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Assessment of Musculoskeletal Disorders (MSDs) in Workers in Selected Metalworking Micro-Enterprises (MMEs) in South-Western Nigeria

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ABSTRACT

In Metalworking Micro-Enterprises (MMEs), MSDs are some of the major injuries that occur in workers due to the nature of the work they subjected their body to. The epidemiological data of the workers were collected using the general Nordic questionnaire of musculoskeletal symptoms and were used for the identification of MSDs causes. Workers postures were noted in their working positions, which also assisted in evaluating the risk level of MSDs for each of the workers using Rapid Entire Body Assessment (REBA) tool. The causes of MSDs in MMEs were as results of the use of vibrating tools, working postures and heavy loads. During the last 12 months of this study, it was seen that 86.40% of the workers complained of discomfort in one or more of the considered regions of the body and 63.60% also complained during the last 7 days. Furthermore, 5 of the respondents had MSDs related illnesses in the last 12 months. REBA results showed that no workers falls into the negligible and low risk levels, while 12%, 48% and 9% of all the workers were at medium, high and very high risk levels, respectively. High percentage of the workers complained of pains in their lower back being the region with the highest discomfort.The results obtained revealed that levels of MSDs in workers at the selected MMEs were high, and necessary steps should be taken to reduce the effects.
Thus, the results will enable the employers to evaluate and draw favourable working hours for their employees.

Keywords: Awkward working posture; discomfort; disorders; musculoskeletal disorders; metalworking micro-enterprises; rapid entire body assessment

Aims Research Journal Reference Format:
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1. INTRODUCTION

The industries today are alert on the rise of Musculoskeletal Disorders (MSDs) among their workers (Emily and Ling, 2010). They have also begun to take heed and understand the factors in the job and workplace that may contribute to musculoskeletal disorders. Emily and Ling (2010) stated that Ergonomists around the world has realize the prevalence of musculoskeletal disorders among workers in the various MMEs hence providing numerous published findings to educate and propose improvements that can be done to reduce such impairments. MSDs are some of the problem faced by workers in MMEs, which arise as a result or the nature of work they subjected themselves to. The relationship between MSDs and work – related factors remains the subject of considerable debate (Ksenia et al., 2012; Bernard, 1997 and Burdorf, 1992). Symptoms may include pain, discomfort, numbness and tingling in the affected area and can differ in severity from mild and periodic to severe, chronic and debilitating conditions. MSDs can be sub divided into more specific and recognized regions of the back, upper limbs and lower limbs etc. These sub categories, when combined, form the overall grouping values presented for the general classification of MSD illness type.

Metal fabricating industry is an industry which transforms purchased metals into intermediate or finished products through some manufacturing processes. Fabricated metal product manufacturing subsector transform metal into intermediate or end products, or treat metals and metal formed products fabricated elsewhere (Raimi, 2014). Due to poor technology which led to excessive physical workload, MSDs risks increase as the metal fabrication employees work at workstations that are rigid in design (Uhumwangho, 2010). This sometimes causes strain to their muscles during material handling and other tasks that have to be carried out to achieve a high production output. Sometimes their tasks require them to remain bent, squatted, seated or standing for long periods of time, and this prolonged work posture can lead to uneasiness, musculoskeletal and physiological disorders among the workers (Health and Safety Executives 2012; Molenbroek et. al., 2003, Bello and Mijinyawa , 2010 and Chandhary et. al., 2004).

Studies showed that being in awkward posture of specific tasks demanded by a given situation or as influenced by bad designed work for a long duration provoked psychological stress and imposed ill effect on human performance (Das and Chakrabarti, 2004 and Ismaila et.al, 2013). The cumulative effect of MSDs is more pronounced in MMEs which are frequently subjected to force lifting of heavy weight boxes, awkward posture of worker and repetition of worker performing similar lifting task all day (Qutubuddin *et al.,* 2013). Therefore, by designing the job to fit the worker, physical capability, good health, absence of accidents and task performance will increase, thus, enhance productivity (Snook SH, 1978 and Sluiter and Frings-Dresen, 2007).

Malikraj *et al.,* (2011) commented that the economic loss due to such disorders affects not only the individual but also the organization and the society as a whole. Ksenia, et. al., (2012) stated that musculoskeletal conditions are the major causes of absence from work and benefit claims due to ill health. The present study was carried out in six MMEs in South-Western Nigeria. This research analyzed the causes and effects of MSDs on workers in MMEs.

2. MATERIALS AND METHODS

This research was carried out in nine MMEs in South-Western Nigeria. In this study, data were collected from 66 workers (18 blacksmiths, 18 machinists and 30 welders) in foundry, machining, and welding units, respectively. Epidemiological data were collected using Nordic Musculoskeletal Questionnaire (Kuorinka, 1987 and Crawford, 2007). The questionnaire consisted of two parts and covered the followings: personal details (including sex, age, health and body weight) and musculoskeletal symptoms in different body regions. Reported MSDs symptoms were restricted to last 7 days and last 12 months (prior to the administration of the questionnaires). The questionnaires were administered by interviewing the workers (blacksmiths, machinists and welders) and pictures of their working postures were taken on duties (plates 1, 2 and 3) which were later reviewed and awkward working postures were selected for REBA analysis. Visitation/observation, data vetting, personnel interview, physical participation and oral interview (especially for those who could not express themselves in written English) were also used in gathering the required information.

Peculiarities of metal fabricating industry in terms: type of equipment in use, mode of operations and type of operations were considered. Rapid Entire Body Assessment (REBA) tool was then used to analyze the collected data, to determine the level of their physical exposure to work – related musculoskeletal risks. Scores (points) were calculated for the postures of each part of the considered body regions. In the evaluation, the combined individual scores for low back, neck and legs give score A and those for upper arms, lower arms and wrists give score B. Also, load and force exerted are assigned a score of 0 or 1 and was added to score A to obtain a Posture Score A, and coupling were assigned a score ranged from 0 to 3 which was added to score B to get a Posture Score B. Posture score A and posture score B were then used to obtain Posture Score C from the final grand REBA score Table. An activity scores of +1 if one or more body parts are held for longer than 1 minute (static), +1 for repeated small range actions (more than 4 times per minute) and +1 for action causes rapid large changes in postures or unstable base were added to the posture score C obtained to determine the risk level of MSDs in workers.

Plate 1: Blacksmith in action

Plate 2: Machinist at work

Plate 3: Welder at work

The risk level (ranged from 1 to 11+) showed the MSDs condition level. Risk level 1 indicated negligible risk and no action required while risk level 2 or 3 indicated low risk and change may be needed. Risk level 4 – 7 indicated medium risk, further investigation and change soon. Furthermore, risk level 8 – 10 indicated high risk, investigation and implement change. Lastly, risk level 11 and above (11+) indicate very high risk and implement change.

3. RESULTS AND DISCUSSION

Table 1 shows the summary of the collected data about the workers of the selected MMEs, which contains the parameters, ranges/conditions, number of respondents and percentage of responses. Table 1 also revealed that 59.09% of the workers are found to be very agile between the ages of 21 – 40 years while none of them has spent over 25 years at work. This may be due to illnesses and some other MSDs experienced at work since 50% of the workers were involved in kneeling/squatting while working, 68.18% of them were using vibrating tools (such as grinding, electric hand cutting and electric hand drilling machines) and 95.45% of the workers were involved in carry heavy loads which were the major MSD causing activities.

Figures 1, 2 and 3 represented percentage responses of the blacksmiths, machinists and welders, respctively, per body region. The analysis in Figure 1 revealed that 100% of the blacksmiths complained of discomforts in the wrists/hands and lower back of their trunk during the last 12 months but 83.3% of them complained of discomforts in the wrists/hands, lower back of the trunk and thighs region in the last 7 days. Fifty percent (50%) of the machinists experienced discomfort in the shoulder and thigh regions during the last 12 months while only 16.7% of them complained of shoulder pains during the last 7 days (Figure 2). However, in Figure 3, lower back of the trunk region of the welders has the highest (80%) value of responses during the last 12 months while 60% of them experienced discomfort in their lower back of their trunk during the last 7 days. Figure 4 summarized the discomforts experienced by all the

Table1: Summary of collected data about the Workers

Parameter	Range/Conditions	No. of Respondents	Percentage (%)
Age	Less than 20	15	22.73
	21 – 40	39	59.09
	Above 40	12	18.18
Workers weight (kg)	Less than 50	3	4.55
	51 – 60	6	9.09
	61 – 70	18	27.27
	Above 70	39	59.09
Working hours in a week (hours)	Less than 40	0	0.00
	41 – 50	27	40.91
	51 – 60	18	27.27
	61 – 70	9	13.64
	Above 71	12	18.18
Year of experience	Less than 5	18	27.28
	5 – 10	18	27.28
	11 – 15	15	22.72
	16 – 20	3	4.54
	21 – 25	12	18.18
	Above 25	0	0.00
Work Posture	Sitting	0	0.00
	Standing	27	40.91
	Kneeling or Squatting	33	50.00
	Both sitting and Squatting/kneeling	6	9.09
Vibrating tools	Workers using vibrating tools	45	68.18
	Workers not using vibrating tools	21	31.82
Carrying of heavy loads	Workers carrying heavy loads	63	95.45
	Workers not carrying heavy loads	3	4.55
Section of metal fabricating industry	Foundary	18	27.27
	Machining	18	27.27
	Welding	30	45.46

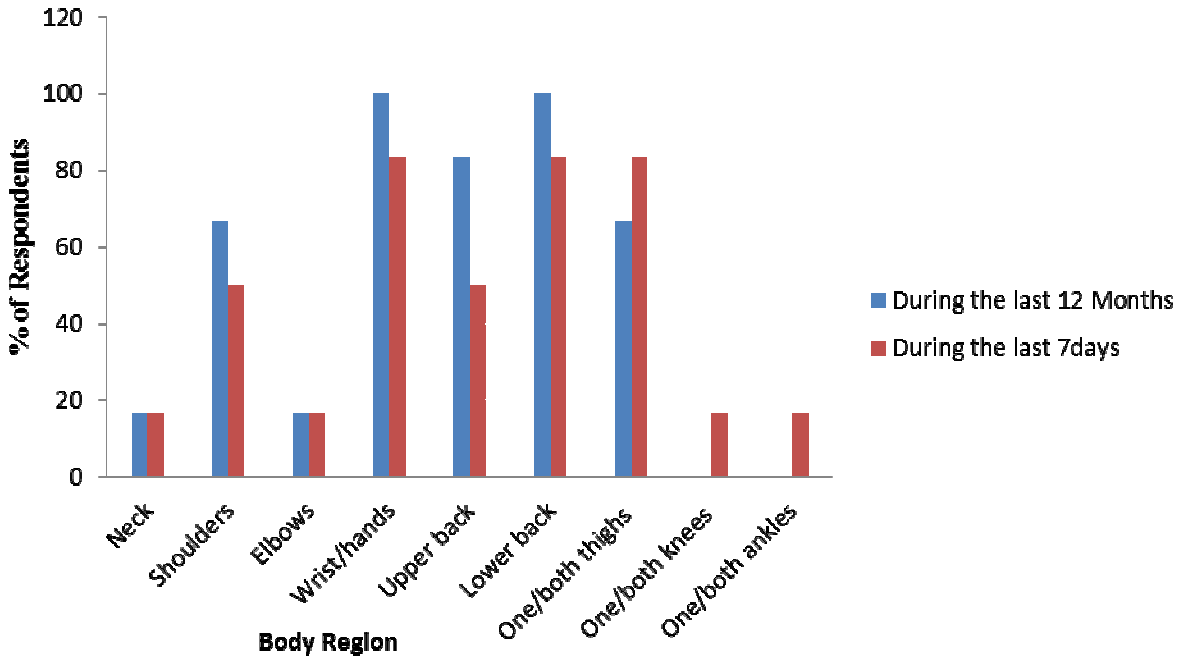

Fig 1: Percentage Responses of the Blacksmith per body region

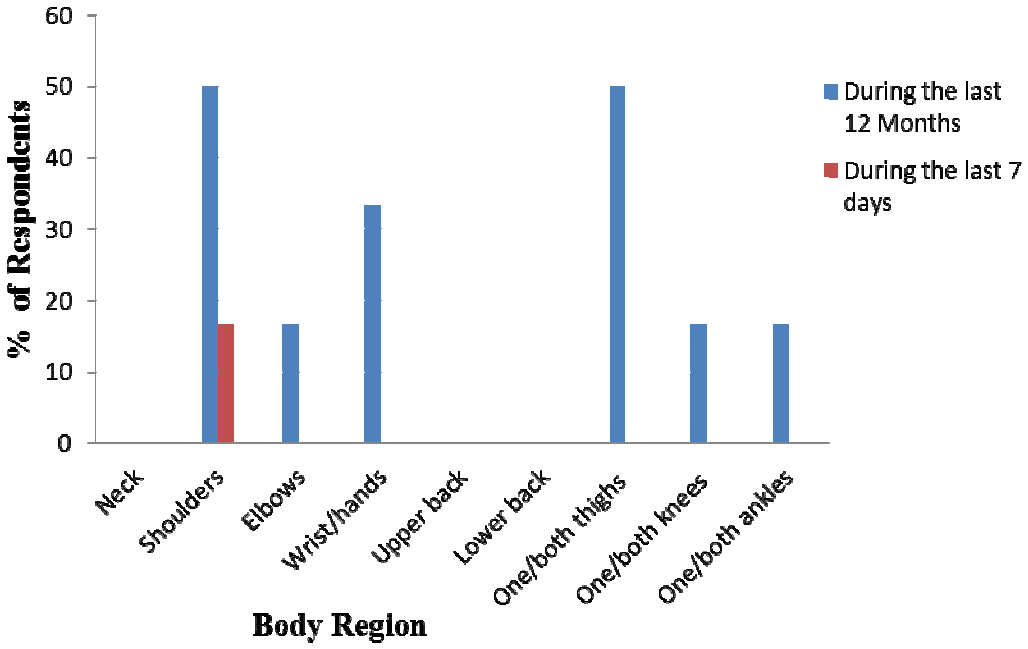

Fig 2: Percentage Responses of the Machinists per body region

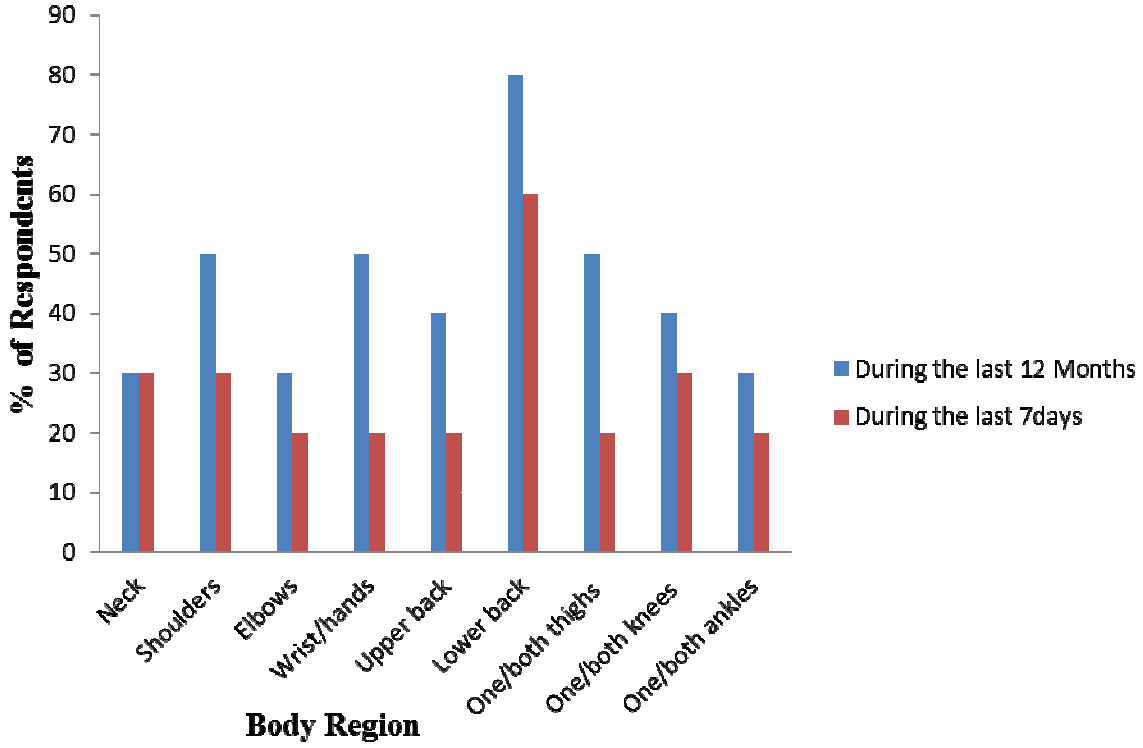

Fig 3: Percentage Responses of the Welders per body region

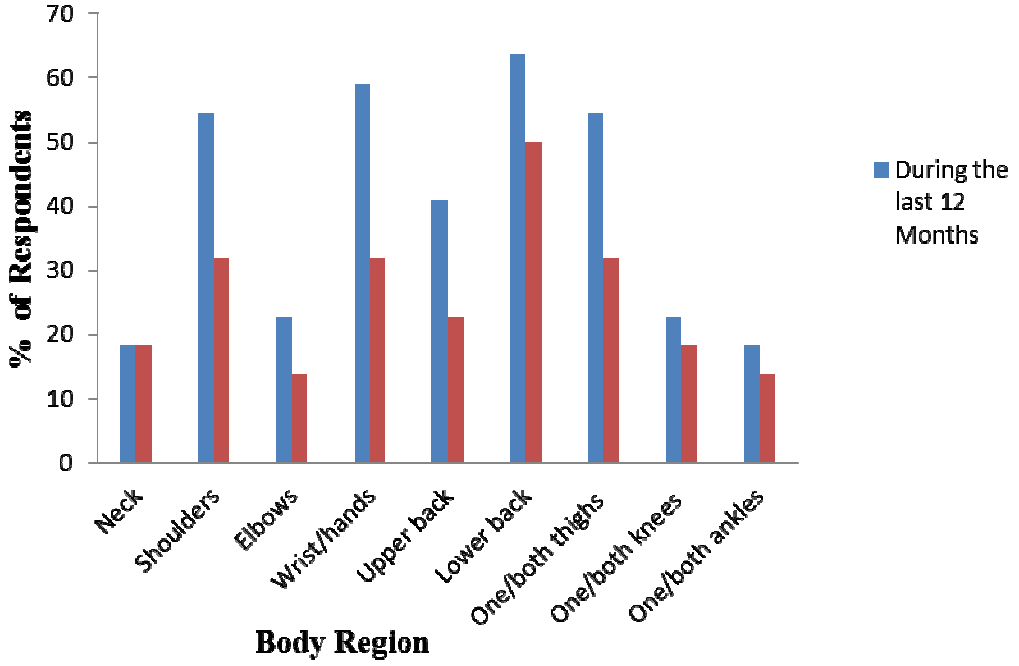

Fig 4: Percentage Responses of the all the Workers per body region

workers. Shoulders, wrists/hands, lower back of the trunk and thigh regions of the workers were affected more compared with any other region of the body during the last 12 months and 7 days. Highest complaints of 63.6% and lowest of 18.2% were experienced in the lower back of the trunk and neck/anckle regions, respectively during the last 12 months while the highest complaints of 50% and lowest of 13.6% were experienced in the lower back of the trunk and elbow/ankle region, respectively, in the last 7 days.

Tables 2, 3, and 4 show the final REBA score for each of the blacksmiths, machinists and welders, respectively. Table 2 revealed that 100% of the blacksmiths were at high risk level (with final REBA of 8 – 10), needed investigation and changes must be implemented. However, 33% of the machinists were at medium risk level (with final REBA of 5 and 6), needed further investigation and changes should be done soon, while the remaining machinists (67%) were at high risk level (with final REBA of 8 – 10), needed investigation and changes must be implemented (Table 3). But in Table 4, 60% of the welders were at high risk level (with final REBA of 8 – 10), needed investigation and changes must be implemented, while the remaining 40% of the welders were at very high risk level (with final REBA of 11 – 13) therefore, change must be implemented immediately.

During the last 12 months prior to the administration of the questionnaires, it was seen that 86.40% of the workers complained of discomfort in one or more of the considered regions of the body and 63.60% also complained during the last 7 days prior to the administration of the questionnaires. Nevertheless, REBA results show that no worker was classified under negligible and low risk levels, but, 12%, 48% and 9% of all the workers were at medium, high and very high risk levels, respectively.

Table 2: Final REBA score for Blacksmiths

S/N	Score A	Score B	Score C	Activity score	Final REBA score
1	6	4	7	1	8
2	6	4	7	1	8
3	6	4	7	1	8
4	7	2	7	1	8
5	7	2	7	1	8
6	7	3	7	1	8
7	7	3	7	1	8
8	7	3	7	1	8
9	7	3	7	1	8
10	7	4	8	1	9
11	7	4	8	1	9
12	7	4	8	1	9
13	7	5	9	1	10
14	7	5	9	1	10
15	8	6	9	1	10
16	8	4	9	1	10
17	8	4	9	1	10
18	8	4	9	1	10

Table 3: Final REBA score for Machinists

S/N	Score A	Score B	Score C	Activity score	Final REBA score
1	3	3	4	2	6
2	3	3	4	2	6
3	3	4	4	2	6
4	5	2	3	2	5
5	5	3	3	2	5
6	5	3	3	2	5
7	5	5	6	2	8
8	5	5	6	2	8
9	5	5	6	2	8
10	4	4	7	2	9
11	4	4	7	2	9
12	4	4	7	2	9
13	5	5	8	2	10
14	5	5	8	2	10
15	6	6	8	2	10
16	2	2	7	2	9
17	3	3	7	2	9
18	3	3	7	2	9

Table 4: Final REBA score for Welders

S/N	Score A	Score B	Score C	Activity score	Final REBA score
1	6	2	6	2	8
2	6	2	6	2	8
3	6	3	6	2	8
4	6	5	7	2	9
5	6	5	7	2	9
6	6	6	7	2	9
7	7	2	7	2	9
8	7	1	7	2	9
9	7	1	7	2	9
10	7	7	9	2	11
11	7	6	9	2	11
12	7	6	9	2	11
13	8	2	8	1	9
14	8	3	8	1	9
15	8	3	8	1	9
16	8	4	9	1	10
17	8	4	9	1	10
18	8	4	9	1	10
19	8	4	9	2	1
20	8	4	9	2	1
21	8	4	9	2	1
22	7	2	7	2	9
23	7	3	7	2	9
24	7	3	7	2	9
25	9	5	10	1	1
26	9	6	10	1	1
27	9	5	10	1	1
28	12	1	12	1	13
29	12	2	12	1	13
30	12	2	12	1	13

4. CONCLUSIONS AND RECOMMENDATIONS

It was revealed that MSDs was experienced in the considered MMEs as results of improper materials handling, awkward working posture, and force repetitive activities. Awkward working posture was seen as the main cause. The effects of MSDs were felt in form of discomfort/pain in all the regions of body, with higher percentage (%) of the workers complaining of pains in their lower back being the region with the highest discomfort. The research also revealed that the discomfort according to their response correlate to the level of risk of MSDs according to the analysis carried out. The analyzed data show that workers in the selected industries were subjected to high or very high risk, which requires action in form of investigation and urgent implementation of change to prevent occurrence of chronic MSDs.

To solve the problem of material handling, proper equipment should be used to move materials when need be instead of carrying heavy weight. Proper means of handling of materials should also be used to minimize the material handling problem. The effects of MSDs felt in form of discomfort or pain in any of the regions of the body should be reported and checked.

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