

Assessment of self-perceived risk and risk rating among chemical sprayers in selected tea plantations in South India

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ABSTRACT

Introduction: Chemical sprayers of the tea plantation industry perceive various degrees of risk involved in their daily work. The objective of the study was to assess self-perceived risk and to rate these risks among the pesticide sprayers working in selected tea plantations in South India.

Methods: A cross-sectional study was conducted among 290 chemical sprayers in six selected tea plantations in South India from September to October 2018 after approval from the Institutional Ethics Committee and permission from the plantations. Data was collected by structured interview schedule with the chemical sprayers and key informant interviews were conducted with their supervisors. The risks perceived by the sprayers were rated and expressed using the Risk Rating Matrix.

Results: The mean age of the participants was 45.6±8.5 years and all of them were males. The most common risks encountered were leech bites (76%), other insect bites (58%) and bruises (46%). Chemical spills, splashes, slips, falls and backaches were considered as minor hazards in risk rating. Animal attacks and falls from trees were assigned the highest risk rating scores.

Conclusion: Insect bite was the most common risk perceived and animal attacks attained the highest risk score. Regular supervision and monitoring of work-related risk factors can help in the reduction of common injuries thereby ensuring safety at the workplace.

Keywords: Chemical sprayer, Risk rating, Tea plantation

Introduction

The idea of risk assessment dates back its history to over 2400 years ago with the Athenians assessing risk before making important decisions.^{1,2} The concept of risk assessment in occupational settings is recently gaining importance. It is the first step towards systematic and successful health, safety and environment (HSE) management. It refers to careful examination of the work to identify the possibilities of harm to people so that enough precautions can be taken to prevent this harm.

Unknown, hidden, undetected, or unrelated risks cause more uneasiness. The information arising from risk assessment must be shared with the right persons. Good risk assessment can help users to choose the most appropriate preventive measures.³

The Occupational Health and Safety (OHS) risk assessment matrix is a part of any general risk assessment form and helps workers put a numerical value on the hazard and risk identification process. In this hazard risk analysis

matrix, every consequence and the probability surrounding it are given a numerical value. When multiplied together they result in a number that correlates with a certain level of risk.^{4,5}

'A tool for risk assessment' written by Dejan Ristic explains the various types of risk assessment matrices.⁶ There are two ways to evaluate the matrices of consequences and likelihood: qualitative and quantitative. The first type is used for qualitative assessment of likelihood and consequences, while the second type is used for quantitative assessment of likelihood and qualitative assessment of consequences. Both matrices classify the consequences by using the following terms: death, major permanent disability, minor permanent disability, and temporary disability. In the qualitative matrix, likelihood is represented through the following categories: frequent, likely (probable), accidental, unlikely, and improbable.

India is also the world's largest consumer of tea with three-fourths of its total production consumed locally. The tea exports reached 837 million dollars in 2017-2018 and contributed to five percent of the national income in agriculture.^{7,8}

The plantation industry is composed of a complex chain of workers whose functions often overlap. The main workforce in the plantation industry includes people involved in various activities like pesticide spraying; weeding (removal of unwanted/weeds that grow among the tea plants); shade lopping/tree cutting (either branch which is causing too much shade or the dead branches of the trees in between the tea plants are chopped by a person climbing up the tree); pruning (mainly involves trimming of the tea bushes to maintain the height at the same time expanding the width of the tea bush) and plucking of tea leaves.⁹

While there are a few studies done among plantation workers, very few are done to date on the sprayers of tea plantations; hence there is scope to explore this area of work further. This study was done to assess self-perceived risk and to rate these risks among the pesticide sprayers working in selected tea plantations in South India.

Methods

A cross-sectional study was conducted among 290 sprayers in selected tea plantations in South India during the period of two months [September – October 2018]. Approval was obtained from the Institutional Ethics Committee (IEC No. 272/2017) and all the six tea estates who consented to be part of this study.

The calculated sample size was 354 using the formula $[n = \{z^2(pq) / d^2\}]$ and using the finite population correction using the formula $[(\sqrt{N-n}/N-1) \times \text{Calculated sample size}]$ the final sample size was estimated to be 255 employees.

However, in this study, we were able to interview all the sprayers who attended the annual health appraisals on the days of data collection. In total, 290 sprayers were included in our study.

Written informed consent was taken and the sprayers were interviewed either in the muster or at the Estate Hospital after their working hours. A structured interview schedule was administered by face-to-face interviews with the sprayers.

Risk rating was done based on the workers' opinion of the hazards they come across. They were first asked to list the most common hazards they came across. After obtaining the list of hazards, sprayers were asked to rate the hazards based on the severity of the hazards outcome and exposure was rated based on the frequency of exposure. Hazards were rated as 1 = no treatment/first aid at home, 2 = minor treatment like dressing at the hospital, 3 = major treatment like suturing, 4 = severe treatment such as surgeries, and 5 = fatal/death. Frequency was rated as 1 = rarely, 2 = unlikely, 3 = possible, 4 = likely, 5 = certain.

The risk rating matrix was applied to the commonly reported hazards to identify the various high-risk factors and the ranking of the risks was done according to the matrix. The results were represented in the form of a color-coded risk rating matrix table.

Results

The mean age of the participants was 45.6±8.5 years and all of them were males. In this study, 132(45.5%) had completed high school and 86 (29.7%) had middle school education. The

majority of them were married 282 (97.2%) and 52 (18%) of them were migrants coming mostly from the Northeastern parts of India. Half the study population 141 (48.6%) belonged to class 3 of B G

Prasad socioeconomic classification for the year 2018. In this study, modified B G Prasad's scale for socio-economic status classification was used taking Consumer Price Index= 307.¹⁰ [Table 1].

Table 1: Socio-demography of the study population (n = 290)

Age group (Years)	Number of respondents (%)
<21	4 (1.4)
21-30	17 (5.9)
31-40	50 (17.2)
41-50	138 (47.6)
51-60	79 (27.2)
≥61	2 (0.7)
Education	
No formal education	19 (6.6)
Primary school	38 (13.1)
Middle school	86 (29.7)
High school	132 (45.5)
PUC	14 (4.8)
Degree	1 (0.3)
Marital status	
Married	282 (97.2)
Unmarried	8 (2.8)
Socioeconomic class (Modified BG Prasad)	
Upper	4 (1.4)
Upper middle	73 (25.2)
Middle	141 (48.6)
Lower middle	70 (24.1)
Lower	2 (0.7)
Total	290 (100)

Table 2: Work profile of the study population (n = 290)

Duration of work as sprayer [Years]	Frequency (%)
0-10	46 [15.9%]
11-20	69 [23.8%]
21-30	129 [44.5%]
≥31	46 [15.9%]
Total	290
Methods of spraying	
High Volume Sprayer	113 [39%]
Knapsack [manually operated] sprayers	106 [36.6%]
Power machine [operated by petrol]	71 [24.5%]
Other activities done by sprayers	
Pruning	104 [35.9%]
Weeding	151 [52.1%]
Plucking	214 [73.8%]
Shade lopping [tree cutting]	35 [12.1%]

More than half of the study population 175 [60.3%] had worked for over 20 years as sprayers in the plantation. More than one-third of the devices used for spraying were high-volume sprayers (brand name Lu-shyong) by 113 [39%] and the knapsack sprayer by 106 [36.6%] of the sprayers. Apart from spraying, the sprayers were rotated in other work on the estate like weeding, pruning, shade lopping and plucking tea leaves. [Table 2]

More than two-thirds of the sprayers listed leech bite, 210 (72.4%) as the most common problem at their workplace. Steep climbing (46.6%), insect bites (25.5%), long walks (24.1%) and the need to carry a machine on their back (24.1%) were the most common occupation-related problems faced by the study participants. The sprayers adopted indigenous methods to prevent leech bites [Table 3].

Table 3: Main problems faced at work by the sprayers

Main problems faced	Leech bites	210 (72.4%)
	Other insect bites	74 (25.5%)
	Climbing steep	135 (46.6%)
	Weight of machine	70 (24.1%)
	Long walks	70 (24.1%)
	Injuries	38 (13.1%)
Solution for leech bites as listed by the participants	Application of snuff	79 (27.2%)
	Work carefully	56 (19.3%)
	Use of PPE	43 (14.8%)
	Chloroxylenol (Dettol)	7 (2.4%)
	Application of salt	8 (2.8%)

The risk was categorized based on severity and frequency as per the study participants. Leech bites, other insect bites and bruises were certain and likely to happen respectively and as a hazard, both did not need any treatment. Cuts/injuries, chemical spills and splashes were certain to happen during their course of work and were considered minor hazards. Slips, falls and backache were also possible and were considered

minor hazards. Fractures and eye injuries were also likely to happen and were considered moderate hazards. Fall from a tree (while involved in shade looping) and snake bites, were considered major risk groups and this exposure was possible. Attacks by animals (elephants and Indian Gaur/bison) were considered major to severe hazards and were possible to unlikely to happen at their workplace.

Figure 1: Categorization of injuries in the Risk rating matrix as perceived by the sprayers

		Frequency of exposure				
		Certain	Likely	Possible	Unlikely	Rare
Severity of hazards	No treatment	Leech bite, Insect bite	Bruise			
	Minor	Cuts/Injuries, spills, Splashes		Slips and falls, Backache		
	Moderate		Fractures, Eye injuries			
	Major			Fall from trees, Snake bites	Bison attack	
	Severe			Elephant attacks		

Very Low risk
 Low risk
 Moderate risk
 High risk

Discussion

Among the 290 sprayers in the study, the finding that all the sprayers in this study were males was obviously due to the selection of only males for the activity of spraying, considering it strenuous and exhaustive. During the discussion with the employers, they mentioned that women do not prefer this job because of exposure to chemicals. Similarities were seen in other studies conducted in Lucknow among pesticide sprayers which reported that only male sprayers were included in the study which could be obviously due to the employment of predominantly males for this activity in those areas also. However the employment in tea plantations as such do not have any gender preferences and females are usually employed more and involved in activities like plucking, weeding, transportation, pruning, and nursing of young plants.^{11,12}

According to the risk rating matrix, elephant and bison attacks were assigned the highest risk rating scores in this study. This finding is mainly due to the study setting which is close to the forest region. The wild animals are often reported to come down to the valleys in search of food and water in the areas where tea plantation and inhabitation is present. The most common problem faced by 72.4% of the sprayers was the leech bite and the insect bites. They also use remedies like 'application of snuff powder, antiseptics/chloroxynol (brand name Dettol) and salt' for the same. The climatic condition and crop favours the growth of these insects in this region. A similar study done in order to assess the risk rating in the tea plantation industry in South India showed that the most common morbidities were small cuts and abrasions. Backaches and insect bites attained the highest risk rating score in that study.¹³ These differences could be because this study included only chemical sprayers whereas

the other study also had workers from the factory and also women involved in tea plucking were included in the study group. Musculoskeletal disorders among these chemical sprayers have been presented elsewhere.¹⁴

Injuries, spills and splashes from the chemicals were also reported to be the second most common issue at the tea plantations. Bruises are also frequently affecting these workers.

These data point to the fact that occupational injuries and issues need to be addressed and recorded so that necessary steps can be taken to prevent them and hence improve the working conditions and in turn productivity. The risk rating matrix is an easy tool that can be used for such periodical assessment.

Conclusions

Insect bites were the most common issue faced by the sprayers in tea plantations. Attacks by animals like elephants and Indian gaur attained the highest risk rating scores in this study.

Continuous risk assessment among the plantation workers is vital to understand their perceived health risks at the workplace and to do the needful rectification to prevent accidents at the workplace and to alleviate health risks perceived by the workers.

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