

# Assessment of Injury-Risks of Work-postures among Building Construction Workers in Anambra State

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## Abstract

Work-Related Musculoskeletal (WMSDs) disorders have been traced to be common in **building construction Industry**. Studies have also been conducted to examine the general believe that Awkward Postures adopted by workers in various Work Fields can give rise to a wide range of Work-related Injuries. Besides, Risk impacts of manual handling of heavy loads like blocks, concrete mixture, and bags of cement, among others cannot be over-emphasized. This ergonomic study assessed the Injury-Risks in various Work Postures adopted by workers in building construction focusing on the bricklayers, the plasterers, the brick-makers, and their assistants. It covered sixteen building construction sites and fourteen brick-making factories in Anambra state, Nigeria. By observing the workers as they perform the tasks, the physical exposure to Risk was assessed using Ovako Working Postures Analyzing System (OWAS). Result of OWAS Assessment indicated Risk Index of 246.81 for Bricklayers, 281.37 for Plasterers, while Brick-makers and Assistants have Risk Index of 310.88 and 329.18 respectively. These high Risk Indexes obtained, revealed that a great number of the workers assume awkward postures, with Brick-makers and the Assistants being at higher level. OWAS recommended the need for corrective measures in improving working postures.

## 1. Introduction

*Work-related Musculoskeletal Disorders* (WMSDs) covers a wide range of inflammatory and degenerative diseases, and disorders that result in pain and functional impairment (Kilbom et al., 1996) and may affect the body's soft tissues, including damage to the tendon, tendon sheaths, muscles and nerves of the hands, wrists, elbows, shoulders, neck and back (Saldana, 1996). These disorders have caused a considerable human suffering and also economically very costly because of reduced working capacity and lessened production (Luopajarvi, 1990). *Musculoskeletal Disorders* (MSDs) accounts for over 50% of total work-related health problems experienced by workers across various work sectors (EUSOS 2002:108). These disorders have been found to be associated with numerous occupational 'risk factors', including physical work load factors such as force, postures, manual handling, repetitive work and vibration (Gerr et al., 1991); and individual factors. According to EASHW, 2004; Musculoskeletal disorders are particularly prevalent across a range of Construction industry trades with estimates suggesting that as many as 30% of the workforce may be affected. Annually, WMSDs accounts for over 50% of health-related problems among workers, leading to high medical cost and economic loss (EUSOS, 2002:108). Building construction processes encompasses various manual activities, which include the following: lifting/carrying of blocks, cement, concrete, sand etc. from one point (level) to another. During these operations, the workers adopt awkward postures which can cause work-related injuries. This study assesses the ergonomic risks associated with the various work postures/positions among workers in building construction.

## 2. Methodology

Ovako Working postures Analyzing System (OWAS), was employed to assess the work-postures adopted by workers in the various Work Groups. The total of 211 work-positions/postures assumed by 80 workers as they perform their various tasks were assessed by OWAS, and based on the resulted Ovako codes obtained, the Risk Classes of the postures/positions were determined. OWAS classified work postures/positions into four ordinal scale action categories which are based on experts' estimate of the health hazards of each work posture or posture combination (Mattila 993), as thus: **Class 1:** Natural position; **Class 2:** Positions which may be dangerous; **Class 3:** Dangerous position; **Class 4:** Very dangerous positions. Subsequently, the Injury-Risk Indexes associated with the work-postures for various work groups were evaluated. Index Risk (I) for each work group was calculated using  $I = [(a \times 1) + (b \times 2) + (c \times 3) + (d \times 4)] \times 1$ ; Where a, b, c, d are the frequencies of classes 1, 2, 3, 4 respectively. Based on OWAS, a posture with Index Risk (I) of 100 has minimum risk; whereas a posture with Index Risk that is more than 100 has higher risk, while Index Risk of 400 has maximum risk.

## 3. Results and Discussion

The results and demographics of the study are given below.

### Assessment of Postures

The total of the 211 work-positions/postures assumed by 80 workers as they perform their various tasks were assessed using OWAS, and the resulted Ovako codes determined the risk classes of the posture/position. The posture risk indexes for various work groups are evaluated, as shown below.

## **Brick Layers**

The postures adopted by 18 bricklayers as they perform the tasks, were assessed, and in 47 work positions, 13 different Ovako postures (codes) were obtained. These postures and their risk classes, as well as their associated frequencies are summarized below.

**Frequency =  $C_n/N$** ; where  **$C_n$**  = Number of occurrence for a given class;

**$N$**  = sum of postures for all Risk Classes;  $N = 4 + 25 + 10 + 8 = 47$

**Frequency Rate = Frequency x 100%**

Table 1: Risk Classes and their frequency rates

S/N	Risk Class	Total No. of Occurrence	Frequency ( $C_n/N$ )	Frequency rate (%)
1	CL1	4	0.0851	08.51
2	CL2	25	0.5319	53.19
3	CL3	10	0.2128	21.28
4	CL4	8	0.1702	17.02

The Index Risk (**I**) associated with these Risk Classes, among Bricklayers, is evaluated thus;

$$I = [(a \times 1) + (b \times 2) + (c \times 3) + (d \times 4)] \times 1$$

Where a, b, c, d are the frequencies of classes 1, 2, 3, 4 respectively.

$$a = 0.0851; b = 0.5319; c = 0.2128; d = 0.1702$$

$$I = \underline{\underline{246.81}}$$

## Plasterers

The postures adopted by 22 plasterers as they perform the tasks, were assessed, and 5 different Ovako postures were obtained in 56 work positions as shown below.

$$N = 2 + 0 + 39 + 15 = 56$$

Table 2: Risk Classes and their frequency rates

S/N	Risk Class	Total No. of Occurrence	Frequency (Cn/N)	Frequency rate (%)
1	CL1	2	0.03571	03.57
2	CL2	0.0	0.00	0.00
3	CL3	39	0.6964	69.64
4	CL4	15	0.2679	26.79

The Index Risk (I) associated with these Risk Classes, among plasterers, is evaluated thus;

$$I = [(a \times 1) + (b \times 2) + (c \times 3) + (d \times 4)] \times 1 = \underline{\underline{281.37}}$$

## Brick-makers

For 18 brick-makers; 6 Ovako postures were obtained in 46 work positions. These postures and their risk classes are tabulated below.

$$N = 3 + 16 + 0 + 27 = 46$$

Table 3: Risk Classes and their frequency rates

S/N	Risk Class	Total No. of Occurrence	Frequency (Cn/N)	Frequency rate (%)
1	CL1	3	0.065	06.52
2	CL2	16	0.35	34.78
3	CL3	0	0.00	0.00
4	CL4	27	0.59	58.69

The Index Risk (I) associated with these Risk Classes, among Brick-makers, is evaluated thus;

$$I = [(a \times 1) + (b \times 2) + (c \times 3) + (d \times 4)] \times 1 = \underline{\underline{310.88}}$$

### Assistants

For 22 workers (assistants); 7 Ovako postures were obtained in 72 work positions. These postures and their risk classes are tabulated below.

$$N = 5 + 18 + 0 + 49 = 72$$

Table 4: Risk Classes and their frequency rates

S/N	Risk Class	Total No. of Occurrence	Frequency (Cn/N)	Frequency rate (%)
1	CL1	5	0.06	06.94
2	CL2	18	0.25	25.00
3	CL3	0	0.00	00.00
4	CL4	49	0.68	68.06

The Index Risk (**I**) associated with these Risk Classes, among Assistants, is evaluated thus;

$$I = [(a \times 1) + (b \times 2) + (c \times 3) + (d \times 4)] \times 1 = \underline{\underline{329.18}}$$

### Summary of the Frequency Rates for the Four Work Groups

Table 5 summarizes the frequency rates of all the work groups for each risk class, followed by the chart in figure 1 that clearly shows the result.

Table 5: Frequency rates for all the risk classes in all work sectors

S/N	Risk Class	Bricklayers (%)	Plasters (%)	Brick-makers (%)	Assistants (%)
1	CL1	08.51	03.17	06.52	06.94
2	CL2	53.19	0.00	34.78	25.00
3	CL3	21.28	69.64	0.00	00.00
4	CL4	17.02	26.79	58.69	68.06

Below is the Chart showing the frequency rates (%) of the various work groups

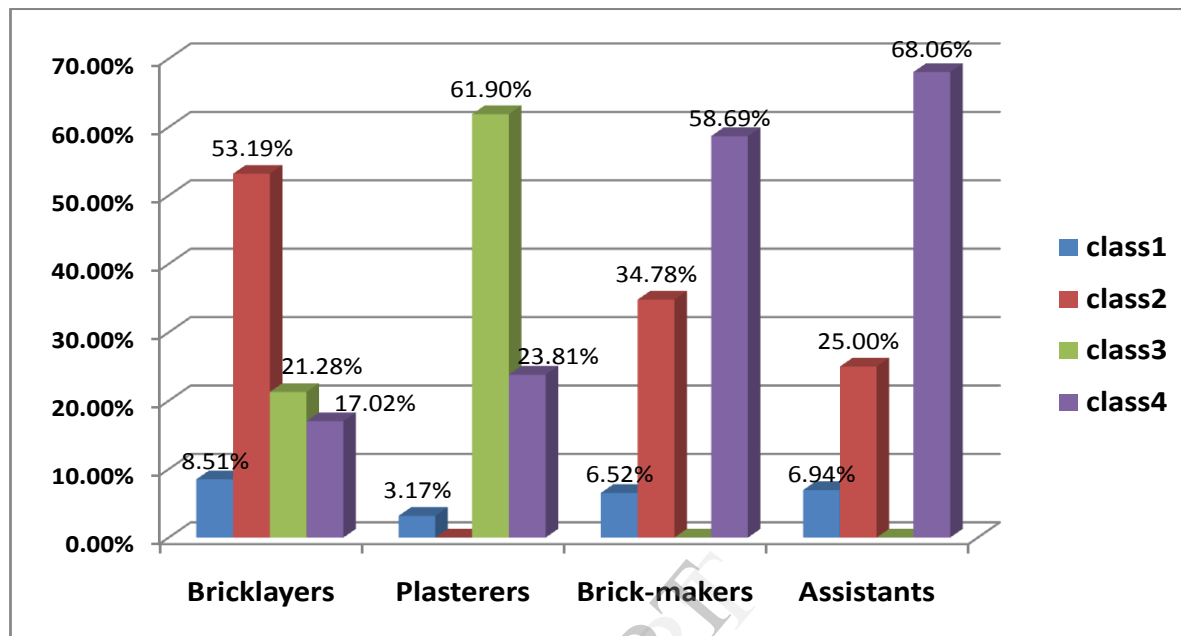


Figure 1: the frequency rates of the four class risks for all the work groups

### Overall Frequency Rates

The frequency rates for the four risk classes among all the workers are summarized in table 6, and subsequently followed by a graphical representation in figure 2.

Table 6: Overall frequency rates of each Risk class for all workers

Class	Bricklayers	Plastering	Brick-makers	Assist	Total	%
CL1	4	2	3	5	14	6.64
CL2	25	0	16	18	49	23.22
CL3	10	39	0	0	49	23.22
CL4	8	15	27	49	99	46.92



For the 211 work-positions/postures assumed by 80 workers as assessed using OWAS; the result shows that 6.64% of the postures/positions adopted by the workers is injury-free (natural position), while 23.22% of the postures may be dangerous. Whereas 23.22% of the postures are dangerous, and up to 46.92% of these postures are very dangerous.

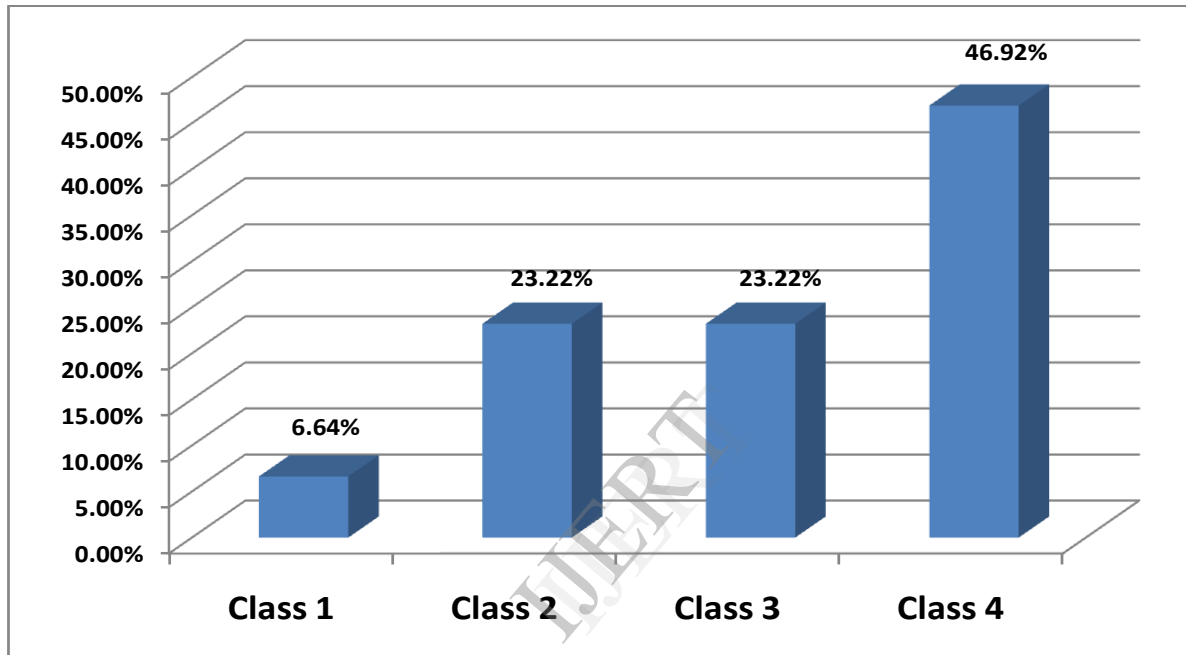


Figure 2: frequency rates for the four risk classes

Based on **Ovako Risk Classes** (already given), the result of the work postures/positions adopted by workers in Building Construction is summarized as shown in figure 3.

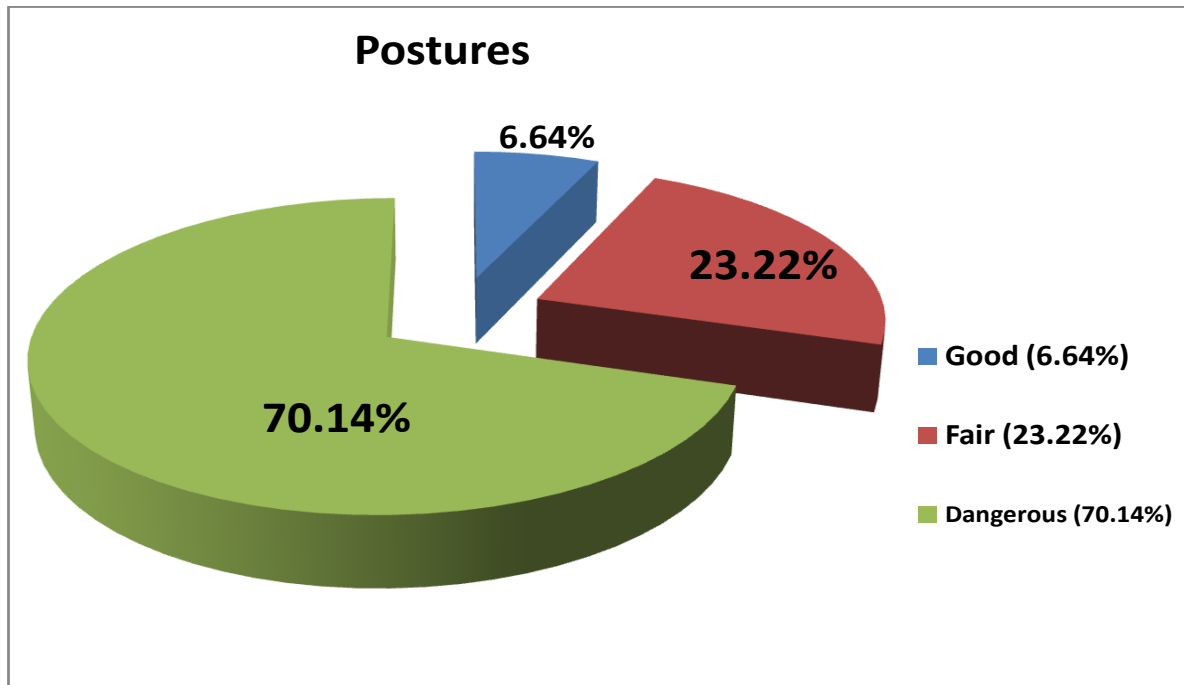


Figure 3: summary of the postures

Hence, only 6.64% of the positions are injury-free, while 23.22% assumed fair, whereas over 70% of the work postures/positions adopted by these workers are dangerous, and therefore can cause musculoskeletal disorders.

### Risk Index

The Risk Indexes, calculated above, for the four Work Groups are summarized in table 7 with graphical representation in figure 4.

Table 7: Risk Index for the work groups

S/No	Work- Group	Risk Index(I)
1.0	Brick layers	246.81
2.0	Plasterers	281.37
3.0	Brick-makers	310.88
4.0	Assistant	329.18

The Risk Index for each of the work groups is far beyond the minimum risk index (which is 100). This indicates that the postures/positions adopted by the workers are capable of causing work-related injury, and therefore need to be ergonomically re-designed.

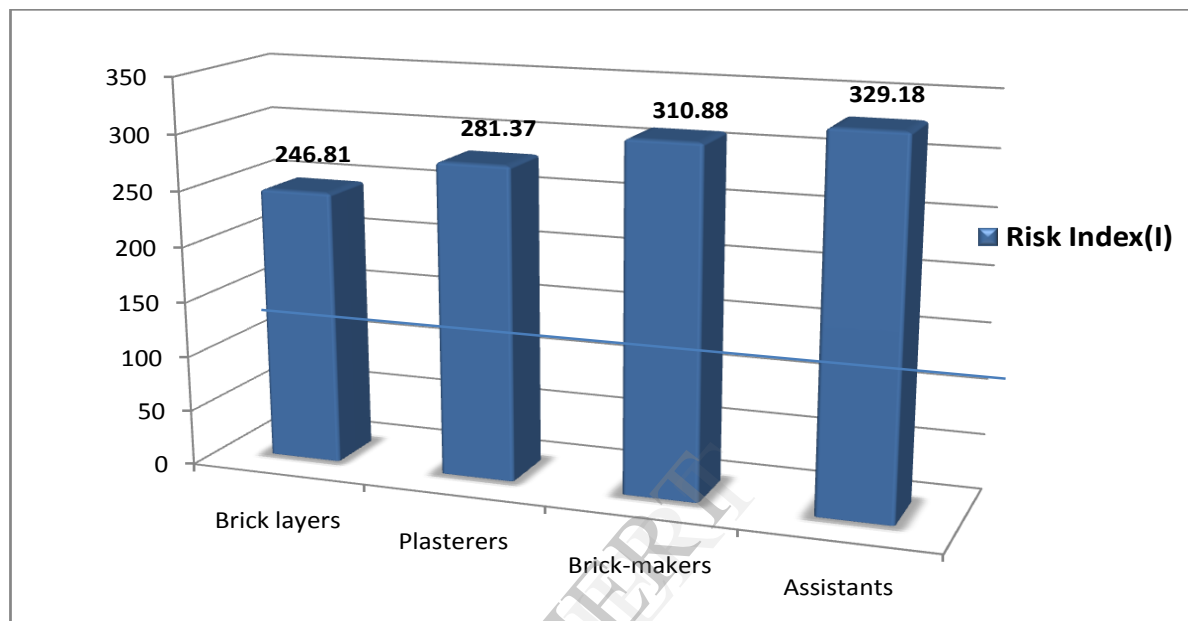


Figure 4: Risk Index for various work groups in Building Construction

## Conclusion

Based on the descriptive result of this study, it could be concluded that workers in building construction performs different activities in various awkward postures for a longer period of time and they suffer from discomfort and pain in different parts of the body, specifically in wrists, elbows, shoulders, neck and back regions. These awkward Postures could be accrued to poor work stations and improper work

methods. Hence, this study pointed out a number of ergonomic factors that needed to be addressed in order to ensure health, safety and reduced risks of developing Work-related Musculoskeletal Disorders among the workers.

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