

## Ergonomics-A Way to Occupational Wellness of Workers Engaged in Industrial Activities: Specific Reference to Assam

Nandita Bhattacharyya<sup>1\*</sup>, Debkumar Chakrabarti<sup>2</sup>

<sup>1</sup>Department of Family Resource Management, Assam Agricultural University, Jorhat, Assam, India

<sup>2</sup>Department of Design, Indian Institute of Technology, Guwahati, Assam, India

\*Corresponding author: Nandita Bhattacharyya, Department of Family Resource Management, Assam Agricultural University, Jorhat, Assam, India, Tel: 91-376-2340090; E-mail: [nbahtta2000@yahoo.com](mailto:nbahtta2000@yahoo.com)

Received date: May 2, 2016; Accepted date: May 24, 2016; Published date: May 30, 2016

Copyright: © 2016 Bhattacharyya N et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

For long term success in controlling occupational problems depends on understanding the causation of the problems. An appropriate scientific approach is required to examine the situation so that theories of body pains causation can be constructed. The purpose of the present study was to examine the epidemiologic evidence that associates the prevalent work related problems such as work related discomfort and body pains (musculoskeletal problems) of the upper extremity and the low back prevalent among the women workers engaged in industrial activities with exposure to different work related factors.

Keywords: Occupational Wellness; Occupational Stress; Musculoskeletal Problems; Design

### Introduction

Occupational health is specifically concerned with safety and wellbeing of the workers, as well as its motive is to improve productivity, using optimum level of human cost comparing the productivity outcome. In normal circumstances, occupational stress appears as an unavoidable part of working life.

A strong relationship exists between the occupational stress of workers and their productivity. Occupational stress of the workers results in reduced production due to inefficiency of the workers and sickness absenteeism. Moreover, the workers have to be paid sickness benefits and compensation wherever applicable. In many cases workers have to face the loss i.e., no work no pay.

Neglect of occupational stress and safety may result in invisible burden to the economy, which, in some cases, may be substantial. The major occupational hazards concerning work motivation and quality productivity in India is the musculoskeletal injuries. The most commonly occurred work related musculoskeletal disorder are found in upper extremities, and neck-back, and have been described by a number of generic terms including cumulative trauma disorders, work related upper limb disorders, occupational overuse syndrome, etc.

The emerging need should be focused on a pro-active response to occupational stress, with emphasis on preventive measures and elimination of the causes, rather than on the treatment of its effects and there by bringing occupational wellness among the workers. The goal is to optimize worker's well-being and productivity by treatment of the stressors of work; specifically when it concerns with human labour force those who have to bear dual pressure of household daily chores and being engaged in specific work for earning with specific reference to women workers. The approach has to be context specific.

The factors that play roles in the process of occupational wellness and stress are body postures, movements, exertion required, environmental factors, and poor design of work method/work tools,

technical systems, inappropriate relationship between workers performance and their tasks demands.

It is noticed that unplanned work methods and use of inappropriate work equipment to carry out a task are the major cause of work related musculoskeletal disorders in the workplace. Sometimes these are reported and records are maintained to refer but the majority of the affected workers remained silent and are seemed to be reluctant to report, probably due to fear of getting exposed of the injury and health disability to lose job or wage and ultimately suffers. The existing legislation does not protect the vast majority of the women workers as well. The Factories Act, 1948 covers working conditions, health and safety, basic amenities like toilets, crèches, working hours etc. but does not apply to work places with fewer than 10 workers using power driven machinery or less than 20 workers without such machinery [1].

Several researches have shown that the application of ergonomic principles and programs in almost all workplaces result in increasing productivity and decreasing work related health problems [2]. Hence, it becomes necessary to see how ergonomics specifically with its design application to the work accessories helps. Many of the ergonomics studies on women workers in India have been carried out in the field of agriculture, beedi industry, handloom industry, tea industry, fish processing, and construction workers (as reported in HWWE proceedings under Indian Society of Ergonomics, 2003, 2005, 2008, 2009) have shown good progress which is reported in many forum from time to time.[ 3-5]

Participation of women workforce in industrial sector is on raise. In the past 15 years, they have become almost 50 percent of the global workforce. Women workers suffer from work related health problems because neither the tasks nor the equipment they use, which are normally designed for men are adapted to their built and physiology [6]. These injuries can be prevented, if causes of injuries are identified.

## Priorities of Ergonomics Research, North East Specific

Ergonomics is relatively young to Indian society compared to its development in the west. In India, it is still an emerging area with heterogeneous nature of research and practices in different spheres of technological needs. The major focus started with analyses, evaluation and optimization of workplace, work methods and tools in agriculture, including informal sectors and mining [7,8]. Though many of the work environment studies and work place modifications were made on an ad-hoc basis, these strongly reflected an increasing trend of ergonomics practices [8] suitable to our country.

Among the North Eastern states, Assam appears to be progressing in industrialization. It has a few agro-based industries and mineral based industries. Agro-based industries like jute, rice mills, fruit processing, tea industries, etc. are of great economic importance. As it is shifting from local ethnic life style to industrial perspective various levels of ergonomic hazards reference to these highly labour intensive industries specifically fruit processing, handloom weaving and tea industries are silently imposing on large number of women workforces. The works in these industries are done manually as machines are either not convenient or do not go along with the traditional skills practiced so far. Work related health problems cause lost work time and lowered work performance. To improve the situation demands systematic ergonomic studies for alleviation of the conditions of work and possible design development of work tools and accessories practicing standardized methods. In Assam such approaches in recent years on women workers are not carried out much, few attempts have been taken with academic interests as mentioned above.

The critical question concerns with the priority to be allocated for work simplification-the method of performing the work or context specific design intervention; proper examination of feasibility for making improvement is necessary. In this efforts, the present status of local small scale agro-based works transparent the need on the study process to be considered; people engaged in respective fields of work may be taken into confidence in valuing them through participatory approach to choose development measures sustainable with their capability and resources.

Among four thrust crops in Northeastern agro-horticultural belt-orange, pineapple, ginger and cashew nuts; pineapple has industrial feasibility in Assam. Few agencies also impart trainings for women self-help groups but not much benefit in reality. The working women group gets from these schemes of financial and know-how supports [9], which transparent the need for awareness programs on overall occupational wellness and work methods in fields and in process units. Need for assessing ergonomic design intervention to help in improving work performance may also be looked into. Workers in fruit processing units are mostly women and they are engaged in multi task activities. Many of the activities performed by the workers in demand a high degree of physical effort because of repetitive hand movements and assuming static.



**Figure 1:** Women workers working in fruit processing.

## The Present Study

Since ergonomic risk factors assessment is still lacking in this sector, there is a need to study on the prolonged working task with awkward postures with a strong empirical evident and analysis. Thus, this study aimed at finding out the ill effects on different body parts during prolonged repetitive tasks. Some occupational health related issues were studied with relevant ergonomic techniques including physiological measures to understand the workload and its relevant subjective rating so that this can be used in evaluating any new design development scopes. Based on the observations on the different tasks performance and opinion survey, it came to fore that assessment of ergonomic risks and need based ergonomic intervention in designing work accessories can be a way to reduce work acquired stress by assisting different operations in fruit processing industry. In a nutshell, the aim of the present study was to assess the current working condition and to suggest the low-cost ergonomic means to improve occupational health and work performance through work tool development possibilities.

## Design Development Strategies

A strong relationship exists between the comfort and productivity. Unfortunately, this fact has not been accepted by many industrial organizations. This is an indication of lack of understanding of the concepts of ergonomics and the roles of its principles for designing a realistic approach in improving awkward posture, and force leading to developing early fatigue and work place acquired health problems.

Productivity along with reducing the incidences of work related health problems among the workers.

While designing an approach below '6Ws and how' must be analyzed [10]

- Who- the individual or organization requiring design
- Whom-the intended users: their basic limitations and the facilities available.
- Why- need of that product/ system; to design required assisting in performing the activity.
- What- considerations to be taken- improved peeling knife, coring and slicing
- When- the context in which the design is to be used;
- Where-the surrounding space and the relationship among the other articles to be used when performing the intended task;
- How-means to interlink the above six 'W's to arrive at a design solution with human compatibility.

A good ergonomic design creates a context for experience that fully respects user's all inbuilt capabilities and acquired skills, and understands users and their requirements. Design is the planning that lays the basis for making of every object or system for a specific purpose. It is an innovative, practical, reproducible solution to conceive various aids to human needs. It is a continuous problem solving process with conversion of ideas into reality, keeping in minds the user's characteristics and limitations, art and aesthetics, material and process, and new technology. Application of principles of ergonomics in design establishes user-friendliness, and compatibility between man and his surroundings and articles for his use. Ergonomics principles for good design comprises following [11].

A product should ensure the basic principles of human compatibility through:

- A product user friendly relationship,
- An anthropometric and behavioral match between the user and the product,
- Ease of handling,
- Ease of decoding of messages, encoded with inbuilt features, and
- Proper semantic applications of recognizing the functions and perceiving usability aspects,

A product conform reliability and safety through

- Designing the overall form, shape, size of the product and layout of the parts for operational ease,
  - Removing unnecessary bad parts,
  - Guarding unsafe things,
  - Warning of probable hazards while using the same, and
  - Training by specific instructions on how to use the product efficiently.
- Design development in the present study consists in translating the need (design modifications of existing knives and work space) into design characteristics.

## Materials and Methods

To address the research objectives, the study has been under taken as follows:

Phase I: Worksite comprehensive analyses were done to find out the causative factors of work acquired problems. In this phase of the study, RULA (Rapid Upper Limb Assessment) and QEC (Quick Exposure Check) were used to find out the ergonomic risk factors prevalent in the selected activities.

Phase II: Ergonomic design suggestions were developed.



**Figure 2:** Peeling and coring of pineapple.

## Results

### Ergonomic risk issues and relevant observations

Ergonomic risk while performing peeling, coring and slicing of pineapple have been assessed by quantifying the ergonomic risk factors by using RULA (Rapid Upper Limb Assessment) and QEC scores (Quick Exposure Check). It was observed that QEC (above 70%) scores indicated high. RULA score was also observed beyond ergonomic risk threshold [12,13] that was 7.

Injuries were being reported among the workers. Nearly 90 percent of respondents were found to suffer from back pain. Finger injuries were quite common along with pains and irritations, wrist pains were

found common among majority of the respondents. Analysis of selected activities showed i.e., awkward postures, force and repetitiveness, exposure to pineapple juice which were conducive for development of physical discomfort.

### Peeling, coring, sorting, cutting and cleaning - women intensive

Pineapple processing requires skills and involves a variety of repetitive movements of hands (Figure 2).

In the processing unit it was found that women workers were engaged in peeling and coring of pineapple. Mostly the activities were found.



(a)



(b)



(c)



(d)

**Figure 3:** Knives and tools used in pineapple peeling in Assam.

Performed with simple long knives and cylindrical tools (Figure 3). The workers reported to face problems for unavailability of sound peeling and coring tools. Need of the hour is suitable equipment to upgrade the peeling process and equipment to be designed should be suitable for small scale industries

Moreover, in fruit processing units it was found that during lean period of pineapple, women workers are engaged in various tasks of varieties of fruits processing activities, requiring specific tool development with local materials suitable for specific tasks.

In fruit processing industry of Assam though both male and females are involved at every stages of production, mostly women are involved in peeling, coring, sorting, cutting and cleaning activities.

These activities remain as women preferred task as women can perform repetitive activities in group formation with less labour charges.

It was noticed that due to the lack of proper work station and work tools the workers are compelled to perform the activities by assuming unnatural postures. (Figure 1 )

Work area needs proper planning so that it facilitates good postures while working.

Ergonomic risk factors identified in were awkward posture, repetitiveness and frequency.

Intermittent rest-pause facility may be introduced

Ergonomic interventions were found deemed necessary to improve working conditions and decrease the level of exposure to health problems risks. This led to see the scope for modifying the existing knives keeping the contextual uses and designing protective measures to avoid the irritations caused by fruit extracts during the activities.

## Conclusion

Work related discomfort and pains are a major occupational health problem amongst the workers in industries. Controlling these problems by using ergonomics begins with identifying exposure to the known risk factors through an on-site assessment of the work being performed. The ergonomics problem-solving technique leads the user through the identification of ergonomic risk factors by body parts first. By generating multiple reasons, each risk is evaluated by asking why it is present. Strategies are generated to reduce the risk; specific short-term and long-term solutions are developed. The preferred solution may be the one that improves the ergonomics of the job and reduces the risk for injury substantially at a relatively low price.

The study concludes that work related risk factors in development of work related body pains can be reduced, even be avoided with ergonomic interventions. This can be achieved by identifying the risk factors in the activity and finding the proper solution with design intervention. For user friendly design, if participatory ergonomics approach is taken into consideration for design development process, the results become fruitful.

As a concluding statement, the present study set out to outline an ergonomic approach to harmonise work and working environment to raise productivity and work efficiency and promote individual well-being through optimising the effort of the worker or user. Further it can be concluded that Identification of ergonomic risk factors in occupational settings would help in developments of various contexts specific solutions. With ergonomic solutions work related stressors can be reduced.

## References

1. Kumar S (1998) *Advances in Occupational Ergonomics and Safety 1998: Proceedings of the International Conference - Advances in occupational ergonomics and safety*, IOS Press, USA.
2. Saraji JN, Hassanzadeh MA, Pourmahabadian M, Shahtaheri SJ (2004) Evaluation of musculoskeletal disorders risk factors among the crew of the Iranian ports and shipping organization's vessels. *Acta Med Iranica* 42: 350-354.
3. Bhattacharyya N, Baruah SC, Borah R, Bhagawati P (2005) Ergonomic assessment of postures assumed by workers in tea cultivation, *Proceedings of International conference on HWWE, IIT, Guwahati*.
4. Parimalam P, Kamamma N, Ganguli AK (2005) Musculoskeletal problems of small scale industrial workers in Madurai – A situational analysis, *Proceedings of HWWE*. 904-911.
5. Borah R, Bhuyan B, Kalita M (2005) Physiological stress of women engaged in handloom weaving: *Proceedings of HWWE*. 5: 61-80
6. Srivastava AK, Bihari V (2000) Occupational health for women: A current need. *J Sci Indian Res* 59: 995-1001.
7. Sen RN, Ganguli AK, Ray GG (1981) Ergonomics study of tea-leaf plucking operations: Criteria for section and categorization. *Applied Ergonomics* 12: 83-85.
8. Nag PK (1986) *Ergonomics: A conceptual and operational approach in agricultural development in Shankar G Production and marketing of farm equipment in India*. Ahmedabad: Indian Institute of Management.
9. *The Telegraph* (2011) Guwahati.
10. Chakrabarti D (1997) Indian anthropometric dimensions for ergonomic design practices, NID.
11. Chakrabarti D (2006) Product Ergonomics: a user oriented product development aspect, *Proc. Indo-US workshop on Design Engineering*, Allied Publishers limited, New Delhi. 157-167.
12. Li G, Buckle P (1998) User participation in the development of exposure assessment method- a think aloud approach, In: *PREMUS-ISEOH '98: Proceedings of the Third International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders*, Helsinki, Finland.
13. McAtamney L, Corlett EN (1993) RULA: a survey method for the investigation of work-related upper limb disorders, *Applied Ergonomics* 24: 674-695.
14. Najarkola, M (2005) Assessment of risk factors of upper extremity musculoskeletal disorders (UEMSDS) by OCRA Method in Repetitive Tasks, *Iranian J. of Public Health* 35: 68-74.