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Clinical and Audiometric Profile and Factors Associated with Hearing Loss in a Brewery in Cameroon

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Abstract

Introduction: The aim of this study was to investigate the clinical and audiometric profiles and the factors associated with hearing disorders in workers exposed to noise in two plants of a brewery company in Cameroon in 2024. **Methods:** This was a descriptive cross-sectional study with analytical aims, conducted over a period of two (02) months from June 01, 2024, to July 31, 2024. It included all workers exposed to noise in the company's factories who agreed to take part in the study. They underwent a clinical examination and baseline tonal audiometry. Data analysis was performed using R software version 5.3. The Chi 2 test was used to compare variables at a significance level of 5%. **Results:** A total of 353 workers, 335 of whom were men (94.90%), were included, giving a sex ratio of 18.61. The mean age of the workers was 40 ± 9.7 years. The average duration of noise exposure was 12.4 years. Workstation noise levels ranged from 80 to 111 dB (A). The prevalence of hearing impairment was 6%. Mild mixed hearing loss (MMS) was the most common anomaly, accounting for 45.45% of cases. Factors associated with hearing loss in workers were: age > 40 years (p = 0.005; OR = 7.2 [2.2 - 23.5]) and company seniority between 15 and 20 years (p = 0.017; OR = 5.86 [1.1 - 29.2]). **Conclusion:** Hearing disorders are a significant reality in the industrial world. Reinforcing preventive measures remains the best option for reducing the prevalence of hearing impairment among them.

Keywords

Prevalence, Associated Factors, Hearing Impairment, Brewing Company, Cameroon

1. Introduction

Noise is one of the main occupational nuisances; it causes a variety of clinical manifestations, the most frequent and disabling of which is occupational deafness (ODD) [1]. According to the WHO in 2017 in the World Hearing Report, one in four people will suffer from hearing loss to varying degrees by 2050 [2]. In Canada, for example, in 2010, around 9000 workers developed some form of hearing loss caused by overexposure to noise in the workplace [3]. In China, in 2016, 18.5% of workers in a cement plant suffered from hearing loss [4]. In the industrial environment, noise is a major health issue for the people who work there. The Sumer 2010 survey in France showed that long-term exposure of more than 20 hours a week to high noise levels of 85 dB(A) concerned 4.8% of employees, and that the sectors most concerned were industry (16.8%) and construction (10.5%) [5]. Africa's industrial sector is booming, even in the agri-food sector. Workers are exposed to high levels of noise from machinery, and noise-induced hearing loss represents a much greater burden. This is mainly due to the absence of prevention programs. In Togo, 20% of cases of deafness were reported among workers in a brewing industry in one study [6]. The food industry is not the only sector affected by noise. Other groups, such as miners and nightclub workers, are also exposed to noise, resulting in significant hearing problems [7] [8].

Cameroon has around eight brewing industries, each of which groups together several production plants, employing thousands of workers. Current regulations provide for audiometric monitoring of noise-exposed workers, but this is not always respected. The aim of this study was to describe the clinical and audiometric profile of noise-exposed workers at one of Cameroon's brewery companies and to identify the factors associated with the occurrence of hearing disorders. This was a prerequisite for implementing preventive measures.

2. Methods

This was a descriptive cross-sectional study with analytical aims. It took place over two (02) months, from June 01 to July 31, 2024, in two factories of a brewing company in Cameroon. All workers exposed to noise in the plants and present at the time of the survey were included after obtaining their informed consent.

In the 1st stage, workers were asked to complete a questionnaire covering their socio-demographic characteristics, clinical history (especially ORL), ototoxic medication use, smoking and alcohol consumption, extra-professional activities that could expose them to noise, current and previous workstations, working hours, duration of noise exposure, risk awareness, and type of hearing protection.

Recent noise mapping (carried out in May 2022 for the glass and preform bottle plants, and in March 2024 for the beer and soft drinks plant) was used to determine noise intensity in each sector. The sound level meter used was a Digital IHM. Serial number: 211177394; range 30 - 130 dB.

In the 2nd stage, audiometries were performed for each exposed worker. The audiometer used was an Interacoustics AD629, serial number: SN 1046058, cali-

brated on January 05, 2024.

Data were analyzed using R software version 4.3.2. The Chi 2 test was used for comparisons. Logistic regression was used to identify noise-related factors, with a significance level of 5%. Authorization from company management was obtained, as was free and informed consent from participants. Data were treated as strictly anonymous. This work is the result of a master's in occupational health at the University of Abomey-Calavi. The clearance of the Ethics Committee of the University of Douala was obtained under number 4719 CEI-UDO/01/2025/M.

3. Results

Of the 533 workers exposed to noise in this company, 335 actually participated in the study, for a participation rate of 66.23%. The others were unable to participate either because they did not give their consent or because they were absent during the study period (Table 1).

Table 1. Distribution of workers at a Cameroon brewing company according to participation by plant in 2024 (n = 353).

	Number of participants expected	Number of participants retained	Participation rate
Bottle manufacturing	148	77	**52.03%**
Beer production	385	276	**71.69%**
Total	**533**	**353**	**66.23%**

- **Socio-professional characteristics**

Of the 353 workers included in the study, 335 were male (94.90%) and 18 were female, *i.e.*, a sex ratio of 18.61. The average age was 40 ± 9.7 years. The most common level of education was tertiary (50.4%), followed by secondary (49%). The average length of service was 12.4 years. The working class was the most represented at 64.9% (Table 2).

- **Noise mapping and distribution of workers by work unit**

More than half the workstations (54.54%) had a noise level >85 dB. Workstations with high noise intensities were melting (85 - 111 dB), MPC (88 - 108 dB), the soft drink plant (UBG) (82 - 104.3 dB), and packaging (81 - 97.1 dB) (Table 3).

- **Prevalence of audiometric disorders**

Approximately 13.04% of workers reported experiencing hearing loss, noise intolerance (11.61%), and tinnitus (9.34%). Slightly less than 2/3 of workers (61%) had an improvement in hearing during the vacations, 29% had noise-related discomfort, 16% had their interlocutors repeat themselves, and 15% of participants had difficulty following a conversation. Otoscopy noted 7% abnormalities, including 72% with cerumen plugs, 20% with otorrhea, and 8% with inflammation of the auditory canal (Table 4).

Table 2. Distribution of workers at a brewing company in Cameroon according to socio-professional characteristics in 2024 (n = 353).

	n	%
Gender		
Male	335	94.90
Femal	18	5.10
Age (year)		
[20 - 30[	66	18.7
[30 - 40[	148	42
[40 - 50[	22	6.2
[50 - 60]	117	33.1
Level of education		
Primary	2	0.6
Secondary	173	49
University	178	50.4
Seniority with the company (in years)		
<5	80	22.7
[5 - 10[	89	25.2
[10 - 15[	91	25.8
[15 - 20[	34	9.6
>20 ans	59	16.7
Socio-professional category		
Employee Manual worker	229	64,87
Supervisors	113	32.02
Framework	11	3.11

Table 3. Distribution of workers at a brewery in Cameroon according to work unit and noise intensity per unit in 2024 (n = 353).

Work unit	Sound intensity (in dB)	n	%
Packaging	81 - 97.1	111	31.4
Infrastructure maintenance	<80	8	2.3
Manufacturing	86.6 - 90	65	18.4
Merger	85 - 111	12	3.4
Laboratory	<80	6	1.7
Maintenance	89.6	70	19.8
MPC	88 - 108	10	2.8
QHSE	<80	10	2.8
SDA	<80	5	1.4
Sorting decors	<80	21	5.9
UBG	82 - 104.3	35	9.9

MPC: Raw Materials and Compounds Section, UBG: Soft Drinks Factory, SDA: Food Safety Section.

Table 4. Distribution of workers at a brewing company in Cameroon by clinical profile in 2024 (n = 353).

	n	%
ENT symptoms		
No	79	22.39
Ear pruritus	63	17.85
Hearing loss	46	13.04
Intolerance to noise	41	11.61
Sensation of blocked ears	41	11.61
Tinnitus	33	9.34
Balance disorders	33	9.34
Ear pain	12	3.40
Otorrhea	5	1.42
Effect of noise on hearing		
Difficulty in following a conversation		
Yes	53	15
No	300	85
Have people repeat themselves		
Yes	55	16
No	298	84
Noise disturbance		
Yes	103	29
No	250	71
Improved hearing during vacations		
Yes	216	61
No	137	39
Otoscopy		
Normal	328	93
Abnormal	25	7
Type of abnormality on otoscopy		
Earwax plug	18	72
Inflammation of the ear canal	2	8
Otorrhea	5	20
Lyfestyle		
Alcohol		
Yes	216	61.19
No	137	38.81
Tobacco		
Yes	9	2.55
No	344	97.45
Exposure to loud noise outside the workplace		
Yes	16	4.53
No	337	95.47

- **Audiometric profile**

The prevalence of hearing loss objectively measured by audiometry was 6%, half of which was bilateral and symmetrical. Mild mixed hearing loss (MMS), *i.e.*, hearing loss between 20 and 40 dB, was the most common bilateral symmetrical hearing impairment, accounting for 45.45% of cases (Table 5).

Table 5. Distribution of workers at a brewing company in Cameroon according to audiometric profile in 2024 (n = 353).

	n	%
Audiometry		
Abnormal	22	6
Normal	331	94
Site of anomaly		
Unilateral	11	50
Bilatéral	11	50
Bilateral symmetrical anomaly type		
Mild mixed hearing loss	05	45.45
Moderate mixed hearing loss	01	9.09
Mild sensorineural hearing loss	01	9.09
Moderate sensorineural hearing loss	01	9.09
Hearing fatigue	03	27.27

- **Factors associated with hearing deficits**

More than 15 years of service and an age of more than 40 years increased the risk of hearing impairment by a factor of 6 and 7, respectively (p = 0.005); OR = 7.2 [2.2 - 23.5]; (p = 0.017) OR = 5.86 [IC95%: 1.1 - 29.2] (Table 6).

Table 6. Distribution of hearing disorders in a brewing company in Cameroon according to socio-demographic characteristics in 2024 after multivariate analysis (n = 353).

	OR	95%CI	p-value
Age			0.005
[20 - 30[	1		
[30 - 40[	4.2	0.5; 34.5	
[40 - 50[	7.2	2.2; 23.5	
[50 - 60]	3.7	1.3; 10.5	
Seniority with the company			0.017
<5 ans	1		
[5 - 10[	2.928	0.8; 10.4	
[10 - 15[	0.628	0.1; 2.0	
[15 - 20[	5.856	1.1; 29.2	
>20 ans	3.455	0.8; 13.9	

Continued

Seniority in the position			0.067
<5 ans	1		
[5 - 10[	3.08	0.77, 13.2	
[10 - 15[	2.59	0.48, 14.3	
[15 - 20[	6.67	0.76, 59.4	
>20 ans	0.31	0.01, 2.90	

4. Discussion

The aim of the present study was to investigate the clinical and audiometric profile of workers in a brewery in Cameroon, and to identify factors associated with hearing impairment. The limitation of data collection to a single brewery may have induced recruitment bias, and limited the generalizability of the results to other industrial sectors. In addition, only workers present on the day of the survey were included, excluding those on leave or sick leave, which could underestimate the actual frequency of hearing disorders. This could also introduce a "healthy worker effect", where the study population is healthier than the workforce as a whole, which could underestimate the true prevalence of hearing disorders. Furthermore, the cross-sectional nature of the study means that no causal link can be established between noise exposure and the hearing problems observed. However, compliance with a rigorous protocol, the use of calibrated equipment, and the exploitation of recent sound mapping data reinforce the reliability of the results obtained.

The sample was predominantly male, with an average age of 40. This male predominance and average age have been reported in other African studies, notably in Burkina Faso (38 years), Chad (38.7 years), and Togo (40 years), but the first two studies were carried out in electricity companies, and only the third was carried out in a brewery company [6] [9] [10]. This average age can be explained partly by the youth of the African population, and partly by the fact that these were young adults of working age. The predominance of men is linked to the fact that the blue-collar categories that are most represented in these various studies are dominated by male subjects, with women often employed in administrative positions or in jobs that do not require too much physical exertion. Indeed, over two-thirds of the workers in this study are manual workers assigned to technical departments.

In the study, more than half the work units (54.54%) had a high noise level (exceeding 85 dB). These results are comparable to those reported in a brewing company in Togo, where 25 out of 30 workstations had noise levels in excess of 80 dB, and in a steel mill in Benin, where 11 out of 19 workstations were noisy [6] [9] [11]. Exposure to harmful noise is a reality in the industrial sector, and not without effect, since exposed workers develop hearing disorders.

The prevalence of hearing disorders was 6% in this study. It is similar to that of Mhalshekar *et al.* in a brewery, *i.e.*, 6.9% [12]. It is lower than that of Mikponhoué *et al.* in a brewery in Togo (20.2%) and that of Hinson *et al.* in a steel company in

Benin (26%) [6] [11]. High prevalences were reported in a glassworks by Benzian *et al.* in Algeria (66.8%) and in a mining industry in Zimbabwe (37%) by Chadamkuba *et al.* [13] [14]. Even higher prevalences were found among artisanal tinsmiths in Cotonou, Benin (99.26%) [15], probably due to a lack of protective measures and underestimation of the risks.

In our study, age was found to be a factor significantly associated with hearing impairment, with a 7.2-fold increase in risk for workers over 40. This phenomenon can be explained in part by presbycusis, the natural aging of the hair cells in the inner ear, which induces a progressive degradation of hearing independently of noise. Age thus modifies the relationship between noise exposure and hearing loss, making workers more vulnerable. These findings have been reported in other studies, whether African [6] [11], European, or American [16] [17].

In addition to age, seniority in the company also appears to be a risk factor for hearing disorders, particularly among employees with more than 15 years' seniority, who had an approximately 6-fold increased risk (OR = 5.86; IC95%: 1.1 - 29.2) compared to those with less than 5 years' seniority. This finding confirms the notion of a "summation" of auditory aggressions over the years, which makes sense in an industry where noise is omnipresent and protection is sometimes insufficient or not systematically worn.

These results are fully in line with those of Nelson in a systematic review covering several countries, and Dobie *et al.* in the USA [16] [17], both of whom highlighted age and duration of exposure as key factors in the genesis of occupational hearing loss. Similarly, Hinson *et al.* found similar associations between length of service and hearing impairment in workers at a steel mill in Benin [11]. Similarly, Mikponhoué *et al.* in Togo also identified seniority and non-use of personal protective equipment (PPE) as associated factors among workers in a food processing industry [6]. We did not find the latter factor in our study, certainly because the company's prevention policy was sound. In fact, all participants had at least one type of personal hearing protection (earmuffs or earplugs). Only 2% said they did not wear them all the time. This contrasts sharply with Traoré's results from Burkina Faso. In his study, 55.77% of workers did not always wear their PPE despite its availability [18].

5. Conclusion

At the end of this study of the clinical and audiometric profile and the factors associated with hearing impairment in a brewing company in Cameroon, we can conclude that the prevalence of hearing impairment was low. The factors associated with hearing impairment were age and seniority in the company. In view of the results, this study prompts further reflection on policies for redeploying older workers and those with at least 15 years' exposure to noise to positions that no longer expose them to noise, in order to avoid hearing problems. In addition, the need for consistent and correct PPE use should be encouraged among exposed personnel.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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