Original Research Article

MANUAL SHELLING OF PRECONDITIONED CASHEW NUT USING HANDTOOL AND ITS IMPACTON OCCUPATIONAL HEALTH OF WORKERS

Abstract

Indian is the second-leading country in production of cashew nut. Cashew nut are roasted or steamed before shelling. The purpose of this study was to compare the cutting strength of cashew nut shells influenced by roasting and steaming. The impact of manual shelling of cashew nut on occupational health of workers was also assessed by using ergonomic tools. The study was conducted in cashew nut processing industries situated in Selsella and Mankachar blocks of Meghalaya and Assam. The moisture content, colour, and hardness of cashew nut shell were measured. The processing of cashew nut influenced the cutting strength of cashew nut significantly. Steamed cashew nut shell was stronger than the roasted cashew nut shell. Hence, manually shelling of steamed cashew nut shell required more force compared to with that of roasted cashew nut shell. Ergonomic parameters like working Heart Rate, energy expenditure, rated perceived exertion, hand grip measurements, RULA and REBA analysis were used to assess occupational health of workers. The results of the study showed that the workers of cashew nut industries were exposed to high occupational health and safety risk due to poor working environment, awkward working posture, repetitive and tedious job.

Key words: Cutting strength of cashew Nut, Musculoskeletal Disorder, Occupational Health, Rapid Upper Limb Assessment, Rapid Entire Body Assessment

1. Introduction

Cashew nut (*Anacardiumoccidentale*) is native plant of Brazil. It was introduced in Indian by Portuguese travelers as a measure to prevent erosion in coastal areas and later on spread in the other parts of India. Cashew nut is grown in Karnataka, Goa, Maharashtra, Tamil Nadu, Andhra Pradesh, Orissa, Meghalaya and West Bengal (Smith et al., 1992, Kumar et al. 2012). Agro climatic condition of Meghalaya: sandy loam soil, heavy rainfall along with hilly topography is very favourable for growing cashew nut (Borah& Kumar, 2022). Some parts of Assam, and Tripuraalso grow cashew nut apart from Meghalayain the North East region of india.

It is a popular cash crop embedded with lots of nutritive value. The shell of cashew nut is very strong and cashew nut kernel is soft, which is one of the main factors for breakage of cashew nut kernel during shelling. Cashew nut kernels are graded based on size, shape and colour. It is desirable to keep breakage percentage as minimum as possible. Hence, processing of cashew nut is quite challenging and difficult. Cashew nut either roasted or steamed before shelling of cashew nut. Roasting of nuts makes the shell brittle and loosens the kernel from the shell.Roasting or steaming of cashew nut shell help in reducing the cutting strength of shell that further help in shelling/

decortication of nut and also provide other benefits in terms of by-products (Kahyaoglu and kaya, 2006; Shakerardekani et al., 2011).

Cashew kernels are obtained through processing (roasting / steaming, shelling and peeling) of raw cashew nuts. Cashew nut processing units may be organized or unorganized. About 46 % of cashew processing units are in the organized sector while 54 % is in the unorganized sector. Cashew nut industry provides employment to rural people and about 95 % of them are women(Anon, 2009) because most of the cashew nut processing units are situated in rural area.For different unit operations involved in cashew nut processing, equipment or humans or both are being used. Machines are used for roasting, shell liquid extraction. However, shelling and peeling of cashew nut may involve machine or labours.

Manual processing of cashew nut is very tedious involving monotonous repetitive work. In the cashew nut processing industries of Meghalaya and Assam, women are mainly involved in cashew nut shelling and peeling of brown testa. Women work for whole day for shelling and peeling of cashew nut that might have results in severe musculoskeletal problems and drudgery (Mallampalli et al., 2021). The long static posture of the worker demands high physiological cost and low productivity. Workers might have experienced health issue in long run like many neuro and musculoskeletal problems in the muscles, joints, tendons, ligaments, nerves, and eventually cause back pain, knee pain, arthritis, cervical pain, joint pain, etc (Borah et al., 2019; Mallampalli et al., 2021).

The objectives of present work was to measure the change in colour, moisture content, cutting strength of cashew nut after processing (roasting and steaming) and to assess the impact manual shelling and peeling on occupational health of workers involved in cashew nut industry.

2. Materials and methods

2.1 Measurement of cashew nut parameters

2.1.1Collection of cashew nut sample

The samples of steamed cashew nut and roasted cashew nut were collected from the industries operating in Selsella and Mankachar block of Meghalaya and Assam. The samples were stored in plastic pouch for further analysis. Colour, moisture content and hardness of cashew nuts and shell of cashew nuts were measured using instruments.

2.1.2Measurement of moisture content of cashew nut

Moisture content of cashew nut and cashew nut shell were measured by heating the samples in hot air oven at 105 ± 1 °C for 24 hours.

2.1.3 Measurement of colour of cashew nut

A tristimulus colorimeter (Chroma Meter CR – 400, Konica Minolta, japan) was used to measure and compare the colour (L, a, b) of cashew nut samples. The instrument was calibrated with white and black tiles before measurement of the colour of cashew nut.

2.1.4 Measurement of strength of cashew nut

The amount of force required for cashew nut shelling was measured with the help of texture analyzer (Model TA-XT plus). The probe, HDP/BSK blade set with knife, and heavy duty platform were used to measure force required to cut cashew nut shell. The knife edge of the probe was attached to the load cell carrier of texture analyzer and lowered into the slotted insert. The heavy duty platform was repositioned so that there should not be any contact between the blade and slot surface. A blank test was conducted to check for any contact force between blade and slot. Cashew nut shell was kept on slotted portion of heavy duty platform and the probe was allowed to move downward at test speed of 2 mm/s and strain of 20 % was applied on cashew nut. The force required to break/cut cashew nut shell was plotted with the distance.

2.2Assessment of occupational health related parameters of workers

2.2.1 Sample size

Four cashew nut processing industries, two each from Selsella and Mankachar block of Meghalaya and Assam, respectively were selected purposively. A group of 10 female workers from each industry were selected randomly as sample for this study. The physiological parameters of the selected worker, for example, body temperature was 99˚F, blood pressure and heart rate were within the normal range of 120/80±10 and 70-90 bpm, respectively. Thus, total 40 workers were randomly selected for the occupational health related study.

2.2.2 Energy expenditure

Through the estimation of energy expenditure through oxygen consumption during work is accurate and reliable, it has certain disadvantages particularly while using field situation, because of involvement of complicated and time-consuming procedure and requirement of elaborate laboratory facilities. Hence, this method was not used in the present study. Here energy expenditure was estimated from average heart rate during rest and during work by using following formula proposed by (Varghese et al. 1994) for Indian housewives:

Energy Expenditure (kj/ min) = 0.159 x Average Heart Rate (beats/ min) – 8.72

Cardiovascular Stress Index

Cardiovascular Stress Index (CSI) was determined by using following formula given by Trites et al. 1993:

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

Where, Heart rate maximum = 220 – Age (years)

2.2.3 Rated Perceived Exertion

Through the heart rate is widely used to estimate occupational workload, it is often difficult to measure it in the tasks of very short duration. To obviate this difficulty, work scientists recommended the use of another simple

method of providing equally reliable information for the assessment of workload i.e. subjective perception of exertion and came out with a scale known as "rating of perceived exertion (RPE)", based on extensive research (Brog 1982, Vergheset *al*. 1994). This scale has now been accepted as a practical method for rapid appraisal of all occupational work. In this study a modified 5- point scale of perceived exertion developed by Vargheset *al*.(1994) was used which is reported as: Very high (1); Light (2); Moderately heavy (3); Heavy (4); Very heavy (5)

2.2.4 Assessment of Musculoskeletal Problems

The musculoskeletal problems were assessed by the means of Postural Deviation, Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA), Discomfort Survey, Hand Grip, and Quick Exposure Checklist. The postural deviation, RULA, Discomfort survey of the respondents were assessed in "Ergomaster" software.

Rapid Upper Limb Assessment (RULA) is an inspection method developed by McAtamney and Corlett in 1993 which is used in rapid ergonomic investigations of the exposure of workers to ergonomic risk factors associated with upper limb musculoskeletal disorders during work. Musculoskeletal workload on the entire upper body with special attention to the neck, upper limbs and trunk can be examined by RULA method. An action level is formed by a "Final Score" produced by the method. The action level specified the level of intervention essential to decrease the risk of injury of the worker due to the current task. RULA method was formed to distinguish risky working posture to conduct improvement (Ansari &Seikh, 2014; Yusuf et al. 2016). In the present study the Rapid Upper Limb Assessment (RULA) was done in "Ergomaster" software. The action level of RULA described as :Acceptable (1 or 2); Investigate Further (3 or 4); Investigate Further and Change Soon (5 or 6); Investigate and Change Immediately (7).

Rapid Entire Body Assessment (REBA) was developed by Hignett and McAtamney as a means to assess entire body posture for risk of Work Related Musculoskeletal Disorders.The REBA assessment tool provides an action level based on the calculated final score. The action level of REBA described as: Negligible risk (1); Low risk, Change may be needed (2 ot 3); Medium risk, Further investigate, Change soon (4 to 7); High risk, Investigate and implement change (8 to10); Very high risk. Implement change (11+)

The grip strength was measured with the help of grip dynamometer. It consists of a handle for handgrip connected with a spring to a pointer on the marked dial. The subject was asked to pull the handle separately with right and left hand before and after the work and the reading given on the dial in kg was recorded for both the hands.The percent reduction in grip muscular strength (muscle fatigue) was calculated from the following formula:

$$\text{Percent reduction in grip muscular strength} = \frac{Sr - Sw}{Sr} \times 100$$

Where, S_r = Strength of muscles during rest (kgs); S_w= Strength of muscles during work (kgs)

3 Results and discussions

3.1 Moisture content of cashew nut and its shell

Mean values of the measured moisture content of cashew nut and cashew nut shell are given in Table 1. Statistical analysis showed that the moisture content of roasted cashew nut and steamed cashew nut were not significantly different at $\alpha = 0.05$. However, moisture content of raw cashew nut was statically different ($\alpha = 0.05$) from roasted and streamed cashew nut. The difference in the value of moisture content of raw cashew nut with that of roasted and streamed cashew nut was due to processing treatment given to raw cashew nut. Similarly, moisture content of roasted cashew nut shell and steamed cashew nut shell was not statistically different. However, moisture content of raw cashew nut shell was statically different ($\alpha = 0.05$) from roasted and streamed cashew nut shell.

Table 1: Moisture content of cashew nut shell and cashew nut

	Raw cashew nut	Roasted cashew nut	Steamed cashew nut	Raw cashew nut shell	Roasted cashew nut shell	Steamed cashew nut shell
Moisture content (% db)	18.22 ± 2.1 %	12.13 ± 0.63	12.68 ± 0.54	11.45 ± 2.11 %	9.26 ± 2.3 %	8.56 ± 2.4 %

3.2 Colour of cashew nut and its shell

Colour of cashew nut and cashew nut shell was influenced by the processing conditions like roasting or steaming method of processing. Whole cashew nuts used in this study are shown in Figure 1. Cashew nut shell collected after shelling of various types of cashew nut (raw, steamed and roasted cashew nut) is given in Figure 2. Mean values of the measured colour parameters of cashew nut samples are listed in Table 2. Comparison of hue angle of roasted cashew nut shell and steamed cashew nuts shell indicated that the roasted cashew nut shell was blackish and the steamed cashew nut shell was brownish. Surface of shell of raw cashew nut burnt due to high temperature roasting of nuts. Colour of raw cashew nut shell and steamed cashew nut shell was not statistically different ($\alpha = 0.05$). However, colour of raw cashew nut shell and roasted cashew nut shell was statistically different ($\alpha = 0.05$).

Processed cashew nuts used in this study are shown in Figure 3. Comparison of hue angle of roasted and steamed cashew nuts indicated that the roasted cashew nut was less yellowish that the steamed cashew nut. The different colour in roasted and steamed cashew nut was developed due to roasting/ steaming and further drying of cashew nut.

Table 2: Colour of cashew nut shell

Samples	Colour attributes (L^*)	Colour attributes (a^*)	Colour attributes (b^*)
Raw cashew nut shell	37.41± 3.54	3.5± 1.12	9.7± 2.92

Roasted cashew nut shell	28.5± 2.75	0.66± 0.92	-2.9± 1.23
Steamed cashew nut shell	32.76± 2.29	4.79± 1.28	3.59± 2.09
Roasted cashew nut	64.92 ± 2.99	2.57 ± 0.30	21.12 ± 2.12
Steamed cashew nut	70.15 ± 4.58	1.77 ± 0.08	21.74 ± 2.52

Figure 1: whole cashew nut

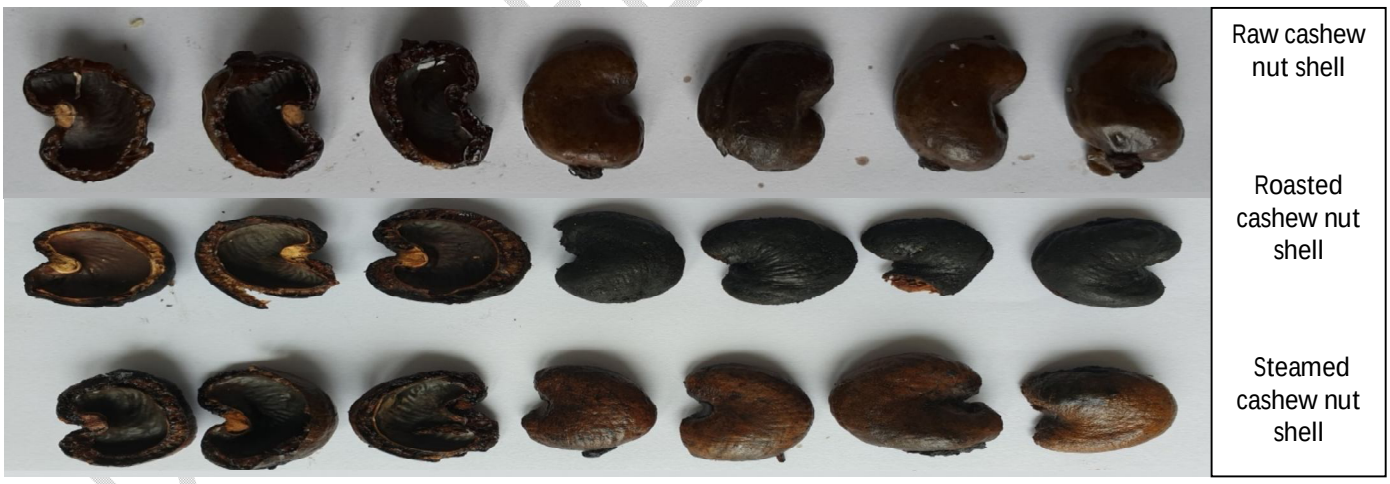


Figure 2: Cashew nut shell only

(a) Roasted cashew nut (b) Steamed cashew nut

Figure 3: Processed cashew nut ready for packaging

3.3 Cutting strength of cashew nut and its shell

The Figure 4 shows the cutting strength of raw cashew nut shell, roasted cashew nut shell and steamed cashew nut shell,which were measured using the texture analyzer. Raw cashew nut shell was hard with 36.4± 5.8 kg cutting strength when compared with roasted and steamed cashew nut shells. Roasting and steaming reduced the cutting strength of cashew nut shell. The mean values of cutting strength of roasted and steamed cashew nut shells were 25.3 ± 5.9 kg and 30.8 ± 7.0 kg, respectively.Statistical analysis of data showed that the hardness of raw cashew nut shell, roasted cashew nut shell and steamed cashew nut shell were significantly different at 0.05 level of significant. Hence, processing steps like roasting and streaming of cashew nut influenced the cutting strength of cashew nut significantly. Steamed cashew nut shell was stronger than the roasted cashew nut shell. Hence, manually shelling of steamed cashew nut shell required more force compared to with that of roasted cashew nut shell. Ogunsina and Bamgboye, 2013 also has reported that fracture strength of roasted and steamed cashew nut shell depended on roasting and steaming, respectively. The mean values of hardness of roasted cashew nut kernel and steamed cashew nut kernel were 2.3 ± 0.56 and 2.1 ± 0.54, respectively. Statistical analysis of data showed that the hardness of roasted cashew nut kernel and steamed cashew nut kernel were not significantly different at 0.05 level of significant. Hence, processing steps like roasting and streaming of cashew nut did not influenced the hardness of cashew nut kernel but influenced the cutting strength of cashew nut shells.The shelling of cashew nutswas challenging and difficult because shell was very hard and kernel was very soft. Hence, manual shelling of cashew nut is still being used in many cashew nut processing units.

Table 3: Cutting strength of cashew nut shell

	Raw cashew nut whole	Roasted cashew nut whole	Steamed cashew nut whole	Raw cashew nut shell	Roasted cashew nut shell	Steamed cashew nut shell	Roasted Cashew nut kernel	Steamed Cashew nut kernel
Cutting strength (kg)	36.4± 5.8	25.3 ± 5.9	30.8 ± 7.0	60.2 ± 2.4	18.6 ± 4.8	29.2 ± 10.5	2.3 ± 0.56	2.1±0.54

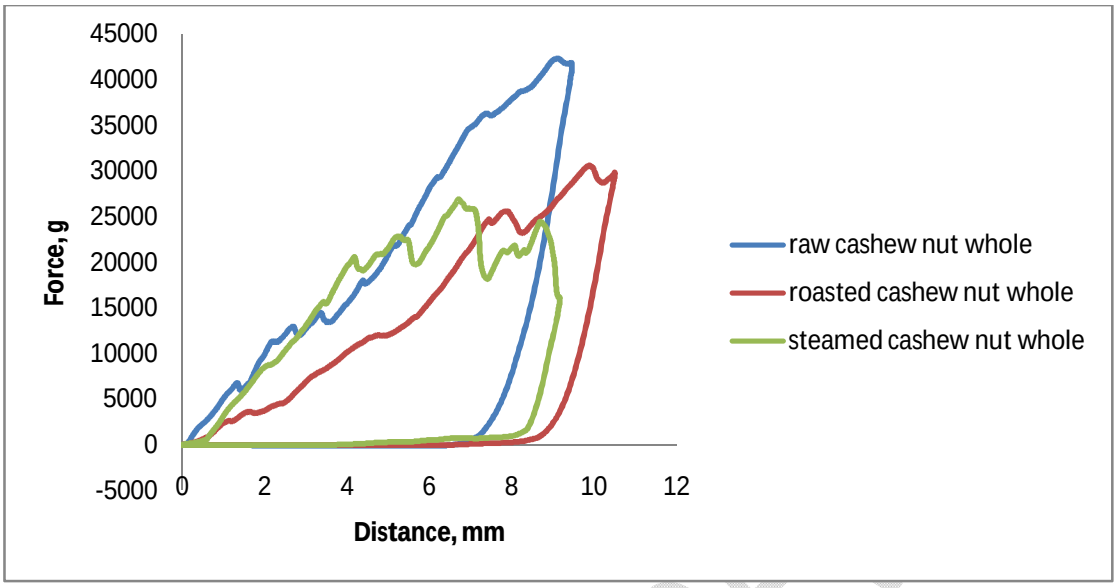


Figure 4: Force required cutting shell of whole cashew nut

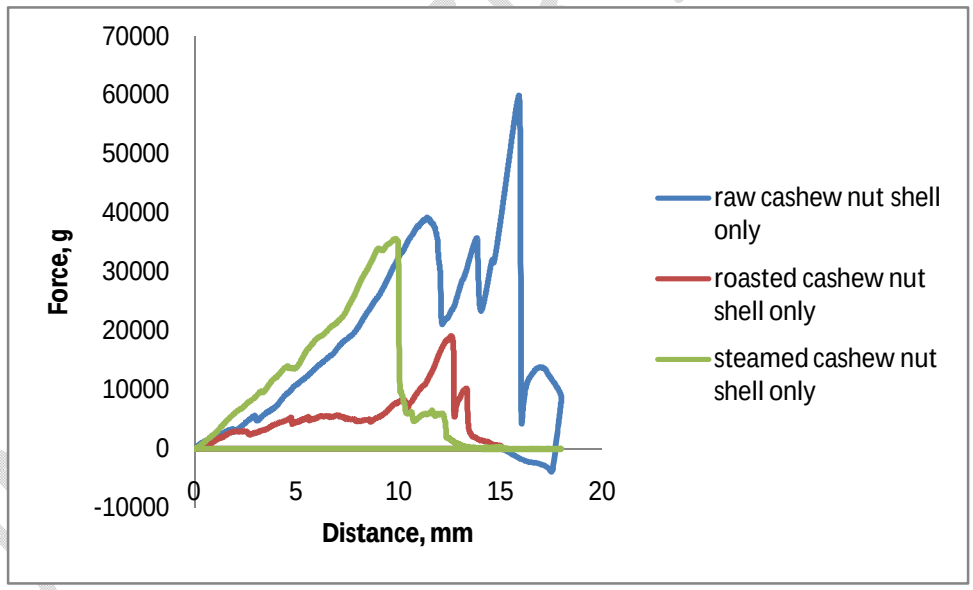
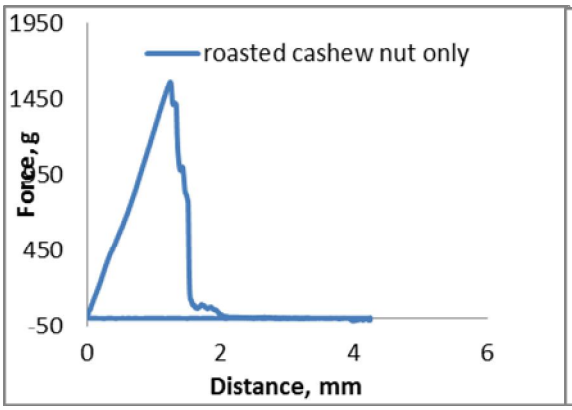


Figure 5: Force required cutting cashew shell only



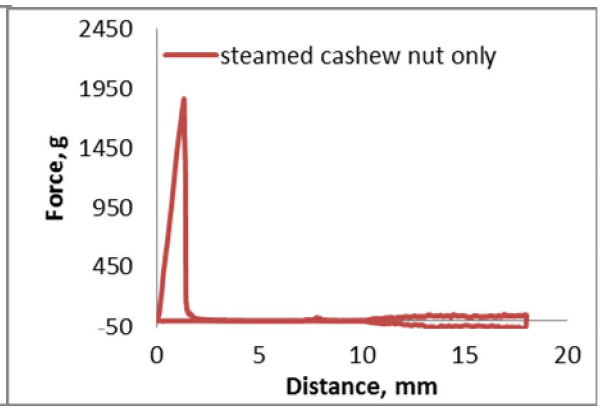


Figure 6: force required to break cashew nut only

3.4 MEASUREMENT OF ERGONOMIC PARAMETERS

3.4.1. Working Heart Rate, Energy Expenditure and Classification of Workload of the Activity of Cashew Nut Shelling

It was found that average heart rate and average peak heart rate were 112 bpm and 118.2 bpm respectively in correspondence with energy expenditure and peak energy expenditure which were 9.07 kj/ min and 10.73 kj/min, respectively. The workload for the shelling activity for Mankachar workers was found to be moderately heavy.

Likewise, in case of cashew nut shelling workers of Selsella, it was found that the average heart rate, average peak heart rate, energy expenditure and peak energy expenditure were 110.1 bpm, 119.1, 8.79, and 10.11 respectively (Table 4).

Table 4: Working Heart Rate, Energy Expenditure and Classification of Workload of women worker involved in shelling activity

	Industry	Av. Heart Rate (BPM)	Av. Peak Heart Rate	Energy Expenditure	Peak Energy Expenditure	Classification Of workload
Mankachar	Industry 1 (n=10)	112.8	119.5	9.21	10.28	Moderately heavy
	Industry 2 (n=10)	111.1	116.9	8.94	9.86	Moderately heavy
	Total N=20	112	118.2	9.07	10.73	Moderately heavy
Phulbari	Industry 1 (n=10)	110.3	120	8.82	10.36	Moderately heavy
	Industry 2 (n=10)	109.9	118.2	8.76	10.07	Moderately heavy
	Total N=20	110.1	119.1	8.79	10.22	Moderately heavy

Cardiovascular Stress Index was evaluated by measuring heart rate during work, heart rate during rest and heart rate maximum. The resulting heart rate of the women workers was measured by Polar Heart Rate Monitor at

an interval of one minute for five minutes before joining the work. The working heart rate was determined in different hours of work.

The Cardiovascular Stress Index of women workers of Mankachar and Phulbari performing shelling and peeling task in Cashew Nut Industry are presented on Table 5. From the extracted data it was found that the Cardiovascular Stress Index of women worker involved in shelling and peeling tasks was 25.23 and 24.97 respectively .It was observed that the stress was higher in cashew nut industry worker than that of the car assembly workers (Goldsmith et al, 1978) and a little lower than steel workers (Vitalis et al. 1994). Such variation of the Cardiovascular Stress Index among group of workers of different industries might be due to difference in the degree of severity of job and environmental conditions and also duration of activity (Dey et al., 2007). The cashew nut industry workers had to work for 10 hours and sometimes more than that in extreme summer (May-August) with no proper ventilation system. The environmental heat may be one of the reasons for increased cardiovascular stress.

Table 5: Cardiovascular Stress Index (CSI) of Subjects involved in shelling activity

Activity	Mankachar	Phulbari	Total
Shelling (n=40)	25.95	24.50	25.23
Peeling (n=40)	25.21	24.73	24.97
Total (N=80)	25.58	24.61	25.10

While performing an activity, individual often complains of tiredness or fatigue which is merely a subjective feeling provides reliable information for the assessment of workload (Borg G 1982). Therefore, this part of the study aims to study the level of perceived exertion by the workers involved in cashew nut shelling and peeling activity to recognize the adverse effect of that work on health and well-being of the workers. It was measured by assembling the response of the workers regarding the amount of force needed to accomplish the selected activities on a 5-point rating scale which was developed by Varghese et al. (1994), rated as Very Heavy, Heavy, Moderately Heavy, Light, and Very Light.

Rated perceived exertion for shelling and peeling task in cashew nut industries was recorded and presented in the Table. 6. It was observed that the average score of rated perceived exertion for shelling and peeling activity was 3.85 and 3.78 respectively which define the both activities as moderately heavy to heavy.

Table 6: Perceived Exertion of subjects involved in shelling and peeling activity of Cashew nut industry

Perceived exertion	Mankachar (n=20)		Phulbari (n=20)		Total (N=40)	
	Average	S. D	Average	S. D	Average	S. D
Shelling	4	0.76	3.70	0.80	3.85	0.78
Peeling	3.85	0.75	3.70	0.80	3.78	0.78
Average	3.93	0.76	3.70	0.80	3.82	0.78

Rating: 5- Very Heavy; 4- Heavy; 3- Moderately Heavy; 2- Light; 1- Very Light

3.4.2 Assessment of Musculoskeletal Risk in Shelling Activity by RULA method

The incident of prevailing postural of deviation of shelling activity was observed in "Ergo Master" and the final RULA score of the task was 6. The action level of the score suggest to do some further investigation about the case and to change the work design as soon as possible (Table 7). The force/ load and awkward working posture of head, arm, shoulder, wrist, trunk, neck, legs etc. may be the reason of the higher risk associated with the task (Yusef et al. 2016).

Table 7: Musculoskeletal Risk in Shelling Activity by RULA method activity

No.	Step	Remarks	Score
1	Upper arm position	15º- 45º	3
		Upper Arm is Abducted	
2	Lower arm position	90° or less	2
		Arm is working across midline of body	
3	Wrist position	15º or grater	4
		Wrist is bent from the Midline	
4	Wrist twist	Wrist is twisted in mid- range	1
5	**Calculate UE Posture Score**		**5**
6	UE Muscle Use Score	Action repeatedly occurs 4 times or more per minute.	1
7	UE Force/Load Score	Load is less than 2 kg (intermittent)	0
8	**Calculate Final Wrist and Arm Score**		**6**
9	Neck position	Flexed 20° or more	3
10	Trunk position	Flexed 20° to 60°	3
11	Leg position	Legs and feet supported and balanced	1
12	**Calculate Trunk Posture Score**		**1**
13	Trunk Muscle Use Score	Action repeatedly occurs 4 times or more per minute	1
14	Trunk Force/Load Score		0
15	**Calculate Final Neck, Trunk & Leg Score**		**5**
Final RULA Score			**6**

3.4.3 Assessment of Shelling Activity by REBA method.

Results of the REBA assessment scores (Table 8)for shelling task showed that the score of all the respondents of both Phulbari and Mankachar block were on and above 8, which indicates the high risk of musculoskeletal injury and it suggest further investigation and implementation of change. Subsequently, more than

20 percent of the respondents were counted as on the score of 11, indicating the association of very high level of risk and the interpretation of the scores showed that there is a high demand of implementation of change as soon as possible. The force/ load and awkward working posture of head, arm, shoulder, wrist, trunk, neck, legs etc. may be the reason of the higher risk associated with the task.

Table 8: Distribution of the REBA scores for the workers of cashew nut shelling activity

Sl. No.	Mankachar (N=20)			Phulbari (N=20)		
	Industry 1 n=10	Industry 2 n=10	Mean scores	Industry 1 n=10	Industry 2 n=10	Mean scores
1	8	9	8.5	11	11	11
2	11	11	11	9	9	9
3	11	9	10	9	9	9
4	9	11	10	9	8	8.5
5	9	9	9	9	9	9
6	8	9	8.5	9	9	9
7	9	8	8.5	8	9	8.5
8	9	9	9	11	11	11
9	9	11	10	9	9	9
10	8	9	8.5	9	9	9
TOTAL	91	95	93	93	93	93

3.4.4 Hand Grip Measurements of the Workers Involved in Cashew Nut Shelling Activity

From the Table 9 it was observed that the average strength of the grip for shelling activity was 13.42 during rest period. After working for 1hour it was noticed that the count was raised a little than earlier with (1.08 percent) and (0.61 percent) for both left hand and right hand respectively, which may be due to warming up of muscles at the start of the activity. The data showed that the grip strength of the left and right hand decreased by 23.69 percent and 32.69 percent for left and right hand respectively after working for 9 hours, which may be due to muscular fatigue developed during work (Table 9).

Table 9**:** Hand grip measurements of workers involved in cashew nut shelling activity

Hand	Period	Mankachar (n=20)		Phulbari (n=20)		Total Average (SD) N=40	Total Percentage Reduction N=40
		Average (SD)	Percentage Reduction	Average (SD)	Percentage Reduction		
Left Hand	Rest	13.42 (7.56)	-	13.95 (7.21)	-	13.69 (7.39)	-
	After1hour	13.66 (4.51)	1.79	14.00 (6.37)	0.36	13.83 (5.44)	1.08
	After 9 hour	10.24 (4.93)	23.69	10.48 (4.75)	24.87	10.36 (4.84)	24.28
Right Hand	Rest	13.56 (7.13)	-	14.50 (6.95)	-	14.03 (7.04)	-
	After 1 hour	13.63 (6.62)	0.52	14.60	0.69	14.12	0.61

				(4.69)		(5.66)	
	After 9 hour	9.10 (4.10)	32.89	9.35 (4.03)	35.51	9.23 (4.06)	34.20

Conclusions

The processing steps like roasting and streaming of cashew nut influenced the cutting strength of cashew nut shells. Roasted cashew nut shell was easy to shell compare with that of steamed cashew nut shell. Hence, cashew nut industries operating in Meghalaya and Assam were using roasted cashew nut for manual shelling. Analysis of ergonomic parameters like working Heart Rate, energy expenditure, rated perceived exertion, hand grip measurements, RULA and REBA showed that the workers involved in manual shelling of cashew nut in cashew nut industries of Meghalaya and Assam were exposed to high occupational health and safety risk due to poor working environment, awkward working posture, repetitive and tedious job.The study demanded intervention with improved hand operated tools and technologies. A hand operated cashew nut cutter was very much essential for shelling of roasted and steamed cashew nut.There should be frequentawareness programmefor workers on significance of correct working posture, hygiene and sanitation, proper indoor climate, musculoskeletal disorders and its prevention and use of new tools for shelling of cashew nut.

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