Prevalence of work-related musculoskeletal symptoms among tea garden workers in Bangladesh: a cross-sectional study

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ABSTRACT

Objectives Occupational health is still in the developmental stage in Bangladesh. There is a lack of focus on agricultural workers. Statistics on musculoskeletal symptoms (MSS) of any occupational group can assist in developing intervention and ergonomics-based prevention. This study aimed to assess work-related MSS among tea garden workers.

Setting This cross-sectional study was done in one tea garden in Moulvibazar district which has the highest number of gardens in Bangladesh.

Design and participants 346 tea garden workers were interviewed using the Nordic Musculoskeletal Questionnaire Extended Version 2. Workers 18–60 years of age and of both sexes were interviewed individually.

Outcome measures Prevalence of MSS among the tea garden workers, MSS in different body regions and MSS related informations. Sociodemographic and work-related factor associated with MSS.

Results Among the tea garden workers, 276 were female and 70 were male. The study showed 80.9% had symptoms in the past 12 months while 80.1% and 76.6% had in the past 4 weeks and on the day of the interview, respectively. Symptoms were most commonly reported at the shoulder (78.2%) followed by upper back (56.1%) and lower back (32.5%). Workers engaged with plucking operation were found to be significantly associated with symptoms compared with non-pluckers (p<0.05). Female workers were more likely to display symptoms in the neck (p<0.05) than male workers. Increased work hours were significantly associated with symptoms in the lower back (p<0.05). Overtime was responsible for symptoms in the elbow and hip/ankle (p<0.05). Statistics from relevant studies in India, Malaysia and Thailand were compared with the results of this study.

Conclusions The prevalence of MSS among tea garden workers was found to be very high, and ergonomic interventions like reduction of weight load, job rotation and small breaks can reduce these symptoms.

INTRODUCTION

Tea plants are evergreen shrubs that reach 30 feet in height if not pruned regularly. A subtropical climate is most suitable for the growth of tea plants and they mostly cultivated in Asian and African countries. They are grown for their leaves, which are dried, then wilted, oxidised and fermented leading to the production of drinkable tea. Bangladesh is the twelfth largest producer of tea in the world,1 Tea is produced all year long in Bangladesh but mostly between June and November. The colonial British administration came up with the idea of tea plantations in the Indian subcontinent at the very beginning of the nineteenth century. Since then, in the subcontinental region, the progress of the tea industry was going at a slow rate but now it is one of the major industries in this region. Now many tea gardens are successfully running in Bangladesh. Tea is cultivated on 115,629.76 hectares of land,2 There is a total of 164 tea gardens present in the country. Over 100,000 workers are registered in these tea gardens and most of them live under a $1 per day income.4 Their activities throughout the year include plucking tea tree leaves and buds, weeding, dressing tea plants, applying fertilisers and pesticides, clearing the forest land for the extension of plantation areas, pruning vulnerable tea trees, repairing canals and roads, and doing domestic chores at the
households of the managers. Among all agricultural works, tea-related works are one of the most labour-intensive occupations. The factory, which makes tea, is mechanised and uses less than 10% of the population. All other workers work in the field with activities related to hoeing, weeding, pruning and plucking tea tree leaves and buds, and so on. After plucking the tea leaves, the workers have to carry the load on their back. They maintain an awkward static posture, repetitive movements, poor lifting and carrying techniques while plucking tea for long periods. In Bangladesh, plucking is done manually which is the most labour-intensive part of tea production. Plucking of leaves is done by both hands in a fast-paced, short-cycled and highly repetitive manner. Plucked leaves are delivered in a wide basket. For increasing work efficiency, the basket is carried on the back. It is hung from the head with the help of a belt/rope/cloth and is supported at the back of the pluckers. During plucking, they flex their trunk and neck. Tea pluckers have to work in varying climatic conditions like high temperatures and rain. They have to maintain an awkward static work posture while plucking with repetitive hand movements. The working condition also imposes physical demands on the pluckers. They also carry plucked tea on their heads until they weigh and unload in the carrying vehicle. Moreover, the work is performed the whole day. Literature on the physical demands of different occupations is in general agreement that the greater the physical demand, the greater the probability of musculoskeletal injury. There is a relationship between repetitive movement and musculoskeletal disorders. Repetitive movement in an awkward posture has also been described as a causal factor in different musculoskeletal symptoms (MSS). Tea garden workers work in similar postures and perform similar activities. Studies about MSS in tea garden workers in Assam, India showed workers were suffering most in the shoulder (71.8%), neck (66.4%) and upper back (65.6%). Another study in Tamil Nadu, India assessed MSS among tea pluckers and found a high prevalence (83.6%) among them. MSS among Cambodian fruit farm workers was found to be 80.4%. Search for literature on MSS among tea garden workers in Bangladesh was done but none was found. MSS among tea garden workers of Bangladesh ask for special attention. This study, therefore, focuses on assessing work-related MSS among tea garden workers. All information from this study may therefore help the provision of better health monitoring practice among tea garden workers in Bangladesh. The objectives of this research are to investigate the prevalence of MSS in nine body regions and any possible demographic or work-related factor correlations among the tea garden workers.

**MATERIALS AND METHODS**

**Settings and sample**

The study was carried out in the largest tea-producing district, Moulvibazar, in the north-east part of Bangladesh. A random tea garden from a list of 91 in the district was selected for this study using simple random sampling. The total population working in the tea garden was 4000 as per the company census. The workers were either permanent or contractual employees in the tea garden. All the tea garden workers, both male and female, aged between 18 years and 60 years were considered to be the sampling unit. Workers who were working since less than 12 months or had a history of accidents that might cause muscle or joint pain were excluded from the study. The sample size was calculated with a 95% CI and relative precision of 5%. A total of 346 tea garden workers was interviewed for this study who volunteered to make themselves available.

**Data collection tool**

The interview had three parts: sociodemographic details of the workers, work-related questions and the extended Nordic Questionnaire Version 2 to assess MSS in different parts of the body. The whole questionnaire was translated into Bengali and then back translated by two independent translators.

### Table 1

Sociodemographic information of the tea garden workers

| Variable         | Category | Frequency | Percentage |
|------------------|----------|-----------|------------|
| Age (years)      | ≤30      | 122       | 35.3       |
|                  | 31–40    | 91        | 26.3       |
|                  | 41–50    | 62        | 17.9       |
|                  | ≥51      | 71        | 20.5       |
| Sex              | Male     | 70        | 20.2       |
|                  | Female   | 276       | 79.8       |
| Religion         | Hindu    | 311       | 89.9       |
|                  | Muslim   | 24        | 6.9        |
|                  | Christian| 11        | 3.2        |
| Marital status   | Unmarried| 31        | 9.0        |
|                  | Married  | 282       | 81.5       |
|                  | Widowed  | 33        | 9.5        |
| Education        | Illiterate| 307     | 88.7       |
|                  | Literate | 39        | 11.3       |

### Table 2

Work-related information of the tea garden workers

| Variable               | Category | Frequency | Percentage |
|------------------------|----------|-----------|------------|
| Type of work           | Pluckers | 277       | 80.1       |
|                        | Non-pluckers | 69  | 19.9       |
| Work experiences (years)| ≤10      | 180       | 52.0       |
|                        | 11–20    | 106       | 30.7       |
|                        | ≥21      | 60        | 17.3       |
| Work hours per day     | ≤7       | 35        | 10.1       |
|                        | 8        | 302       | 87.3       |
|                        | ≥9       | 9         | 2.6        |
| Overtime work          | Overtime | 26        | 7.5        |
|                        | No overtime | 320 | 92.5       |
| Break during work      | Break    | 243       | 70.2       |
|                        | No break | 103       | 29.8       |
Musculoskeletal symptoms (MSS) information of the tea garden workers

| Variable | Frequency | Percentage |
|----------|-----------|------------|
| MSS prevalence in the past 12 months | 280 | 80.9 |
| MSS prevalence in the past 4 weeks | 277 | 80.1 |
| MSS prevalence on the day of the interview | 265 | 76.6 |
| Hospitalisation | 56 | 16.1 |
| Consultation with doctor/physiotherapist | 280 | 80.9 |
| Medication due to MSS in the past 12 months | 279 | 80.6 |
| Sick leave in the past 12 months | 271 | 78.3 |
| Change of jobs | 40 | 11.6 |
| Reduced work activity in the past 12 months | 269 | 77.7 |
| Reduced leisure activity in the past 12 months | 265 | 76.6 |

Table 4: Musculoskeletal symptoms (MSS) information according to body regions of the tea garden workers

| Body regions | MSS frequency | MSS percentage |
|--------------|---------------|----------------|
| Neck         | 90            | 32.1           |
| Shoulder     | 219           | 78.2           |
| Elbow        | 58            | 20.7           |
| Wrist/hand   | 84            | 30.0           |
| Upper back   | 157           | 56.1           |
| Lower back   | 91            | 32.5           |
| Hip/buttock  | 72            | 25.7           |
| Knee         | 30            | 10.7           |
| Ankle/foot   | 19            | 6.8            |
| Any body region | 280  | 80.9 |

Data collection method

Data were collected by direct face-to-face interviews of the tea garden workers who fulfilled the selection criteria. The interviews were taken without disturbing their routine work. The purpose and objectives of the study were explained to the respondents before the interview. If the participant agreed to participate then a written consent form was explained before the interview. Assurance was given regarding confidentiality and secrecy of the information they provided. Then the study participants were requested to answer the questions according to the developed format of questions. To prevent comprehensive difficulties, the questions were read to the subjects, and answers were filled one by one. First sociodemographic and work-related questions were asked. To identify their symptoms, they were provided with a diagram of the human body with nine different regions shaded and identified in a different colour to help them distinguish the regions where they have experienced symptoms. Each interview for each body region started with the question, for example, ‘have you ever had neck trouble (pain, ache, or discomfort)?’ If the answer is ‘yes’, then the interview continued to the other questions related to that body region. If the answer is ‘no’, then the interview moved to the next body region. The average time of one interview was calculated to be about 30 min.

Data analysis

For analysis purposes data were grouped as follows: age was grouped as ≤30 years, 31–40 years, 41–50 years and ≥51 years; educational qualifications were grouped as illiterate and literate; work experience was grouped as ≤10 years, 11–20 years and ≥21 years; work hours per day was grouped as ≤9 hours, 10 hours and ≥11 hours. For significance, the χ² test was used to see the relation between MSS and associated factors. Data were analysed using SPSS V.24.

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of this study.

RESULT

The questionnaire was used to collect data from 346 respondents. Sociodemographic information of the tea garden workers is presented in Table 1. About 20.2% of the workers were male and 79.8% were female. Among the workers 35.3% were ≤30 years, 26.3% between 31

Table 3: Musculoskeletal symptoms (MSS) information of the tea garden workers

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| Knee         | 30            | 10.7           |
| Ankle/foot   | 19            | 6.8            |
| Any body region | 280  | 80.9 |
years and 40 years, 17.9% between 41 years and 50 years, and 20.5% were ≥51 years of age. The majority of the sample was found to follow the Hindu (89.9%) religion and 81.5% of them were married; 88.7% of the workers were illiterate.

Work-related information about the tea garden workers is presented in table 2. Among the workers 80.1% of them were directly related to plucking work from the garden while the rest of the workers were engaged in other works like spraying fertilisers and pesticides, weeding and pruning vulnerable tea trees, and domestic chores. Most of the workers (52%) had ≤10 years of experience, 30.7% had 11–20 years of experience and 17.3% had ≥21 years of work experience. Almost all workers (87.3%) had an 8-hour working day while a small proportion (10.1%) had ≤7 hours of work and 2.6% of workers had ≥9 hours of work every day. Among the workers, 92.5% did not do overtime work and 7.5% stated that they did overtime work; 70.2% of the workers took one break during work and 29.8% took no break during work.

MSS-related information of the tea garden workers is presented in table 3; 80.9% of the workers reported MSS in the last 12 months while 80.1% reported suffering from MSS in the last 4 weeks and 76.6% reported that they had MSS on the day of the interview. Almost six of the workers (16.1%) required hospitalisation due to MSS in their local tea garden hospital. Every worker suffering from MSS in the past 12 months required consultation with a doctor/physiotherapist; 80.6% of the respondents had taken medication due to MSS and 78.3% of participants had to take sick leave in the past 12 months. A small number of participants (11.6%) had to change their jobs. Of the respondents, 77.7% think MSS had reduced their work activity and 76.6% think MSS had reduced their leisure activity.

Table 4 demonstrates the MSS information in nine body regions as reported by the tea garden workers. The participants mostly suffered from MSS in the shoulder (78.2%) followed by upper back (56.1%), lower back (32.5%), neck (32.1%), wrist/hand (30%), hip/buttock (25.7%), elbow (20.7%), knee (10.7%) and ankle/foot (6.8%).

Factors associated with MSS of the tea garden workers are presented in table 5. Workers who were directly related to plucking work in the garden had a higher (83.4%) proportion of MSS (p=0.019). Female workers suffered more than male workers (p=0.028) in the neck region. Plucking workers reported suffering more from MSS in the neck (p=0.015), shoulder (p=0.032) and wrist/hand (p=0.034) compared with non-pluckers. Tea garden workers who worked 9 hours or more every day had MSS more in the lower back (p=0.036) compared with workers who had fewer work hours. Workers who did overtime suffered more in the elbow (p=0.047) and hip/buttock (p=0.021) than those who did not do overtime.

**DISCUSSION**

MSS is a very common health problem among agricultural workers. In this study, most of the tea garden workers were female (79.8%). Traditionally most of the tea garden workers in Bangladesh are female which reflects among the respondents in this study. A similar study in India also
reported 92.6% female respondents. Most participants were illiterate and belonged to the ≤30 years age group. Dihingia and Dewangan in their study found 91.2% illiterate, and 88.8% educated respondents in Assam, India, which is similar to this study. The prevalence of MSS for the past 12 months was found to be 89.9%. In a similar study in Tamil Nadu, India the prevalence of MSS among tea garden workers was found to be 83.6% which is quite similar. This is probably due to similar geographical, socioeconomic and work-related factors in neighbouring countries. Another study among Cambodian fruit farm workers shows the prevalence of MSS to be 80.4%, which is also similar to this study.

In this study participants were found mostly suffering from MSS in the shoulder (78.2%) followed by upper back (56.1%), lower back (32.5%), neck (32.1%), wrist/hand (30%), hip/buttock (25.7%), elbow (20.7%), knee (10.7%) and ankle/foot (6.8%). Vasanth et al in a similar study found the prevalence of MSS mostly in the shoulder (59%) followed by the lower back (58%), neck (49.1%), knee (43.9%), elbow (41.5%), upper back (37.3%), wrist (25.9%), ankle (7.1%) and hip (3%); the result of this study has some similarities with the current study. A similar study in Malaysia showed the prevalence of tea garden workers having MSS for the past 12 months in different body parts on the neck (34.6%), shoulder (24.8), elbow (22.2%), wrist (38.5%), upper back (26.9%), lower back (35%), hip (24.4%), knee (32.9%), ankle (18.4%) and feet (24.4%). In Malaysia plucking is done by shear and machine rather than conventional hand plucking in basket method in most parts of the world. This can be the reason for the lower prevalence of MSS compared with Bangladesh. A study done by Dihingia and Dewangan showed that the symptoms were most commonly reported in the shoulders (71.8%) followed by the neck (66.4%), upper back (65.6%), wrists/hands (50.4%), lower back (47.2%), elbows (39.4%), knees (10.0%), hips/buttocks (5.4%) and ankles/feet (2.6%); this study also has some similarities with the results of the current study. Since the amount of tea plucked depends on the number of tea leaves and buds plucked per cycle of hand movements and frequency of movement, therefore to increase output, pluckers increase hand movement cycles, which increases the load on the shoulders. This can explain why the shoulder is the prime region of MSS found in these studies.

There are many pieces of literature explaining that MSS is multifactorial. The symptoms may be influenced by working techniques, characteristics, types of work, and individual and sociodemographic characteristics. Psychosocial factors can also play role in developing MSS. The role played by age, job experience, breaks and overtime are of great importance in developing MSS. Here, the researchers tried to find out whether some sociodemographic and work characteristics were associated with MSS among tea garden workers.

In the neck region, the female workers (28.6%) suffered more than the male workers (15.7%), which was statistically significant (p=0.028). Plucking workers (83.4%) were suffering more from MSS than non-pluckers (71%) (p=0.019). Also, plucking work was associated with MSS in the neck (p=0.015), shoulder (p=0.032) and wrist/hand (p=0.034). All the participants who worked ≥9 hours per day were associated with MSS in the lower back (p=0.036). Overtime was also associated with MSS in the elbow (p=0.047) and hip/buttock (p=0.021).

The information regarding MSS in the past 12 months relies purely on recall and the answers may be subjective. MSS were recorded by asking questions, not by observation. Posture analysis and measuring repetition of work were not done in this study. These limitations can be pursued to obtain further information to identify causative factors for developing MSS among tea garden workers.

MSS prevalence was found to be very high among tea garden workers. Working in awkward postures should be avoided; also workers need to reduce excessive force and repetitive movements and minimise static unsupported postures. Workers should take small breaks such as stretching, sitting or change of posture, if possible, to avoid prolonged awkward posture and repetitive motion. Tea is mostly cultivated in developing and underdeveloped countries. So occupational problems of tea workers have always been neglected. Musculoskeletal problems are now being studied in all occupational settings all over the world, yet it is not enough. This study adds research to that small number of studies.

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Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article. Data queries can be addressed to the corresponding author.

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