RESEARCH ARTICLE

ADVANCE RESEARCH JOURNAL OF SOCIAL SCIENCE

Volume 9 | Issue 1 | June, 2018 | 95-101 ■ e ISSN–2231–6418

DOI: 10.15740/HAS/ARJSS/9.1/95-101 Visit us : *www.researchjournal.co.in*

Postural analysis of women workers in bakery industry using RULA method

■ Pinky Saikia* and Ruplekha Borah

Department of Family Resource Management, College of Home Science, Assam Agricultural University, Jorhat (Assam) India

ARTICLE INFO :

Received : 28.02.2018
Revised : 09.05.2018
Accepted : 24.05.2018

KEY WORDS :

Work postures, Musculoskeletal symptoms, Bakery industry, RULA method

HOW TO CITE THIS ARTICLE :

Saikia, Pinky and Borah, Ruplekha (2018). Postural analysis of women workers in bakery industry using RULA method. *Adv. Res. J. Soc. Sci.*, **9** (1) : 95-101, **DOI: 10.15740/HAS/ARJSS/9.1/95-101.**

*Author for correspondence

ABSTRACT

Work posture is the position and condition of the body or body parts during the performance of work. Good work posture is as important for the performance of tasks as it promotes health and minimizes stress and discomfort during work. Ergonomics assessment of women workers were carried out on a sample of purposively selected 30 respondents in normal health who were engaged in pre-packaging activities in a Bakery industry, Jorhat. An attempt was made to identify the working postures and musculoskeletal disorders prevailing among the women workers in the industry. The Rapid Upper Limb Assessment (RULA) is a widely used tool designed for the investigations of the work posture. RULA method was applied to analyze the working postures and musculoskeletal pain scale was developed to observe acuteness of pain among the workers in bakery Industry. From the observation and analysis of the result it was concluded that the women workers were highly affected by adopting awkward body posture while performing the activities. Twisting, bending and static repetitive tasks are the resultant of poorly designed workstation. These actions force them into a non-neutral position that increases the overall discomfort and pains at the knees, feet, legs, arms and shoulders.

INTRODUCTION

Small scale industry plays a vital role in development in countries like India; they play an important role in employing the majority of the woman workers in industries. According to WHO, over 1000 million people worldwide are employed in small scale industries and also have a great contribution in the development of women employees in India. There are a huge number of women employees engaged in small scale industries performing different type of jobs at different level. India today engages more than 4.5 crores of women workers employed in the industrial work. Such industries in which the workers are engaged demand various working postures which may be adopted repeatedly during a day and continuing for many years which are expected to affect the musculoskeletal harmony of the individual. The workers complaints about discomfort and pain, come most of the time, from inadequate postures during work activities. Majority of workers are suffering from musculoskeletal disorders which is a most common work-related problem. The common occupational problem of the workers is musculoskeletal disorders in India. Being a bio-mechanic nature factor, the skeletal-muscular lesions can be better understood after an analysis of the work postures (Fernanda *et al.*, 2006). In

different occupations women are engaged in various activities with high postural load due to constraints of work method and working conditions. They perform the activities by assuming varieties of postures. To maintain a few Corlett's (Corlett and Bishop, 1988) investigation of repetitive operation revealed that particular posture were required in order to do the work and these postures were maintained over many hours with small period of relaxation. WMSDs are a group of disorders affecting the bones, muscles, ligaments and tendons of the human body. There are certain risk factors like awkward posture, force, repetitive activities and inadequate rest (Mukhopadhyay *et al.*, 2007). Presence of all these factors sets the stage for WMSDs. This eventually leads to a decline in the productivity and quality of the work. Moreover, work organization and work environmental factor also affects work performance such as long period of work duration, no rest break, no job rotation and too hot or cold temperature which may lead to fatigue and decreased performance in workers and resulting in development of WMSD.

One of the fastest growing trends in the world over the past two decades the increase in the number of women fully employed outside the home. In the future years women will account for one half of the work force and two thirds of the labor force growth. There is a strong need to study women in stress at work. In packaging industry mostly women workers are involved in different activities related to pre-packaging and packaging. While performing the activities they are required to maintain different static postures for a long period of time which may cause damage to the health. Women laborer are the main working force in any industry, so to increase the productivity of industries, it is very essential to improve their working conditions as well as their health problems so that they can performs their activities more efficiently. Many researchers found that long term standing has been the cause of pain and discomfort to body parts, increasing over time starting from the one near to the standing in floor to the upper body parts (Kamalinia *et al.*, 2008 and Deros *et al.*, 2010). There is a lack of ergonomics awareness and understanding in small scale industries (Ansari and Shaikh, 2014).

Thus realizing the importance of women workers in bakery industry relating to their working conditions and health problems, the present study was undertaken with the following objectives:

– To analyze the working postures of the female workers engaged in pre-packaging of bakery products.

– To determine the prevalence of Work Related Musculoskeletal problems among women workers.

– To study the relationship between RULA scores with work related musculoskeletal problems of the workers.

MATERIAL AND METHODS

In the present study, to analyze the work postures of workers, rapid upper limb assessment (RULA) technique has been used. RULA has been developed specifically to examine the level of risk associated with upper limb disorder of individual workers by scoring the different body region of the workers. RULA divides the body into two segments which form two distinct groups. Group A includes the upper limbs (upper arms, lower arms and wrists), while Group B, includes legs, trunk and the neck (Anonymous, 2009). Posture scores for each of the group A and B are calculated by means of a table into which the individual posture scores for each body part (legs, wrists, arms, trunk) are entered.

The posture scores for each body part are obtained from measuring the angles formed by the operator's different body parts. This method applies a different procedure to each part of the body depending on its angle measurements.

The global posture scores for groups A and B are calculated and lastly a final score is obtained from the modification of such global values.

The requirements for action into which the grand scores are divided are summarized into Action levels as follows:

Action level 1 :

A score of 1 or 2 indicates that posture is acceptable if it is not maintained or repeated for long periods.

Action level 2 :

A score of 3 or 4 indicates that further investigation is needed and changes may be required.

Action level 3 :

A score of 5 or 6 indicates that investigation and changes are required soon.

Action level 4 :

A score of 7 indicates that investigation and changes are required immediately.

Musculoskeletal problems :

Musculoskeletal problems are associated with static muscles and skeletal efforts which may produce painful fatigue symptoms in muscles concerned. If the static efforts is repeated daily over a long period more or less permanent aches will appear and involve not only the muscles but also joints tendons and other tissues. MSD was categorized as mild pain, moderate pain, continuous pain and severe pain with scores ranging from 1, 2, 3, 4, respectively.

Statistical analysis:

Frequency, percentage, mean and standard deviations were computed to elicit information according to the objectives of the study. Karl Pearson's co-efficient of correlation and t test were used to find out the relationship between independent variables and dependent variables.

OBSERVATIONS AND ANALYSIS

In one process of packaging, the packed biscuit packets delivered from the outlet of the machine were collected by the workers and stored in the cartoons for marketing to distant places. This is a highly repetitive task and daily performed packaging activity.

Working posture of the female workers engaged in prepackaging of Bakery products :

The female workers are involved in performance of various activities in bakery industry for prepackaging of the products. A prepackage is defined as the combination of a product and the individual package in which it is prepackaged. While performing various prepackaging activities the workers assume different postures which were studied by observation and the still photography technique, where from postures were analyzed.

The data revealed that cent percent of the respondents assumed standing posture while performing activities in industry. The activities were performed both manually and by using machines. The work place *i.e.* the machines were above the ground level for which the female workers adopted different awkward static postures by using both the extremities.

RULA scores obtained by the respondents in pre-packaging activity :

RULA method was applied to analyze each postures adopted in pre-packaging activities. RULA scores are presented and analyzed according to the age, years of involvement in job and height of the respondents.

From the Table 1 it reveals that maximum percentage of respondents *i.e.* 40 per cent of the respondents age group of 15-25 years followed by 26 per cent of the respondents in the age group of 15-25 years obtained a score of 5 or 6 (Table 1). This indicates that further investigation and change is required soon. Nearly, 27 per cent respondents in the age group 15-25 years obtained grand score 7. The action level indicated that change is required immediately in the work place and attention is necessary to enable the workers to work in a corrective posture. Only 6.66 per cent old age group of the respondents obtained grand scores of 3 and 4 and indicated that further investigation is needed and changes may be required in the work station.

As regards to years of involvement in the job, data on Table 2 depicted that same percentage (26.66%) of the respondents engaged in pre-packaging activity for less than 2 years and 2-4 years of service obtained scores of 5 and 6 (Table 2). Nearly 6.7 per cent of the respondents with job exposure for 4-6 years and 6-8 years obtained scores of 5 and 6. This action level indicates that further investigation and change is required soon in their work station and work posture. However, 20 per cent of the respondents with less than 2 years of involvement and 6.66% percentage of respondents with

Table 1 : RULA scores obtained by the respondents in pre-packaging according to age **(n=15)**

Age (in years)	RULA scores		
	3 or 4 (%)	5 or 6 (%)	7 (%)
15-25	-	40.00	26.66
25-35	-	26.66	-
35-45	6.66	-	-

2-4 years of involvement obtained score of 7. This indicates that further investigation and change is required immediately in work station. This clearly shows that harmful posture working in pre-packaging activity. Only a meager percentage of respondents (6.66%) obtained RULA scores of 3 and 4, indicating that change may required on work place and they had 6-8 years of involvement (Table 2). It was evident from the result that respondents with less years of involvement in industry had less skill in performance of pre-packaging activity and adopted improper postures leading to high RULA scores.

Musculoskeletal problems prevailing among the female workers :

Muscular disorder occurs in almost every small scale industries and workers are subjected to high risk of MSD (Singh *et al.*, 2012 and Borah, 2009). Keeping the importance of musculoskeletal problems faced by the workers in mind an attempt has been made to ascertain the musculoskeletal problems faced by the women workers in performance of different activities in industry.

Musculoskeletal pain was analyzed according to age, years of involvement and height of the respondents. Findings revealed that maximum percent of respondents *i.e.* 76.66 per cent of the respondents had pain in their legs, followed by 60 per cent of the respondents with pain in their feet (Table 3). The musculoskeletal problems were found to be abundantly present with pain among the respondents. It was observed that the respondents had severe pain in the lower extremities. Since they had to perform their work in static posture by standing for long hours, they felt pain in their legs and feet. High repetitiveness, prolonged work activity and remaining in static posture for a prolong period of time may be regarded as the causative factors in the occurrence of musculoskeletal disorder (Gangopadhyay *et al*., 2003).

Further, 53.33 per cent respondents suffered from shoulder pain because pre-packaging and packaging were highly repetitive tasks. Rosecrance and Cook (1998) also reported that several work-related risk factors such as awkward postures, high repetition rates have been associated with the increased prevalence of MSDs. Fifty per cent of the respondents had pain in their knees because they had to work by standing in one place and had to give much effort in their legs. It was followed by 43.33 per cent of the respondents who had pain in their neck because they had to bend and twist their neck while

Table 2 : RULA scores obtained by the respondents in pre-packaging according to the years of involvement **(n=15)**

Years of involvements (in years)	RULA Scores		
	3 or 4 (%)	5 or 6 (%)	7 (%)
Less than 2 years	-	26.66	20.00
2-4 years	-	26.66	6.66
4-6 years	-	6.66	-
6-8 years	6.66	6.66	-

Table 3 : Intensity of the body pain felt by respondents

Body parts	Intensity				Total (%)
	Mild pain (%)	Moderate pain (%)	Continuous pain (%)	Severe pain (%)	
Neck	53.84	-	7.70	38.46	43.33
Shoulder	37.50	6.25	6.25	50.00	53.33
Back	25.00	8.33	8.33	58.33	40.00
Arms	41.66	8.66	8.66	41.66	40.00
Knees	33.33	6.66	6.66	53.84	50.00
Wrist	50.00	-	-	50.00	26.66
Leg	30.43	4.34	13.04	52.17	76.66
Feet	27.77	5.55	11.11	55.56	60.00

Figures in parentheses indicate percentage

performing the tasks in the bakery industry (Table 3). An equal percentage of respondents *i.e.* 40 per cent suffered from back and arms pain. Only 26.66 per cent of the respondents had pain in their wrists.

From the above interpretation, we can conclude that maximum percentage of respondents had pain in their lower segment of the body because they maintained a static posture with high motion repetitiveness. Similar findings were reported by Chee and Rampal (2004) who found that highest prevalence's of pain were found in the lower limbs, neck/shoulders, and upper back due to highest exposures to prolonged hand/wrist movement and standing positions.

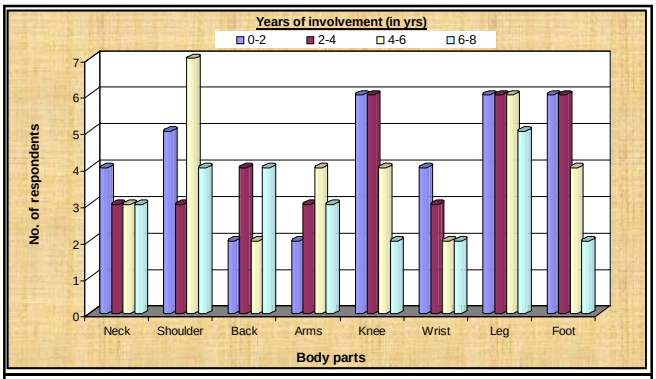

Fig. 2 : Musculoskeletal problems according to years of involvement

Musculoskeletal problems faced according to different age group of the respondents :

Further analysis of data reveals that the respondents from the young age group (between 15-25 years) felt continuous pain in different body parts as compared to middle and old age groups. Young respondents reported mild to continuous pain in legs, feet, shoulder and back. Less number of respondents in middle age group had suffered from body pains, while least number of respondents in older age group reported pain in body parts (Fig. 1).

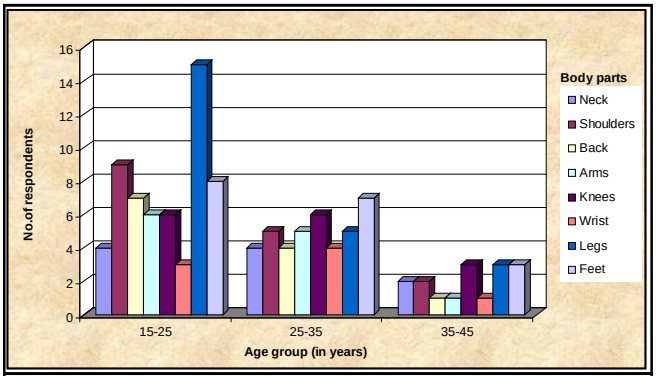

Fig. 1 : Musculoskeletal pain in different age groups of respondents

Consistently, the most affecting body part was shoulder. For the risk factors of wmsds, the frequency of bodily movement has the most contribution to the development of WMSDS.

An attempt was made to assess the musculoskeletal problem faced by respondents according to their years of involvement (Fig. 2). It was revealed from the Table 4 that most of the respondents engaged for less years of involvement in job faced more work related musculoskeletal problems compared to respondents with more years of job exposure. It was observed that the stress of repetitive work has a cumulative effect on the pathogenesis of diverse health problems. An association between musculoskeletal disorders and work related physical factors when there are long exposures in combination with physical factors such as repetitiveness force level and awkward disorders were reported in almost every joint of the upper limbs (Farooq and Khan, 2009). In the present study it was found that various activities that take place in industry were repetitive in nature. This may probably lead to the fact that young respondents with less years of involvement suffered more musculoskeletal pains.

Table 4 : Musculoskeletal problems faced according to years of involvement

Years of involvement (in years)	Musculoskeletal pain							
	Neck	Shoulder	Back	Arms	Knee	Wrist	Leg	Foot
0-2	57.14	28.57	28.57	28.57	85.71	57.14	85.70	87.51
2-4	18.75	18.75	25.00	18.75	37.50	18.75	37.50	37.50
4-6	21.42	50.00	14.28	28.75	7.12	14.28	42.84	28.75
6-8	18.75	25.00	25.00	18.75	12.50	12.50	31.25	12.50

Figures in parentheses indicate percentage

Table 5 : Problems faced by the respondents regarding work place and work environment (n = 30)	
Problems faced	Pre-packaging (%)
Work place too high	40.00
Work place too low	13.33
Work place is congested	73.00
Improper lighting	66.60
Improper ventilation	86.60

Problems faced by the woman workers regarding work place and work environment :

Work environment is the sum of the interrelationship that exists within the employees and between the employees and the environment in which the employees work. An attempt was made to identify the problems faced by the women workers in their work place and work environment.

Findings indicated (Table 5) that majority of the workers who performed pre-packaging activities found the work place too high and congested while performimg there activities.

The lighting level in working areas of pre-packaging 134 lux, respectively which was found to be less than recommended illumination level (200 lux in packaging industry). Majority of the respondents expressed discomfort in performing pre-packaging activities due to improper ventilation.

There existed a significant negative correlation between age of the respondents, height of the respondents with RULA scores and musculoskeletal problems. Thus it can be inferred that short height respondents and younger respondents obtained higher RULA scores and faced more musculoskeletal problems. Further, there existed a significant positive relationship between RULA scores and musculoskeletal pain.

Conclusion :

The evaluation of body posture has been carried out on women workers in bakery industry by RULA method and it can be concluded that; significant proportion of the workers are working in uncomfortable and painful postures as found by analysis. This is due to lack of ergonomics knowledge and awareness in small scale industry. Thus the workers were highly affected by adopting awkward body posture as determined by RULA method. This study recommends the immediate implementation of ergonomics interventions with proper knowledge among workers and health education on common postural change.

REFERENCES

Anonymous RULA (Rapid Upper Limb Assessmnet). Retrieved from www.ergonautas.upv.es/en/metodos/rula/rula-analyze on 4th December 2009.

Ansari, N.A. and Sheikh, M.J. (2014). Evaluation of work posture by RULA and REBA: *IOSR J. Mechanical & Civil Engg. (IOSR-JMCE),* **11** (4) : 18-23.

Borah, S. (2009). Musculoskeletal disorders of women labour engaged in shelling activity of cashew nut Factory. *International Ergonomics Conference* **1**: 111.

Chee, H.L. and Rampal, K.G. (2004). Work related Musculoskeletal problems among women worker in the serves conductor Industry. *Internat. J. Occupational Environ. Health*, **10**: 63-71.

Corlett, E.N. and Bishop, R.P. (1988). A technique for assessing posture discomfort. *Appl. Ergonomics*, **19**: 175-182.

Deros, Md. B., Darunis, I., Ismail, A.R., Sawal, A.N. and Ghani, A.J. (2010). Work related musculoskeletal disorder among the workers of automotive industry. *American J. Appl. Sci.,* **7** (8) : 1087-1092.

Farooq, M. and Khan, A.A. (2009). Risk of upper limb musculoskeletal disorders in small scale industries around Aligarh. *International Ergonomics Conference,* p. 85.

Fernanada, B., Felipe, P.C. and Mota, C. (2006). Effect of a program of trunk strength and stability on pain, low back and pelis kinematics and body balance. *J. Body Work & Movement Therapies*, **12** : 22-30.

Gangopadhyay, S., Ray, A., Das, A., Das, T., Ghoshal, G., Banerjee, P. and Bagehi, S. (2003). A study on upper extremity cumulative trauma disorder in different unorganised sectors of West Bengal. *J. Occupational Health*, **45**(6) : 351-357.

Kamalinia, M., Nest, S.G., Choobineh, A., Hossieni, M. and Kee, D. (2008). Postural loading on upper Limbs in workers of the assem by line of an Iranian Teclecommunication Mawefacturing company using the LUBA- technique. *J. School Public Health & Institute Public Health Res.,* **6**(4-3) : 101-109.

Mukhopadhyay, P., Sullivan, L. and Gallwey, T. (2007). Estimating upper limb discomfort level due to intermittent isometric pronation torque with various combinations of elbow angles, forearm rotation angles, force and frequency with arm at 90° abduction. *Internat. J. Industrial Ergonomics,* **37**(4): 313-325

Rosecrance, J.C. and Cook, T.M. (1998). Upper extremity musculoskeletal disorders: Occupational association and a model for prevention. *Central European J. Occupational & Environ. Med.*, **4**(3) : 214-231.

Singh, J., Kocher, G. and Lal, H. (2012). Musculoskeletal disorder among workers in small scale forging industry: *Internat. J. Appl. Res. Mechanical Engg., (IJARME)*, **2**(2): 142-152.