International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Postural Analysis of Female Workers while Performing Load Carrying Activity by Conventional Method and Using Head Load Manager

Swati S.Gaikwad[1], Jayshree P. Zend[2]

[1] Senior Research Fellow, College of Community Science, VasantraoNaik Marathwada KrishiVidyapeeth, Parbhani- 431 402 (M.S.)

[2]Professor, College of Community Science, VasantraoNaik Marathwada KrishiVidyapeeth, Parbhani- 431 402 (M.S.)

Abstract: ***The present study was carried out in Parbhani district of Marathwada region in Maharashtra state. The thirty selected brick kiln female workers performing brick carrying activity since 5-10 years between the age groups of 25-50 yr were selected for the experiment. The posture of the women workers have been analyzed while working in existing method and with new technology head load managerwith the help of Goniometer. Postural analysis of the female workers has been done by calculating criticality index of perceived postures and localized postures and by measuring angle of deviation. It was found that in case of perceived postures, criticality index of posture of upper arm (5.92) and neck (5.78) was higher in conventional method compared to improved method (3.60 and 3.25 respectively). Regarding localized postural discomfort, the highest reduction of criticality index was in case of neck (1.61). The posture at cervical and elbow region was improved with the help of head load manager. Grip strength for the brick carrying activity was measured in terms percentage reduction in grip strength. It was concluded that use of head load manager for performing the brick carrying activity helped to reduce grip fatigue of the female workers while performing brick carrying activity.***

Keywords: Brick kiln, Postural analysis, Grip strength, Criticality index, Goniometer, Head Load manager

1. Introduction

Ergonomic is the science of designing the job; equipment and workplace to fit the worker. Proper ergonomic design is necessary to prevent repetitive strain injuries which can develop over a time and can lead to long term disability.

The workers adopt long static postures for some of the activities, which increase the static muscular effort resulting in physiological cost and low productivity. The use of traditional method for work adds to further their drudgeries. The postures adapted by the workers in their working place depends upon the type of work, the design of work place, personal characteristics, the tools required to perform the particular work and also the duration and frequency of the work cycle (Bridger, 1995 ; putz-Anderson, 1988).

There are two groups of female workers in brick manufacturing units, whose main tasks are brick making and carrying bricks respectively. The group of female workers that carry raw bricks from the stacks in the field to the brick kiln and baked bricks back from the kiln, to stack in some other places in the field are grouped as the brick carriers. They work from 6:00 am to 10: 30 am, take a break and again work from 2: 00 pm to 6:00 pm. The other groups of female workers that mix mud, carry the mud in a wooden cart to the field, dump it and then use the mud for moulding bricks in the field are grouped as the brick moulders. Both groups of female workers work six days a week. The jobs of the two groups are not interchangeable and they can only perform the task that is allotted to them. In the developed countries some mechanization was introduced but various studies show that the workers working in brick manufacturing units suffers forms musculoskeletal problems (buckle and Stubbs, 1990). Musculoskeletal disorders (MSDS) resulted from frequent trunk bending, twisting and repetitive handling of several bricks at a time. Moreover some studies report that women have higher prevalence rate of work related musculoskeletal disorders than that of men (Treaster and Burr, 2004; Basu*et al*. 2008b)

2. Materials and Method

The present study was carried out in brick kiln area of Parbhani city of Marathwada region of Maharashtra state. Purposive random sampling was followed to select thirty female workers who were involved in brick kiln industries for performing brick carrying activity since 5 years. The selected subjects were healthy and without any physical deformities and illness. The women workers between the age ranges of 25-50 years were selected. Postural analysis of the female workers has been done by calculating criticality index of perceived postures and localized postures and by measuring angle of deviation.

2.1 Determination of criticality Index

2.1.1 Perceived posture

The women workers were asked to rate their perception of the posture of neck, shoulder, upper arm, elbow, hand/wrist, upper back, lower back, thigh muscles, knee, calf muscles, ankles / feet. This response was based on seven point scale (1=very favorable, 3= favorable, 5=unfavorable, 7= very favorable, score of 2, 4 and 6 were indicated the intermediate responses). The workers were asked to rate as per the favorable or unfavorable condition of the different postures of the human body. (Balraj*et al*. 2005)

2.1.2 Localized postural Discomfort

The women workers were asked to rate their postural discomfort of the neck, shoulder, upper arm, elbow, hand / wrist, upper back lower back, thigh muscles, knee, calf

muscles, ankles /feet and whole body. The responses were based on six point scale (1=No discomfort, 2=some discomfort, 3= minor discomfort, 4= major discomfort, 5= severe discomfort and 6= very severe discomfort)

Criticality index was calculated by using the given formula:

Criticality Index = $\frac{\sum X_1 - \sum Y_1}{\sum X_1}$

Where, Y1 = perception of the workers in specific category
X1 = Weightage given to each point on scale
(Balraj *et al.*2005)

2.1.3 Postural analysis

Postural analysis of the brick kiln female workers at cervical and elbow region was carried out by calculating the angle of deviation while performing the brick carrying activity. Before the experiment the natural angle of the female workers at cervical and elbow region was noted down at static position. Further, the angle of the women workers at the cervical and elbow was considered while performing the brick carrying activity in conventional and improved method. The angle of deviation was obtained by subtracting the angle in dynamic position from the natural angle obtained in static position. Goniometer was used for measuring the postural angle at cervical and elbow region.

Assessment of percentage change in grip strength

Grip strengthwas measured with the help of grip dynamometer. It consists of handle for handgrip connected with a spring to a pointer on the marked dial. The grip fatigue was measured by asking the subject to pull the grip handle before the start of the activity with right and left hand respectively and readings on the dial in were recorded. Similar procedure was repeated immediately after the completion of the activity. Percentage decrease or increase in grip strength was calculated by the following formula:

Grip Strength (%) = $\frac{Sr-Sw}{Sr}$ X 100

Where, Sr= Strength of muscles at rest
Sw=Strength of the muscles after work
(Hasalkar*et al.*2007)

3. Results

3.1 Postural analysis of the female workers while conducting brick carrying activity

Postural analysis of the workers has been done by calculating the critically index of perceived postures and localized postural discomfort of female workers in brick kiln.

3.2 Response rate of female workers for perceived postures

a) Conventional Method

Table 1 indicate the response rate of female workers while performing brick carrying activity by conventional method. The criticality index of the posture of upper arm (5.92), neck (5.78) and elbow (5.78) in conventional method was higher as compared to other body parts. The lowest criticality index was for the posture of upper back (3.85). As per the data presented in this table, the critical perceived postures while performing brick carrying activity were posture of upper arm, neck and elbow.

b) Improved Method

The criticality index of posture of shoulder was highest (5.64) in case of improved method compared to posture of other body parts. The least criticality index was noted for posture of wrist (1.71). Result revealed that, as the criticality index of perceived postures were higher in conventional method; response rate of perceived posture was unfavorable and intermediate response was between 3&5 while brick carrying activity. In improved method, criticality index of perceived postures were lower and accordingly favorable response rate was increased while carrying out the brick carrying activity. On the other hand, posture of shoulders was favorable while brick carrying activity in conventional method. In improved method, criticality index of posture of shoulder showed unfavorable response rate while performing brick carrying activity. Reason for unfavorable response rate was that while carrying brick with head load manager, the load was borne on shoulder instead of head.
On the whole, it can be said that criticality index of the posture of neck, upper arm and elbow was higher in conventional method as compared to improved method, whereas in improved method posture of shoulder was unfaurable. **Perception of brick kiln female workers about localized postural discomfort.**

c) Conventional Method

As shown in Table 2 the criticality index was highest (6.85) in case discomfort of neck when activity of brick carrying was performed in conventional method. It was followed by discomfort of upper arm (6.85), elbow (5.95) and hand /wrist (4.90). It indicated that as criticality index was highest in case of neck, upper arm, elbow and wrist. The need of technology to improve posture and reduce the pain of these body parts was necessary. The critical posture while performing brick carrying activity were posture of neck, upper arm, elbow and wrist.

d) Improved Method

When the work of brick carrying activity was carried out with the help of Head load manager the criticality index was reduced in all selected discomfort areas of body. The highest reduction in criticality index was in case of neck (1.61). It can be concluded from the data that feeling of discomfort was highest in case of critical postures viz. neck, upper arm; wrist and elbow when work performed the activity in existing method. The decrease of criticality index in improved method showed reduction in discomfort of selected critical postures experienced by female workers. On other hand, the discomfort of shoulders was highest (5.19) in improved method as compared to conventional method (3.85).

Hence, it can be concluded from data, the feeling of discomfort was highest in case of neck while performing brick carrying activity in conventional method and decrease of criticality index in improved method showed reduction in discomfort level experienced by brick kiln female workers.

3.3 Postural analysis of the brick carrying activity

Table 3indicate the angle of deviation measured while analyzing posture of female workers while performing the brick carrying activity. Table revealed that angle of deviation at cervical region of female workers was in the range 92° - 120° which was highest while performing brick carrying activity in conventional method compared to the angle of deviation in improved method i.e. 90°-100°. Similarly, the angle of deviation at elbow region of female workers was higher in the range of 80° - 100° while performing brick carrying activity in conventional method compared to the improved method i.e. between 65° to 82°. Hence the average difference (15°-18°) in angle of deviation at elbow region was more compared to the average difference in angle deviation at cervical region (2°-20°) of female workers in brick kiln. It can be concluded from the data that posture of cervical and elbow region was improved with the help of head load manager because angle of deviation was decreased in case of cervical and elbow region of female workers.

3.4 Percentage change in grip strength while performing brick carrying activity with conventional method and improved method

Grip strength for the brick carrying activity was measured in terms percentage reduction in grip strength. Change in grip strength while performing the brick carrying activity both conventional and improved method is shown in Table 4.

In conventional method the percentage change in grip strength of right hand was 15.9 and that of in improved method was 18.2 while performing the brick carrying activity. The grip strength of right hand was increased after performing brick carrying activity with both conventional and improved method. But percentage increase in grip strength (3.11) was observed to be higher in improved method compared to conventional method.

Hence, it can be concluded that use of head load manager for performing the brick carrying activity helped to reduce grip fatigue of the female workers while performing brick carrying activity.

4. Conclusion

Postural analysis of the female workers has been done by calculating criticality index of perceived postures and localized postures and by measuring angle of deviation. It was found that in case of perceived postures, criticality index of posture of upper arm (5.92) and neck (5.78) was higher in conventional method compared to improved method (3.60 and 3.25 respectively). Regarding localized postural discomfort, the highest reduction of criticality index was in case of neck (1.61). The posture at cervical and elbow region was improved with the help of head load manager.

Grip strength for the brick carrying activity was measured in terms percentage reduction in grip strength. It was concluded that use of head load manager for performing the brick carrying activity helped to reduce grip fatigue of the female workers while performing brick carrying activity. In case of work related feeling of exhaustion and workload perception, statistical analysis revealed the significant results which indicated that the work related feeling of exhaustion and workload perception was significantly reduced while performing brick carrying activity with the help of head load manager.

References

[1] Bridger, R.S. (1995) Introduction to ergonomics (McGraw-Hill Book Co.) Singapore.
[2] Balraj, S., Chandandeep S. and S. Kuldeep (2005) Parameters for ergonomically fit sewing machine work station using workers perception, HWWE, proceeding of the international conference, ISBN- 8424-124-0, Pp.205-211.
[3] Buckle, P. and S. Stubbs (1990) Contemporary ergonomics, (Taylor and Francis, London), Lovesy, E.J. (Ed) Epidemiological aspects of musculoskeletal disorders of the shoulder and upper limbs Pp.75-78.
[4] Hasalkar, S., Shivalli R. and R. Budihal (2007) Musculoskeletal Disorders of the farm women while performing the top dressing of fertilizer activity. J. of human Ecol. 21(2): 109-112.
[5] Putz-Anderson, V. (1988) Cumulative trauma disorders: a manual for musculoskeletal diseases of the upper limbs, (Taylor and Francis), London
[6] Treaster, D.E. and D. Burr (2004) Gender differences in prevalence of upper extremity musculoskeletal disorder, Ergonomics, 47(5):495-498.

Table 1: Response rate of brick kiln female workers for perceived postures

Parameters	Discomfort areas																					
	Posture of Neck		Posture of Shoulders		Posture of Upper arm		Posture of Elbows		Posture of Hand/wrist		Posture of Upper back		Posture of Low Back		Posture of Thigh Muscles		Posture of Knees		Posture of Calf Muscles		Posture of Ankles/Feet	
	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I
1) Very Favorable	-	2	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	1
2)Intermediate response b/w 1 & 3	-	4	-	-	-	4	-	3	-	10	2	7	-	1	-	8	-	4	-	5	2	12
3)Favorable	-	16	5	2	-	14	-	13	-	4	13	13	8	9	7	12	4	10	3	9	11	9
4) Intermediate	5	7	15	8	4	9	4	12	9	-	10	8	9	8	12	10	10	11	11	11	11	7

response b/w 3& 5																						
5)Unfavorable	13	1	9	7	12	3	14	2	12	-	5	2	11	10	11	11	11	5	11	5	7	1
6)Intermediate response b/w 5& 7	7	-	1	6	8	-	8	-	7	-	-	-	2	2	-	-	5	-	5	-	-	-
7)) Very Unfavorable	5	-	-	7	6	-	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Criticality Index	5.78	3.25	4.5	5.64	5.92	3.60	5.78	3.67	5.42	1.71	3.85	3.39	4.53	4.39	4.42	5.25	4.89	3.82	4.92	3.78	4.14	3.03

C = Conventional Method
I= Improved Method
b/w= Between

Table 2: Perception of brick kiln Female workers about localized postural discomfort

Parameters	Discomfort areas																					
	Discomfort of Neck		Discomfort of Shoulders		Discomfort of Upper arm		Discomfort of Elbows		Discomfort of Hand/wrist		Discomfort of Upper back		Discomfort of Low Back		Discomfort of Thigh Muscles		Discomfort of Knees		Discomfort of Calf Muscles		Discomfort of Ankles/Feet	
	C	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**
No Discomfort (1)	-	26	1	-	-	10	-	16	-	10	-	5	-	1	-	-	2	-	-	-	-	-
Some Discomfort (2)	-	4	11	2	-	9	-	10	3	9	5	14	4	5	13	7	4	4	9	6	7	7
Minor Discomfort (3)	-	-	14	13	1	8	6	4	13	11	14	11	17	15	8	15	6	14	13	11	12	15
Major Discomfort (4)	13	-	4	9	9	3	13	-	12	-	9	-	3	9	3	7	16	9	5	12	6	5
Severe Discomfort (5)	10	-	-	6	15	-	11	-	2	-	2	-	3	-	6	1	2	3	3	1	5	3
Very Severe Discomfort (6)	7	-	-	-	5	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Criticality Index	6.85	1.61	3.85	5.19	6.85	3.04	5.95	2.28	4.90	2.90	4.66	3.14	4.95	4.38	4.38	4.38	4.85	4.80	4.38	4.66	4.71	4.47

C = Conventional Method
I= Improved Method
b/w= Between

Table 3: Postural analysis of the brick carrying activity

Name of the body part	Angle of deviation			
	Conventional method		Improved method	
	Minimum	Maximum	Minimum	Maximum
Cervical region.	92°	120°	90°	100°
Elbow region	80°	100°	65°	82°

Table 4: Change in grip strength while performing brick carrying activity with conventional method and improved method

Name of the activity	Parameters	Conventional Method (Right hand)	Improved Method (Right hand)	Percentage change in Grip strength (improved vs conventional method)
Brick Carrying	Before Work (Sw)	5.4	6.2	
	After work (Sr)	6.7	6.7	
	Percentage change in grip Strength	18.2	15.9	3.11

Conventional method

Improved method