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Respiratory Symptoms and Pulmonary Function tests among Informal Sector Workers Exposed to Wood Dust in Douala, Cameroon

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Abstract

Background: Wood sector is the second source of employment in Cameroon after the public sector and the second Cameroon's export product after oil.

Objective: In order to provide data on the extent of respiratory function related to wood, we assess carpenter from informal sector in Douala.

Methods: From March to July 2015, we studied two randomly selected groups: the exposed group (carpenters) and the unexposed group in Douala. After a questionnaire, we when through a clinical examination and performed a respiratory test with a manual portable spirometer. Our data were entered and analyzed using SPSS Version 22.0 for Windows.

Results: Respectively Carpenters vs unexposed: Smokers: 23.7%vs16.4%, p=NS; Alcohol consumption: 78.4%; vs 73.8%. Prevalence of symptoms: 51% vs26.2%, p<0.001. Lung function impairments: 24.2 %vs16.4%; Increasing age (P=0.007), smoking status, (P=0.013), length of stay in the job greater than or equal to 21 years (P=0.009) were associated to function impairment in univariate analysis. In a logistic regression age was associated to lung function test impairment: [OR=1.037 (CI 1.000 to 1.070) p=0.006)].

Conclusion: Carpenters have higher function impairment that unexposed subjects. Smoking is associated with respiratory symptoms among carpenters. Age of increases their risk of function impairments. Carpenters need to be included in health at work surveillance system.

Keywords: Occupational diseases; Spirometer test; Carpenters; Occupational exposure

Introduction

Wood dust related diseases are known since years [1]. Carpentry requires the use of high speed rotary machines, usually producing fine dust suspended in the air, exposing workers to a massive dust [2]. The various products used in the wood industry and mold are a significant additional respiratory risk [3-4]. Many epidemiological studies [5-10] have assessed respiratory manifestations among carpenters and associated factors. Belabed et al. [11] in 2009, in Algeria found 66.25% of symptomatic subjects, Laraqui et al. [5] in 2001 Morocco found 61.9% leading to the implementation of preventive measures. In Cameroon, the prevalence of respiratory symptoms and functional anomalies is still unknown; yet wood is of great use as it represents the second source of employment in the public sector (170,000 jobs) and the second Cameroon's export product after oil (10%) [12]. In order to provide data on the extent of respiratory function related to wood, we assess carpenter from informal sector in Douala.

Methodology

This cross sectional study took place in carpentries of Douala in Cameroon from March to July 2015. We studied two groups of males: the exposed (carpenters) and the unexposed group, other than carpenters located at least 50 meters away from carpentry. We included workers with at least 3 years practice and working in one of the 6 districts of Douala. We excluded workers with heart disease, or with spirometry contraindication or history of chronic respiratory disease or chest deformity.

The sample size was set at 135 carpenters and 135 unexposed workers using the following Snedecor and Cochran formula [13]. Pulmonary function tests (PFTs) were performed according to the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines for subject maneuver, techniques, and quality control [14], using Spirobank II (Medical International Research, Roma-Italy). PFTs were performed by a trained investigator with the patient in a sitting position. A maximum of 8 tests were performed by each participant. Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC) and FEV1/FVC ratio were measured. A bronchodilation test using salbutamol was also performed for all the participants. Airflow obstruction was defined as a post-bronchodilation FEV1/FVC <70% with FVC >80%, restrictive disorder as an FEV1/FVC ratio of ≥70%

with FVC<80% predicted, and mixed or combined defects as FVC of <80% predicted with FEV1/FVC ratio of <70% [14] and Global Initiative for Chronic Obstructive Lung Disease [15].

Our data were entered and analyzed using SPSS Version 22.0 for Windows software.

We used analysis of variance and the "t" test of Student for the comparison of averages. For percentages, we used Chi-square. The significance threshold level for significance was a value of $p<0.05$. We proceeded to a logistic regression model for analysis associated factors.

Results

Study population general characteristics

Education level: The majority of individuals had left school at the secondary level: 64.4% carpenters, 63.9% unexposed.

	Carpenters (N=194)		Non-exposed (N=122)		p
	n	%	n	%	
Respiratory symptoms					
Cough	67	34.5	8	6.6	< 0.001
Expectoration	6	3.1	1	0.8	0.256
Dyspnoe	8	4.1	8	6.6	0.43
ChestpainThoracique	14	7.2	13	10.7	0.306
Nose symptoms					
Rhinitis	60	30	4	3.3	< 0.001
Noseirritation	7	3,6	1	0.8	0.158
Symptomatic	99	51	32	26.2	< 0.001

Table 1: Prevalence of clinical symptoms in relation to exposure.

Syndrome	Carpenters		Unexposed		p
	n	%	n	%	
Restriction	34	17.50%	14	11.50%	0.152
Obstruction	12	6.20%	6	4.90%	0.804
Mixed syndrome	1	0.50%	0	0.00%	
Total	47	24.20%	20	16.40%	0.156

Table 2: Prevalence of respiratory function impairments in relation to exposures.

Lifestyle: There was no significant difference between the prevalence of smoking in carpenters and unexposed: respectively 23.7% and 16.4%, p=non-significant; There was no significant difference between the carpenters 78.4% and unexposed 73.8% for alcohol consumption.

Clinical symptoms and exposure: The prevalence of symptomatic patients was higher among carpenters 51% than in unexposed 26.2 %; $p<0.001$. Cough was the most represented respiratory symptom 34.5%. The prevalence of cough and rhinitis were significantly higher among carpenters 34.5% and 30 % than in unexposed 6.6% and 3.3%, $p<0.001$.

Respiratory function impairment and exposure: Lung function impairments were found in 24.2% of carpenter's 16.4% of unexposed; P: NS. In the 2 groups, the restrictive syndrome was the most represented: 17% of carpenters and 11.5% of non-exposed. Obstructive syndrome: 6.2% of carpenters' vs 4.9 of unexposed.

Risk factors of respiratory symptoms and function impairments

Factors associated with respiratory symptoms: "Smoker" and "former smokers" were significantly associated with respiratory symptoms [OR=1.955 (CI 1.002 to 3.818) p=0.049].

Characteristics	Respiratory symptoms	p-value	OR (CI 95%)
Age (mean ± SD, years)	37.9 ± 11.2	0.106	0.977 (0.950-1.005)
BMI (mean ± SD, kg/m^2)	25.8 ± 3.7	0.232	0.947 (0.867-1.035)
Carpentry specific tasks			
Carpetworkers	6 (42.9%)	0.623	
Ebenworkers	27 (36.0 %)	0.627	0.750 (0.235-2.389)
Machinists	21 (47.7%)	0.751	1.217 (0.362-4.093)
Multitask	23 (37.7%)	0.721	0.807 (0.248-2.622)
Smoking status			
Smokersandformersmokers	24 (52.2%)	0.049	1.955 (1.002-3.818)
Length of stay in the job			
≤ 10 years	38 (41.8%)	0.875	
11 to 20 years	23 (37.7%)	0.617	0.844 (0.434-1.641)
≥ 21 years	16(39.0%)	0.768	0.893 (0.420-1.896)
Use of respiratory masks	26 (34.2%)	0.211	0.683 (0.376-1.242)
OR : Odd Ratio,	CI: Confident Interval, SD: Standard deviation		

Table 3: Sociodemographic characteristics and respiratory symptoms.

Nasal symptoms and socio-demographic characteristics: Age, specificity carpentry tasks, smoking status, length of stay in job and the use of safety masks were not significantly associated with nasal symptoms.

Characteristics	Nasal symptoms	p-value	OR (CI 95%)
Age (mean ± SD, years)	37.9 ± 11.2	0.958	1.001 (0.973-1.029)
BMI (mean ± SD, kg/m^2)	25.8 ± 3.7	0.7	1.018 (0.930-1.114)
Carpentry specific tasks			
Carpet workers	3 (21.4%)	0.707	
Eben workers	27(36.0 %)	0.297	2.062 (0.529-8.043)
Machinists	13 (29.5%)	0.556	1.538 (0.367-6.435)

Multitask	19 (31.1%)	0.474	1.659 (0.414-6.639)
Smoking status			
Smokers and former smokers	15 (32.6%)	0.914	1.040 (0.513-2.109)
Length of stay in the job			
≤ 10 years	28 (30.8%)	0.601	
11 to 20 years	22 (36.1%)	0.496	1.269 (0.639-2.522)
≥ 21 years	11 (26.8%)	0.646	0.825 (0.363-1.877)
Use of respiratory masks	19 (25.0 %)	0.097	0.581 (0.306-1.103)
OR: Odd Ratio, CI: Confident Interval, SD: Standard deviation			

Table 4: Nasal symptoms and sociodemographic characteristics.

Factors associated with function impairments: In univariate analysis, factors associated with respiratory function impairments were increasing age (p=0.007), "smokers" and "former smokers" (p=0.013), length of stay in the job greater than 21 years (p=0.009).

Characteristics	Function impairments	p-value	OR (CI 95%)
Age (mean ± SD, years)	37.9 ± 11.2	0.007	1.043 (1.012-1.076)
BMI (mean ± SD, kg/m^2)	25.8 ± 3.7	0.213	0.936 (0.842-1.039)
Carpentry specific tasks			
Carpetworkers	2 (14.3%)	0.633	
Ebenworkers	17 (22.7%)	0.487	1.759 (0.358-8.637
Machinists	13 (29.5%)	0.268	2.516 (0.492-12.855)
Multitask	13 (21.3%)	0.556	1.625 (0.322-8.191)
Smoking status			
Smokers and former smokers	17 (37.0)	0.013	2.512 (1.215-5.194)
Length of stay in the job			
≤ 10 years	16 (17.6)	0.023	
11 to 20 years	12 (19.7)	0.745	1.148 (0.500-2.634)
≥ 21 years	16 (39.0)	0.009	3.000 (1.311-6.864)
Use of respiratory masks	16 (21.1	0.571	0.818 (0.409-1.636)
OR: Odd Ratio, CI: Confident Interval, SD: Standard deviation			

Table 5: Characteristics associated with function impairments.

Multivariate analysis of factors associated with function impairments: In multivariate logistic regression, increasing age remained the only factor associated with function impairment in our study [OR=1.037 (CI 1.000 to 1.070) p=0.006)].

Discussion

Prevalence of respiratory symptoms

We found high prevalence of respiratory symptoms among carpenters in the city of Douala. Boskabady et al. [16] in 2010 in Iran and Bonnaud et al. [17] in 1998 in Haute Vienne found similar results; this could be explained by different mechanisms of action of wood dust and components on the respiratory system. Marcuccilli et al. [4] noted that besides occupational exposure, tobacco had an influence on the occurrence of cough and sputum. The prevalence of symptomatic patients was high and close to values found by Laraqui et al [5] in 2001 in Morocco and Belabed et al [11] in 2009 in Algeria. Wimander et al. [18] in 1980 in Sweden found 19%. African countries are known for their forest and agricultural vocation. In such a setting, woods employees may work up to the age of 60 years, without a medical care at work. According to Bonnaud et al. [17] such high prevalence could be attributed to specific conditions for drying wood that allowed contamination. The prevalence of clinical symptoms we found among carpenters was significantly higher than that found in unexposed; this was also observed by Laraqui et al. [5] in their series. As for Boskabady et al. [16] and Laraqui et al. [5] series, cough was also the most represented symptom among carpenters, unlike Belabed et al. [11] who found expectoration as the commonest respiratory symptom. The prevalence of rhinitis may be related to allergic, irritative or toxic mechanism. These divergent possible causes for rhinitis may also explain diversity in value of rhinitis prevalence's found in studies [5,16,17,19,20,21]. However, Ahman et al. [22] looked for inflammatory markers in nasal fluid, and found inflammatory effects associated with wood dust on the nasal mucosa. The variability observed in the prevalence of clinical between subjects among the carpenters could be explained by the fact that this prevalence would be linked to concentrations of dust, the hardness of the wood, their nature, handling method and the nature of the associated chemicals [23,24].

	Multivariate analysis	
Characteristics	p-value	OR (IC95%)
Age	0.006	1.037 (1.010-1.063)
Smoking status		
Smokers and former smokers	0.087	1.763 (0.930-3.372)
Length of stay in job		
≤ 10 years	0.693	
11-20 years	0.56	0.803 (0.383-1.680)
≥ 21 years	0.814	1.117 (0.446-2.798)

Table 6: Multivariate analysis of factors associated with function impairments.

Prevalence of function impairments

There was no significant difference between the prevalence of abnormalities in lung function of carpenters and control subjects. Our results corroborate with those of Belabed et al. [11] who did not find any difference or correlation between exposed and unexposed subjects. Other studies had similar conclusions regarding lung function [6,7,25],

unlike Laraqui et al. [5], who found a significant difference between the prevalence between two categories. These results could be explained by the fact that more often lung function impairments is related to a synergistic effect between tobacco and wood dust and not a separate impact of only one.

The restrictive syndrome was the most represented one in our study, to the opposite of Laraqui et.al [5] who found more restrictive syndrome, meanwhile in Belabed et al. [11] series, both syndromes were equally represented.

Associated factors

As for Laraqui et al. [5] Smoking was significantly associated with respiratory symptoms in carpenters. Note the important role of smoking associated with professional pollutants in the occurrence of respiratory symptoms. Marcuccilli et al. [4] noted that besides occupational exposure to wood, tobacco had an influence on the occurrence of cough and expectoration. So as Marcuccilli et al. [4], we found no association between age or length of stay in the profession, and risk of developing respiratory symptoms. This result is different from Belabed et al. [11] series who found a clear correlation between the prevalence of respiratory symptoms and seniority at the workplace. This could be explained by healthy worker effect in our study, meanwhile Belabed et al. [11] worked on subjects spending two third of their time in the factory. The increasing age was found as the only factor associated with function impairment in logistic regression.

Conclusion

There is a high prevalence of respiratory symptoms among carpenters in Douala, predominantly cough. The prevalence of function impairment in Carpenters in Douala higher in exposed than in non-unexposed the syndrome is described as the most represented in the 2 groups with higher rate in carpenters. Smoking is the factor associated with respiratory symptoms among carpenters in the city of Douala. The increasing age of carpenters in Douala increases their risk of function impairments. These workers are prompt to respiratory abnormalities at work and need to be included in health at work surveillance system.

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