

Significance of Ergonomically Designed Tools and Equipment in Drudgery Reduction among Farm Women: A Review

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Abstract

Farm women plays significant role in shaping the country's economy through their effective participation in agriculture. Agriculture sector employs highest number of women labor up to of 76% in India but their hard work has mostly been unpaid. Women contributes to the most back-breaking tasks in arduous fields of agriculture, horticulture, animal husbandry along with the domestic work, child rearing and taking care of elderly in family(if any). It has been estimated that all women irrespective of land status of family, provide 14 to 18 hours of productive physical labor in different chores. One of the major drudgery producing factors is the usage of un-ergonomic tools and equipments by farm women. Result of literature review suggests that the tools and equipment which are ergonomically designed taking care of Indian women's anthropometric measurements and its usage results in decline of drudgery by minimizing energy expenditure, physiological fatigue and contributing in betterment of health, safety and productivity.

Keywords: drudgery reduction, anthropometry, ergonomically designed tools, farm women

Introduction

Although, GREEN REVOLUTION has given our country self-sufficiency in agriculture sector however its benefits have not been reached to the agricultural labourers specially the women,

who in spite of being the backbone of agricultural workforce worldwide, are still unpaid for their hard work. In India the agricultural sector is the largest employer of women. According to official statistics (National Sample Survey [NSS] of 2004-05), women make up 32 per cent of the total workforce in the Indian economy. Majority of the female workforce (84 percent) works in rural India. A very large share (73 percent) of this female workforce toils in the agricultural sector (self-employed) approximately 103 million in number, of which mostly (96 per cent) are in rural areas. 55 per cent of female agricultural workers are casual labour, reflecting their poorer land holding status (27.5 per cent). Farm women found working for 14-18 hours while in lean period it came down to 14-16 hours. Reportedly more than 50 per cent of all female agricultural workers are unpaid family workers and rest receive wages below statutory minimum with widening gender gap in wages in the last decade

particularly for tasks which are specialized by women probably due to the illiteracy of overwhelming majority (70 per cent) with only 4 per cent having at least secondary school qualifications. Further, farm women were found taking rest from 1-3 months during carrying stage before the delivery of their children whereas 14% had delivered their children without availing any rest. Women are found active in all operations and activities in agriculture and allied sectors but are concentrated in cultivation and livestock, along with their contribution to household survival and food security. However it has been divulged that they work under severe limitations due to their subordinate position in society and the market.

Ergonomics and its significance in Agriculture

Ergonomics is the scientific discipline understanding the interactions among human and other elements within the system and is concerned with the solutions of designing work system for optimization of overall system

performance.. The term Ergonomics is coined from the Greek words "ergon" meaning work and "nomos" meaning natural law. Wojciech Jastrzêbowski

used the word Ergonomics in 1857 in a philosophical narrative, “based upon the truths drawn from the Science of Nature” The International Ergonomics Association (IEA) defines Ergonomics (or human factors) as the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance, where the two terms “human factors” and “ergonomics” are essentially synonymous. Moreover, International Labour Organisation (ILO) defines Ergonomics as, ‘the application of human biological sciences, its conjunction with engineering sciences to the workers and his/her working environment to obtain maximum satisfaction and enhance productivity. It’s a study of man at work and environment. It is basically a man, machine and environment system focusing on fitting the job to the worker. Incorporation of ergonomics in product development can resolve numerous problems and will improve the work standard among farm women. Anthropometry and its implication in agriculture Anthropometry is a science concerned with comparative measurements of the human body and its parts as well as the variables which impact these measurements. Anthropometric data consists of measurements of human figures. This data is used in application of ergonomics in order to ensure that designs and standards are fit for human body. Anthropometry, when applied to agriculture, is used to study interaction of farmers with tasks, tools, equipment, vehicles, and personal protective equipment — intended to determine the degree of protection with enhanced health, productivity and minimized drudgery. For efficient use of agricultural tools and equipment, good knowledge and appropriate design of agricultural machinery is required, with special consideration to efficiency, safety and comfort of its users. Anthropometric dimensions are one of the major factors to consider while designing tools and equipment. The design and dimensions of agricultural tools and implements have a great bearing on the body dimensions and physical built of the users, requiring compatibility essentially between machine devices and worker body dimension (which varies with age, sex, ethnic groups). Hence, it is required to collect anthropometric data of different regions of the country through extensive surveys for designing appropriate

farm equipment and tools (Dixit et al. 2014). Researches states that anthropometric data surveys carried out in India were limited to the male agricultural workers only (Dewangana et. al 2008). Due to dearth of female anthropometric data, male anthropometric data was often used for women at work wherever necessary, assuming that it would also benefit female workers. Inappropriate anthropometry would aggravate occupational risk factors in agriculture such as static positioning, forward bending, heavy lifting, kneeling and prolonged contact of vibratory equipment, which result in musculoskeletal disorders such as disorders of the back and neck, nerve entrapment syndromes, tenosynovitis, tendonitis, peri-tendonitis, epicondylitis and non-specific muscle and forearm tenderness (Singh and Arora 2010). Inappropriate design and excessive use of hand tools were found associated with prevalence of both acute and sub-acute cumulative trauma of hand, wrist and fore arm among farm women (Oberoi et. al 2006). It was only in recent past, when some steps have been taken towards women anthropometry. (Singh et al 2016). It has been observed that collected women anthropometric data from north eastern hill states of India, were found to be lesser than of eight other countries namely, America, British, China, Egypt, Japan, Korea, Mexico and Taiwan. Collected data was intended to be used for design//modification of agricultural hand tools/ implements/machinery, for drudgery reduction and at the same time increase efficiency, safety and comfort of operators in hill agriculture (Dewangana et. al 2008). Impact of ergonomically designed Tools and equipment in drudgery Reduction Drudgery is conceived as physical and mental strain, agony, monotony and hardship experienced by human beings (Momin 2009). However, women report more fatigue than men (Nelson and Burke 2002). So, the plight of the Indian farm woman in this regard is alarming as they work for long hours without leisure, perform multiple roles in family and continue to be constrained by illiteracy, malnutrition and unemployment (Samanta, 1995). This fatigue concerns mental and physical fatigue, sleepiness, feeling tired or emotional exhaustion (Bakker et al. 2002). Almost all farmwomen suffer from physical drudgery in various operations. Drudgery load on farm women can be described under various factors such as Physical Load, Postural Load, Repetitive Strain Load, Time Load and Musculoskeletal Disorder Load. Designing equipment and tools with

respect to an individual sex (male or female), is likely to be inaccurate due to obvious anthropometric, physiological and biomechanical differences. For comfortable usage of tools, improved work efficiency and to minimize risk of musculoskeletal injuries, it has been advised to design/modify hand tools and equipment with reference to the standard anthropometric dimensions of concerned operator, i.e. women (Singh et. al 2009, Singh and Arora 2010, Kaur and Sharma 2011, Vyas and Laxmi. 2013). Researchers of ICAR institutes took an initiative towards introducing various time and energy saving tools, which resulted in reduced drudgery (Sharma et. al 2015). A study focused upon inquiring adoption level of women friendly improved equipment and farm tools. Based on ergonomic studies, 20 hand operated improved farm tools and equipment viz. hand ridger, seed treatment drum, CIAE fertilizer broadcaster, CIAE seed drill, PAU seed drill, Naveen dibbler, TNAU four row paddy drum seeder, CRRRI two row and four row rice transplanters, twin wheel hoe, conoweeder, improved sickle, groundnut stripper, groundnut decorticator (sitting and standing type), tubular maize sheller, rotary maize sheller, cotton stalk puller (wheel type), OUAT pedal operated paddy thresher, CRRRI paddy winnower and CIAE hanging type grain cleaner with sack holder were found suitable for farm women to perform various farm operations. Thus, these tools and equipment have potential for commercialization so that same may be provided to farm women for increasing efficiency and reducing drudgery (Singh et. al 2009). Tools and equipment, designed with an intention to reducing drudgery, namely hand ridger, groundnut decorticator, improved sickle and tubular maize sheller were introduced among two different groups of farm women in post-harvest handling and processing on usage. These tools and equipment were found effective in reducing drudgery and increasing efficiency and work output among women agricultural workers (Singh et al 2016). Similarly, technically prepared serrated sickle, mechanized cotton picking activity, fodder collector when tested on farm women to improve work efficiency and to reduce the drudgery of women, resulting in increased work efficiency (Kaur and Sharma 2011, Momin 2009). Muscular stress of selected drudgery prone activities (weeding, harvesting, milking of animals, cleaning animal shed, mud plastering

of house etc.) was evaluated using traditional and improved tools for farm women. Improved tools resulted in enhanced work posture, working efficiency, health with reduced muscular stress (Oberoi et. al 2006). A comparative assessment of traditional tools (i.e. khurpi and hoe) and improved garden tools (i.e. garden rack, circular blade weeder and hand fork) was done on the basis of economic viability and physiological workload of women. Acceptability of improved tools among farm women was higher than of traditional tools as improved garden tools resulted in less labour cost, less energy expenditure and reduction in physiological fatigue (Sharma et. al 2015). Hand operated maize dehusker-sheller was ergonomically evaluated to assess the physiological workload and its performance in standing and sitting postures and it was found that ergonomic designed equipment reduced physiological and economic costs. (Singh et.al 2007). However along with improvised tools for harvesting activities training regarding the same was also imparted. It was concluded that women involved in harvesting operations were willing to purchase improved tools which are useful in improving efficiency and reducing drudgery (Vyas and Laxmi. 2013).

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