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Ergonomic assessment of drudgery of women worker involved in cashew nut processing factory in Meghalaya, India

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Abstract

In Meghalaya, a state of North East India, where cashew nut cultivation and processing is an important new area in case of agro-industrial development. The labour intensive processes are breaking (shelling) and peeling of brown skin where women worker are involved. This study was envisaged to know the drudgery in terms of physiological responses, work related musculoskeletal problem and relationship between demographic factors and health risk factors of women worker. Forty women workers were selected randomly from the cashew nut processing factory whose on an average BMI was 19.44 with mesomorphic type of body. The work in cashew nut factory was moderately heavy and the cardiovascular stress index was 23.82 with 8.85 kJ/min energy expenditure. Musculoskeletal disorder was reported and high level investigation and changes are required soon.

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Keywords: BMI; Perceived exertion; Musculoskeletal problem; Drudgery Index; Grip strength; Back strength; Postural deviation

1. Introduction

Meghalaya is one of the eight states of North East India where cashew nut (*Anacardium Occidental L.*) cultivation and processing is an important new area and gaining momentum in case of agro-industrial development. Cashew nut, often referred to as “wonder nut” is one of the most valuable processed nuts traded on the global commodity markets and is also an important cash crop [1]. In the world scenario, India occupies a premier position contributing about 43% of the cashew nut production. Indian cashew exports are inching closer to a new peak of Rs. 4,5000 crore in the current fiscal [2]. In Meghalaya particularly western part due to sandy loam, heavy rainfall along with natural well drained provision as because of hilly terrain, cultivation of cashew nut is a most suitable cash crop.

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Along with cultivation, cashew nut processing industries are also mushrooming in this area for processing raw cashew nut. The raw cashew has a very acid content (caustic oil) which can burn the skin and produce noxious fumes when heated and therefore it required an elaborate process of sun drying, roasting, shelling, heating and peeling off brown layer (testa) to make it suitable for consumption [3]. As industries develops both in size and complexity, occupational health posses new and more difficult problems in developing countries. In cashew nut factory, the labor intensive processes are shelling and peeling off brown layer where women are majority of workers in Meghalaya. Factory women perform extremely tedious, time and labour intensive work for more than nine hours resulting in fatigue and drudgery. All the time unnatural squatting posture on a fourfold gunny bag is adopted by the women labour while performing these activities. Postural stress can increase the physiological cost and fatigue during any task and may lead to injuries to vertebral column in long run [4]. Due to the adoption of long static sitting posture on the ground, they always suffer from paraesthesia in legs which may lead to many nerve and musculoskeletal problems. Musculoskeletal disorders (MSDs) can affect the body's muscles, joints, tendons, ligaments and nerves. Most work-related MSDs develop over time and are caused either by the work itself or by the worker's working environment. Typically, MSDs affect the back, neck, shoulders and upper limbs, but sometimes it may also affect lower limbs. Therefore, there was a great need of ergonomic assessment of drudgery of women worker, so that some suitable techniques/technologies can be developed to reduce drudgery of women worker of cashew nut factory.

2. Material and methods

Forty women labour of age group of 20-50 years who were involved in shelling and peeling activity of cashew nut factory were selected purposively for the study. The subjects who had body temperature not above 99° F, blood pressure $120/80 \pm 10$, and heart rate 70-90 bpm were selected for the experiments. In order to collect the reliable experimental data, the selected subjects were given enough rest before putting them on selected tasks. Extreme summer months (June to August) were selected for conducting the experiment as it is also the season of cashew nut processing.

2.1. Methods of measuring the physiological parameters

Heart rate (beats/min) was measured with the help of polar heart rate monitor and recorded at rest, during the entire period of work and recovery thereafter for a period of 5 minutes. Energy expenditure was estimated from average heart rate during rest and during work by using following formula proposed for Indian housewives [5]:

$$\text{Energy Expenditure (kj/min)} = 0.159 \times \text{Average heart rate (beats/min)} - 8.72 \quad (1)$$

Physiological workload was classified on the basis of working heart rate [5]. Total cardiac cost of work (TCCW) and physiological cost of work (PCW) were determined in this study by using average heart rate during rest and work, recovery heart rate and duration of work and recovery through the following formulas:

$$\text{Total cardiac cost of work (TCCW)} = \text{Cardiac cost of work (CCW)} + \text{Cardiac cost of recovery (CCR)} \quad (2)$$

Where, $\text{CCW} = \text{AHR} \times \text{Duration of work}$

$$\text{AHR} = (\text{Average working heart rate} - \text{Average resting heart rate}) \quad (3)$$

$$\text{CCR} = (\text{Avg. recovery heart rate} - \text{Avg. resting heart rate}) \times \text{Duration of recovery} \quad (4)$$

$$\text{Physiological Cost of work} = (\text{Total Cardiac Cost of Work}) / (\text{Total Time of Work}) \quad (5)$$

Cardiovascular Stress Index (CSI) was determined by using following formula [6].

$$\text{CSI} = (100(\text{Heart rate during work} - \text{Heart rate during rest})) / (\text{Heart rate maximum} - \text{Heart rate at rest}) \quad (6)$$

Where, $\text{Heart rate maximum} = 220 - \text{Age (years)}$

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