Journal of Ergonomics

Pandey and Vats, J Ergonomics 2012, 2:2
DOI: 10.4172/2165-7556.1000104

Research Article Open Access

An Owas-Based Analysis of Workers Engaged in Brick Making Factories, Faizabad District of Uttar Pradesh, India

Kumkum Pandey* **and Aditi Vats**

Departmant of Family Resource Management, College Of Home Science, GB Pant University Of Agriculture and Technology, Pantnagar, Udhamsingh Nagar, Uttarakhand -263145,India

Abstract

The main objectives of this study were to identify the most problematic postures in brick making tasks performed by workers through application of the OWAS (Ovako Working Posture Analysis System) method, and to help them for improvement of working method and workplaces. Owing to poor socioeconomic conditions they are compelled to carry out a considerable number of manual, rigorous tasks in brick factories. Twenty construction workers, ten male and ten female, from five brick making industries participated in the field study. The brick making tasks observed during the two-month period included digging clay, loading clay, unloading clay, mixing clay etc. Of all the observations, poor working postures were observed most frequently in digging clay, crushing clay, mixing clay loading to the wheelbarrow, loading and unloading to the truck. And all these indicating that these postures should be corrected either soon or immediately. It was observed that workers who worked continuously in awkward postures during certain raw brick making activities consequently they suffered from discomfort in different parts of their body. Even though they were young, they were likely to suffer from serious musculoskeletal disorders in the future in the brick factory there is a need of immediate corrective measures. Though the OWAS method for postural data analysis proved to be a very useful way to reduce postural load of dynamic brick making tasks, and allowed for efficient application of the original OWAS method.

Keywords: Ergonomics; WMSD; Awkward posture; Risk factor; Observation; Exposure assessment

Introduction

Technological advancement causes considerable change to the worker's position in industrial system. A worker ceased to mean 'strength and energy required to perform a task [1]. At present his function is to operate manual devices and to do ancillary jobs and it compels man to continuously perform the same simple actions and creates static posture negative for workers health. Long maintained static posture impairs proper tissue nutrition and blocks the necessary oxygen inflow to muscles. As a result of permanent muscles tension, owing to static posture, they become stiff and painful. It is the result of static load (overload). Static effort is performed during work in stagnant conditions. It is associated with the necessity to maintain uncomfortable and/or compulsory body posture.

Two experiments were performed to examine the usability of different marker-less approaches in image analysis and computer vision for automatic registration of OWAS (Ovako working posture analysing system) postures from video film. In experiment 1, a parametric method based on image analysis routines is developed both for separating the subject from its background and for relating the shapes of the extracted subject to OWAS postures. All 12 analysed images were correctly classified by the method. In experiment 2 a computer neural network is taught to relate postures of a subject to OWAS postures. When the network was trained with 53 images the rest of the set of 138 images was correctly classified. The experiments described in this paper show promising results regarding the use of image analysis and computer vision for tracking and assessing working postures. However, further research is needed including tests of different human models, neural networks, and template matching for making the OWAS method more useful in identifying and evaluating potentially harmful working postures [2].

An ergonomic research based on a biomechanical focus that aims to evaluate the posture adopted by the workers on the production of charcoal in vertical metallic cylinders. Thus, it was verified the incidence of pain and/or musculoskeletal injuries to these workers. Also, it was evaluated the weight carried by them and the positions taken in their daily tasks. Applying the Ergonomic Analysis of Labor, the data collection was done by directly observing the workers, registering images, by interviews, and posture analysis based on the OWAS method. The main results of the research show that there are postures with risks in the four levels of musculoskeletal injuries classified by OWAS, concluding that the method is imperative for ergonomic recommendations for minimization or eradication of suffering injury and worker's postural constraints [3].

A study on the working postures of Dutch nurses (n = 18) was conducted in an orthopedic ward and a urology ward were observed using-the Ovako Working posture Analysis System (OWAS). During observation, both working postures and activities were recorded. A specially developed computer program was used for data analysis. By means of this program, it was possible to calculate the working posture load for each activity and the contribution of a specific activity to the total working posture load. This study shows that some activities of the nurses in both wards were performed with poor working postures. In the orthopedic (resp. urology) ward two (resp. one) out of 19 observed postures of parts of the body were classified as Action Category 2. Moreover, 20% (resp. 16%) of the so-called typical working postures

***Corresponding author:** Kumkum Pandey, Departmant of Family Resource Management, College Of Home Science GB Pant University Of Agriculture and Technology, Pantnagar, Udhamsingh Nagar, Uttarakhand, India, E-mail: kumkum.pandey.unique@gmail.com

Received March 17, 2012; **Accepted** May 26, 2012; **Published** June 02, 2012

Citation: Pandey K, Vats A (2012) An Owas-Based Analysis of Workers Engaged in Brick Making Factories, Faizabad District of Uttar Pradesh, India. J Ergonomics 2:104. doi:10.4172/2165-7556.1000104

was classified in Action Category 2. This suggests, that in both wards working postures that are slightly harmful to the musculoskeletal system, occur during a substantial part of the working day. Differences between both wards with respect to working posture load and time expenditure were determined. Activities causing the workload to fall into OWAS higher Action Categories were identified. The data show that poor working postures in the nursing profession not only occur during patient handling activities but also during takes like 'administration'. Focusing on patient-handling (i.e., lifting patients) in order to determine the load on the musculoskeletal system would therefore lead to an underestimation of the total working posture load of nurses [4].

On the basis of problem identified in above literature a number of task performed in brick factory such as operating a brick-making machine, cutting raw bricks, extracting (digging clay) crushing or grinding clay, mixing clay, carrying clay, loading bricks in and out of the kiln, loading brick on the truck, pulling a brick wheelbarrow and arranging the bricks to dry performed manually by male and female factory workers. So the factory workers are the main sufferers who spend most of their time in factory work and therefore experience the greatest amount of exposure and are at greatest risk. The brick factory has not only been labor intensive but also a hand intensive industry where common postural discomfort occurs among the worker.

This paper raises an issue of brick factory workers' static load and its evaluation by means of OWAS method (*Ovako Working Posture Analysis System; Ovako Working Posture Analyzing System*) as it is crucial from health and work safety perspective.

OWAS Method

OWAS method allows estimating the degree of a worker's static load at workstation by analyzing his posture. It is an analytical method which enables the improvement of ergonomic conditions at a workstation. The method was developed in Finland by Ovako Company. It takes into consideration various positions of the back, shoulders and legs. It also includes the weight lifted by a worker. Each body position is encoded and categorized in four risk groups of static injuries. The method also requires the analysis of force exerted during work as well as the time of force influence in a defined position.

OWAS method considers static load owing to:

· back position,

· forearms position,

· legs position and work,

· external load dimension.

Each of these factors has an attributed code value. On the basis of identified evaluation factors of the back, arms, legs position, and load one must determine position code. Each posture is defined by a four digit code (Figure 1). Sometimes there can be additional fifth element of the code which determines the head and neck position5. Identifying four-digit body position code with OWAS method allows determining risk class of every workstation. According to OWAS method and basing on the body position code there are four classes which reflect static load risk degree.

Class 1 identifies body position as regular and natural; the load is optimal or acceptable. There is no need then to introduce changes to a workstation.

Class 2 encompasses potentially hazardous postures which may have negative effects. Static load is practically acceptable which indicates future assumption of certain means in order to improve working conditions as well as to change methods and manners of performing the job.

Class 3 points out a clearly hazardous influence of body posture, while static load is fairly large. Actions must be taken promptly which should improve working conditions and methods.

Methodology

Selection of locale and sample

For the present study 5 brick factories, which were 20 percent of the total factories, were purposively selected in the Pura block of Faizabad district in Uttar Pradesh, India. Purposive and random sampling was used to select the study area and workers. The total sample i.e. 20 (10 male and 10 female) were selected which was 4 percent of the total Population. Most of the male and female workers were from the 31-45 years of age.

Analysis of working posture

The analysis of different working postures of the brick factory workers of the raw brick making unit was done with the help of Ovako Working Posture Analysis System (OWAS) and aid of digital photography. Later on stick diagrams were drawn from freezed frame video records and eventually subjected to analysis. The most frequent postures adopted by the workers were taken into consideration.

Results and Discussion

OWAS (Ovako Working Posture Analysis System): Scoring and determination of action category of raw brick making task.

Posture adopted by respondents while performing raw brick making task: A good working posture is as important for the performance of tasks as it is for promoting health and minimizing stress and discomfort during work. For analyzing and evaluating the working

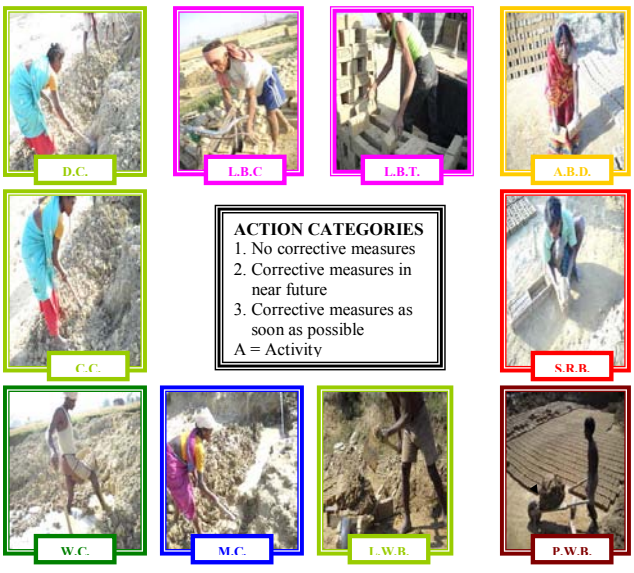

Figure 1:

S.no	**Body Parts**	**Activities**									
1.	**Back** 1.Straight 2. Bent 3.Twisted 4. Bent & twisted	**D.C.** - 6 (30) - 14 (70)	**C.C.** - 7 (35) - 13 (65)	W.C. - 4 (20) - 16 (80)	M.C. - 16 (80) - 6 (20)	**L.W.B** - - - 20 (100)	**P.W.B.** - 20 (100) - -	**S.B.** - - - 20 (100)	A.B.D. - 3 (15) - 17 (85)	L.B.T. - - - 20 (100)	L.B.C. - - - 20 (100)
2.	**Arms/Upper limbs** 1. Both arms are below shoulder level 2. One arm is at or above shoulder Level 3. Both arms at or above shoulder level	15 (75) - 5 (25)	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -	7 (35) - 13 (65)	6 (30) - 14 (70)
3.	**Legs** 1. Sitting 2. Standing on both leg straight 3. Standing on one straight leg 4. Standing on both knees bent 5. Standing on one knee bent 6. Kneeling on one or both leg 7. Walking or moving	- 7 (35) - 13 (65) - - -	- 6 (30) - 14 (70) - - -	- 12 (60) - 8 (40) - - -	- - - 17 (85) 3 (15) - -	- 7 (35) - 13 (65) - - -	- - - - - - 20 (100)	20 (100) - - - -	5 (25) - - - 15 (75)	- 6 (30) - 14 (70) - -	- 9 (45) - 11 (55) - -
4.	**Load/use of force** 1. Weight or force needed is 10 kg or less 2. Weight or force needed exceeds 10 kg but is less than 20 kg. 3. Weight or force needed exceeds 20 kg.	20 (10) - -	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -	- - 20 (100)	20 (100) - -	20 (100) - -	20 (100) - -	20 (100) - -

D.C.	Digging Clay	C.C.	Crushing Clay	W.C.	Wetting Clay
M.C.	Mixing Clay	L.W.B	Loading Wheelbarrow	P.W.B.	Pushing Wheelbarrow
S.B.	Shaping Raw Bricks	A.B.D.	Arranging Bricks to Dry	L.B.T	Loading bricks on to the truck
		L.B.C	Loading Bricks on to the Cycle		

Table 1: Posture adopted by respondents while performing the raw brick making task.

postures adopted by the brick factory workers while performing different activities Ovako Working Posture Analyzing System (OWAS) was used.

Posture adopted by the respondents while performing the activity: The working postures of the respondents while performing different activities in raw brick making task were observed by the researcher and a code number was assigned to each posture by using the posture coding sheet of OWAS method. The position of back, upper limbs i.e. arms and lower limbs i.e. legs as well as load of force used in carrying out activities were considered for analysis of posture.

1 - Digging clay: posture adopted

It was found that maximum respondents kept their back bent and twisted (70 percent), both arms are below shoulder level (75 percent), standing on both knees bent (65 percent), and weight or force needed was 10 kg. or less. They were experiencing the pain in back arms, knees and neck (Table 1).

2- Crushing clay: posture adopted

In crushing clay activity it was found that 65 percent of respondents kept their back bent and twisted, both arms below shoulder level as reported by all the respondents, 70 percent were standing on both knees bent, and all respondents were carrying weight or force is 10 kg or less (Table 1).

3- Wetting clay: posture adopted

It was found that in wetting clay 80 percent respondents kept their back bent and twisted, all the respondents kept both arms below shoulder level, 60 percent standing on both leg straight and all respondents carried load or force less than 10 kg (Table 1).

4- Mixing clay: Posture adopted

In mixing clay 80 percent respondents kept their back bent, all respondents kept their both arms below shoulder level, maximum (85 percent) standing on both knees bent and weight and force was less than 20 kg by all the respondents (Table 1).

5- Loading wheel barrow: Posture adopted

All respondents kept their back bent and twisted, both arms below shoulder level, standing on both knees bent (65 percent) and all respondents carried weight or load less than 10 kg (Table 1).

6- Pushing wheel barrow: Posture adopted

It was found that all respondents kept their back bent, both arms below shoulder level; walking or moving and weight or force needed exceeds 20 kg (Table 1).

7- Shaping raw bricks: Posture adopted

It was found that all respondents kept their back bent and twisted both arms below shoulder level, legs were in sitting position, and load or force needed 10 kg or less (Table 1).

8- Arraigning bricks to dry: Posture adopted

It was found that maximum respondents (85 percent) kept their back bent and twisted, all kept both arms below shoulder level, walking or moving (75 percent) and weight or force needed 10 kg or less by cent percent of the respondents (Table 1).

9- Loading bricks on to the truck: Posture adopted

All respondents kept their back bent and twisted, kept both arms

S. No	Action Level categories	Posture
1	No corrective measures	Good posture
2	Corrective measures in the near future	Less poor posture
3	Corrective measures as soon as possible	Somewhat poor posture
4	Corrective measures immediately	Very poor posture

Table 2: Action level categories in OWAS method for work posture.

S. No.	Action category	No corrective measures (Good posture)	Corrective measures in the near future (Less poor posture)	Corrective measures as soon as possible (Somewhat poor posture)	Corrective measures immediately (Very poor posture)
	Digging clay	-	-	6 (30)	14 (70)
	Crushing clay	-	3 (15)	7 (35)	10 ((50)
	Wetting clay	4 (20)	14 (70)	2 (10)	-
	Mixing clay	-	4 (20)	16 (80)	-
	Loading the wheel barrow	-	4 (20)	7 (35)	9 (45)
	Pushing the wheel barrow	3 (15)	6 (30)	11 (55)	-
	Shaping raw bricks	5 (25)	15 (75)	-	-
	Arranging brings to dry	14 (70)	6 (30)	-	-
	Loading bricks on to the truck	-	-	4 (20)	16 (80)
	Loading bricks on to the cycle	-	-	7 (35)	13 (65)

Values in parentheses indicate percentage

Table 3: Frequency percentage showing that the corrective measures needed for the posture adopted by respondents in raw brick making task.

below shoulder level (65 percent), standing on both knees bent (70 percent) and all respondents needed weight less than 10 kg (Table 1).

10- Loading bricks on to the cycle: Posture adopted

It was found that all respondents kept their back straight, both arms below shoulder level, standing on both knees bent (55 percent) and cent percent respondents needed weight or force (Table 1).

The OWAS posture codes are explained in table 4.18 i.e. code 4 means back bent forward and twisted, 3 means back twisted and 2 means back bent forward. Arms (1) both arms below shoulder level and legs (1) means sitting , (2) means standing on both legs straight, (4) means standing on one knee bent and (7) means walking or moving. Force (1) means weight or force needed is 10 kg or less, 2 means weight or force needed exceeds 10 kg but is less than 20 kg and 3 means weight or force needed exceeds 20 kg.

Postures adopted by the workers

The action category for the assessment of postural stress on brick making workers was calculated and was found to be 4 for the tasks like digging, and crushing, loading brick on to the truck and cycle which means posture needs corrective measures immediately, 2 for the sub tasks like wetting, loading on the wheelbarrow, shaping raw bricks as well as arraigning to dry, means posture needs corrective measures in near future. The action category of 3 was found for the mixing clay and pushing the wheelbarrow which means posture needs corrective measures as soon as possible. Corlett (1998) showed adoption of poor working posture in order to perform tasks which could lead to a postural stress, fatigue and pain, which may in turn force the operator to stop work until the muscles recovery (Table 3).

Corrective measures needed for the posture adopted by respondents in raw brick making task

1- Digging clay: corrective measures

Action level for adopted posture depicts that 30 percent respondents need corrective measures and 70 percent respondents needed corrective measures immediately in their posture as shown in (Table 4).

2- Crushing Clay: corrective measures

Data showed that only 15 percent respondents needs corrective measures in the near future, 35 percent needed corrective measures as soon as possible and half of the respondents (50 percent) needs corrective measures immediately in their posture (Table 4).

3- Wetting clay: corrective measures

It was found that 20 percent respondents needed no corrective measures, 70 percent needed corrective measures in the near future, and only 10 percent needed corrective measures as soon as possible.

4- Mixing clay: corrective measures

It was found that only 20 percent respondents need corrective measures in the near future and 80 percent respondent's needed corrective measures as soon as possible.

5- Loading the wheelbarrow: corrective measures

It was also found that only 20 percent respondent's need corrective measures in the near future, 35 percent need corrective measures as soon as possible and 45 percent needed corrective measures immediately in this activity.

6- Pushing the wheel barrow: corrective measures

Data depicts that 15 percent respondents needs no corrective measures, 30 percent needs corrective measures in the near future and more than half (55 percent) respondent needs corrective measures as soon as possible in their posture.

7- Shaping raw bricks: corrective measures

It was found that 25 percent respondents need no corrective measures and 75 percent respondents need corrective measures in the near future in their posture due to this activity.

8- Arraigning bricks to dry: Corrective measures

In this activity 70 percent respondents needs no corrective measures and only 30 percent needed corrective measures in the near future in their posture.

		OWAS Posture codes Back Arms Legs Force	Action categories
1	**Digging clay**	4 1 4 1	**4** **(**Corrective measures immediately**)**
2	**Crushing clay**	4 1 4 1	**4** **(Corrective measures immediately)**
3	**Wetting clay**	4 1 2 1	**2** **(**Corrective measures in the near future**)**
4	**Mixing clay**	2 1 4 1	**3** **(**Corrective measures as soon as possible**)**
5	**Loading the wheel barrow**	4 1 4 1	**4** **(**Corrective measures immediately**)**
6	**Pushing the wheelbarrow**	2 1 7 3	**3** **(**Corrective measures as soon as possible**)**
7	**Shaping raw bricks**	4 1 1 1	**2** **(**Corrective measures in the near future**)**
8	**Arranging bricks to dry**	4 1 7 1	**2** **(**Corrective measures in the near future**)**
9	**Loading bricks on to the truck**	4 3 4 1	**4** **(**Corrective measures immediately**)**
10	**Loading bricks on to the cycle**	4 3 4 1	**4** **(**Corrective measures immediately**)**

Table 4: Description of raw brick making tasks and action level for adopted posture in different activities.

9- Loading bricks on to the tractor: Corrective measures

It was found that 2% percent respondents need corrective measures as soon as possible and 80 percent respondent's needs corrective measures immediately.

10- Loading bricks on to the cycle: Corrective measures

Data showed that 35 percent needs corrective measures as soon as possible and only 35 percent respondents' needs corrective measures immediately.

Implications

1) Various beneficiary schemes should be formulated by Government especially the deprived ones i.e. the women workers for labour welfare and health benefits.

2) Various guidelines and measures to prevent postural discomfort should be formulated.

3) Short term training programmes can organize to educate employees about different awkward postures, its effects and preventions. As it will help to increase their working efficiency and reduction in WMSDs.

4) The present study done on workers of raw brick making unit can be utilized for policy planning at organization level.

5) The same study can be conducted on other factory workers.

6) Lack of education emerged as the major constraint regarding workers involvement in different activities and adopting awkward postures. Hence ergonomist, development organizations, extension personnel's have a significant role to play in educating the workers through literacy programme.

Recommendations

1) Implement an ongoing training programme to enable each employee to become aware of the relevant factors concerning awkward postures/discomfort

2) Workplace improvement and equipment design can be implemented by making minor and costless changes to prevent bending and twisting.

3) Well designed truck and trolleys for transportation of brick and/or raw materials.

4) Minimal and maximal heights should be considered to avoid bending and reach over shoulders height. Wheels sizes.

5) Team lifting strategies can be used when loads are too high.

6) Breaks: about 5 to 10 minutes per hour of work to improve physiological recovery of body.

7) Better organize work place layout in other to avoid twisting and asymmetrical lifting/lowering.

8) Limits heights of bricks stoves avoiding reaching over shoulder height.

9) Implement job rotation after analyzing its feasibility.

Reduce if possible the work shift to 8hours as is generally accepted.

Conclusion

From this study it can be concluded that the brick making factory workers work continuously in a bent posture and by remaining in an awkward or stressful posture during a particular raw brick making activity, they suffer from discomfort or pain in different parts of their body, specifically the lower back, neck and knee regions. The feeling is aggravated if that strenuous posture is maintained for a prolonged time. Consequently they are fatigued after such hazardous tasks. This not only hampers their education and normal physical activity but it may also result in the development of a serious musculoskeletal disorder in the near future. In most of the activities there is a need of immediate corrective measures.

Acknowledgement

First of all I am highly indebted to my god (Krishna), parents and family who gave me strength, encouragement and showed their blessings during entire past and present, their lesson for hard work, and sincerity and their faith in my abilities helped me to complete this task.

Indeed the word at my command are inadequate in form to express my heartfelt, deep sense of unbound gratitude to Dr. Aditi Vats, Associate Professor, Department of Family Resource Management and chairperson of my advisory committee for laying out the guidelines of research work and framing my mind to think systematically and logically. I am highly grateful to the members of my advisory committee, Dr. Deepa Vinay, Professor and Head, Department of Family Resource Management, Dr. A.K. Shukla, Professor and Head, Department of Mathematics, Statistics and Computer Science, Dr. R.N. Pateriya, Associate Professor, Department of Farm, Machinery and Power Engineering for their encouragement, constructive suggestions and valuable advice.

Although it is like the drop of ocean, yet, It would like to avail this opportunity to express my heartiest sense of reverence immense love to my most vulnerable parents Mr. Babban Pandey and Mrs. Sudha Pandey whose endless love, blessing, moral support, inspiration and sacrifices made me comfortable enough to fight the battle of life and achieve goal. My deep emotional sense of feelings goes toward my brother and sister Vikas, Vivek and Priya Pandey who's encouraged and supported me throughout my study.

The Junior Research Fellowship received from ICAR during the study is duly acknowledged and my warmest thanks to Mr. Pankaj Rai manager of Brick Factory, respondents of my study.

References

1. Tytyk E (2001) Projek to wanie ergonomiczne. PWN Warszawa-Poznań.
2. Pinzke S, Kopp L (2001) Marker-less systems for tracking working postures—results from two experiments. Applied Ergonomics 32: 461-471.
3. Ivana MOM, Antonio Carlos de F (2012) Workers' postural conditions in the charcoal production process based on vertical metallic cylinders. Journal of Work 41: 453-446.
4. Engels JA, Landeweerd JA, Kant Y (1994) An OWAS-based analysis of nurses' working postures Ergonomics 37: 5.
5. Corlet EN (1998) The investigation and evaluation of work and workplace. Ergonomics 31:727-734.
6. Frei D (1996) Analyse and Bewertung von Korperhaltungen bei der Forstarbeit mit Hilfe der OWAS-Methode Wien.
7. Keyserling WM (1986) Postural analysis of the trunk and shoulders in simulated real time Human Factors Ergonomics 29:4.