

| Number of working hours per day | ≤ 8     | >8     | Odds Ratio | p-value  |
|--------------------------------|---------|--------|------------|----------|
| ≤ 8                            | 169 (61.5) | 106 (38.5) | 0.66       | 0.056    |
| >8                             | 63 (51.2)  | 60 (48.8)   |            |          |

| Length of working experience (years) | <10     | ≥10     | Odds Ratio | p-value  |
|-------------------------------------|---------|--------|------------|----------|
| <10                                 | 176 (59.3) | 121 (40.7) | 0.86       | 0.502    |
| ≥10                                 | 56 (55.4)  | 45 (44.6)   |            |          |

*Crude Odds ratio; *(single, divorced, and separated)

Table 4: Predictors of symptoms of respiratory morbidity among respondents

| Variables                                           | aOR | 95% Confidence Interval | p-value |
|-----------------------------------------------------|-----|-------------------------|---------|
| 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

| Variables | Number of respondents | Percentage (%) |
|-----------|-----------------------|----------------|
| Use of PPE (n=398) |                      |                |
| Yes       | 145                   | 36.4           |
| No        | 253                   | 63.6           |
| *Type of PPE used (n=145) |                      |                |
| 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.²,⁸,¹⁸,¹⁹ 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.² 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.²,⁸,²² However, in a study in Malaysia, chest tightness was the most prevalent respiratory symptom.⁵ 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.²⁶ The prevalence of morning cough reported in this study is higher than the 32.83% reported in India.⁵ It was much lower than the 64.35% and 62.9% reported among rice millers in Ebonyi and Ekiti states of Nigeria respectively.²,²² 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.\textsuperscript{5,9,19,22} The proportion of workers with chest tightness in this study is higher than the 20.7% reported in Ekiti,\textsuperscript{3} 34.9% reported in Malaysia, and 29.5% reported in India.\textsuperscript{5,20,22} 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.\textsuperscript{5, 19, 20}

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.\textsuperscript{9} 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.\textsuperscript{22,27} 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.\textsuperscript{8,28}

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.\textsuperscript{19,20} 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.\textsuperscript{20} A similar finding was reported among rice mill workers in Malaysia.\textsuperscript{5} 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.\textsuperscript{5,31} 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.

ACKNOWLEDGEMENTS

The authors wish to appreciate the executives of the rice miller’s association in Sokoto state for permitting the conduct of this study. We would also want to thank all the administrative staff of the Department of Community Medicine of Usmanu Danfodiyo University Teaching Hospital Sokoto State for their support during the conduct of the study.

REFERENCES

1. Awika JM. Major Cereal Grains Production and Use around the World. 2011 [cited 25th June 2018]. In: Advances in Cereal Science: Implications to Food Processing and Health Promotion [Internet]. Texas, [cited 25th June 2018]; [1-13]. Available from: http://pubs.acs.org/doi/full/10.1021/bk-2011-1089.ch001.

2. Oginyi CNR, Mbam OS, Abojei CO, James ON. Assessment of Occupational Health Hazard and the Use of Safety Measures among Rice Mill Workers in Ebonyi State, Nigeria. World Applied Sciences Journal. 2017;35(7):1133-41.

3. Prasanna GVK, Dewangan KN, Sarkar A, Kumari A, Kar B. Occupational noise in rice mills. Noise Health [serial online] 2008;10(39):55-67.
4. Darbastwar AM, Kumar B, Ravinder A. A study of prevalence of musculoskeletal disorder among the rice mill workers in Karimnagar. J Evolution Med Dent Sci. 2016;5(21):1106-10.

5. Musa R, Naing L, Ahmad Z, Kamarul Y. Respiratory health of rice millers in Kelantan, Malaysia. Southeast Asian J Trop Med Public Health. 2000;31(3):575-8.

6. Mansouri F, Pili JP, Abbasi A, Soltani M, Izadi N. Respiratory problems among cotton textile workers. Lung India. 2016;33(2):163-6.

7. Meo SA. Dose responses of years of exposure on lung functions in flour mill workers. J Occup Health. 2004;46(3):187-91.

8. Ratnaprabha GK, Manjunath. Respiratory Morbidities and Pulmonary Function Tests of Rice Mill Workers in a City of Kamataka. J Pub Health Med Res. 2016;4(1):1-5.

9. Lim HH, Domala Z, Joginder S, Lee SH, Lim CS, Abubakar CM. Rice millers’ syndrome: a preliminary report. British Journal of Industrial Medicine. 1984;41(4):445-9.

10. Batsungneon K, Kulworawanichpong T. Effect of Dust Particles in Local Rice Mills on Human Respiratory System. World Academy of Science, Engineering and Technology. 2011;80:421-6.

11. Singh SK, Nishith SD, Tandon GS, Shukla N, Saxena SK. Some observations on pulmonary function tests in rice mill workers. Ind J Physiol Pharmac. 1988;32(2):152-7.

12. Meo SA, Al-Drees A. Lung function among non-smoking wheat flour mill workers. International Journal of Occupational Medicine and Environmental Health. 2005;18(3):259-64.

13. Wang XR, Eisen EA, Zhang HX, Sun BX, Dai HL, Pan LD, et al. Respiratory symptoms and cotton dust exposure; results of a 15-year follow up observation. Occup Environ Med. 2003;60(12):935-41.

14. Ige OM, Awoyemi OB. Respiratory symptoms and ventilatory function of the bakery workers in Ibadan, Nigeria. West Afr J Med. 2002;21(4):316-8.

15. Asia AA, Atram GG. Respiratory symptoms and ventilatory functions among saw mill workers. Indian Journal of Basic and Applied Medical Research. 2017;6(4):336-40.

16. Dhillon SK, Bassi R, Kaur H. A Study of Lung Function Abnormalities in Workers of Rice Mills. Indian Journal of Fundamental and Applied Life Sciences. 2011;1(3):217-20.

17. Zaman MA, Farouk SM, Islam AKMS. Work Environment and Environmental pollutions in Rice Mills of Bangladesh. Journal of AgricMachBioresour Eng. 2006; 4(1,2):67-73.

18. Chandraithalika KRM, Seneviratne SDA, Lankathilake KN, Samaranyake DBDL, Karunarathna AK, editors. Respiratory health problems of rice mill workers in Ampara divisional secretariat division. KDU International Research Symposium; 2014; General Sir John Kotelawala Defence University. Sri Lanka2018. 116-21.

19. Ghosh T, Gangopadhayay S, Das B. Prevalence of respiratory symptoms and disorders among rice mill workers in India. Environ Health Prev Med. 2014;19(3):226-33.

20. Naik PR, Nirgude AS, Megana P. Respiratory Morbidity and Peak Expiratory Flow Rate among Rice Mill Workers in a Rural Area of South India. National Journal of Community Medicine. 2017;8(5):246-9.

21. Rana MC, Naskar S, Roy R, Das DK, Das S. Respiratory morbidity among rice mill workers in an urban area of Burdwan District, West Bengal: A cross-sectional study. Indian J Occup Environ Med. 2018;22(1):5-10.

22. Marcus O, Emmanuel EE, Bamidele JO. Assessment of occupational hazards, safety measures, and lung function among small scale rice mill workers in Ekiti state South Western Nigeria. 2018.

23. Ibrahim T. Research Methodology and Dissertation writing for Health & Allied Health Professionals. 1st ed. Abuja: Cress Global Link; 2009.

24. Kirkwood BR, Sterne JAC. Essential Medical statistics. 2nd ed. Oxford: Blackwell; 2003:423.

25. Medical Research Council’s Committee on Environmental and Occupational Health. Questionnaire on respiratory symptoms London, Medical Research Council1986 [cited 2017 6th December]. Available from: https://www.mrc.ac.uk/documents/pdf/questionnaire-on-respiratory-symptoms-1986/.

26. Desai MS, Ghosh SK. Aflatoxin Related Occupational Hazards Among Rice Mill Workers. Journal of Toxicology. 2008;8(2):81-7.

27. Sabitu K, Iliyasu Z, M. M. Dauda. Awareness of occupational hazards and utilization of safety measures among welders in Kaduna metropolis, Northern Nigeria. Ann Afr Med. 2009;8(1):46-51.

28. Prakash S, Manjunatha S, Shashikala C. Morbidity patterns among rice mill workers. Indian J Occup Environ Med. 2010;14(3):91-3.

29. Yach D, Myers J, Bradshaw D, Benatar SR. A respiratory epidemiologic survey of grain mill workers in Cape Town, South Africa. The American review of respiratory disease. 1985;131(4):505-10.

30. Tse LA, Yu ITS, Qiu H, Leung CC. Joint effects of smoking and silicosis on diseases of the lungs. PLoS One. 2014;9(8):e104494.

31. Mulamalla RR, Shaik AR, Challa SR. A Study of Respiratory Symptoms and Disorders among Rice Mill Workers. Journal of Evolution of Medical and Dental Sciences. 2020;9(39):2874-9.