Asian Science
Volume 7 | Issue 2 | December, 2012 | 168-172

RESEARCH PAPER

Postural discomfort during loading and unloading work

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ABSTRACT

Adoption of poor working posture in order to perform tasks could lead to a postural stress, fatigue and pain, which may in turn force the operator to stop work until the muscles recover. To prevent pain and injuries, the manual material handling tasks should be designed to take into account several risk factors related to the task being handled.This paper describes the results of an experimental study aimed at evaluating the postural discomfort during loading and unloading in warehouses through standard OWAS scale and a revised Nordic musculoskeletal questionnaire validated by Kuroinka *et al*. (1987). It was found through OWAS scale that the corrective measures were required immediately and as soon as possible in most of the activities in warehouse.

Key Words : Workload, Posture, Loading, Unloading, Energy expenditure

View point paper : Bhatt, Hema and Sharma, Promila (2012). Postural discomfort during loading and unloading work. *Asian Sci.*, **7**(2): 168-172.

Manual handling is a severe problem in developing and underdeveloped countries. Work related disorders has increased dramatically in these countries and workers are exposed to much worse conditions due to inadequate safety system, lack of awareness, lack of training of occupational safety, health and lack of ergonomic standards. A significant problem associated with manual handling activities involving loading and unloading tasks is the fact that they are the primary cause of overexertion injuries. Loading and unloading tasks include diverse activities such as lifting, lowering, holding, pushing, pulling, carrying and turning of weights etc. The types of back injuries most frequently reported are strains and sprains, dislocation (herniation) of the lumbar disc, fracture, joint inflammation (mostly L4/L5 and L5/S1; occasionally other joints such as the shoulder and hip), laceration of muscle tissue, contusion, and nerve (sciatic) involvement, often leading to activity limitation and workplace accidents.

Epidemiological and biomechanical studies have found that a combination of high external load and poor movement patterns cause a high internal load on the spinal structure and increases the risk of pain and injury. Poor movement patterns consist primarily of bending or twisting of the trunk, or both. Bending occurs during reaching and lifting of an object from a low to a high surface. Twisting of the trunk is mostly the result of inadequate workspace. Excessive bending and twisting of the trunk have been related to higher biomechanical and physiological costs and musculoskeletal injuries. The involvement of back and abdominal muscles in lifting activity has long been established. Several researches have shown that the application of ergonomic principles and programs in almost all workplaces result in increasing productivity and decreasing work related musculoskeletal disorders (WMSDs) (Saraji *et al*., 2004). The moral and economic consequences that result from pain and injury made it necessary to study and, therefore, attempt to solve such a problem. Hence an

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effort in this research was made to ergonomically analyse the postural stress of the warehouse workers involved in manual loading and unloading work.

RESEARCH METHODOLOGY

The study population comprised the twenty warehouse workers employed at Food Corporation of India's unit at Rudrapur city in Uttarakhand. Personal interview method was used to elicit the information relating to individual details, type of work, musculoskeletal pain and discomfort with the locomotive organs by using the revised Nordic musculoskeletal and postural discomfort questionnaire. The already established OWAS (Ovako Work Assessment System) scale was used for work posture analysis.

RESULTS AND REMONSTRATION

The results obtained from the present investigation are presented below:

General profile of the respondents:

The mean age of the respondents selected for the study was 36.75 years with standard deviation ± 5.99, height was 158.87 cm with standard deviation ±7.69 and weight was 68.42 kg with standard deviation ± 3.93 (Table 1).

Table 1 : General profile of the respondents (n=20)

Sr. No.	Physical characteristic	Mean ± S. D.
1.	Age (years)	36.75 ± 5.99
2.	Height (cm)	158.87±7.69
3.	Weight (kg)	68.42± 3.93

OWAS- Scoring and determination of action category during loading and unloading:

OWAS analysis provides the opportunity to compare the job studies according to the number of postures which need to be corrected soon or immediately (Kivi and Mattila, 1991). The OWAS method collects observation information on worker postures on back, arms and legs. Each posture of the OWAS is determined by the four digit code in which the numbers indicates the postures of the back, the arms and the load needed. Each OWAS posture code is then analysed by using the individual OWAS classified posture combination to get the action category for each work phases. The classification for individual posture combination indicates the level of risk injury for the musculoskeletal system. If the risk for musculoskeletal disorder is high, then the action category indicates the need and urgency for corrective actions. So,

Table 2 : Posture adopted by respondents while performing various tasks involving loading and unloading work (n=20)

Sr. No.	Body posture and assigned Code no.	Action				
		LGS	C.G.	U.G.	L.G.O	A.G.
1.	Back					
	Straight	-	-	-	-	-
	Bent	15 (75)	8 (40)	-	10 (50)	12 (60)
	Twisted	-	-	-	4 (20)	4 (20)
	Bent and twisted	5 (25)	12 (60)	20 (100)	6 (30)	4 (20)
2.	Arms/Upper limbs					
	Both arms are below shoulder level	-	-	4 (20)	-	20 (100)
	One arm is at or above shoulder level	-	5 (25)	6 (30)	-	-
	Both arms at or above shoulder level	20 (100)	15 (75)	10 (50)	20 (100)	-
3.	Legs					
	Sitting	-	-	-	-	-
	Standing on both leg straight	-	-	-	7 (35)	-
	Standing on one straight leg	-	-	-	-	-
	Standing on both knees bent	7 (35)	-	-	13 (65)	15 (75)
	Standing on one knee bent	13 (65)	-	4 (20)	-	-
	Kneeling on one or both leg	-	-	16 (80)	-	5 (25)
	Walking or moving	-	20 (100)	-	-	-
4.	Load/use of force					
	Weight or force needed is 10 kg or less	-	-	-	-	-
	Weight or force needed exceeds 10 kg but is less than 20 kg.	-	-	-	-	-
	Weight or force needed exceeds 20 kg.	20 (100)	20 (100)	20 (100)	20 (100)	20 (100)

Values in parentheses indicate percentage.
LGS-Loading grain bag on self CG- Carrying grain bag, UG- Unloading grain bag LGO- Loading grain bag on other
AG- Arranging grain bag

accordingly the working postures of the respondents while performing various tasks involving loading and unloading activities 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, legs as well as load of force used in carrying out activities were considered for analysis of posture.

Loading grain bag on self:

Data presented in Table 2 show that maximum respondents kept their back bent with a forward flexion (75%), both arms are above shoulder level (100%), standing on one knees bent (65 %), and weight or force needed exceeded 20 kg. They were experiencing the pain in back arms, knees and neck.

Carrying grain bag:

In carrying grain bag activity it was found that 60 per cent of respondents kept their back bent and twisted, both arms above shoulder level as reported by majority (75%) respondents, all the respondents were in a state of walking or moving (100%) while carrying grain bags from one place to other, and all respondents were carrying weight or force is exceeding 20kg.

Unloading grain bag:

It was found that in unloading grain bag all respondents (100%) kept their back bent and twisted, with majority (50%) having arms at or above shoulder level, followed by respondents (30%) who adopted posture with one arm at or above shoulder level and few (20%) with both arm below shoulder level. Majority of the respondents (80%) adopted posture with on one or both leg kneeling , while 20 per cent standing on one knee bent while unloading grain bags. In this activity too respondents carried load or force less than 10 kg.

Loading grain bag on other:

In loading grain bag on other worker who will carry it, it was found that 50 per cent of respondents kept their back bent while 30 per cent bent and twisted. Both arms above shoulder level as reported by all of the respondents. Majority of respondents were standing on both knees bent, and all respondents were carrying weight or force is exceeding 20kg.

Arranging grain bag:

In arranging grain bags 60 per cent respondents kept their back bent, all respondents kept their both arms below shoulder level, maximum (75 %) standing on both knees bent, weight and force was exceeding 20kg by all respondents.

Action level - corrective measures needed for posture adopted during task involving loading and unloading:

The codes assigned by the investigator to the postures adopted by the respondents while working on existing workplace were further analyzed to suggest action category for each adopted posture. The suggested action level categories were as follows:

Loading grain bag on self:

Action level for adopted posture depicts that 50 per cent respondents need corrective measures immediately due to very poor posture and 35 per cent respondents needed corrective measures as soon as possible followed by 15 per cent due to less poor posture needed to be corrected in near future as shown in Table 4.

Carrying grain bag:

Data showed that only 15 per cent respondents need

Table 3 : Action level categories in OWAS method for work posture

Sr. 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 4 : Corrective measures needed for the posture adopted by respondents loading and unloading (n=20)

Sr. 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)
1.	Loading grain bag on self	-	3 (15)	7 (35)	10 (50)
2.	Carrying grain bag	-	-	6 (30)	14 (70)
3.	Unloading grain bag		3 (15)	14 (70)	3 (15)
4.	Loading grain bag on other	-	-	16 (80)	4 (20)
5.	Arranging grain bag	-	13 (65)	7 (35)	-

Values in parentheses indicate percentage.

Table 5 : Action categories in OWAS method for work posture combination in loading and unloading work

Back	Arms	1			2			3			4			5			6			7			Legs
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Use of force
	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	
1	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	
	3	1	1	1	1	1	1	1	1	1	2	2	3	2	2	3	1	1	1	1	1	2	
	1	2	2	3	2	2	3	2	2	3	3	3	3	3	3	3	2	2	2	2	3	3	
2	2	2	2	3	2	2	3	2	3	3	3	4	4	3	4	4	3	3	4	2	3	4	
	3	3	3	4	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	2	3	4	
	1	1	1	1	1	1	1	1	2	3	3	3	4	4	4	1	1	1	1	1	1	
3	2	2	2	3	1	1	1	1	2	4	4	4	4	4	4	3	3	3	1	1	1	
	3	2	2	3	1	1	1	2	3	3	4	4	4	4	4	4	4	4	4	1	1	1	
	1	2	3	3	2	2	3	2	2	3	4	4	4	4	4	4	4	4	4	2	3	4	
4	2	3	3	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4	
	3	4	4	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4	

Table 6 : Description of loading and unloading tasks and action level for adopted posture in different activities (n=20)

Sr. No.	Activities	OWAS posture codes				Action categories
		Back	Arms	Legs	Force	
1	Loading grain bag on self	2	3	5	3	4 (Corrective measures immediately
2	Carrying grain bag	4	3	7	3	4 (Corrective measures immediately)
3	Unloading grain bag	4	3	6	3	4 (Corrective measures immediately)
4	Loading grain bag on other	2	3	4	3	4 (Corrective measures immediately)
5	Arranging grain bag	2	1	4	3	3 (Corrective measures as soon as possible)

corrective measures in the near future, 35 per cent needed corrective measures as soon as possible and half of the respondents (50%) needs corrective measures immediately in their posture (Table 4).

Unloading grain bag:

It was found that 70 per cent respondents needed corrective measures immediately, while 30 per cent needed corrective measures as soon as possible.

Loading grain bag on other:

Majority of the respondents (80%) posture needed corrective measures as soon as possible, with 20 per cent indicating to be corrected immediately.

Arranging grain bag:

It was found that only 35 per cent respondents need corrective measures as soon as possible while 65 per cent in the near future needed corrective measures.

Postural stress on workers while doing loading and unloading work was calculated and was found to be 4 for the tasks like loading grain bag on self, carrying grain bag, unloading grain bag and loading grain bags on other, which means posture needs corrective measures immediately; 3 for the sub tasks like arranging grain bags, means posture needs corrective measures in near future (Table 5 and 6).

Conclusion:

A tremendous number of workers are routinely exposed to physical hazards and many of them develop one or more serious postural and musculoskeletal disorders during their working life time. Prevalence of these has increased dramatically in developing countries. So there is a need to address the inadequate safety system, lack of awareness, lack of training of occupational safety and health and lack of ergonomic standards and epidemiological studies.

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Received : *01.02.2012;* **Accepted :** *15.12.2012*