Research Paper

LUNG FUNCTION PARAMETERS, NECK PAIN AND ASSOCIATED FACTORS AMONG MALE RUBBER TAPPING WORKERS IN KERALA

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Rubber tapping causes various health problems among rubber tapping workers. It varies from simple musculoskeletal aches to more serious and complicated structural damage to bone, muscles, tendons and nerves of musculoskeletal system. The present study was conducted in rubber tapping workers in two districts of Kerala. A total of 343 rubber tapping workers were included and 246 subjects with same socio economic status and equivalent physical activity workers were elected as control subject. The most common affected body region among respondents was neck pain (NP) (72.2%) followed by low back pain (66.2%), shoulders pain (44.9%), knee pain (55.8%), ankles/feet pain (34.4%), elbow pain (33.2%), upper back pain (30.8%), wrists pain (50.1%) and hip/thighs pain (15.3%). Boarder line significant difference was observed in the alteration of lung function in rubber tappers and controls. The study revealed that the workers were in potential risk of neck pain and various other musculo skeletal diseases (MSD) and lung function abnormalities due to exposure to acids, which are being used for the coagulation of latex.

Keywords: Rubber tappers, Lung function, Neck pain, Musculo skeletal diseases

INTRODUCTION

Rubber industry is becoming the largest agriculture industries in Kerala (God's own country). The rubber plant is not a native plant of India, which was introduced in Kerala (A state in India) by the Dutch colonialists. They cultivated rubber in Indonesia and then to Kerala as the climate in Kerala is similar to that in Indonesia. The Rubber plant (*Havea brasiliensis*) produces sticky, white latex that is collected and processed to produce natural rubber. The rubber tappers harvest the rubber by making a long curving cut on the outer bark of the trunk of the rubber tree after 6-7 years growth of the rubber tree. When the cut is made the latex from the tree seeps through the cut surface and flows down the cut into a container.

Farming and agriculture tasks in rubber industries are highly physical demanding, arduous and require extremely large of energy in

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performing their tasks, which may cause farm workers at potential risk of health problems caused by physical hazards, chemical hazards, biological hazards and ergonomic hazards. Ergonomic hazards poses variety of musculoskeletal symptoms (MSS) encompasses the neck, low back pain, osteoarthritis of the hip and knee, upper limb complaints and hand-arm vibration syndrome (Walker-bone and Palmer, 2002). Overall tasks of rubber tapping would expose rubber tappers to ergonomics risk factors such as repetitiveness, awkward postures, static muscle loading and forceful exertion (Asyraf *et al.*, 2007). Among the ergonomic factors present in rubber tapping process include age of the trees, height of tapping areas, number of area being tapped, uneven ground and technique of performing the tapping. However, the main risk factors for NP in rubber field are neck extension, twisted head, flexion of neck, awkward postures and repetitive moving of the head. In addition, use of acids for the coagulation of the latex may cause various inflammation and lung function abnormalities (Danwanichakul *et al.*, 2011).

Ergonomic risk factors cause wide range of occupational related diseases among agriculture workers especially rubber plantation population and need extensive exploration in Kerala. In view of limited study on prevalence of NP, MSDs and lung function among rubber workers in Kerala state, this study was attempted to determine the prevalence of NP and its association with personal characteristics, physical workloads and lung function parameters in rubber tapping workers in Kerala state.

MATERIAL AND METHODS

Study Design and Study Population

A cross-sectional study was conducted among rubber workers from October 2007 until May 2010 in two districts (Thiruvananthapuram and Kollam) in Kerala state using stratified random sampling in which sample was stratified and drawn from the overall total population of rubber workers age from 28 to 62 years old without medical diseases or trauma affecting musculoskeletal system and accident in any part of the body as majority of the active rubber workers. A total of 343 rubber tapping workers were included and 246 subjects with same socio economic status and equivalent physical activity workers were elected as control subject.

Data Collection Material

A modified Standardized Nordic Questionnaire (SNQ) consists of four parts (i) socio-demographic characteristics, (ii) general questionnaire, (iii) detailed body part-specific symptoms and (iv) physical workload rating was used to determine prevalence of NP (Kuorinka *et al.*, 1987). Socio-demographic-economic part contain question on age, education level, height, weight, working hours per day, length of working, smoking habit and trees tapped per day and income. General questionnaire showed a body map of various-anatomical body regions and asking about ache, pain, and discomfort for the last one year. Rubber workers who faced 3 months continuous ache, pain and discomfort in last 12 months was included in the analysis instead of 7 days discomfort as 7 days may be an acute pain which may resolve itself after a while. All answers are in the form of dichotomous yes or no responses.

Pulmonary Function Testing

Pulmonary function tests; forced expiratory volume 1 s (FEV_1), forced vital capacity (FVC), and the FEV_1/FVC ratio were measured using a

medspiror according to European Respiratory Society/ American Thoracic standards. The best of 3 maneuvers were expressed as a percentage of the predicted normal valve.

Statistical Analysis

Student's t-test was used to compare mean values at baseline among test group with those in the control group. Categorical data were compared with the use of the c^2 test. Pearson coefficient to evaluate the association between normally distributed continuous variables; Spearman rank correlation test was test to evaluate the association between nonparametric variables. Data was expressed as mean ± SD. Significance was defined as *p* value of <0.05. All statistical tests were performed with the uses of SPSS version18 and ORIGIN Pro8.0 software's.

RESULTS

Table 1 shows the mean age of rubber tappers (48.04 ± 6.51 years) and the age ranges from 28 to 62 years old. Majority of the test and control group were in the age group of 28-42 years and married (96.4%). The educational level, 87.3% of the tappers achieved education up to Standard 10 level (High school) with only 12.7% obtained +2 (Higher Secondary Education). The mean BMI was 25.88 ± 7.15 kg/m² and 91.6% of the test subjects were within ideal BMI ($<25Kg/m^2$) whereas remaining were overweight (>25-29Kg/ m²). 64% of the subject and controls were smokers. The working hours were 8hr/day and mean working years were 16.88 ± 10.56 yrs. 40% of them were working morethan 25 yrs and 10% of them work less than 10 years. The median of trees tapped per day was 400 ± 200 trees.

| Table 1: Personal Details of Rubber Tappers and Controls (Total Number 343 Rubber Tappers and 246 Controls)			
Details		Total number	Mean/Percentage (%)
Age	Rubber tappers	28-62 yrs	48.04 ± 6.51
	Controls	26-62 yrs	46.51 ± 8.22
Marital status	Rubber tappers		96.4%
	Controls		98.5%
BMI (kg/m²)	Rubber tappers	25.88 ± 7.15	
	Controls	25.22 ± 6.11	
Smoking status	Rubber tappers		64%
	Controls		63.6%
Education level	Rubber tappers High School Higher Secondary		87.3%12.7%
	ControlsHigh School Higher Secondary		82.4%17.6%
Number of working hours	Rubber tappers	8hr	
	Controls	8hr	
Trees tapping per day	Rubber tappers	400 ± 200	
	Controls	0	
Exposed to acid	Rubber tappers	343	100%
	Controls	0	0%

Figure 1: MSD Prevalence in Controls and Rubber Tappers for the Last One Year
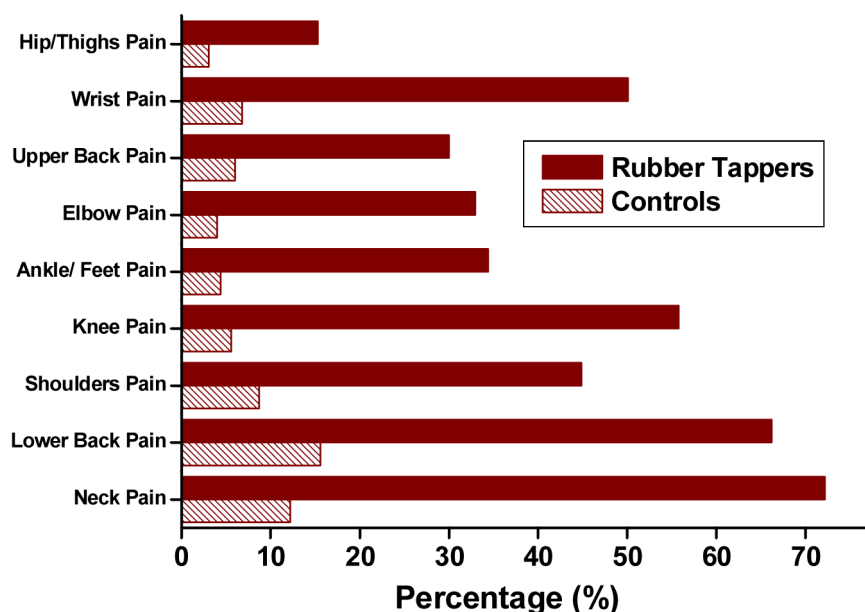
Figure 1 showed the prevalence of MSDs in different body region during last 12 months. The most common affected body region among respondents was NP (72.2%) followed by low back pain (66.2%), shoulders pain (44.9%), knee pain (55.8%), ankles/feet pain (34.4%), elbow pain (33.2%), upper back pain (30.8%), wrists pain (50.1%) and hip/thighs pain (15.3%). Bivariate analysis (c²) showed that neck region had significant association with age (*p*= 0.001). A variation was observed in the lung function analysis however it was in the border line significant level.

Table 2 shows the lung volumes in controls and rubber tapping workers. A borderline significant decrease in FVC and FEV_1 was observed in workers group compared with controls (p=0.05) and a positive correlation was observed with increase in working years and decrease in the FEV_1. A statistical significant decrease in FVC, FEV_1 and FEV_1/FVC was also observed with increase in BMI among rubber tappers (r=0.89, p<0.000), reflecting the increased restrictive pattern in these patients. A statistically significant difference was observed in FEV_1/FVC as duration (years) of tapping

Table 2: Lung Volumes and Capacities in Different Groups

Group	FVC	FEV_1	FEV_1/FVC	PEF	FEF25-50	FEF50-75	FEF75
Control	96 ± 3	101 ± 6	98.41 ± 1.22	100 ± 2	92 ± 2	86 ± 4	74 ± 5
Rubber Tappers	84 ± 6 (p=0.047)	106 ± 9 (p=0.45)	90.25 ± 3.21 (p=0.08)	103 ± 6 (p=0.87)	81 ± 4 (p=0.21)	88 ± 3 (p=0.88)	61 ± 6 (p=0.03)
Note: All values are expressed in percentage of predicted values.							

increased. However, no statistically significant difference was observed between obese individuals in the control group and obese subjects with rubber tappers.

DISCUSSION

The present work was conducted in two districts i.e., Thiruvananthapuram and Kollam among the fourteen districts in Kerala. 343 rubber tappers were included, which comprises of many youngsters also. In addition, work description was different among female and male in Kerala as female mostly keen to be a helper in latex collection rather than in tapping. Majority of the workers have morethan 7hrs working per day. The results of this study found overall prevalence of MSDs was high among rubber workers. This finding is in line with a study conducted by Shan *et al*. (2012) and Hartman *et al*. (2006) (Shan *et al*., 2012; and Hartman *et al*., 2006). The highest prevalence of MSDs found in this study was NP with prevalence of 72%, followed by LBP and SP. These findings were consistent with a study conducted by Shan *et al*. (2012) in Malaysia (Shan *et al*., 2012), in which NP, LBP and SP were the most common and predominantly occurring prevalence of MSDs. Based on observation in rubber field on the tapping process, high prevalence of NP among the rubber workers could be due to the rubber trees condition. Most of the rubber trees are old and need to be tapped above their head level and hence extreme force was required to extend their postures mainly on neck, shoulders and forearm area. This will induce a high risk to the neck pain. There were no significant association found between NP and amount of trees tapped per day. NP had no significant association with working hrs per day, BMI, ethnic, marital status, education level, smoking habit, length of working and trees tapped per day. There was limited literature on association between NP and personal characteristics factors, which was in consistent with a study conducted by Kermit and Susan (2007) on low back pain among rubber tappers show no significant association with socio-demographic factors (educational level, length of working, working experience and pain on low back).

The present study also revealed a border line significant association between the lung function parameters in controls and rubber tappers. This decrease in the lung function may be due to the exposure to acids which is using for the coagulation of the rubber latex. No previous work has been conducted on the effects of acids using for the coagulation of latex and its biological effects in human beings, a detailed study is need to be conducted on this.

CONCLUSION

This study recommended that a detailed study should be carried out on each ergonomic factor with objective measurement tools which include anthropometry measurement and biomechanics also the effects of chemicals using for the latex coagulation on the biological systems. Thus the future study should concentrate on the health promotion activities and guidelines to empower workers to minimize the risk and better quality of life including the youngsters. The authors hope the rubber board of Kerala will take initiation for the same.

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