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Research Paper

Physical problems faced by women engaged in *papad* rolling activity-An analysis of job strain

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ABSTRACT : In a megacity like Ludhiana women from low socio-economic strata are mainly involved in construction industry, cottage industries, domestic services etc. *Papad* making industry in the city is also among one of them which has provided ample opportunity of employment for the women workers but they suffer adverse health impacts due to awkward postures maintained for long durations and repetitive actions. The present study was therefore conducted primarily with an aim to study the work profile of women engaged in *papad* rolling and to assess the nature of work and musculo-skeletal problems of women intensively engaged in this activity. The assessment of work was done using Job Strain Index (JSI) and musculo-skeletal problems were identified from intensity of pain using Body Map. The results revealed that women perform *papad* rolling activity daily for 4-6 hrs./day in sitting –cum-forward bending posture with neck, shoulder and hip flexion and with no rest in between the work. Intensity of exertion indicated that there was noticeable or definite effort made by the women engaged in *papad* rolling activity. Overall the JSI score was found to be 30.81 which indicated that the work was hazard prone for health. Percentage of mean scores of the intensity of body pain indicated that the respondents felt very severe pain in low back (83.20 %), severe pain in upper back (63.20 %), hands and wrist (63.20 %) and moderate pain in neck, shoulder joints and lower arm (40-50 %) indicating trouble in these parts. These being predisposing factors causing musculo-skeletal disorders, there is a need for ergonomic intervention for preventing them in terms of improvement in work posture, modified workplace and introduction of appropriate rest pauses.

KEY WORDS : Musculo-skeletal problems, Awkward posture, Repetitive actions

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A large number of women workforce in India is employed in the unorganised sector. In rural areas, they are mainly engaged in agriculture and allied activities whereas in urban areas they are involved in construction industry, cottage industry and as a domestic help. Unorganised sector in India is broadly characterized as consisting of units engaged in the production of goods and services with the primary objectives of generating employment and incomes to the persons concerned. It plays a vital role in terms of providing employment opportunity to large segment of the working force in the country and contributes to the national product significantly. But the unorganized sector workers do not have any job security, income security, health security or social security. They are exploited for low wages and overburdened with work. They don't get health benefits or sick leave and have to pay from their own pockets. A considerable number of adverse health conditions are linked to women working in awkward postures in unorganised sector. They adopt unnatural postures such as twisting, bending, stooping, reaching forward, squatting, kneeling etc. while performing various activities. Apart from that, the highly repetitive, forceful movements performed by women often with badly designed tools under subhuman working and living conditions, cause a number of health problems of which musculo-skeletal problems are one of the commonest problems of women.

One such industry where a large number of women are employed and are involved in repetitive, forceful movements

of the arms and the hands is "*Papad* making industry". Although such industries are identified with women empowerment in India, the employees are found to have not subjected to occupational health-and-safety provisions. As a result, they suffer adverse health impacts. This investigation was therefore planned to study the work profile of women engaged in *papad* rolling, to assess the nature of their work and to assess the musculo-skeletal problems of these women.

■ RESEARCH METHODS

The study was conducted on 200 female workers of Ludhiana district intensively engaged in *papad* rolling activity in the year 2011. The respondents upto the age of 40 years were purposively selected out of the complete list of female workers engaged in this activity. Field survey was conducted to study the work profile, postures adopted by female workers and musculo-skeletal problems of the respondents. A predesigned and pretested interview schedule was used which included background information of the respondents (Socio-demographic and health profile) and specific information (work profile, postures adopted while performing *papad making* activity and extent of problems faced). Record sheets were prepared for recording Job strain index (Moore and Garg, 1995) and for recording body pains using body map (Corlett and Bishop, 1976)

Job strain index (JSI):

It is a semi-quantitative job analysis model which was used for discriminating between jobs which expose and jobs which don't expose the workers to musculo-skeletal risk factors (different task variables) that lead to different types of upper extremity disorders. It relies more on qualitative rather than on quantitative estimates.

It was calculated from the following six factors, namely a) Intensity of exertion, b) Duration of exertion, c) Efforts per minute, d) Hand/wrist posture, e) Speed of work, f)Duration of task per day.

Body Map:

It was used to measure the localized discomfort, and intensity of pain in different body parts resulting from postural discomfort. The intensity of pain reported in each body part is determined on a 5-point continuum.

Assigned score values for pain by subjects in different parts of the body

Pain level	Assigned score
Very severe pain	5
Severe pain	4
Moderate pain	3
Mild pain	2
Very mild pain	1

Scores of all the subjects were added to get an average mean score. From the mean scores, mean percentage of the intensity of the pain was derived. Based on the scoring technique, the overall score attained were : up to 20 per cent = very mild pain, 20 to 40 per cent = mild pain, 40 to 60 per cent = moderate pain, 60 to 80 per cent = severe pain and 80 to 100 per cent = very severe pain. So, the body part discomfort was judged on the basis of these overall discomfort scores.

Analysis of data:

Simple averages, percentages, mean scores and standard deviation were calculated and the results are presented in the form of tables. Frequencies and mean scores were calculated for analysis of data regarding musculo-skeletal disorders.

Job Strain Index

Rating	Intensity of exertion (IE)	Duration of exertion (DE)	Efforts /minute (EM)	Hand/wrist posture (HWP)	Speed of work (SW)	Duration per day (DD)
1	Light (1)	<10 % (0.5)	<4 (0.5)	Very good (1)	Very slow (1)	<1 (.25)
2	Somewhat hard (3)	10-29% (1)	4-8 (1)	Good (1)	Slow (1)	1-2 (.50)
3	Hard (6)	30-49 % (1.5)	9-14 (1.5)	Fair (1.5)	Fair (1)	2-4 (.75)
4	Very hard (9)	50-79 % (2)	15-19 (2)	Bad (2)	Fast (1.5)	4-8 (1)
5	Near maximal (13)	80-100 % (3)	>=20 (3)	Very bad (3)	Very fast (2)	>=8 (1.5)

Job strain index worksheet

	Intensity of exertion (IE)	Duration of exertion (DE)	Efforts /minute (EM)	Hand/wrist posture (HWP)	Speed of work (SW)	Duration per day (DD)
Exposure data						
Ratings						
Multipliers						

JSI = IE x DE x EM x HWP x SW x DD

Scoring technique : SI scores $\leq$ 3 = Safe

SI scores > 5 = Jobs associated with upper distal extremity disorders

SI scores $\geq$ 7 = Hazardous jobs

■ RESEARCH FINDINGS AND DISCUSSION

The findings obtained from the present study have been discussed under the following sub-heads:

Socio-demographic profile of the respondents:

The data revealed that the average age of the respondents was 33.66 years and majority of the respondents belonged to the age category of 31-35 years. Twenty nine per cent of the respondents were illiterate, whereas 40 per cent had education upto primary level. Nineteen per cent of the respondents studied upto matric. Majority of the respondents were married, had nuclear family setup with an average of 4-5 members in the family. The family occupation of majority of the respondents was service and a few of the respondent families were engaged in business. The personal income of the respondents ranged from Rs. 1500 to Rs. 3500/month with an average income of Rs. 2373/month. The wages were ‘ 23/ kg of dough. The family income ranged from Rs. 5000 to Rs. 25000/-, per month whereas average family income was found to be Rs. 11000/-per month.

Health related problems of the respondents:

The women workers engaged in *papad* rolling activity suffered from various health related problems. Table 1 shows the distribution of respondents according to physiological, symptomatic and psychological health problems suffered by them for the last two years due to work stress, other reasons and combined from work stress and other reasons. The illnesses from other reasons may be due to extreme weather conditions, faulty food habits, environmental pollution etc.

Physiological problems:

From the perusal of Table 1, it is revealed that among the physiological problems from the work stress *i.e*. long hours of *papad* rolling, “low back pain” was reported by 73 per cent of the respondents, 54 per cent suffered from callosities on the skin, 30 per cent had whole body aches, 26 per cent suffered from joint pains, 25 per cent had gastrointestinal disorders, 19 per cent reported strain on eyes due to extended concentration during *papad* rolling. Twenty two per cent respondents also suffered from insomnia due to fatigue and pain from work stress.

Symptomatic problems:

Regarding the symptomatic problems, 85 per cent of the respondents felt fatigue during the day both due to work

Table 1 : Health related problems of the respondents **(n=200)**

Problems	From work stress	Other reasons	Combined work stress and other reasons
Physiological problems			
Low back pain	146 (73.00)	4 (2.00)	28 (14.00)
Callosity	108 (54.00)	12 (6.00)	0 (0.00)
Body ache	60 (30.00)	38 (19.00)	60 (30.00)
Joint pains	52 (26.00)	14 (7.00)	4 (2.00)
Gastrointestinal disorder (Acidity)	50 (25.00)	18 (9.00)	4 (2.00)
Insomnia	44 (22.00)	22 (11.00)	0 (0.00)
Strain on eyes	38 (19.00)	2 (1.00)	20 (10.00)
Headache	34 (17.00)	60 (30.00)	56 (28.00)
Skin problems (Allergies, sun burns)	24 (12.00)	4 (2.00)	2 (1.00)
Symptomatic problems			
Muscle tightness	138 (69.00)	4 (2.00)	0 (0.00)
Joint stiffness	110 (55.00)	0 (0.00)	0 (0.00)
Excessive perspiration	84 (42.00)	2 (1.00)	12 (6.00)
Numbness of arms/hands	50 (25.00)	8 (4.00)	16 (8.00)
Hand trembling	10 (5.00)	6 (3.00)	2 (1.00)
Fatigue	10 (5.00)	18 (9.00)	170 (85.00)
Difficulty in movement such as sitting, standing, bending etc.	6 (3.00)	10 (5.00)	4 (2.00)
Psychological problems			
Increased negativity and irritation	16 (4.00)	10 (5.00)	0 (0.00)
Depression	0 (0.00)	4 (2.00)	0 (0.00)
Frequent bad mood	6 (3.00)	20 (10.00)	8 (4.00)
Low self-confidence	0 (0.00)	22 (11.00)	0 (0.00)

Note: Multiple responses, Figures in parenthesis are percentages

stress and other reasons like household chores, child care etc. Sixty nine per cent respondents felt muscle tightness in the hips, upper back, neck and shoulders from work stress. This may be because muscles can get tight as a result of their restricted movement. When a person sits in a flexed position with hips bent, this puts the muscles on the front of the hip (hip flexors) in a shortened position, and the muscles on the back of the hip (glutes) in a lengthened position. Over time, this can result in muscle imbalances with the shortened muscles becoming "tight" and the lengthened muscles becoming weak. Many people develop poor posture with forward rounded shoulders and underdeveloped glutes. Fifty five per cent of the respondents felt stiffness in the neck, back and joints due to prolonged hours of sitting in poor posture such as slouching the neck when *papad* rolling. Numbness in one or the other body parts such as legs / feet / arms and hands due to work stress was reported by 25 per cent of the respondents. Numbness in legs and feet may be caused by remaining in the same posture for long time, which interrupts the blood circulation to that part of the body. Numbness in hands/arms is caused due to repetitive and forceful movement of the hands/wrist for prolonged hours. Repetitive hand movements also causes carpal tunnel syndrome which is often a cause for numbness. Four per cent of the respondents also felt numbness due to other reasons such as extreme cold weather. Forty two per cent of the respondents suffered from the problem of excessive perspiration especially in summer months due to hot climate. Three per cent of the respondents who suffered from joint pains also reported difficulty in movement such as sitting, standing, bending etc. Kaergaard and Andersen (2000) in a study on women sewing machine operators found out that many of them suffered from myofascial pain syndrome and rotator cuff tendinitis.

Psychological problems:

The table further reveals that some of the respondents suffered from psychological problems but they were more due to other reasons rather than work stress. Four per cent of the respondents felt irritation and had negative attitude towards this activity which may be because sometimes the dough was hard and they had to stretch it a lot to make it flexible. So, a lot of effort is required to make it soft causing pain in the shoulders, arms, hands and wrists. Three per cent of the respondents reported frequent bad mood due to work stress because the rejection rate of *papads* in the company was high and their wages were deducted accordingly causing loss in income.

The present results are in line with the findings of Roy and Dasgupta (2008). They studied the health profile of the women involved in *papad* making and disclosed that musculo-skeletal problem was their commonest health problem. Neck was the most commonly affected part followed by the low back. Their other problems included generalized weakness, acidity, menstrual problems, insomnia, headache, excessive sweating, burning sensation during micturition, swelling of feet and problem with vision.

Work profile and postures adopted by the female workers*:*

Table 2 shows that almost all the respondents were engaged in fetching dough, beating dough, stretching dough, making balls, rolling *papads*, drying and packing *papads*. Twenty six per cent of the respondents had 11-15 years of experience, 27 per cent had 16-20 years of experience, 12 per cent had 21-25 years and 4 per cent had more than 25 years of experience of performing this activity. Majority of them performed this activity at outside verandah of the house with no rest pause in between. Roy and Dasgupta (2008) revealed

Table 2 : Work profile of the respondents (n=200)

Activities	Number	Percentage
Fetching dough	194	97.00
Beating dough	176	88.00
Stretching dough	200	100.00
Making balls	200	100.00
Rolling papads	200	100.00
Drying papads	200	100.00
Packing papads	186	93.00
Experience of performing the activity		
1 to 5 years	30	15.00
6-10 years	32	16.00
11-15 years	52	26.00
16-20 years	54	27.00
21-25 years	24	12.00
Above 25 years	8	4.00
Place of activity		
Outside verandah of the house	170	85.00
On the terrace	30	15.00
Rest pause		
Yes	14	7.00
No	186	93.00
Satisfaction from wages		
Yes	94	47.00
No	106	53.00
Distance of fetching the dough		
Less than 1 km	100	50.00
5-6 km	50	25.00
11-12 km	50	25.00
Mode of transport		
Walking	92	46.00
Autorickshaw	86	43.00
Cycle	18	9.00
scooter	4	2.00

that 60 per cent of the total women surveyed were in this occupation of papad making for more than ten years and most of them spent about five hours for the '*papad*' making work over and above their household job.

Table 2 further reveals that more than half of the respondents (53%) reported dissatisfaction from the wage amount as this job involved a lot of their effort and time and they were not appropriately paid for that. The rejection rate was also high *i.e.* when the *papad* was not made up to their quality standards then the *papads* were rejected and the wages were cut accordingly. Roy and Dasgupta (2008) also reported that all the women involved in *papad* making in slum area of Kolkatta considered that they were poorly paid and their pay must increase. Whereas, 47 per cent respondents were of the view that whatever money they earned adds to their family income. Also, they could take care of their children while working from home. So, whatever money they get is satisfying for them. Fifty per cent of the respondents travelled less than 1 km to fetch dough from the company, whereas an equal number of respondents travelled 5-6 km and 11-12 km. daily. Regarding the mode of transport they use, 46 per cent reported that they went walking to fetch the dough as the distance was less than a kilometre. Forty three per cent travel by auto rickshaw, 9 per cent used bicycle and 2 per cent went with their family member on a scooter/motorcycle.

Time spent on papad making activities:

Fig. 1 depicts that average daily time spent on fetching dough was 115.80 minutes. Maximum time spent on *papad* rolling *i.e.* 240 min./day.

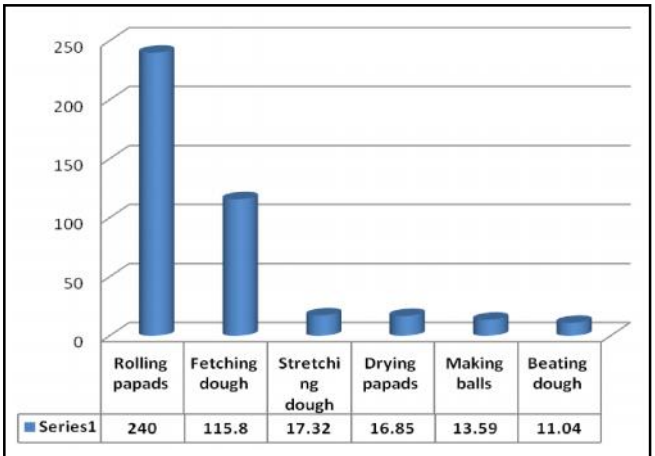

Fig. 1 : Time spent by the respondents on activities related to *papad* making (min.)

Beating the dough with hammer and making of balls took 11-13 min. per day. Stretching the dough and drying *papad*s took approximately 16-17 min./day. So, it can be said that out of all the sub activities in *papad* making process, *papad* rolling was performed for maximum number of hours *i.e.* 4 hrs./day. It was very tiring and back breaking activity since it involves repetitive and forceful movements of arms and hands along with sitting in poor posture. Though the other activities also involve forceful movements of hands and arms but since they are performed for a short period only so persistent pain is not felt while performing these sub activities.

Posture adopted while performing the activity of papad rolling:

The *papads* were rolled while sitting in a forward bending posture with neck, shoulders and hips flexed. The arms and the hands moved repeatedly to roll *papads* of uniform size. The wrists were in non-neutral position thus leading to strain on the median nerve of the hand. Singh (2007) reported that forward sitting posture is undesirable to hold very long period because it increases the load on musculature supporting the head and it produces muscular pain in the neck and small part of the back. The orthopaedists have agreed that a bent back encourages disk problems. According to Saha (1978), poor or faulty body posture may lead to permanent body damage besides increasing the cost of work.

Physical problems faced by the respondents :

Table 3 reveals the extent of problems faced by respondents while performing the activity of *papad* rolling. Data revealed that all the respondents felt the problem of "prolonged adoption of poor posture" and "repetitive movements" while performing the activity. These two problems obtained the maximum score of 2.00.

Table 3 : Extent of problems faced while performing the activity of *papad* rolling (n=200)

Problems	WMS ± SD
Prolonged adoption of poor posture	2.00 ± 0.00
Repetitive movements	2.00 ± 0.00
Forceful movements	1.89 ± 0.31
Unnatural body posture	1.87 ± 0.39
Ill-designed tools	1.55 ± 0.76
Inappropriate raw material	1.03 ± 24
Unsuitable work environment	0.98 ± 0.14
High physiological stress	0.30 ± 0.50
Improper work method	0.13 ± 0.46

Note : Multiple responses

Gangopadhyay *et al.* (2007) reported that repetition in job may lead to discomfort in the upper extremities of the body like hand, wrist, fingers and shoulders. A mean score of 1.89 and 1.87 was given to the statements "forceful movements" and "unnatural body posture", respectively, which is also a very high score *i.e.* the respondents felt these problems to a large extent while rolling *papads*. Mean score of 1.55 was obtained by the statement "ill-designed tools" which indicated that the tools need to be re-designed for

performing this activity more comfortably. Unsuitable work environment was given a mean score of 0.98 as the respondents stated that sometimes when the weather is not good or noise levels are too disturbing then they faced problems in performing this activity. Bad weather upsets their whole work routine due to the problem of drying *papads.*

A mean score of 1.03 was given to the statement "inappropriate raw material" as respondents reported that sometimes the dough is too hard, so they have to apply more effort when stretching the dough. A mean score of 0.30 was given to the statement "high physiological stress", which was quite a low score. So, it can be concluded that respondents always faced the problem of poor posture, badly designed tools, repetitive and forceful movements of arms and hands, while performing *papad* rolling activity and sometimes the problems were also due to unsuitable work environment and inappropriate raw material.

Job strain index for job analysis:

Nature of work was assessed on the basis of job strain index (Table 4).

Mean scores of intensity of exertion revealed that there was noticeable or definite effort made by the workers while performing this activity as their facial expressions changed on applying force. Out of the total time of activity, the duration of exertion made by the respondents was between 50 and 79 per cent. Efforts made by the respondents were between 15 and 19 per minute. Hand and wrist were in non-neutral position causing wrist strain while rolling *papads.* The speed of work was normal. The respondents on an average worked for 4 to 8 hours per day. Overall the JSI score was calculated to be 30.81 which indicated that the work is hazard prone. These findings corroborate the work of Armstrong and Silverstein (1987) and Wells *et al.* (1994). They also reported that poor wrist posture during work is regarded as a risk factor for hand and wrist

Table 4 : Mean scores of Job Strain Index for *papad* rolling activity

Parameters	Exposure data	Mean Scores ± S.D.	JSI Score and interpretation
Intensity of exertion	Somewhat hard: Noticeable or definite effort	4.80 ± 1.51	30.81
Duration of exertion	50-79%	2.10 ± 0.31	Hazardous Job
Efforts/minute	15-19	1.95 ± 0.43	
Hand/wrist posture	Non neutral	1.50 ± 0.00	
Speed of work	'Normal' speed of motion	1.10 ± 0.21	
Duration per day (hrs.)	4-8	0.95±0.10	

Job Strain Index scoring interpretation:
Less than or equal to 3 = Safe
More than 5 = Jobs associated with upper distal extremity disorders
More than or equal to 7 = Hazardous job

Table 5 : Mean scores of intensity of body pain for *papad* rolling activity

Body parts	Intensity of pain		
	Mean ± SD	Percentage of mean scores of pain	Overall discomfort
The upper extremities			
Neck	2.11 ± 1.07	42.20	Moderate
Shoulder joint	2.62 ± 0.82	52.40	Moderate
Upper back	3.16 ± 0.94	63.20	Severe
Upper arms	1.24 ± 1.16	24.80	Mild
Elbow	1.49± 0.51	29.80	Mild
Lower arm	2.02 ± 1.17	40.40	Moderate
Wrist/Hands	3.16 ± 0.73	63.20	Severe
The lower extremities			
Lower back	4.16 ± 0.84	83.20	Very severe
Buttocks	0.81 ± 0.97	16.20	Very mild
Thigh/upper leg	0.25 ± 0.71	5.00	Very mild
Knees	0.42 ± 0.97	8.40	Very mild
Calf muscles	0.63 ± 0.96	12.60	Very mild
Ankle/Feet	1.72 ± 1.04	34.40	Mild

Multiple responses
Scoring interpretation: 1=Very mild; 2=Mild; 3=Moderate, 4=Severe; 5=Very severe
(Overall score attained - Very mild = Upto 20%; Mild = 20-40%; Moderate = 40-60%; Severe = 60-80%; Very severe = >80%)

problems.

Musculo-skeletal problems using body map technique :

Table 5 reveals the overall scores of pain obtained by the body parts which indicates that the respondents felt very severe pain in lower back (83.20 %), severe pain in upper back (63.20 %), wrist and hands (63.20 %), moderate pain in shoulder joints (52.40 %), neck (42.20 %) and lower arm (40.40 %) and mild pain in upper arms, elbows, ankles and feet. The intensity of pain in these body parts indicated trouble which needs to be looked into. Feeling of discomfort or pain in the low back among women may be due to the awkward posture sustained for long periods without any rest pauses in between. According to Punnett *et al*. (1991) postures especially severe flexion or lateral twist and bending have been found to be significantly related to low back pain. Ray (1998) in a study of construction industry in India also indicated that 75 per cent of women had pain in the lumbar and calf region, 62.5 per cent complained of pain in cervical region and 67 per cent in the whole body.

Conclusion:

From the observation and analysis of the results, it can be concluded that *papad* rolling activity is a hazard prone activity. Women are working in awkward postures, with the potential risks of MSD's primarily affecting the low back, neck region and wrist/hands. Repetitive motions of the upper limbs, long duration, high exertion further amplifies their problems. These being predisposing factors causing musculo-skeletal disorders, there is a need for ergonomic intervention for preventing them in terms of improvement in work posture and modified workplace. Women are also strongly suggested to take rest pauses during work period.

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