Prevalence and Factors Associated with Work-related Rhinitis among Dust-exposed Congolese Cassava and Corn Millers

Prévalence et Facteurs associés à la Rhinite Professionnelle chez les Meuniers Congolais exposés aux poussières de Farine de Manioc et Maïs

Mbutshu HL[1], Ngatu RN[2], Malonga FK[1], Mbelambela PE[3], Nyembwe DS[4], Kayembe NJ M[5].

Corresponding author
Ngatu Roger Nlandu, *MD. PhD.*
Address: University of Kochi; Ike campus. 2751-1 Ike; Kochi-city. Zipcode: 781-8515. Kochi prefecture, Japan.
Tel/Fax: +81-888478633;
E-mail: doc.rogerngatu@gmail.com

Résumé

Contexte et objectif: La Rhinite Professionnelle (RP) est fréquente chez des travailleurs exposés aux poussières. Elle serait 2 à 4 fois plus fréquente que l'asthme professionnel. Cette étude évalue l'ampleur et les facteurs associés à la RP chez des meuniers congolais exposés aux poussières de farine de manioc et maïs à Lubumbashi, en RD Congo.
Méthodes. Enquête transversale comparant les données de santé respiratoire et musculo-squelettique entre un groupe de 365 meuniers exposés aux poussières et 365 agents des services administratifs réputés non exposés à Lubumbashi. Un questionnaire anonyme et validé sur l'asthme professionnel a été administré à tous les 730 participants, de même que des questions supplémentaires sur la RP, définie selon ECDC (European Center for Disease Control).
Résultats: La RP est significativement plus fréquente chez les meuniers (76% vs. 23%, p<0.001). Ses déterminants sont : la non utilisation du masque de protection (OR=5.5; 95% IC: 4.1-11.0), le tabagisme (OR=1.8; 95% IC: 1.0-3.3) et le niveau bas d'éducation (O.R. =1.62: 95% CI: 1.26–4.58; p=0.014).
Conclusion: Cette enquête illustre la nécessité d'implanter des mesures préventives et de protection en milieu de travail, dans cette catégorie de la population.

Mots clés: Meuniers, Rhinite professionnelle, Fréquence, Déterminants, Lubumbashi

[1] Ecole de Santé Publique, Lubumbashi, DRC
[2] School of Health & Nursing Sciences, University of Kochi, Japan
[3] Dpt of Environmental Medicine, Kochi University
[4] Oto-Rhino-Lanryngology, Kinshasa University Hospital, DRC.
[5] Pneumology, Kinshasa University Hospital, DRC

Summary

Context and objective: Work-related rhinitis (WRR) is a common disorder in dust-exposed workers; it is reported to be 2 to 4 times more frequent than occupational asthma. This study aims to assess the scope and factors associated to WRR in a sample of dust-exposed Congolese cassava and corn millers in Lubumbashi, Democratic Republic of the Congo.
Methods: A cross-sectional study covering a 12 months period was conducted on the respiratory and musculo-squeletal health of 730 workers, including 365 dust-exposed millers matched to 365 unexposed office workers. They anonymously answered a self-administered and validated asthma questionnaire with additional questions related to occupational rhinitis. WRR was defined according to the European Center for Disease Control (ECDC) position paper.
Results: Results showed a markedly high frequency of WRR in millers as compared with non-exposed office workers (76% vs. 23%; p<0.001). In addition, lack of protective mask (OR= 5.5; 95% IC: 4.1-11.0), smoking (OR=1.8; 95% IC: 1.0-3.3) and low education level (O.R. = 1.62: 95% CI: 1.26–4.58; p=0.014) increased the risk of developing WRR.
Conclusion: This study showed that WRR complaints were prevalent among cassava and corn flour-exposed millers, suggesting the need to improve occupational safety to reduce the magnitude of exposure and related nuisance in cassava and/or corn milling facilities.

Keywords: Millers, Professional rhinitis, Frequency, Risk factors, Lubumbashi

Introduction

Work-related rhinitis (WRR) is an inflammatory illness of the nose characterized by intermittent or permanent nasal symptoms such as rhinorrhea, nasal congestion, sneezing, itching due to causes attributable to work environment (1). Slavin define WRR as an episodic, work-related occurrence of sneezing, nasal discharge and nasal obstruction (2).

WRR is considered one of the most prevalent occupational disease whose prevalence is estimated to be 2-4 times higher compared to occupational asthma; it is a common disorder among dust-exposed workers and can lead to asthma. According to the etiology, WRR can be allergic or non-allergic (3, 4). WRR is often underdiagnosed due to under-reporting of cases, a lack of awareness among doctors and an insufficient occupational medicine specialists, particularly in developing countries.

WRR has a negative impact on the worker's health, often resulting in psychosocial problems, a deficit of work performance and a reduced productivity. The adverse effects of exposure to organic dust from crops or grains on human's health were first reported by Bernardino Ramazzini in 1713, who stated that this health hazard irritates the throat, the lungs, as well as the eyes and skin of grain workers (5). In addition, several epidemiological studies have shown the association between chronic exposure to organic dust and respiratory symptoms such as rhinitis, cough, asthma, airway obstruction, etc. (6). Cassava and corn milling is a growing small-scale business in central African countries where millers have multiple exposure to health hazards such as organic dust, vibration and noise (7). The present report highlights the scope and factors associated with occupational rhinitis-related complaints among Congolese cassava and corn millers occurring in the previous 12 months in Lubumbashi, Democratic Republic of the Congo (DRC).

Material and methods

Study design, site and participants

From January 2011 to December 2012, we conducted a cross-sectional study in Lubumbashi among 365 workers exposed to cassava and/or corn flour dust (exposed group) who were age-matched to 365 office workers (non-exposed group). The detailed methods were reported elsewhere (7). Lubumbashi is an area with a lot of both legal and illegal mining exploitation activities; male millers and office workers not involved in any activity with possible dust-exposure were enrolled in this study. An informed consent was provided by each of the consecutive participants after being given details about the study and before enrollment.

Definition of work-related rhinitis and questionnaire

WRR was defined according to the European Center for Disease Control (ECDC) position paper on occupational rhinitis as one or more episodes of "inflammatory disease of the nose characterized by intermittent or persistent symptoms (i.e., nasal congestion, sneezing, rhinorrhea, itching), variable nasal airflow limitation or hypersecretion due to conditions attributable to a particular work environment and not to stimuli encountered outside the workplace" (1), occurring in the previous 12 months and lasting for days. An adapted questionnaire from the American Thoracic Society (ATS) questionnaire on occupational asthma was administered and data on WRR occurring during the previous 12 months were collected. WRR was evaluated using the following item: "in the previous 12 months, have you had problems such as blocked nose, runny nose, sneezing or itching nose lasting several days due to dust-exposure at workplace?" The questionnaire was anonymously answered and surveyors were trained medical staff from the School of Public Health, University of Lubumbashi.

Ethical consideration and statistical analysis

A written ethical approval was obtained from the Research Ethics Committee of the School of Public Health, University of Lubumbashi, Democratic Republic of the Congo. Variables were dichotomized (no=0; yes=1) and data are expressed as proportions (%). Differences between and within each of the groups were determined with the use of chi-square test. Cross-tabulation was performed and odds ratios (ORs) determined to estimate the risk of having

WRR. The significance of the differences was set at a p-value of 0.05. Stata package was used for all statistical analyses (Stata Corp., College Station, Texas, USA).

Results

Characteristics of the study participants

The characteristics of 730 participants, including 365 cassava/corn millers and 365 office workers are shown in Table 1. Office workers were quite younger than millers and the majority of participants were of high school level of education. In both groups, more than half of participants have been working for less than 5 years, 56.7% in office workers and 51.7% in millers. Among millers, 25.7% (94/365) worked more than 8 h or more a day. More than half (57%) of office workers were married (vs. 37% in millers).

Table 1. Demographic and occupational characteristics of the participants

Characteristics		Cassava/corn millers		Office workers		P-value
		N1	%	N2	%	
Gender	M	365	100	365	100	-
	F	0	0	0	0	
Age (y)	<18	9	2.5	20	5.5	0.057
	≥ 18	356	97.5	345	94.5	
Marital status	Married	136	37.3	208	57.0	<0.010
	Single	227	62.2	156	42.7	
	Divorced	2	0.5	1	0.3	
Education	Primary	19	5.2	16	4.4	0.318
	Secondary1	88	24.1	77	21.1	
	Secondary2	249	68.2	255	69.8	
	Higher	9	2.5	17	4.7	
Smoking	Yes	39	10.7	108	29.6	< 0.001
	No	326	89.3	257	70.4	
Nature of product Processed	Cassava	11	0.3	-	-	-
	Corn	86	23.6	-	-	
	Both	264	73.4	-	-	
Daily exposure duration (hours)	≤ 8	271	74.3	-	-	-
	< 8	94	25.7			
Duration since employed (seniority)	< 5 y	189	51.7	207	56.7	0.207
	≥ 5 y	176	48.2	158	43.3	
Use of appropriate protective mask	Yes	160	43.8	-	-	-
	No	205	56.2			
Satisfactory work conditions	Yes	187	51.2	147	45.1	0.03
	No	178	48.8	186	54.9	
Total		**365**	**100**	**365**	**100**	-

Regarding smoking habit, there were more smokers among office workers than millers, 29.6% and 10.7% respectively (p<0.001). Less than 50% (43.8%; 160/365) of millers were using protective mask. Of them, only 18.7% (30/160) had appropriate masks, whereas the remaining 130 millers out of 160(81.3%) were using either inappropriate masks or handkerchiefs to prevent the exposure to cassava and/or corn flour dust. Furthermore, a relatively high proportion of cassava and corn millers and office workers reported unsatisfactory work conditions (51% and 68%, respectively; no statistically significant difference was found when comparing the two groups (p<0.05) as shown in Table 1.

Prevalence and factors associated with work-related Rhinitis

Figure 1 shows the distribution of WRR complaints among office workers and cassava/ corn millers. WRR was more common among dust-exposed cassava and corn millers group than in non-exposed office workers and the difference between the groups was statistically significant (76% vs. 23%; p<0.001). When smoking status was taken into account within the group of cassava/corn dust-exposed workers, it was found that there were 108 smokers of whom 83.3% (90/108) have had WRR in the previous 12 months. However, among the non-smoking millers only 73.2% (188/257) have reported WRR complaints occurring in the same period (p=0.034).

Prevalence and risk factors associated with work-related rhinitis (WRR)

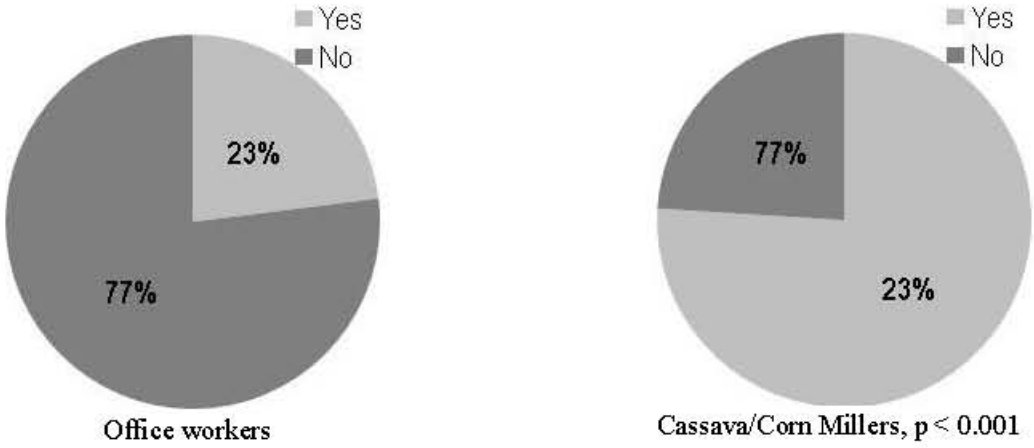

Figure 1. Prevalence of work-related Rhinitis (WRR) among millers and office workers

Table 1 shows the factors that are associated with WRR and the level of risk. In the group of cassava/corn millers who did not use mask (including those who used inappropriate ones), the risk of developing WRR was 5.5 times higher as compared with those who used appropriate mask (O.R.= 5.56; 95%CI: 4.11-7.01; p=0.016), 1.8 times higher in smoking than in non-smoking millers (O.R.= 1.83; 95%CI: 1.03 – 3.26; p=0.039) and 1.6 times higher in millers with low education level (O.R.=1.62: 95%CI: 1.26 – 4.58; p=0.014). Other factors such as age, seniority in the occupation, history of asthma, exposure duration, the nature of the product processed and work conditions were not associated with WRR (Table 2).

Table 2. Risk of work-related rhinitis among cassava and corn millers

Factors associated with work- related rhinitis	Odds ratio (SE)	95% Confidence interval	P-value
Age (<18 vs. ≥ 18)	0.02 (0.00)	0.01 - 0.04	0.213
Education level (low vs. high)	1.62 (0.13)	1.26 – 4.58	**0.014**
Product (cassava vs. corn)	1.07 (0.15)	0.81– 1.41	0.625
Exposure duration/day (< 8 hours vs. ≥ 8 hours)	0.22 (0.01)	0.19 – 0.25	0.739
Seniority (y) (< 5 years vs. ≥ 5 years)	0.40 (0.01)	0.37 – 0.42	0.718
History of asthma (Yes vs. no)	1.41 (1.27)	5.12 – 0.71	0.194
Smoking (Yes vs. no)	1.83 (0.53)	1.03 - 3.26	**0.039**
Smoking duration (< 5 years vs. ≥ 5 years)	0.14 (0.02)	0.15 – 1.66	0.746
Use of protective mask (No vs. yes)	5.56 (0.73)	4.11 – 11.01	**0.016**
Work conditions (Unsatisfied vs. satisfied)	1.08 (0.33)	1.01- 1.67	0.232

Discussion

The present work consisted of a cross-sectional analysis of data on WRR among Congolese cassava and corn millers which showed the magnitude of this health problem and associated factors. Working in cassava and corn milling facilities in African countries, in DRC particularly, is hazardous given high levels of dust accumulated within narrow spaces often having no window at all and where the grinders are located.

Our study showed that the prevalence of WRR was markedly high (76%) in dust-exposed millers as compared with non-exposed office workers (23%). This is the first report on WRR in African cassava and corn millers. Sigaru and colleagues have reported a lower rate (9%) in Iranian bakery workers (8) in a cross-sectional study (76% in our study). Other cases of occupational rhinitis and also conjunctivitis in organic dust-exposed workers have been reported in the literature. For example, Kim and colleagues have reported WRR symptoms caused by occupational exposure to rice powder in a grain industry (9). Narjis *et al.* reported a prevalence of nasal symptoms of 47% among workers in three flour millindustries in Basrah, Irak (10).

In the present study, smoking and lack of protective mask were associated with WRR. Grains, crops are known to be invaded by molds and other environmental agents that may either irritate the respiratory tract or sensitize the exposed workers (11-13). Thus, it is obvious that lack of use of appropriate protective mask by most Congolese cassava and corn millers (more than 80%) represent a real risk for their respiratory health. In addition, in our study millers who were exposed to both organic dust and tobacco smoke had higher risk of having WRR; this fact suggests that smoking might trigger the development of WRR. Low education level was also found to be associated to WRR; this fact may be explained by the ignorance of the necessity to use protective devices in order to reduce exposure and prevent this respiratory disorder.

The respiratory tract, the nasal fossae in particular, constitutes one of the principal routes through which foreign bodies enter into the body and the first contact point with inhaled aerosols, including organic dust. Their location exposes them to harmful agents such as dust, mists, gas and other particle matters in the air that may exert irritant, allergic or corrosive effects in the respiratory system (14-18). Their presence at workplace may either cause or exacerbate rhinitis among exposed workers. Thus, the control of dust or aerosols exposure in occupational settings is of utmost importance to promote safety and health at work (19-20).

The present study is limited by its cross-sectional nature; in addition, no clinical test was performed to determine whether the rhinitis was of allergic origin or irritant effect of dust. As stated above, organic dust exposure may induce either allergic or irritant respiratory disorders. As a conclusion, the present report showed a high incidence of WRR among cassava and corn millers from Lubumbashi, Democratic Republic of the Congo, and that smoking and the lack of use of protective mask as main factors associated with WRR. There is a necessity to implement interventions that aim at reducing the risk through improving work safety conditions in cassava and corn milling facilities.

Acknowledgments

The authors thank the staff of the School of Public Health of the University of Lubumbashi for their wonderful support.

Conflicts of interest

The authors declared they have no conflict of interest related to this study.

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