

# Effect of Noise Pollution Among Milling Machine Operators in North-West Nigeria

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**Abstract:** Commercial activities are mostly centralized to main markets in many towns and cities of the Northern part of Nigeria. Such central markets constitute the noisiest part of the towns. Yet, there is no evidence that the workers and traders in such markets are aware of the challenges excessive noise pollution pose to their health. This problem serves as the basis for this research, which investigated the major source of noise pollution in Kebbi central market and make recommendation to improve the well being of the people in the market. The market was divided into thirteen sections based on activities. These sections were visited twice a day for two weeks to measure their sound levels. The sound level was measured with a CEM digital noise level meter with an accuracy of  $\pm 3.5\text{dB}@1\text{KHz}$ . Thereafter, an ergonomic observation assessment of the noisiest section was carried out. The assessment was carried out based on rapid entire body assessment (REBA) methodology. The average sound intensity in all the sections exceeded the recommended safe sound level of 40dB. However, only the sound intensity at the grain and spice milling section (89.13 dB) exceeded the noise harmfulness level of 85dB. Operators were encouraged to use ear muffs or earplugs to minimise the exposure to harmful noise level. Proper electrification of the section was also recommended to minimise the use of internal combustion engines. The findings emphasised the need for government and relevant authorities to carry out occupational safety awareness among workers in the non-formal sector of the society.

**Keywords:** Noise; Musculoskeletal disorder; occupational safety; ergonomic assessments

## 1. Introduction

Noise has been globally classified as an environmental pollutant and a major health hazard [3], [9]. It accounts for significant percentage of auditory and non-auditory health challenges faced by people. Noise pollution affects workers' health, efficiency and performance during work [7]. It also affects people's satisfaction with their environment [7].

Although noise pollution occurs in both urban and rural centres, it is more prevalent in urban centres due to greater population, commercial and transport activities [12], [4]. This may justify why most intervention [12], [4]. This may justify why most intervention studies were carried out mostly in urban centres of developed countries. The outcome of these studies has helped in putting legislation in place to minimise the negative consequences and also to carry out proper awareness among the population. Such consequences include noise induced hearing loss (NIHL), headache, lack of sleep, hypertension, irritation and high stress level [11]. Among them, NIHL has been identified as global occupational health problem [5]. Just like the impact assessment studies, most of the NIHL studies were from America, Europe, Australia and Asia [5]. These studies focused on the workers' exposure to noise and different control or prevention measures. However, lesser effort has been devoted to investigating the sources of noise pollution [6]. Moreover, modern acoustic equipment are also limited in their ability to identify sources of noise [8].

Noise control is a critical component of every environment impact study. This is because noise pollution has been

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identified as a consequence of urbanisation [10]. Regions, such as Europe and North America have completed noise mapping studies [12], with some countries taken it to local government levels by ensuring that every city has multiple measuring stations [2]. In Africa, only Egypt and South Africa have documented evidence of such law in the literature. In Nigeria, few studies has also identified high level of noise pollution in Ilorin in the central part of the country [10]. Yet, the reliability and validity of such results as general national measure is unsatisfactory [8] because it is restricted to a single location.

The North-western part of the country, which has the largest percentage regional population in the country, has not reported any result of noise pollution study. The only study in the literature was limited in scope to school environment [1]. This is a region where commercial activities constitute the major occupation and these commercial activities are mostly centralized to main markets in many towns and cities. Such central markets constitute the noisiest part of the towns. Yet, there is no evidence that the workers and traders in such markets are aware of the challenges excessive noise pollution pose to their health. This problem serves as the basis of this study that investigated the major sources of noise pollution in the central market of Birnin Kebbi and proposes solutions to mitigate the harmful effect of the exposure.

## 2. Methodology

The study was conducted at the Birnin Kebbi Central market. Birnin Kebbi is the capital of Kebbi state, which is located in the North-western part of Nigeria. The study was conducted for two weeks in the month of July. The market was divided into thirteen sections based on commercial activities and each section was visited in the morning (10am to 12 noon) and afternoon (2pm to 4pm). The noise level was measured using a CEM digital sound level meter ( $\pm 3.5\text{dB}@1\text{kHz}$ ). Thereafter, the video recordings of the operators in the milling section were observed and analysed by the research team. The findings were presented in descriptive statistics and the difference in noise intensity at different times of the day was investigated using Mann-Whitney U test. All data were collated and analysed using SPSS 18.

## 3. Result

Table 1 shows the noise level at different segment of the Birnin Kebbi Central market. The mean noise level is higher in the afternoon (76.27dB) than in the morning (69.65dB). Maximum noise level in the morning was 103.10db at the grinding/milling section while the minimum noise level was 50dB at the textile section. The maximum noise level in the afternoon was 103.70dB and also occurred at the grinding/milling section. The minimum noise level of 59.5dB also occurred at the textile section. However, all the sections recorded noise level higher than the comfort level of 40dB [1].

Figure 1 shows the mean value of noise level intensity at different sections in the market at different periods of the day. Noise exposure were classified as high risk (80-90dB), medium risk (70-80dB) and low risk (60-70dB) [6]. Two sections; the road that leads to the market and the milling sections were high risked with Milling section recording the highest average noise intensity and also the maximum noise intensity as shown in Table 1. Six sections were medium risked while five sections with no machining activities around were classified as low risked. The non-parametric Mann-Whitney U test in Table 2 also reveals that the noise level in three sections significantly increased from morning to afternoon. These sections are the poultry (U=1.00, p=0.016), textile (U=2.0, p=0.028) and the main road (p=0.009).

S/N	Section		Mean	Standard Deviation	Minimum	Maximum
1	Road divider	Am	78.94	5.27	73.5	87.2
		Pm	82.54	5.43	76.9	90.0
2	Outside market 1	Am	74.34	7.54	65.0	85.7
		Pm	78.88	2.21	75.3	80.5
3	Meat	Am	77.28	3.99	73.5	82.9
		Pm	74.24	1.86	72.3	77.1
4	Poultry	Am	68.78	5.25	64.2	74.6
		Pm	78.12	3.94	74.5	84.6

5	Milling/ Grinding	Am	83.38	16.65	61.9	103.1
		Pm	94.88	15.42	67.4	103.7
6	Fish	Am	71.18	7.88	63.5	82.2
		Pm	74.08	3.45	68.8	77.6
7	Vegetable	Am	65.2	6.15	59.2	74.9
		Pm	72.92	2.21	69.00	74.3
8	Groceries	Am	62.26	6.42	55.8	71.4
		Pm	68.22	2.94	64.2	70.9
9	Horology	Am	65.94	4.40	61.8	72.5
		Pm	70.36	4.31	62.7	72.9
10	Textile and cosmetics	Am	55.67	4.89	50	62.9
		Pm	67.32	6.61	59.5	75.9
11	Main road	Am	62.18	3.8	57.4	68
		Pm	79.22	3.03	75	82.5
12	Grains	Am	64.88	4.81	58.9	70.3
		Pm	69.67	2.33	68.1	73.6
13	Outside market 2	Am	75.4	4.91	70.6	83.4
		Pm	81.02	2.63	78.9	85.3

Table 1. Noise level (dB) at different segment of the Birnin Kebbi Central Market.

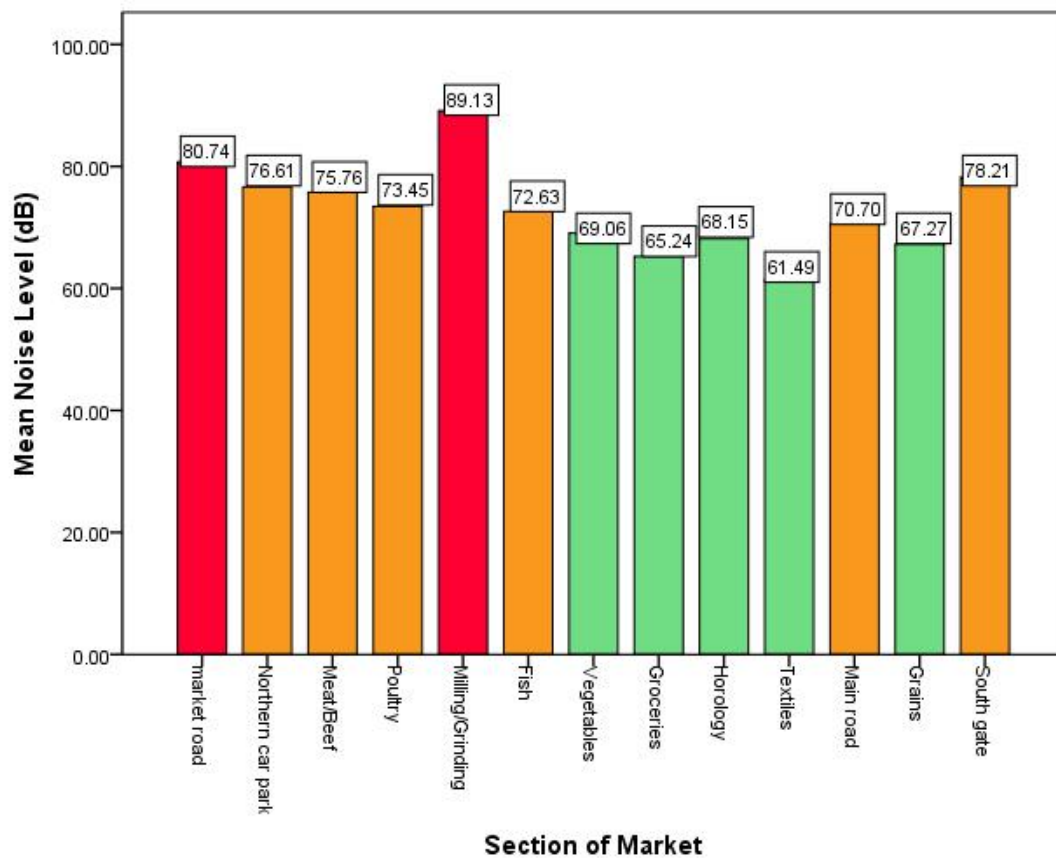


Figure 1: The daily average noise level at different section of the market

	RD	Outnar	Meat	Poultry	Milling/Grind	Fish	Veg	Groceries	horology	Textile	Mainroad	riceBeans	Outside2
Mann-Whitney U	8.00	5.00	5.00	1.00	7.00	8.00	5.00	6.00	6.00	2.00	.000	7.00	4.00
Asymp. Sig. (2-tailed)	.347	.117	.116	.016	.251	.346	.117	.175	.175	.028	.009	.249	.076

Table 2. Mann-Whitney U test result for differences in noise intensity between morning and afternoon

## 4. Discussion

The study revealed that the noise level in all the sections of the market at any time exceeded the minimum safe level of 40 dB. Two sections stood out as the noisiest sections in the market, the market road that served as a link between the main road and the central market, and the milling/grinding section. Transportation system is the major cause of noise pollution in urban areas [12]. Hence, the identification of traffic noise as one of the highest in this study is consistent with what is reported in the literature [7], [4]. The noise level on the road exceeded the standard and recommended level in other countries [4]. A major contributor to this noise is the honking practice of Nigerian motorists. Therefore, proper enforcement of traffic rules by providing more traffic police around the market and also awareness about road signs could significantly reduce the noise on the roads.

The milling and grinding section is the only section that exceeded the 85dB harmfulness level, thus justifying the need to minimise the noise level in this section. The workers in this section are also constantly busy as there was no difference in the noise level throughout the day ( $U=7.00$ ,  $p=0.251$ ). Two factors are responsible for the noise in this section, the human traffic visiting the section and the milling machines. This section is very important to the population because of the activity of milling grains and spices. Grains are the major energy giving food in Nigeria and many other African countries. They are consumed as pudding or porridge for breakfast and taken with spiced soup or stew during other periods of the day. Almost all these diets involved milling or grinding of the food materials. Hence, every processing operation of grains and spices involve the milling process. This explains the concentration of activities in this section since township authorities restricted grinding operations to the central market in order to minimise the level of disturbances in residential areas. The volume of activity justifies why there was no significant difference in noise level in the section either in the morning or in the afternoon. However, there is the need to protect the operators from this occupational hazard by carrying out proper awareness and providing a conducive working environment for them. The awareness is necessary because of the high level of ignorance among Nigerians about the harmful effect of noise pollution [10]. Hence, the use of ear plugs or muffs has been recommended and the authorities must encourage the operators to embrace such to protect them from occupational disorders such as NIHL. Also, there is need for proper electrification of the area so that the milling or grinding machines will be electric motor driven instead of the present usage of internal combustion engines.

## 5. Conclusion

The milling section is the noisiest part of the market while the textile section has the lowest noise level. However, the sound levels in all the sections were above the recommended comfort level of 40dB with the noise level in the milling section exceeding the harmful level of 85dB. There is therefore the need for concerned authorities to intensify awareness campaign among the operators who are mostly ignorant of the harmful effect of noise to their health. This can be achieved by encouraging the use of ear plugs or muffs. Electric- motor driven milling machines should also be used by providing electricity in the section.

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