



STUDY ON ERGONOMIC DISCOMFORT AMONG SELF-HELP GROUP WOMEN INVOLVED IN LARGE-SCALE CHAPATTI MAKING

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ABSTRACT

Self-help group women have a lot of success stories for the method of functioning, revenue generation and scaling up, across India. This study is about one such group from Hosur, Tamilnadu, involved in large-scale chapatti making. The objective of the study was to assess the physical discomforts of self-help group women while making chapattis in large scale and to assess the work environment with their productivity. The women are making around 8,000-9,000 chapattis per day per group manually for the last 15 years. The total women involved in chapatti making were around 70, with age group varying between 30 and 62. Though there was no correlation between age and Body Mass Index (BMI), there was a significant correlation between BMI & rolling, BMI & frying process for few groups. Further, the study revealed the physical discomforts caused during this process and the severe stress on muscles and tissues created by the awkward postures used. Using Cornell Musculoskeletal Disorder Questionnaire (CMDQ), the most pain point scores were observed and it showed that 75% of the pain was in the wrist and shoulder during kneading and portioning process and about 80% of women had severe wrist, shoulder and back pain while rolling, whereas about 85% of members felt the leg, knee and the wrist pain while frying. The discomforts caused by work place environment were contributed more by heat and temperature, which is produced at the gas fryers while frying chapattis. The clinical significance of pain for rolling process was more among 2 groups compared to other groups and was due to the improper layout planning and space constraints at the work unit. An awareness programme for a period of six months on posture positioning, proper seating, exercise and yoga could potentially reduce the pain and discomforts caused. This study is a continuous process and focusses on the long-term intervention activities.

KEYWORDS : Self Help Group, Physical Discomforts, Ergonomics, Chapatti Making

1.0 INTRODUCTION

Self-help group (SHG) is a method of organising the poor people and the marginalized to come together to solve their individual problems. SHG method is used by the government, NGOs and others, worldwide. SHGs have become the vehicle of change for the economically backward class (1, 2). The strata of rural families, handled through SHGs, are capital scarce, labour surplus, and, by and large, bereft of proper knowledge as well as management skills. Thus, installation of income-generation activities and micro enterprises in the rural areas, helps promote first-generation micro entrepreneurs with resource mobilization on their own, through their SHGs (3). This study is about such self-help groups involved in large scale chapatti making from Hosur, Tamilnadu, India. The study focussed more on the physical discomfort, postural variations and the work place environment than on the modus operandi of the SHG. Since many studies about SHGs in India has always focussed in terms on finance, empowerment and sustainability, the author stressed on the impact of ergonomics on the members' physical and mental well-being.

In this context, ergonomics plays an important role in making the workplace as efficient, safe and comfortable as possible and at the same time enhance human performance. Effective application of ergonomics in work system design can achieve a balance between worker characteristics and task demands, enhancing worker productivity, provide worker safety, physical and mental well-being and job satisfaction (4). The workers working in a constant and iterative position, incur injuries in their shoulder, neck, back, and lower extremities. Holding the left upper arm up, bending the body and head, ankle and knee at non-optimum angles causes these injuries or makes the situation more serious. Work related musculoskeletal disorders are one of the greatest occupational health concerns of these women today (5).

The quality of the design of the work place in terms of the task and the worker has an important effect on the ease with which the action is achieved. The work place design is evaluated in terms of its elements, function and design (6). The basic objective of considering the requirements of the worker in designing work places are to determine the condition where there is minimum strain on the worker and require minimum efforts to perform the task. This involves physical strain, effort, affective, cognitive and temporal cost of work. To develop the physical design of work place, the aspects considered are location in

horizontal space; spatial arrangement of furniture; amount, dimensions and space to worker; worker at work and storage of supplies, provision of special features. According to Sharma and Sharma (7), bodily discomfort means a state of ill health. It is closely related with fatigue, both physical as well as mental. Thus, bodily discomfort is a painful state which can follow unsuitable work stress, psychological or sociological conflict and finally ill health. Developments of hard and painful muscles are normal examples of bodily discomfort.

This study was conducted to evaluate the physical discomforts of self-help group women while making chapattis in larger scale and to assess the work environment with their productivity. The women are making around 8,000-9,000 chapattis per day per group, manually, for the last 15 years. The importance of correct posture and awareness of bodily discomfort and pain were completely ignored by the women as their main aim was to produce the chapattis on time and generate basic income for survival. This long-term ignorance on personal postural comforts has led to body pain, physical and mental fatigue. Hence, this study was done with two main objectives: one to assess the physical discomforts of self-help group women while making chapattis in large scale and the other to understand the work environment in relation to their discomfort and productivity.

2.0 METHODOLOGY

The aim of the study was to understand the pain-points in the chapatti-making process in a pre-designed workplace within a limited time frame.

Design of the study:

To evaluate and understand the problem, the study was done in Hosur, Tamil Nadu, India among the selected self-help group members involved in large-scale chapatti making. The sample selected was 7 groups with varying number of members per group (N=70, in total) involved in Chapatti making for the last 15 years and the depth of physical discomfort and pain points were observed using varied techniques. The collection of data was in three phases: 1) Productivity analysis, 2) Physical discomfort and postural analysis 3) Work place design and environment analysis. The information was gathered through a structured questionnaire which included demographic information, body discomfort and environmental parameters related to chapatti making.

Productivity Analysis:

This was analysed with the observation method while the members were involved in the production. Each group were observed for the number of dough balls portioned, number of chapattis rolled per hour per member, number of chapattis fried per hour and the packing and dispatching process.

The actual productivity happens in a very systematic cyclic pattern. The women start their work at 5:30 am and two women are involved in preparing the dough, kneading and portioning the balls (30g per ball per chapatti) and set up the work place ready for the day. By 6:30 am rolling members for that particular day start the rolling process and around 250-300 chapattis are rolled per hour per women and the members assigned for frying, complete 1000 chapattis per hour. The rolling and frying members get the job rotation every hour. In contrast, members for the kneading, packing, dispatching and billing process are taken up by those who arrive early.

Physical and Postural analysis:

The members were observed while performing individual tasks for their postural variations, the number of movements and the body discomfort. Since the women work force involved were only educated up to primary education, the researcher used the body mapping image

along with structured questionnaire to understand the depth of pain while working. The pain points were measured with the use of body mapping and Cornell Musculoskeletal discomfort Questionnaire (CMDQ).

Cornell Musculoskeletal Discomfort Questionnaire:

Cornell Musculoskeletal discomfort Questionnaire (CMDQ) is a well-designed data collection tool which was developed by Professor Alan Hedge and ergonomics graduate students at Cornell University (8). CMDQ addresses 7-day frequency, severity and working ability interference effects of MS discomfort across 20 body parts. It has been used in assessment of MS discomfort among different working populations.

This format was modified and validated with the help of experts and the women involved in chapatti making for reliability and authentication. The modification done based on the process of chapatti making, the intensity of pain for each activity and the frequency of pain. The scores were then calculated as shown in the equation below with excel coding sheet from the basic scores obtained for each parameter as per the members response.

$$Score = Activity * Discomfort\ interference * Frequency$$

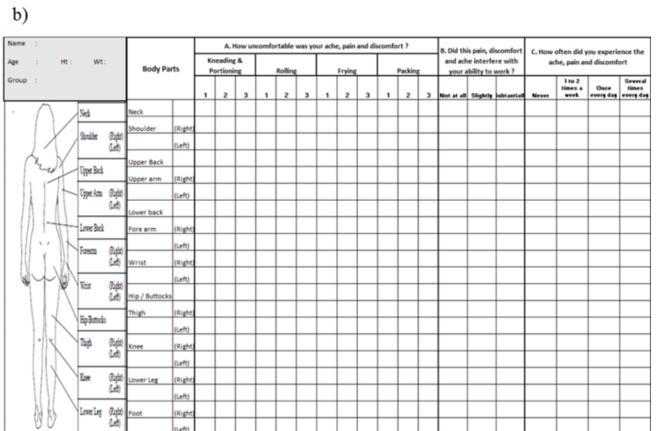
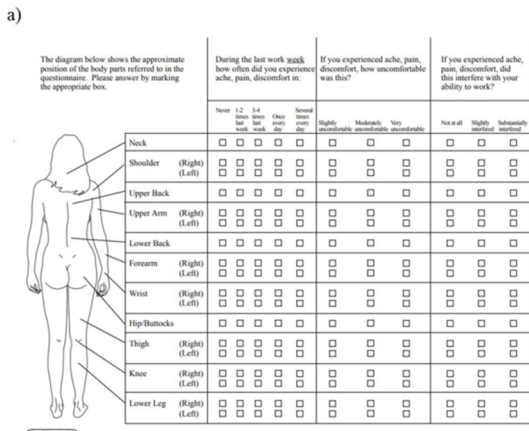


Figure 1: Format of CMDQ. a) Original CMD questionnaire as developed by Prof. Alan Hedge. b) Modified CMDQ according to the needs of the current study.

Work place design and environment analysis:

The work place was mapped and measured to understand the minimum space requirement for each activity and the layouts were later drawn to scale with Auto CAD and Google Sketch up. We observed the environmental parameters using the lux meter, sound meter and thermometer to measure the actual light waves, noise produced and the heat and humidity generated and then validated with the respondents.

3.0 RESULTS

Physical characteristics:

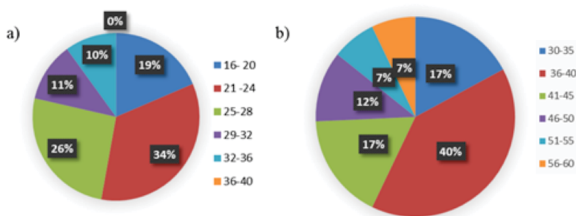
85% of the women have been involved in this chapatti making process for the last 15 years. Though it's a long work span, the women were not aware of their postural positioning and physical discomforts. There was no evidence of study on their discomforts in the last several years. The physical characteristics such as age and BMI were collected through a systematic questionnaire.

a) BMI pattern for the members reflects that most members have a normal BMI. b) Age distribution of members which shows that most members fall in the age group of 36-40.

Figure 2 depicts the distribution pattern of age and BMI among the members. We found that while 34 % of the women fall in the normal BMI, about 26 percent of them fall in the obese category with the average age being 40. From the Anova test performed, it is understood that the age and BMI between groups have no significant difference, whereas within the group it has some differences, which reflects in their work productivity and pain scores (Data not shown). Though the scores of age and BMI do not differ significantly with pain and physical discomfort directly, there was a significant difference with the activity performed and the layouts within and among groups.

Analysis of Discomfort scores:

The chapatti making process involves kneading & portioning, rolling, frying, packing and dispatching. The highest discomfort caused was during kneading, rolling and frying processes compared to the other activities. Using CMDQ scoring, the most pain point scores were observed and it showed that 75% of the pain was in the wrist and shoulder during kneading process and 80% of women had severe wrist, shoulder and back pain while rolling, while 85% of members felt leg, knee and wrist pain while frying.



Relationship between physical discomforts, Age and BMI

Figure 2: BMI and age distribution pattern among members of all groups. N=70

Figure 4 shows the scores of body parts with respect to activity performed among all the groups. The wrist is the most affected body part in all the three major activities performed (kneading, rolling and frying) with average pain score of 7.3, 11.5, 11.3 respectively. The next most painful part is the knee and leg for the frying process. Not surprisingly, the second most affected part during the kneading and rolling process was the shoulder.

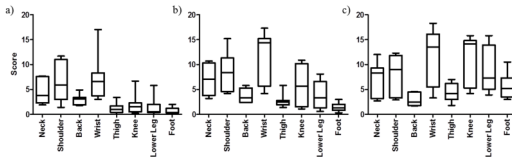


Figure 4: Pain scores of the body parts during each activity performed. a) Kneading and portioning process. b) Rolling process. c) Frying process.

To understand the work environment in relation to their discomfort and productivity

The work environment is one of the most important parameters for enhanced productivity, physical and mental health well-being. The study concentrated on the work place environment with 2 parameters. First, on the physical environmental parameters and the other parameter studied was the layout and activity performance.

Physical environment parameters:

Table 1: Environmental Parameters of working Units

Parameters	Range	Mean
Lighting (Lux)	620-850	735
Noise (dB)	61-77	69
Temperature (°C)	33-44	38.5
Humidity (%)	30-52	41

From table 1, it is observed that in most of the units, lighting level ranged from 620 to 850 lux with mean of 735. According to Gandotra et al (9), the lighting between 500 lux and 1000 lux gives satisfaction to workers. Here, the lighting ambience was very satisfactory and lot of natural lighting was observed in the work area. The average threshold level of noise exposure was 69 dB. The temperature ranges from 33 to 44°C and the mean temperature was 38.5°C which is very high. The study showed that the mean humidity was 41%. The humidity of the air may affect the health and comfort of the workers due to excess dryness.

The layout and activity performance:

The layout pattern was studied based on the number of members performing the activities and the space available for each activity. It was then classified as “More congested”, “Congested” and “Not Congested”. It was seen that the rolling process requires the maximum space per member compared to all other activities. In the “Congested” and “More congested” units, there was high significance in pain and discomfort compared to the non-congested ones. While rolling, the movement pattern of the upper arms, wrist and the shoulder were not in comfort zone, due to the non-availability of space and being seated very close to each other.

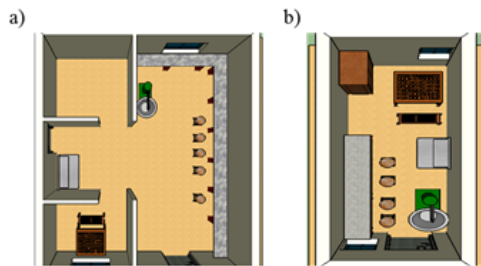


Figure 3: Top view layout of the units. a) “Not congested” unit providing more space per member. b) “More congested” unit showing that each member was seated very close to one another.

Productivity analysis:

Table 2 revealed the time taken for the production of each activity and we found there is no significant difference among the groups, but it is significant between the groups. The layout design has a direct impact in the rolling process. It is observed that in the more congested area, the women took lesser time (8.6, 7.4, 8.2 seconds/chapatti, respectively) than the congested and not congested area (10.4 seconds). Age and BMI do not affect the productivity of the members.

Table 2: Average speed of chapatti rolling among the group members in different layouts

SHG Group	Space Design	Average rolling speed (in seconds)	Wrist Pain Score
Group 1	More Congested	8.6	14.4

Group 2	More Congested	7.4	17.3
Group 3	More Congested	8.2	14.8
Group 4	Congested	9.7	8.6
Group 5	Not Congested	9.0	5.7
Group 6	Not Congested	9.32	4.2
Group 7*	Not Congested	10.4	17.2

***Group 7 functioning modality is slightly different from other groups.**

4.0 DISCUSSION

In the current study, we found that the actual cause for the physical discomforts could be attributed to various factors. These factors include the awkward positioning while kneading and rolling, the height of the stool, the work surface and the layout of the work place. The results obtained with respect to the pain scores necessities the need for postural adjustment. The temperature at the frying area is causing extreme discomfort to these women and especially during peak summers, the constant exposure to the heat in a standing posture is having a major effect on the muscle and tissues of the thigh, leg and knee parts. The lesser time taken for rolling per chapatti in more congested units showed the discomfort caused due to space constraints and increased wrist pain scores prove the need for proper space management. Thus, the importance of workspace redesigning in layout, the work surface and using personal protective equipment will have a better impact on the long run in the self-help group women involved in this large-scale chapatti making. Ergonomic interventions are commonly classified as engineering, administrative, behavioural or personal (5). In this study, the engineering and personal interventions will be administered to create a comfortable work environment. As it is an on-going project, the effectiveness of the impact will be assessed periodically.

5.0 CONCLUSION

The study found that these women were suffering from severe musculoskeletal problems, as evidenced by the occurrence of the neck, shoulder, wrist and lower body pain and stress. Preventive measures need to be adopted to eliminate this body discomfort and maintain good posture while making chapattis. It was observed that the study group was unaware of posture and comfortable workplace design. Hence, an effective application of ergonomics in workplace design, proper posture for each activity is essential to achieve a balance between worker and task demands. The self-help group women work towards the motto of sustainable income generation and to be an independent women work force of the society. Our findings have opened more avenues for the enhanced productivity with minimal physical discomfort by adapting to the above said practises for a healthy and better living.

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