
Title : Ergonomic approach in designing work tool for manual tea leaf plucking

Author(s) : Nandita Bhattacharyya^a Debkumar Chakrabarti^b

Institution : Department of Family Resource Management^a, Assam Agricultural University, Jorhat, Assam, India; Department of Design^b, Indian Institute of Technology, Guwahati, Assam, India

Email : nbhatta2000@yahoo.com

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Introduction:

Joining of women in workforce is increasing in numbers day by day, especially in industries and service sectors. The sectors where women workers are the prime workforce include agriculture, agro based industry (tea, fruit processing, cottage industries, etc.) and services; making up about 42 per cent of the estimated global working population who also bear their homemaking responsibilities. Due to their low literacy level and lack of technical knowledge, mostly such women workers are engaged in occupations with repetitive, monotonous and low-paid work. They are therefore prone to suffer from work-related hazards. The exposure of women workers to these issues may affect them in one or more of three ways: health, performance, and comfort. Studies have shown that roughly, 1 out of 300 female is suffering from some occupation related health problems. Musculoskeletal disorders are one of the major problems among women workers in such industries (NIOSH, 1997; OSHA, 2000; Perimalam et.al, 2005). The causative factors of work related health problems are poor ergonomic design of work place, work accessories, poor working posture, repetitive work, frequent bending and twisting, load carrying and forceful movements. Individual factors like age, sex, muscle strength and physical fitness, lack of task variation and insufficient rest break contribute to work related health hazards. The women workers often suffer from work related body pains because neither the tasks nor the equipment they use, which are normally designed for men, are being adapted to women specific built and physiological limits. The ergonomics risks factors in an occupational set up while performing any activity can be tackled by developing safe, trust worthy work equipment and workplace design (Chakrabarti, 2009). Hence, to increase efficiency in work performances, importance should be given on the working conditions, design of the work accessories/machines and health of the workers. Work accessories/machines should be designed according to ergonomic principles. In practice, while attempting design development studying the risk factors in occupational setting in organized way would be the correct approach. The Tea Industry is one of the largest employers of women amongst agro-based corporate industries in India. The tea-leaf plucking activity (accounts for 40 per cent of the total cost of production of tea leaves) in tea plantation demands a high degree of physical effort because of repetitive hand movements and assuming static awkward posture, leading to early fatigue and work related health problems. 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.

Methodology:

Occupational health related issues were studied with relevant ergonomic techniques i.e., RULA and OCRA. For the field trial of the plucking device, 30 physically fit women tea pluckers without having any physical disability and chronic ailments were selected purposively from three tea gardens of Jorhat district of Assam.

Results:

The tea gardens of Assam do not feel appropriate to go for mechanisation and automation because of compromising quality harvest in comparison to hand plucked method; followed traditionally till today employing women pluckers. The hand plucking activities performed by workers are subjected to ergonomic risk factors i.e., awkward posture, force, and frequency of action along with inclement of environmental issues. Specifically in tea-leaf plucking operation, handling of low loads at high frequency (repetitive work) is required for the entire shift by the workers. Risk factors in repetitive work in tea-leaf plucking include the frequency of actions; the exposure duration; the postures and movement of body segments. Good ergonomic design of work accessories and proper organisation of work are basic requirements to avoid the adverse effects mentioned, the occupational stress. From the workers' interviews, the study identified a high prevalence of work related musculoskeletal disorders among the tea-leaf pluckers; more than 80% of the studied subjects met the criteria for



the condition; shoulder, back, neck and fingers were the most frequently affected body regions. Based on the observation on the task performing and opinion survey, it came to fore that ergonomic intervention in designing work accessories can be a way to reduce work related stress by assisting the plucking operation. Work accessories design development identified in priority is a cutting blade imbedded thimble type device to relieve ergonomic risk factor prevalent in the activity. From the field trials of the new plucking device it was revealed that use of work tools to assist plucking of tea leaves is beneficial. Results from grip strength test, pinch strength test, dexterity test and EMG studies confirmed that with design intervention work related stress in plucking operation can be reduced.

Conclusion:

The study concludes that work related risk factors in development of work related body pains can be reduced, even be avoided with consideration of ergonomic while designing work tools. 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.