INFLUENCE OF AGE, SOCIOECONOMIC AND NUTRITIONAL STATUS ON MUSCULOSKELETAL DISORDERS OF FEMALE PADDY THRESHING WORKERS

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ABSTRACT ■ Female workers in India actively participate in different agricultural jobs. Work related Musculoskeletal Disorders (MSDs) are common among them. The main aim of the present investigation was to evaluate the prevalence of MSD in relation to their age, socioeconomic and nutritional status. For the study 82 female workers engaged in paddy threshing were selected at random from the different villages of different districts in West Bengal state. Socioeconomic Status (SES) was evaluated by modified Kuppuswami Scale. The MSDs of the female threshers were evaluated by the modified Nordic questionnaire method. The Perceived Discomfort Rating (PDR) was assessed during work by a 10-point subjective scale. The nutritional status of the workers was determined by cut-off values of Body Mass Index (BMI) prescribed by WHO. The results revealed that the subjects of upper-lower socioeconomic class had higher prevalence of MSDs than that of the lower-middle class. The MSD was the most prevalent in thigh, knee, shoulder and lower back of the female workers and high values of PDR was noted in those segments. It was noted that the occurrence of MSDs was significantly different (P<0.01) in most of the body segments in under- and over-nourished females than that of normal weight counterparts. The higher rate of MSDs and discomfort in different segments of the workers was observed in younger age group (20-35 years.) which might be due to lesser experience and skill in young age than that of the middle age group (36-45 years.). It was concluded that the socioeconomic status, BMI and age of the female threshing workers might be influencing factors for the occurrence of MSDs.

Key words: female, threshing, socioeconomic Status, BMI and MSD

INTRODUCTION

A large numbers of rural Indian females are engaged in agriculture and exert manual labour for the production of rice. According to the census report it has been found that in West Bengal state about 46.3% of the female population are engaged in agricultural work (Census of India, 2011). Agricultural jobs are executed by hard manual labour and the workers are exposed to a high degree of occupational stress. Female workers are involved in different phases of paddy cultivation, such as, scattering of seeds, uprooting, transplantation, weeding, reaping, binding of straw, carrying of straw bundles, threshing and collection of paddy or grains and straw bundles etc. Threshing is a post-harvesting activity and female workers actively participate in this job. Traditional threshing of paddy is generally done by the

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hand: bunches of panicles are beaten against a hard element (e.g., a stiff wooden bar, stone or bamboo table or drum) or with a flail. A little amount unthreshed grains or paddy can also be lost in around the threshing area. Manual pedal operated threshing machines are also used to thresh the paddy in the field or farm. One or two person operates the machine with foot pedal and feed the bales from behind for threshing. In addition to that the operator keeps on spreading the paddy bundle on the threshing drum so that panicles get detached. This requires suitable hand orientation to keep the paddy spreading. These threshing machines were also motorized with single phase 1Horses Power (HP) electric motor for threshing of Paddy. The machine is run and two or one workers feed the bales from at the rear for threshing. Some of the villages and rural areas of the West Bengal there was no electric supply. Further, motorized threshing machine is costlier than that of pedal operated machine. Therefore, in West Bengal state, rural farmers, specially small and marginal farmers because of economic restrain still carry out threshing with use of bullock, betting of paddy bundle on stone or wooden platform and manual pedal threshing by using foot. In recent years pedal threshing becomes popular in West Bengal state. Pedal threshing requires both hand and leg synchronization. However, little hindrance cannot be avoided, as the pedal movement is continuous and very fast. Working in the same situation for prolonged periods was the work factor recognized as most challenging, where most respondents rated it as a most important problem causative to musculoskeletal symptoms. Madeleine (2003) noted that prolonged static muscle loads have appeared as a major risk factor in the development of load-related illnesses. Due to adopting different inappropriate postures during

performing paddy threshing they may suffer from pain / discomfort in their limbs as well as in other parts of body. Awkward postures and static postures during the occupation are some samples of the risk factors that may influence in musculoskeletal illnesses (Nonnenmann, *et al.*, 2010). Musculoskeletal disorders (MSDs) have been reported as an important cause of morbidity in many occupational groups, including farmers and also the general population (Waheed, 2003). The relationship between MSDs and job-related psychosocial factors such as high workload/demands, high perceived stress levels, low social support, low job control, low job satisfaction and monotonous work have been reported (Deeney and Sullivan, 2009). The major occupational risk factors associated with low back pain have been identified as awkward/poor work postures, bending, twisting, lifting and physical strenuous work (Solecki, 2011).Investigators (Mishra et al., 2013) reported that activities in paddy farming like weeding, cutting, uprooting, transplanting, removal of stalk and stubble, threshing workers were found to be maximum drudgery involved cultivation activities performed by female. For symptoms of neck/shoulder, upper and lower limbs, evidence was also found that high body mass index (BMI) is an important risk factor for the development of MSDs (Nilsen *et al*., 2011; Oliveria *et al*., 1999). Overweight/obesity has been shown to boost the hazard for musculoskeletal pain (Bihari *et al.,* 2011). Obesity was linked with harmful consequences in working populations, including more frequent absenteeism, workplace injury and higher health care costs (Linde *et al.,* 2012). Among mechanical factors, adjustment for physical workload could affect the relationship between body mass index and MSDs .Occupational and

physical workload has found to be associated with musculoskeletal disorders (Kim *et al*., 2010; Schouten *et al*., 2002).

The main aim of the present study was to evaluate different musculo-skeletal disorders (MSDs) of female agricultural workers during performing paddy threshing activities and to acquire insight whether socioeconomic, nutritional status and age were associated with prevalence of MSDs.

METHODOLOGY:
i) Site and subjects:

The present study was conducted on 82 female paddy threshers (age group of 20-45 years), randomly selected form different villages of different districts of the state of West Bengal, India. Prior permission and ethical approval was obtained from Institutional Ethics Committee before commencement of the study and the experiment was performed in accordance with the ethical standards of the committee and with the Helsinki Declaration.

Inclusion criteria:
➢ Subjects having age 20 years to 45 years
➢ Apparently healthy subjects
➢ Only female subjects

Exclusion criteria:
➢ Subjects below 20 years
➢ Subjects above 45 years
➢ Subjects with physical deformities
➢ Subjects having acute cardiovascular, serious arrhythmias, chronic addiction and other diseases.

ii) Socioeconomic status (SES):

Socioeconomic status of the subjects was evaluated by modified Kuppuswami Scale (Gururaj and Maheshwaran, 2014). From the response of the subjects each question quoted against their score and determined summated score is compared with the graded chart of social status.

iii) Measurement of anthropometric dimensions:

Anthropometric measures were taken from the subjects following standard techniques and appropriate landmarks (Ermakova *et al.,* 1985; Weiner *et al.,* 1981). Weight was measured to the nearest 0.1 kg using portable weighing machine (Libra) and height was measured to the nearest 0.1 cm using anthropometer (Hindustan Minerals).

iv) Body Mass Index (BMI):

From measures of height and weight of the subjects the body mass index (BMI) was computed using the following standard equation (Park, 2005): BMI = weight (kg)/ height^2 (m). The subject was classified into three classes, viz., underweight (BMI <18.5 kg/m^2), normal weight (BMI 18.50-24.99 kg/ m^2) and overweight (BMI = 25.00 kg/m^2) in accordance with the international classification system of the WHO (2004).

v) Musculoskeletal disorders (MSDs):

The musculoskeletal disorders of the paddy threshers were evaluated by the modified Nordic questionnaire technique (Kuorinka *et al*., 1987). The questionnaire emphasized their type and details of work and the occurrence or frequency of pain felt in different body parts.

vi) Perceived Discomfort Rating (PDR):

For the assessment of the intensity of pain / discomfort in different body parts, a 10-point psychophysical rating scale (0-no discomfort, 10-extreme discomfort) was used which is an assuming of Corlett and Bishop (1976) technique.

The 10 point scale arranged in the following way –

    0 : No pain
    1 : Discomfort
    2 : Very mild pain
    3 : Mild pain
    4 : Numbness
    5 : Average pain

6 : Moderate pain
7 : Severe pain
8 : Very much severe pain
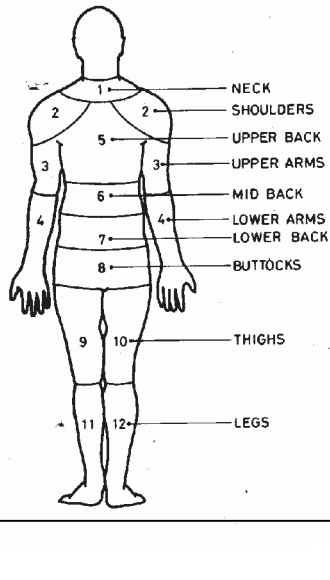9 : Very very much severe pain
10 : Intolerable

Fig.1: Different segments of the body

RESULTS :

In the present study it was noted that about 35.36% of the female workers engaged in paddy threshing was belonging to the lower middle socioeconomic category (Table 1). About 64.63% workers belong to upper lower socioeconomic category. No subjects were found other than these two categories.

The subjects was classified into different nutritional categories according to WHO (2004) prescribed BMI classification. From the results (Table 2) it was revealed that the undernourishment (underweight) was prevalent (58.53%) among them. About 35.36% subjects were belonging to normal categories. However, the prevalence of overweight was low (6.09%) among them.

The prevalence of MSDs of the female threshing workers has been presented in Table 3. From the results it was depicted that the prevalence of problem was the highest in the knee (79.27%) of the female workers. High rate of prevalence was also noted in thigh (71.95%), shoulder (60.98%) and lower back (58.54%) of the workers. The female workers also complained problems in upper back, feet, elbow, wrist and neck.

The frequency of occurrence of MSDs in different segments of the body was analyzed separately in different socioeconomic groups. From the results of Chi square (χ^2) test (Table 4) it was revealed that the prevalence of MSDs was significantly higher in different body segments, e.g., shoulder ($p<0.05$), upper back ($p<0.05$), lower back ($p<0.01$), thigh ($p<0.05$) and knee ($p<0.05$) in the subjects upper- lower socioeconomic class than that of lower-middle socioeconomic class. But only in case of feet, the frequency of occurrence of MSDs was significantly higher ($P<0.05$) among the subjects belongs to lower-middle socioeconomic class than upper-lower classes.

Table 1: Socioeconomic status of the female paddy thresher (N=82) according to the modified Kuppuswami Scale

Socioeconomic class	Upper (I) (26-29)	Upper Middle (II) (16-25)	Lower middle (III) (11-15)	Upper lower (IV) (5-10)	Lower (V) (<5)
Frequency (percentage)	-	-	29 (35.36%)	53(64.63%)	-

Table 2: Distribution of female agricultural workers (N=82) according to BMI Classification

BMI Classification	Frequency (*f*)	Percentage (%)
Under Weight (>18.50 kg/m^2)	48	58.53
Normal weight (18.50-24.99 kg/m^2)	29	35.36
Over Weight (≥25.00 kg/m^2)	5	6.09

The perceived discomfort rating (PDR) of female workers in different body segments was analyzed on a comparative basis among two socioeconomic (SE) groups (lower-middle and upper-lower).The results of t-test showed (Table 5) that the there was a significant difference (p<0.05) in the extent of pain / discomfort in different segments of the body, viz., shoulder, upper back, lower back, thigh and right calf between the subjects of lower-middle and upper-lower SE groups. However, no significant difference was observed in overall discomfort between two SE groups. However, the trends of results showed that

Table 3: Frequency and percentage (%) of musculoskeletal disorders (MSD) of female threshing workers (N=82)

Body Segments	Frequency (*f*)	Percentage (%)
Neck	18	21.95
Shoulder	50	60.98
Elbow	37	45.12
Wrist	36	43.90
Upper-Back	43	52.44
Lower-Back	48	58.54
Thigh	59	71.95
Knee	65	79.27
Feet	38	46.34

the subjects of Upper-lower SE group had greater extent of PDR than that of Lower-middle SE group.

The subjects were classified into underweight, normal weight and overweight according to BMI cutoff values (WHO, 2004) and the prevalence of MSDs of the female workers were studied among the BMI groups. The results of the Chi square test (Table 6) within three BMI classes revealed that there was

Table 4: Frequency, Percentage (%) of musculoskeletal disorders (MSD) of female threshing workers according to socioeconomic status

Body Segments	Socioeconomic Status				χ^2
	Lower-middle (n=29)		Upper-lower (n=53)		
	Frequency (*f*)	Percentage (%)	Frequency (*f*)	Percentage (%)	
Neck	7	24.14	11	20.75	0.475
Shoulder	15	51.72	35	66.04	6.121*
Elbow	13	44.83	24	45.28	0.006
Wrist	13	44.83	23	43.40	0.059
Upper-Back	13	44.83	30	56.60	3.953*
Lower-Back	14	48.28	34	64.15	7.382**
Thigh	19	65.52	40	75.47	3.491*
Knee	21	72.41	44	83.02	4.865*
Feet	16	55.17	22	41.51	5.337*

With respect to lower middle *p<0.05, **p<0.01

significant (p<0.001) differences in the occurrence of BMI in different body segments, viz., knee, thigh, shoulder, lower back, upper back, feet, elbow and wrist. From the results it was also noted that the subjects who were belonging to overweight category had significantly higher (p<0.05) prevalence of MSD in the shoulder, lower back, knee and feet regions than normal weight category. The results also indicated that the subjects of underweight category had significantly higher (p<0.05) prevalence of MSD in the thigh and knee regions than that of normal weight category. Overweight subjects had significantly higher (p<0.05) prevalence of discomfort in the feet than underweight category. The occurrence of MSD in underweight group was also significantly higher (p<0.05) in thigh and knee segments when compared to normal weight group.

The quantitative assessment of the discomfort of the female workers engaged in paddy threshing jobs was also performed. The perceived discomfort rating (PDR) of female workers in different body segments was analyzed on a comparative basis among three BMI classes The results of analysis of variance showed (Table 7) that there was a significant variation (p<0.05) in the extent of pain / discomfort in different segments of the body, viz., shoulder, upper back, lower back, calf, and thigh among the subjects of BMI classes. However, no significant variations were observed in neck, upper arm, lower arm, buttock and feet. Overweight threshers had a significantly higher (p<0.05) degree of pain at shoulder, upper back and lower back region than that of the normal weight paddy threshing workers and showed a significantly higher degree of discomfort at upper back

Table 5: The perceived discomfort rating (PDR) in different segments of the body of female cultivators (N=82) during performing paddy threshing jobs (in a 10 point scale) according to socioeconomic status

Body segments		Lower-middle (n=29)	Upper-lower (n=53)	t value
Neck		0.97±1.86	0.87±1.85	0.843
Shoulder	R	3.79±1.68	4.70±1.54	2.466*
	L	3.69±1.69	4.64±1.67	2.460*
Upper arm	R	1.90±2.35	2.11±2.28	0.406
	L	1.86±2.34	2.00±2.26	0.260
Lower arm	R	2.07±2.78	1.98±2.05	0.163
	L	2.03±2.74	1.96±2.16	0.131
Upper back		2.07±1.00	2.70±1.49	2.037*
Middle back		1.59±1.15	2.06±1.42	1.529
Lower Back		3.03±1.59	3.77±1.60	2.002*
Buttock		0.76±1.60	0.75±1.27	0.012
Thigh	R	3.76±1.18	4.30±1.15	2.019*
	L	3.55±0.83	3.98±0.97	2.014*
Calf	R	4.07±0.84	4.45±0.82	2.004*
	L	3.59±1.05	3.96±0.94	1.659
Feet	R	1.34±1.70	1.42±1.60	0.134
	L	1.40±1.63	1.94±2.19	0.315
Overall Discomfort		2.46±1.66	2.77±1.57	0.837

*p<0.05

(p<0.05) than that of the underweight threshers. The paddy threshers of underweight class had a significantly higher (p<0.05) extent of discomfort at shoulder, lower back, thigh and calf segments than that of the normal weight workers. However, there was no significant variance the overall discomforts between three BMI classes, although the average score of all body segments was the highest in overweight group and it was least in normal weight group.

Table 6: Frequency and percentage (%) of musculoskeletal disorders (MSD) of female paddy threshing workers according to BMI Classification

Body Segments	BMI Classification						χ^2	P Value
	Underweight (n=48)		Normal Weight (n=29)		Overweight (n=5)			
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)		
Neck	11	22.92	5	17.24	2	40.00	1.352	NS
Shoulder	32	66.67	14	48.28	4*	80.00	77.583	.001
Elbow	22	45.83	12	41.38	3	60.00	26.593	.001
Wrist	21	43.75	12	41.38	3	60.00	23.927	.001
Upper-Back	27	56.25	13	44.83	3	60.00	46.042	.001
Lower-Back	30	62.50	14	48.28	4*	80.00	67.629	.001
Thigh	38*	79.17	17	58.62	4	80.00	124.310	.001
Knee	41*	85.42	19	65.52	5*	100.00	162.752	.001
Feet	20	41.67	14	48.28	4*#	80.00	32.454	.001

With respect to Normal Weight *P<0.05, With respect to Under Weight #P<0.05

Table 7: The perceived discomfort rating (PDR) in different segments of the body of female cultivators (N=82) during performing paddy threshing jobs (in a 10 point scale)

Body segments		Underweight (n=48)	Normal Weight (n=29)	Overweight (n=5)	F ratio
Neck		1.08±2.13	0.59±1.38	0.60±0.89	0.71409
Shoulder	R	3.73±2.85$	2.34±2.61	5.00±2.83$	3.25173*
	L	3.71±2.97$	2.28±2.39	4.80±2.95$	3.21888*
Upper arm	R	2.06±2.56	2.21±2.69	2.00±2.00	0.03302
	L	1.90±2.32	2.07±2.49	2.60±1.95	0.21996
Lower arm	R	1.85±2.43	1.79±2.46	2.00±2.00	0.01718
	L	1.75±2.47	1.93±2.59	1.40±2.19	0.11301
Upper back		1.83±1.62	1.79±1.52	4.00±3.81$#	3.60189*
Middle back		1.71±2.41	1.69±2.44	2.00±2.83	0.03558
Lower Back		3.54±2.31$	2.45±1.50	4.20±2.68$	3.49759*
Buttock		0.63±1.33	0.55±1.33	0.40±0.89	0.08156
Thigh	R	4.38±2.38$	3.10±1.37	4.60±2.97	3.5296*
	L	3.42±2.29$	3.45±2.20	4.20±2.77	3.33664*
Calf	R	4.75±2.52$	3.28±2.48	4.80±2.95	3.20352*
	L	4.35±2.34$	3.00±2.38	4.60±2.97	3.14409*
Feet	R	1.27±1.61	1.38±1.61	1.80±1.79	0.25409
	L	1.77±2.33	1.76±2.18	2.40±2.51	0.18063
Overall Discomfort		2.57±2.29	2.10±2.10	3.02±2.41	0.5866

*P<0.05, With respect to normal weight $P<0.05, With respect to under weight #P<0.05

Table 8: Frequency and percentage (%) of prevalence of musculoskeletal disorders (MSD) of female paddy thresher according to their age (Gr.-A. and Gr.-B)

Body Segments	Age Groups				χ^2
	Group A (20-35 yrs.) (n=60)		Group B (36-45 yrs.) (n=22)		
	Frequency (*f*)	Percentage (%)	Frequency (*f*)	Percentage (%)	
Neck	12	20.00	6	27.27	1.885
Shoulder	34	56.67	16	72.73	6.618*
Elbow	31	51.67	6	27.27	14.672***
Wrist	30	50.00	6	27.27	12.805***
Upper-Back	29	48.33	14	63.64	5.733*
Lower-Back	32	53.33	16	72.73	9.461**
Thigh	46	76.67	13	59.09	9.345**
Knee	52	86.67	13	59.09	28.251***
Feet	28	46.67	10	45.45	0.036

*P<0.05, **P<0.01, ***P<0.001

Table 9: The perceived discomfort rating (PDR) (Mean ±SD) in a 10 point scale in different body segments of two groups of the paddy threshers according to their age

Body Region		Group A (20-35 years.) (n=60)	Group B (36-45 years.) (n=22)	t-value
Neck		0.72±1.78	1.32±1.99	1.31623
Shoulder	R	3.85±3.00	2.00±2.02	2.67132**
	L	3.57±2.90	1.95±1.70	2.45418*
Upper arm	R	2.50±2.67	1.23±2.18	2.00124*
	L	2.38±2.59	1.18±1.59	2.03381*
Lower arm	R	2.23±2.48	1.05±2.06	2.00576*
	L	2.20±2.61	0.95±1.94	2.03883*
Upper back		2.58±3.07	1.64±2.52	1.29401
Middle back		2.00±2.49	1.05±2.06	1.60597
Lower Back		2.50±2.43	3.91±3.69	2.01013*
Buttock		0.43±1.16	1.00±1.57	1.77852
Thigh	R	4.62±2.61	3.82±2.68	1.21801
	L	3.67±2.21	2.95±2.38	1.26783
Calf	R	4.98±2.38	3.27±2.78	2.75817**
	L	4.48±2.27	2.86±2.66	2.73523**
Feet	R	1.28±1.54	1.50±1.79	0.53953
	L	2.05±2.39	1.14±1.75	1.63639
Overall Discomfort		2.71±2.39	1.93±2.20	1.336

*P<0.05,**P<0.01

According to the age, the female paddy threshing workers were divided into two groups (Table 8), viz., Group A (Gr.-A: 20-35 years.) and Group B (Gr.-B: 36-45 years.). Numbers of subject in each group were 60 and 22 respectively. The result of the Chi square test between two age groups revealed that the occurrence of MSDs among the subjects of lower age group (Gr.-A) was significantly higher (P<0.001) in different segments of the body viz., elbow, wrist, thigh and knee than that of higher age group (Gr.-B). However, the subjects of higher age group (Gr.-B) also showed significantly higher percentage of MSDs in shoulder (p<0.05), upper back (p<0.05) and lower back (p<0.01) than that of the workers of lower age group (Gr.-A).

The results of PDR of two age groups of female paddy threshers have been shown in Table 9. The results showed that the subjects of lower age group (Gr.-A) had a significantly higher extent of discomfort in different body segments, viz., shoulder (right: p<0.01; left: p<0.05), upper arm (right and left: p<0.05), lower arm (right and left: p<0.05) and calf (p<0.01) than that of the subjects of higher age groups (Gr.-B). The trends of results indicated that other body segments had higher extent of PDR, although non-significantly, in the females of lower age group in comparison to the subjects of higher age group excepting buttock and neck segments. It was observed that the overall body discomfort, which was the average scores of all body segments, was comparatively higher in lower age group (Gr.-A) than that of higher age group (Gr.-B), although it was not statistically significant.

DISCUSSION:

The socioeconomic status of an individual or a population is dependent on several factors.

In the present study this status of female paddy threshing workers was determined by terms of their literacy level, occupation, and financial condition. It was observed (Table 1) that a large number of workers were belonging to the lower socioeconomic class (64.63%) which might be owing to low daily wage and also non-availability of work throughout the year. The low literacy rate might be another reason behind it. A large number of female workers were compelled to leave school before finishing primary education due to poor economic condition. The low socioeconomic status of the agricultural workers may be related to their nutrition and health (Bose *et al.,* 2007). This might be one of the risk factors for the occurrence of occupational diseases and hazards (Kar and Dhara, 2007).

From the result (Table 2) it was observed that a major percentage of female paddy threshing workers were underweight (58.35%). Such health condition of the workers might be due to the deprived nourishment as a result of low consumption of nutritious food. This in turn might be related to lower socioeconomic condition (64.63%) of the workers. Low BMI and high levels of under nutrition (based on BMI) are the most important public health problem especially among rural deprived adults of developing countries (WHO, 1995). Investigations carried out by different group of researchers revealed that adult Indian rural population suffers from underweight or CED (Chakraborty *et al.* 2007; Pal *et al.* 2014).

High prevalence of MSDs (Table 3) in knee (79.27%) and thigh (71.95%) of the female paddy threshers might be due to adopting long term static posture during performing the task. During using manual type threshing

machine the workers required continuous standing on one leg. This imposed static load on the lower limbs of the body. The static contraction of muscle for a long duration might lead to fatigue. It may be pointed out that during using manual threshing machine the workers had to paddle by the other leg for a long duration to run the machine. Repeated movement of lower limb might be another cause of occurrence of pain / discomfort in those segments (Girish *et al.,* 2012). Kar and Dhara (2007) also reported the same finding where the upper leg of the cultivators had problem in threshing (72.0%) activity. Static postures and awkward postures during the task are some samples of the risk factors that might effect in musculoskeletal illnesses (Meyers, et al., 2002). In the other hand the prevalence of MSDs and PDR rating were comparatively lower in case of sitting posture (Maity *et al.,* 2014; Maity *et al.*, 2016).

During paddy threshing activity, a high prevalence of MSD was also noted in the shoulder (60.98%). During threshing the workers were required to hold the straw bundle with paddy and to place the front part of the bundle on the rotating wheel of the threshing machine for a long time of the day. In this condition, the shoulder of the workers was found to remain abducted for long period and as a result static load had been obligatory on the shoulder. The arm rose to some extent that might cause shoulder muscle tenderness. This might be due to the static fatigue of trapezius muscle (Onishi *et. al.,* 1976). In addition to that frequent movement of shoulder was required to pick up unthreshed straw bundle before threshing and to throw away the straw bundle after threshing. Working tasks with repetitive limb movements may inducing shoulder tendovaginitis or tendonitis probably due to

friction (Herberts *et al.,* 1984). Al-Rahamneh *et al.* (2010) pointed out in their studies that those performing highly repetitive tasks for prolonged period had higher prevalence of pain at different segments of their body.

The frequency of occurrence of MSDs and PDR in different segments of the body, in our study (Table 4 and Table 5) indicated that the subjects of lower socioeconomic class have higher prevalence of MSDs than the lower middle class. Investigators (Hagen *et al.,* 2005; Pingle and Pandit, 2006) pointed out strongest association between low socioeconomic status (SES) and dominance of widespread musculoskeletal complaints (MSC). Individuals with low SES had higher prevalence of unrelieved MSC than those with high SES.

Study of MSDs (Table 6) and PDR (Table 7) revealed that the occurrence of MSD and degree of perceived discomfort was higher in the segments of lower extremities, especially in thigh and calf, in comparison to other body segments. Those were observed more or less consistently in all nutritional groups. It might be due to the fact that the workers had to work in standing posture continuously. During paddy threshing, pedal maneuver was continuous, one leg on the pedal and the other leg on the ground. The operator required adjusting the bodyweight between his two legs to sustain a static position. The thresher had to exert leg force on the pedal on its descending movement and had to lift the leg when the pedal moved up so that the retardation of the pedal by the weight of the leg was less. The main problem of the existing system of operation was that the worker was required to bear the whole body weight on one leg during the operation of the machine. Thus the leg muscle becomes fatigue and the workers report pain in their leg (Mohanty *et al.*, 2008). When nutritional status was

considered separately it was noted that the incidence of MSDs and PDR in different body segments was comparatively higher among the workers in underweight and overweight groups than the normal weight group. Among the subjects of underweight, deprived nutrition may influence the muscle strength and endurance of the workers. Early fatigue may be initiated in underweight females during work. These might be the probable risk factor for the high incidence of MSDs in underweight paddy threshers. The present results depicted that obesity was a strong determinant for knee MSDs. Other investigators (Cooper *et al.,* 2000; Reijman *et al.,* 2007) also reported higher incidence of Knee problems among obese persons. Besides, overweight showed a significant relationship with musculoskeletal symptoms on knees. Overweight influences the effect of mechanical strain on the weight-bearing joints. Investigators (Forde *et al.*, 2005; Tsigonia *et al*., 2009) showed that the relationship between period of task and musculoskeletal symptoms on knees was statistically significant and it could be that the consequence of dose-response relationship. In the present study, overweight has been shown to increase the risk for musculoskeletal pain (Table 7) in different body segments and this was documented by other investigator also (Moreira-Silva *et al.* 2013). Shiri et al. (2009) and Morken et al. (2000) also recognized that workers being overweight seem enhance the risk of low back pain by putting additional stress on their back. The risk factors for the occurrence of low back pain as indexed by many researchers are awkward postures, lumbo-spinal strain, high repetition, excessive forces, intense physical work, etc. (Shiri *et al.,*2008;Todd, 2008).

The female paddy threshing workers were divided into two age groups: young age group (Gr.-A: 20-35 years.) and middle age group (Gr.-B: 36-45 years) to account for studying variation of different parameters. Such kind of division of age groups has been also made by other workers (Monteiro *et al.*, 2009; Rehman *et al.*, 2013). The occurrence of MSDs (Table 8) and perceived discomfort rating (Table 9) exhibited variation in the subjects of different age groups. The MSDs was higher in the subjects of young age group (20-35 years) than the middle age Gr.-B (36-45 years.). The higher prevalence of MSD in the workers of younger age group might be due to lesser experience and skill in their work (Häkkänen *et al.,* 2001; Madeleine et al., 2003). The pervasiveness of MSD in different body segments was the lowest in moderate experience group (Chatterjee *et al.,* 2015). As the workers of lower age group were young and they were new in adopting the job, they were untrained and possessed a little knowledge to operate the machine; they were suffering from the musculoskeletal problems. More specifically, the imbalance between the functional capacity of the aging workforce and the work demands puts them at more risk than their younger counterparts (Okunribido *et al.,* 2010). The physiological problems that arise from repetitive work or overuse of certain muscles, soft-tissue structures and tendons have been addressed in terms of muscle fatigue, tissue strain and tissue density changes (Gallagher and Heberger, 2013; Gerr *et al.* 2014). In case of upper age group (Gr.-B.), the occurrence of MSDs in back (72.73%) and the perceived rating of discomfort was higher ($P<0.05$) than that of the younger age group. The relationship between age and some specific factors were well established (Manek *et al.,* 2005).

CONCLUSION

It appeared from the BMI study that a large

percentage of the female thresher was undernourished, which might be related to their low socioeconomic status. The female workers of lower socioeconomic status exhibited higher occurrence of musculoskeletal problems than that of lower middle socioeconomic status. Further, undernourished workers had greater prevalence of MSDs as well as greater extent of PDR than that of workers with normal weight. The age influenced the occurrence of work related musculoskeletal problems of the female threshers. The workers of younger age group had higher occurrence of MSDs and greater degree of PDR than that of upper age group. Therefore, it may be concluded that the socioeconomic status, nutritional status and age of the female paddy threshing workers affected the prevalence of MSDs.

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