

An Ergonomic Assessment of Women Workers Involved in Tea Plantation in Himachal Pradesh

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ABSTRACT The present study was conducted in Kangra district of Himachal Pradesh to study the socio- personal, physical characteristics (n=80) and physiological workload (n=30) of respondents engaged in plucking tea leaves. Majority of the respondents were illiterate and belonged to scheduled caste and other backward classes. Majority of the respondents had ectomorph body with average physical fitness level. The average working heart rate values were upto acceptable limits whereas, the peak heart rate values ($HR_{25-35} = 110.93$; 111.44 ; $HR_{35-45} = 106.22$, 110.58 beats/ min.) were beyond acceptable limits. Both average and peak heart rate values were significantly related with elder age group, indicating work to be stressful especially with increase in age. Thus, it is recommended to generate awareness regarding faulty working habits and to develop women friendly technologies to improve efficiency and output of women workers.

INTRODUCTION

The women labourers bear a greater significance in plantation establishment and constitute about 52 percent of the labour force. The tea plantation industry is seasonal and over 90 percent operations are carried in the fields. To keep pace with production, especially plucking, more labour is required. The role of women is at forefront because they are deft in tasks related to tea plucking and other related tasks. The work is being performed in traditional way without knowing its impact on health. Due to this backbreaking and drudgery prone work, the output of leisure of the worker decreases and the health is also affected. Thus, keeping in view the most neglected and essentially required aspect of women's drudgery due to the tea plucking activity the study has been designed with the following objectives:

1. To study the socio- personal and physical characteristics of women engaged in tea plantation.
2. To determine the physiological workload of respondents engaged in tea plucking.

HYPOTHESES

Ho: There is no significant difference in average and peak heart rate values of the respondents of both the age groups.

Ho: There is no significant relationship between age and heart rate of the respondents.

MATERIAL AND METHODS

The present study was conducted in Kangra district of Himachal Pradesh. A multi stage random sampling technique was adopted to select the Tehsil, tea growers and ultimately Himachali bonafied women labourers (n=80) engaged in tea plantation and finally, a sub sample of thirty volunteer women workers from main sample engaged in tea plucking, for ergonomic assessment. The data were collected on well structured interview schedule through survey method as well as with various equipments viz., heart rate monitor, measuring tape, weighing balance, various analytical tools were employed for the analysis and interpretation of data.

Body Mass Index: The quetelet's index was used for the determination of body composition.

Quetelet's Index = Weight (kg)/ Height (m²)

Body Type: <20 = Ectomorph; 20-25 = Mesomorph; >25 = Endomorph.

Aerobic capacity: [$\dot{V}O_2$ max (l/min)]

$\dot{V}O_2$ max (l/min) = $0.023 \times \text{body weight (kg)} - 0.034 \times \text{age (years)} + 1.652$

Further the data were analysed by applying descriptive statistics (frequency, percentage mean, standard deviation, scores) and relational

statistics viz. paired t- test and correlation.

RESULTS AND DISCUSSION

Nearly three fourth (72.5%) of the sampled respondents were illiterate, 25 percent were educated upto primary and 2.5 percent upto middle level (Roy, 2001) also reported higher illiteracy rate among women workers in tea plantation activity. Majority of the respondents (93.75%) were married, followed by widows (5%) in elder age group only.

On the basis of caste structure one- half of the respondents were scheduled caste, 45 percent belonged to other backward classes and only 2.5 percent belonged to general category. Majority of the respondents (82.5%) belonged to nuclear family system and others (17.5%) to joint family system. Increasing popularity of nuclear family system in hill areas was also reported by Kalra (2000).

The main source of income for respondents was through earnings from tea estates (87.5%) only and 12.5 percent generated income by work-

ing in petty occupations such as in other households on holidays. The average monthly income of respondents was higher (Rs. 1,412) for elder age group than younger age group (Rs. 1,386.25) (Table 1). Gupta (1990) also revealed that women workers had very low average incomes that were involved as labourers in tea plantation.

Years of Employment: All the respondents under study were employed as casual labourers in the tea estates. On an average, they were employed for the last 12-28 years (Table 2).

Physical Characteristics: The physical characteristics of 30 respondents segregated into two age groups i.e. 25-35 years (50%) and 35-45 years (50%) involved in tea plucking were studied.

The mean age, height and weight of the respondents was 34.63 years, 1.54 m and 44.37 kg, respectively. On an average, body mass index of the respondents was 18.81 kg/m². However, it was slightly higher (19.40 kg/ m²) in case of younger age group than elder age group (18.22 kg/ m²).

On an average VO₂ max was 1.49 l/min. for all the respondents. Among both the age groups,

Table 1: Personal characteristics of the respondents (N=80)

S. No.	Personal characteristics	Age group (Year)		Overall
		25-35	35-45	
I	Education			
	a. Illiterate	27 (67.50)	31 (77.50)	58 (72.50)
	b. Upto primary	11 (27.50)	9 (22.50)	20 (25.00)
	c. Middle	2 (5.00)	-	2 (2.50)
	Total	40 (100)	40 (100)	80 (100)
II	Marital Status			
	a. Unmarried	1 (2.50)	-	1 (1.25)
	b. Married	39 (97.50)	36 (90.00)	75 (93.75)
	c. Widow	-	4 (10.00)	4 (5.00)
	Total	40 (100)	40 (100)	80 (100)
III	Source of Monthly Income			
	a. Tea estate only	32 (80.00)	38 (95.00)	70 (87.50)
	b. Tea estate & other source	8 (20.00)	2 (5.00)	10 (12.50)
	Total	40 (100.00)	40 (100)	80 (100)
IV	Monthly Income (in Rs.)			
	a. 1000 – 1200	1 (2.50)	-	1 (1.25)
	b. 1200 – 1400	11 (27.50)	11 (27.50)	22 (27.50)
	c. 1400 – 1600	25 (62.50)	28 (70.00)	53 (66.25)
	d. 1600 – 1800	3 (7.50)	1 (2.50)	4 (5.00)
	Total	40 (100)	40 (100)	80 (100)
V	Caste			
	a. Scheduled caste	22 (55.00)	18 (45.00)	40 (50.00)
	b. OBC	17 (42.50)	21 (52.50)	38 (47.50)
	c. General category	1 (2.50)	1 (2.50)	2 (2.50)
	Total	40 (100)	40 (100)	80 (100)
Average $\pm$ S.E.		1386.25 $\pm$ 133.49	1412 $\pm$ 120.75	1399.13 $\pm$ 127.13

Figures in parentheses indicate percentage of total sample in each category

Table 2: Distribution of respondents according to their years of employment in the tea estates (N=80)

S. No.	Years of employment	Age group (year)		Overall
		25 – 35	35 – 45	
1.	0 - 5	1 (2.50)	-	1 (1.25)
2.	5 - 10	39 (97.50)	-	39 (48.75)
3.	10 - 15	-	2 (5.00)	2 (2.50)
4.	15 - 20	-	29 (72.50)	29 (36.25)
5.	20 - 25	40 (100)	40 (100)	80 (100)
Total-		9 (22.50)	9 (11.25)	
Average $\pm$ S.E.		7.16 $\pm$ 1.32	17.4 $\pm$ 2.40	12.28 $\pm$ 5.47

Figures in parentheses indicate the percentage of total sample in each category

Table 3. Physical characteristics of the respondents (N=30)

S. No	Variable	Age group (year)				Total	
		25-35		35-45			
		Mean $\pm$ S.E.	Range	Mean $\pm$ S.E.	Range	Mean $\pm$ S.E.	Range
1.	Age (year)	30.13 $\pm$ 3.70	25-35	39.13 $\pm$ 3.01	35-45	34.63 $\pm$ 5.59	25 - 45
2.	Height (m)	1.53 $\pm$ 0.05	1.45-1.62	1.55 $\pm$ 0.05	1.45-1.67	1.54 $\pm$ 0.05	1.45 - 1.67
3.	Weight (kg)	45.4 $\pm$ 5.652	30-55	43.33 $\pm$ 4.73	34.5-55	44.37 $\pm$ 5.23	30 - 55
4.	Body mass index (kg/m ²)	19.40	14.27 - 23.65	18.22	13.82 - 24.44	18.81	13.82 - 24.44
5.	VO ₂ max (l/min)	1.67	1.25 - 2.03	1.32	1.02 - 1.66	1.49	1.02 - 2.03
6.	Body Type	No.	%	No.	%	No.	%
	Ectomorph	10	66.67	11	73.33	21	70.00
	Mesomorph	5	33.33	4	26.67	9	30.00

Table 4: Average and peak heart rate of the respondents while performing the plucking activity (beats/min.) (N=30)

Activity	Age group (years)							
	25-35				35 - 45			
	Average		Peak		Average		Peak	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Onward journey	98.87	102.60	106.73	111.13	95.67	104.73	101.87	112.27
Plucking	99.07	101.13	110.13	111.67	97.80	99.00	106.20	109.33
Backward journey	103.00	102.27	115.93	111.53	101.40	101.33	110.60	110.13
Complete cycle	100.31	102.00	110.93	111.44	98.29	101.69	106.22	110.58

younger age group had higher VO₂ max (1.67 l/min.) than elder age group (1.32 l/min.). It indicated that people of larger body build have higher VO₂ max, which declines more obviously with age. Almost similar findings were reported by AICRP, Palampur (2001). The body type of the respondents categorized on the basis of body mass index showed that majority (70%) of the respondents had ectomorph whereas, 30 percent had mesomorph body type (Table 3). Similar results were reported by AICRP, Palampur (2001).

Physical Stress: Physical stress of respondents was determined on the basis of average and peak

heart rate values. At rest, the heart rate in a normal individual is about 70 beats/min. The average heart rate for complete cycle of the activity in younger age group was 100.31 bpm in morning and 102 bpm in evening. In elder age group it was found to be 98.29 bpm and 101.69 bpm, respectively. The peak heart rate for younger age group was 110.93 bpm and 111.44 bpm, respectively in morning and evening, whereas, for elder age group it was 106.22 bpm and 110.58 bpm, respectively (Table 4).

On an average the average heart rate values for respondents were upto acceptable workload limits. But, the peak heart rate values were bey-

ond acceptable limits, which might be due to traditional plucking/ working methods.

The data were analysed for significance of difference in average and peak heart rate values

Table 5: Paired t- test for difference between average and peak heart rate of the respondents

S.No.	Particulars	Mean	Standard deviation
1.	Peak heart rate	116.3167	13.5177
2.	Average heart rate	100.5723	10.9037
3.	Mean difference	15.7444	
4.	t - value	16.8166*	

* Significant at 5 percent level

Table 6: Correlation between age and heart rate values of the respondents

S. No.	Particulars	Correlation values			
		Average heart rate		Peak heart rate	
		25-35yr	35-45yr	25-35yr	35-45yr
1.	Onward journey	0.0206 ^{NS}	0.5254*	0.0563 ^{NS}	0.4359*
2.	Plucking	-0.0880 ^{NS}	0.6087*	-0.0649 ^{NS}	0.6374*
3.	Backward journey	-0.0590 ^{NS}	0.4507*	0.0126 ^{NS}	0.5265*
4.	Complete cycle	-0.0464 ^{NS}	0.5901*	-0.0509 ^{NS}	0.5632*

* Significant at 5 percent level; NS- non significant

of both the age groups. The perusal of Table 5 revealed a clear difference in average and peak heart rate values. The difference was also found statistically significant. Thus H_0 was rejected.

Age and heart rate values of the respondents (average and peak) were positively and significantly correlated in elder age group (Table 6). Hence, it can be said that increase in age affects heart rate while performing the complete cycle of activity. Thus, H_0 was rejected.

CONCLUSION

Majority of the respondents were married, illiterate, belonged to scheduled caste and other backward classes and followed a nuclear family with 4-7 members in the family. On an average, the respondents were employed for last 12.28 years and earned the average monthly income of Rs. 1,399.13 per month.

Majority of the respondents had ectomorph body build and younger age group had higher VO_2 max than elder age group.

Both average and peak heart rate values were

significantly related with age for elder age group. Thus, it may be inferred that workload was high and stressful for elder age group.

RECOMMENDATION

Awareness regarding drudgery due to traditional working methods and faulty working habits must be imparted with the help of visits in tea farms and audiovisual aids, so as to enhance the work output and improve the health of women working in tea estates.

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