

## ARTICLE

# Prevalence of musculoskeletal pain and environmental health hazards among tea pluckers of Maddekanda tea estate in Balangoda Pradeshiya Saba Division, Sri Lanka

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## Abstract

**Background:** Tea pluckers in Sri Lanka play a prominent role in supplying tea for the local and foreign demand. Long standing, bearing weight on back, repetitive hand movements, slip and falls due to walking on uneven grounds lead to various health problems among them. Thus, this study was aimed to assess the prevalence of musculoskeletal pain and environmental health hazards among tea pluckers of Maddekanda tea estate in Balangoda area, Sri Lanka.

**Design and Methods:** A descriptive cross-sectional study was carried out among 378 tea pluckers, recruited using simple random sampling method. Data were collected by validated, pre-tested interviewer administered questionnaire and descriptive and inferential statistical analyses were performed by using SPSS v20.

**Results:** The prevalence of musculoskeletal pain in any region of the body was 68.5% (95% CI 63.6-73.2) among all participants and prevalence of lower back pain 43.4% (95% CI 38.3-48.8) was high compared to other site of pain. Nearly 98.4% had experienced of leech biting during their work as a main health hazard. Participants who had experienced stress (OR=2.12, 95% CI: 1.119-3.764), and worked for more than 20 years (OR=2.28, 95% CI: 1.37- 3.81) were nearly 2 times more likely to have musculoskeletal pain when compared to their counterparts.

**Conclusions:** Prevalence of musculoskeletal pain was high among tea pluckers and lower back region was the common site of pain. Leech bite was the other dominant health problem faced by them. Stress, duration of work and age were associated with musculoskeletal pain.

## Introduction

Tea is the major agricultural export crop of Sri Lanka which was introduced to the country in 1867 by James Taylor.<sup>1</sup> Tea has been recognized as a pleasant, safe, healthy drink and it is enjoyed every day by many people all over the world.<sup>2</sup> Sri Lanka is the world's fourth-largest producer of tea. Sri Lankan tea estate

workers play a prominent role in order to supply tea for the local and foreign demand. Most of the estate workers are female tea pluckers who are involved in picking tea leaves. According to the nature of the tea plucking job, workers are exposed to various physical, psychological and environmental health hazards. Physical hazards include long standing, bearing weight on back, repetitive hand movements, slip, strip and falls due to walking on uneven grounds by bearing weights on back lead to various health problems. With regards to environmental condition these workers are exposed to different windy, rainy and sunny weather conditions in the outfield. Psychologically they experience time pressure to complete targets, supervisor pressure and job insecurity related to various climate conditions as day labors.

According to Ilyas,<sup>3</sup> most of the Tamil people who live in hill country are employed in the plantation sector of Sri Lanka. They live in typical houses known as line rooms with less healthy conditions.<sup>3</sup> Their houses do not have adequate ventilation, sunlight, sanitary facilities, safe drinking water and privacy for grown up children and most of the houses are overcrowded due to increased number of family members of few generation. Further, there are serious social problems such as widespread poverty, alcoholism, domestic violence, poor housing conditions and lack of support at old age as well as under nutrition and anemia.<sup>4</sup>

Occupational health is defined as the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs.<sup>5</sup> Estate workers are vulnerable for various health condition and diseases due to physical , psycho social and environment factors.

Further, Park<sup>6</sup> stated that occupation and health are closely related, and the occupational environment of the worker cannot be separated from his domestic environment because, both are complementary to each other. And stress at workplace may disturb their domestic life just as stress at home may affect their work.<sup>6</sup> A research studies related to workers in the tea industry revealed that musculoskeletal disorders are common in this worker as a result of occupational health hazards in the working environment.<sup>7</sup>

### Significance for public health

Identified occupation related health problems such as musculoskeletal pain, stress and health hazards such as leech bite, honey bee or wasp attacks, snake bite among tea pluckers of Maddekanda tea estate in Balangoda area, need to be addressed by the relevant authorizes in order to ensure the good health and the safety of the workers. In addition, the findings of this study would further emphasize to carry out more studies in order to assess the associated factors for each occupational health problems among tea pluckers. Further, there is need for health campaign to identify undiagnosed health problems among this population.

According to Department of Census and Statistics of Sri Lanka, Labour force Survey 2014, nearly 30% of Sri Lankan population working in agriculture and many are at risk for work related musculoskeletal disorders. Tuzun<sup>8</sup> stressed that musculoskeletal (MS) pain is associated with poor quality of life and reduced productivity.<sup>8</sup> Even though large number of research studies have been carried out in other countries on physical problems related to musculoskeletal system and psychological stress related to occupation, majority had not been touched on previous experiences on biological hazards of working place among tea pluckers. In addition, there is a sparsity in reported evidence on occupational health condition among tea pluckers in Sri Lanka. Therefore, present study may contribute to the existing gap on knowledge regarding occupational health among tea pluckers. Thus, focus on their health problems is very important in order to provide healthy life to the people in estate sector whose main income totally depend on the working capacity of workers in tea estates and the majority represent tea pluckers. Thus, aim of this study was to assess prevalence of musculoskeletal pain and environmental health hazards among tea pluckers of Maddekanda tea estate in Balangoda Pradeshiya Saba Division, Sri Lanka.

## Methodology

This study was a descriptive cross-sectional study, conducted

**Table 1. Socio-demographic characteristics of tea pluckers.**

Variable	Frequency (n=378)	%
<b>Age</b>		
18-30 years	54	14.3
31-50 years	195	51.6
51-60 years	85	22.5
61-80 years	43	11.4
>80 years	1	0.3
<b>Gender</b>		
Female	262	69.3
Male	116	30.7
<b>Civil Status</b>		
Married	365	94.2
Unmarried	19	5.0
Divorced	3	0.8
<b>Family type</b>		
Nuclear family	209	55.3
Extended family	169	44.7
<b>Ethnicity</b>		
Tamil	276	73.0
Sinhala	102	27.0
<b>Educational level</b>		
Illiterate	60	15.9
Up to grade 5	82	21.7
Not complete grade 5	67	17.7
Not complete grade 10	92	24.3
Up to O/L	70	18.5
Up to A/L	6	1.6
<b>Monthly income (Rs)</b>		
<5000	18	4.8
5000-10000	205	54.2
10001-20000	107	28.3
20001-30000	35	9.3
>30000	12	3.2

in the Maddekanda tea estate in Balangoda division. Balangoda is situated in the Rathnapura district of the Sabaragamuwa province of the Sri Lanka. All tea pluckers in Maddekanda tea estate in Balangoda division who had working experience more than 1 year whose age above 18 years were included and pregnant mothers were excluded in this study. A total of 384 tea pluckers was included by selecting them through simple random sampling method using the pay rolls of the workers as the sampling frame. Respondent rate was 98.4%.

Data were collected using pretested interviewer administered questionnaire (IAQ). IAQ was validated through judgemental validity of face validity and content validity by occupational experts. All experts did some overall changes especially on the wording and the understanding in the local context. These changes were attended to by the investigator. The IAQ was prepared in English and then was translated to Tamil language by two bilingual English-Tamil experts. They were requested by the principle investigator (PI) to retain the original structure and content as much as possible. The PI discussed some variations with the two experts and consensual alterations were made. The agreed Tamil version of the IAQ was back translated to English by other two bilingual English – Tamil experts. The back translated version was again rechecked with the original version of IAQ by the PI for consistency and accuracy of the information. However, only a few minor discrepancies were found and were corrected again after discussions with the expert translators.

IAQ was pretested among ten (10) tea pluckers who were living in other tea estate of the Balangoda Pradeshiya Saba Division. The modifications were made in the questionnaire by

**Table 2. Work characteristics of tea pluckers.**

Variable (n=378)	Frequency	%	Mean ± SD
<b>Age at started to work as a tea plucker</b>			
≤20 Years	235	62.2	20.92± 8.631
21 Years	143	37.8	
<b>Years of working experience as a tea plucker</b>			
≤10 Years	100	26.5	23.11 ±15.02
11-30 Years	154	40.7	
≥31 Years	124	32.8	
<b>Weight of plucked tea leaves per day</b>			
≤25 kg	169	44.7	30.26 ± 9.08
26-50 kg	205	54.2	
≥51 kg	04	1.1	
<b>Weight of carrying tea leaves on your back per day</b>			
≤35 kg	241	64.3	30.82 ±14.39
≥36 kg	134	35.7	
<b>Hours of working per day</b>			
< 8 hours	196	51.9	48.1
≥ 8 hours	182	48.1	
<b>Site of hang your basket</b>			
On head	364	96.3	0.5
On shoulder	6	1.6	
On head and on shoulder	6	1.6	
On the floor	2	0.5	
<b>Transport mode of plucked tea leaves</b>			
On head	294	77.8	1.3
On shoulders	67	17.7	
On back	3	0.8	
On head and shoulder	4	1.1	
On head and back	4	0.3	
Not carrying weight	5	1.3	

improving the clarification of questions, dropping some questions and changing some words from technical terms to local language based on the pre-testing.

In addition, Anthropometric measures were also obtained from study participants using standard measurements. Data were collected by trained data collectors who were fluent in the mother tongue (Tamil language) of the participants. Accuracy, reliability and specially honesty were stressed to the data collectors.

Data analysis was carried out using statistical package for social science SPSS (version 20) and descriptive statistics was used to estimate the prevalence of health problems and chi-square test was used to determine the associations between two categorical variables. Chi square and unadjusted odds ratio with their 95% confidence interval (95% CI) test was used to check the significance of the differences observed. A probability level of  $p < 0.05$  was accepted as statistical significance. Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura.

## Results

### Socio-demographic characteristics of the participants

Among all participants, only 378 were responded and response rate was 98.4%. More than half (52%) of participants were within the age range of 31-50 years with the mean age of 44.75 ( $\pm 13.07$ ) years. Majority (69%) of tea pluckers were female and were married (94.2%). Only very few (1.6%) participants had followed advanced level and nearly 54% of them had the monthly income of Sri Lanka Rs 5000-10000 (Table 1).

### Working characteristics of the participants

The mean years of working experience was 23.92 ( $\pm 15.02$ ) years. Nearly 62% of the participants had started to work as a tea plucker before age of 20 years. Around half (54%) of them usually pluck more than 25 kilograms of tea leaves per day. All participants had used nylon bag and majority of them had kept their Nylon bag on the head to put plucked tea leaves. Nearly 78% of them carry plucked tea leaves to the collecting center on their head (Table 2).

**Table 3. Participants' habits of substance usage.**

	Total (n=378)		Female (n=262)		Male (n=116)	
	n	%	n	%	n	%
Betel chewing						
Yes	233	61.6	142	54.2	91	78.4
No	145	38.4	120	45.8	25	21.6
Usage of alcohol						
Yes	97	25.7	6	2.3	91	78.4
No		281	74.3	256	97.7	25 21.6
Years of alcohol usage		Frequency		%		
<5		17		17.5		
5-10		13		13.4		
10.1- 20		28		28.9		
>20		39		40.2		
Type of liquor						
Local		9		9.3		
Branded		85		87.6		
Both type		3		3.1		
Currently smoking		Total (n=378)		Female (n=262)		Male (n=116)
	n	%	n	%	n	%
Yes	49	13.0	2	0.8	47	40.5
No	329	87.0	260	99.2	69	59.5
Years of smoking		Frequency		%		
<5		5		10.2		
5-10		9		18.4		
10.1-20		11		22.4		
>20		24		49.0		
Type of smoking						
Cigarettes		14		28.6		
Biddies		34		69.4		
Cigarettes & biddies		1		2.0		
Number of cigarettes /biddies per day						
5 /day		37		75.5		
6-10/day		9		18.4		
11-20/ay		2		4.1		
>21/day		1		2.0		

### Participants' habits of substance usage

Nearly 62% of participants had the habits of betel chewing and among them, males were dominant (78.4%) in betel chewing. Nearly one fourth of participants do consume alcohol regularly and among them 40% of them had consumed alcohol more than 20 years. Further, only 13% of participants smoke regularly (Table 3).

### Prevalence of musculoskeletal pain

The prevalence of musculoskeletal pain in any region of the body was 68.5% (95% CI 63.6-73.2) among all participants (Table 4).

### Prevalence of environmental health hazard

Leech biting (98%) was the most common work hazard among workers during working hours. Around 38 % of tea pluckers had experienced with cut injuries and punch from sharp wood (especially, sharp tea branches) was nearly 26 % during working hours (Table 5).

### Factors associated with musculoskeletal pain among tea pluckers

Participants who had experienced stress were nearly 2 times more likely to have musculoskeletal pain than participants who had no stress (OR=1.974, 95% CI: 1.149-3.393). Further, participants who worked for more than 20 years (OR=2.225, 95% CI: 1.421-3.485) and aged more than 50 years (OR=1.767, 95% CI: 1.138-2.745) were nearly 2 times more likely to have musculoskeletal pain when compared to their counterparts (Table 6).

## Discussion

This study assessed the prevalence of musculoskeletal pain and environmental health hazards among tea pluckers of Maddekanda tea estate in Balangoda Pradeshiya Saba Division, Sri Lanka. Majority of tea pluckers were married which is consistent with a

Lankan carried out in agriculture sector.<sup>9</sup>

Majority of workers had more than 10 years' experience as a tea plucker. Similarly, agricultural studies also have shown that majority of workers had 10-30-years' experience.<sup>10,11</sup> Mean weight of plucked tea leaves per day was 30.26 kg and most of them plucked more than 25 kg per day. This finding was consistent with

**Table 4. Musculoskeletal pain among tea pluckers.**

Type of pain	Frequency (n=378)	Prevalence (95% CI)
Any musculoskeletal pain	259	68.5 (63.6-73.2)
Neck pain	85	22.5 (18.4-27.0)
Shoulder pain	97	25.7 (21.3-30.4)
Hand/arm pain	88	23.3 (19.1-27.9)
Upper back pain	113	29.9 (25.3-34.8)
Low back pain	164	43.4 (38.3-48.8)
Knee pain	158	41.8 (36.8-47.0)
Ankle pain	33	8.7 (6.1-12.0)

**Table 5. Other occupational hazards experienced by the participants.**

Variable	Frequency (n=378)	%
Honeybee or wasp attack	93	24.6
Snake bite	53	14.0
Fallen from height	73	19.3
Cut injuries	145	38.4
Punch from sharp wood	99	26.2
Injuries to head	19	5.0
Muscle sprain	97	25.7
Experience of leech bite (very often)	372	98.4
Non-healing wound	22	5.8

**Table 6. Factors associated with any musculoskeletal pain**

	Any type of musculoskeletal pain		p-value	OR	95% CI	p-value	AOR	95% CI
	Yes	No						
Stress			0.013*	1.974	1.149-3.393	0.010	2.121	1.196-3.764
Yes	77	21						
No	182	98						
Duration of work			0.001*	2.225	1.421-3.485	0.002	2.281	1.366-3.809
>20 years	142	42						
≤20 years	117	77						
Age			0.011*	1.767	1.138-2.745	0.048	1.027	1.000-1.055
>50 years	141	48						
≤50 years	118	71						
Support from supervisor			0.077	1.742	0.936-3.240	0.192	1.540	0.805-2.945
Yes	52	15						
No	207	104						
Age at started to work			0.363	1.229	0.788-1.916	0.925	0.975	0.572-2.945
≤20 years	165	70						
≥21 years	94	49						
Hours of work per day			0.088	0.685	0.443-1.059	0.152	1.419	0.879- 2.293
≥8 hours	117	65						
<8 hours	142	54						

\*Chi-square test; OR, odd ratio; AOR, adjusted odd ratio.

a Kenyan study.<sup>12</sup> Further, majority of tea pluckers used Nylon bag for collecting tea leaves and hanging the bag on their head. Bhattacharyya and Chakrabarti have written in their study that the newly designed plucking basket fits to back curvature of the workers well and it is better than existing round basket.<sup>13</sup> But, none of them used cane basket or any other basket other than nylon bags in the present study. This might be due to the difference between plucking operations of tea pluckers in Sri Lanka and Assam in India.

Alcohol consumption among tea pluckers was slightly higher among both gender of tea pluckers. Similarly, an epidemiological study carried out among female tea pluckers in Nuwara Eliya district, Sri Lanka revealed that one third of estate women consume alcohol.<sup>14</sup> This might be due to the cold climate of the place and workers are used to consume alcohol in a regular basis.

The results of this study have shown that musculoskeletal pain (MSP) was most common health problem among the participants and majority (68.5%) of workers suffered from at least one of MSP. Similarly, a recent study conducted among rubber trappers in Sri Lanka, found that nearly 66% of workers had MSP.<sup>10</sup> In addition, the prevalence of any MSD among oil palm plantation workers in Malaysia was 93%<sup>15</sup> and pineapple plantation workers in Johor was around 87.0%.<sup>11</sup> Prevalence of MSP was high among tea pluckers might be due to the increased physical activities, long time standing, walking long distance, hard-working compared to other occupational population so on.

Nearly half of the study participants have experienced pain on lower back, followed by knee upper back and shoulder. The similar finding was reported in a Kenyan study that prevalence of lower back pain (LBP) among tea pickers was 45.4%<sup>12</sup> and a study done among tea pluckers in India has found that prevalence of LBP was around 47.2%.<sup>16</sup> In addition, It was similar with prevalence of LBP among rubber trappers in Sri Lanka (43%)<sup>10</sup> too though job tasks of rubber trappers are quite different from tea pluckers. But, contrast to this findings, LBP among Pineapple plantation workers was high (64.8%).<sup>11</sup> MSP among tea pluckers were high, this can be justified that most of time workers have to climb mountain while working where Maddekanda tea estate of Balangoda area which is situated in hill areas due to geographical situation.

According to current study, most of MSPs are associated with years of working duration, stress level and age of the workers. Similarly, a study by Warnakulasuriya *et al.* reported that pain was strongly associated with psycho-social factors in working populations<sup>17</sup> and also age and work experience have positive correlations and people who are more towards old age more prone to get musculoskeletal pains. Further, previous studies reported that the MSP is associated with duration of employment and age of the workers.<sup>9,12</sup>

Limitation of the study was that the study was confined and conducted to one study area.

## Conclusions

Prevalence of musculoskeletal disorders were high among tea pluckers. Lower back region was the common site of pain followed by knee pain. Leech bite was the other dominant health hazard faced by them. Stress, working duration and age were determinant of musculoskeletal pain. Actions should be taken to minimize the risk factors associated with occupational health problem in order to minimize the musculoskeletal pain among tea pluckers.

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**Contributions:** UHSC and SSPW have designed the study, collected, analyzed, and interpreted the data; GK has interpreted the data and wrote the manuscript. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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**Ethics approval and consent to participate:** Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura, Gangodawila, Sri Lanka. Participants' written informed consent was obtained before the commencement of the study

**Availability of data and materials:** The data used to support the findings of this study are available from the corresponding author upon request.

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