

## THE PREVALENCE OF MUSCULOSKELETAL DISORDERS AMONG PRAWN SEED COLLECTORS OF SUNDERBANS

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In India, particularly in Sunderban of West Bengal, collection of prawn seeds is one of the major earning resources among prawn seed collectors. They are compelled to carry out a considerable amount of hard, manual, rigorous tasks in the river of the Sunderban area for collecting prawn seeds. They have to adopt some undesirable postures that may lead to the development of musculo skeletal disorder (MSD). The main aim of the present study is to investigate the prevalent postures adopted by the prawn seed collectors during individual prawn seed collection and to analyze the causation of discomfort feeling related with those postures. For this study, 21 male and 25 female prawn seed collectors were selected randomly and a detailed posture analysis was performed among them by means of OWAS method. It was observed that these workers worked continuously in awkward postures during certain prawn seed collection activity and consequently they suffered from discomfort feeling (pain) in different parts of the body.

**Key words:** Prawn-seed collectors; Posture; OWAS; Discomfort feeling

### INTRODUCTION

Sunderbans is the largest delta of the world. It is famous for its marine and estuarine fish resources. A large number of people are mainly dependent on fishery activity and capture fisheries are treated as the backbone of Sunderban economy. The soil due to salinity in the Sunderban delta area is not suitable for agriculture. Collection and cultivation of prawns is an alternative means for subsistence in the area. Prawn cultivation not only provides them with ready cash but it appears to provide more earning opportunities than agriculture.

Recently brackish water aquaculture has been in the limelight because of its very high potentiality in production of prawns, particularly of "Tiger Prawn". Catching of "Tiger Prawn" seeds is not a new occupation to the people of Sunderban. West Bengal is fortunate to have naturally available "Tiger prawn" seeds in large quantities (Bhowmick, 1993). Tiger Prawn seeds are generally available throughout the year in varying quantities in the Ganga Estuary System (Mahapatra et al., 1993). A group of people locally known as "Meendhara" are generally involved in catching of "Tiger Prawn" seeds. Sunderban region has high representation of poor people. Being motivated by a regular cash income, the majority of coastal people, even women and children, have adopted prawn seed collection as their profession almost throughout the year.

The main aim of the present study is to investigate the postures adopted by the prawn seed collectors during individual prawn seed collection activity and to analyze the causation of discomfort feeling related with those postures. These studies are also meant to assess the prevalence of musculoskeletal disorders among the prawn seed collectors (both male and female) of West Bengal.

## METHODS

### *Location and Area:*

The study was conducted in the Sandeshkhali block of Sunderban. The village under study is within the district of South 24 Parganas, which lies in the extreme southeastern part of the state of West Bengal. The district is bounded on the north by the district of Kolkata, on the east by the portion of north 24 Parganas and on the south by Bay of Bengal.

### *Selection of Subjects:*

After selections of the sites, 46 prawn seed collectors (mean age  $33.5 \pm 12.2$  years) were randomly selected comprising 21 male and 25 female collectors. All of them had a minimum work experience of 10 years in their present occupation.

### *Measurement of physical parameters:*

The height and weight of the prawn seed collectors were measured by an anthropometer (Martin's Anthropometer) and "Crown" weighing machine (Mfg. by Raymon Surgical Co.) respectively. The Body Surface Area (BSA) (Banerjee and Sen, 1955) and Body Mass Index (BMI) of all the subjects were also computed.

### *Study of the daily work schedule:*

The regular work schedule of these workers was observed meticulously. Generally during high tide the "Tiger prawn" seeds or "meens" come up the stream in great quantity due to pressure from sea (Raychaudhuri, 1980). Quantity of fish increases with the rate of increase of water towards new moon and full moon. But the collection of these seeds takes place during low tide of the river. It was also observed that summer season is the best time for collection of a good amount of prawn seeds, whereas winter months are the poorest season. There are mainly two types of process of prawn seed collection- 1) dragging of a net (Figures 1 and 2) and 2) spreading of a net (Figure 3).

Each day, the prawn seed collectors perform two types of activities- 1) forward or backward dragging of the net (Figure 1 or Figure 2) / spreading of a net (Figure 3) and 2) collection of seeds (Figure 4). They cannot afford the big net to spread. So they mainly use hand-operated small nets, which they drag through the 1.5 feet thick sticky mud and salty water for prawn seed collection activities. They drag their small hand operated net by two processes- 1) forward dragging or 2) backward dragging. During dragging, they have to travel a long distance (approximately 4 miles/day) about 4 hours in a day through 1.5 feet thick sticky mud and salty water for prawn seed collection activities.



Fig. 1. Forward dragging of a net in the salty water.



Fig. 2. Backward dragging of a net through sticky mud and salty water.



Fig. 3. Spreading and setting of a net.



Fig. 4. Separation of prawn seeds.

#### *Analysis of working postures:*

The analysis of different working postures of the prawn seed collectors by Ovako Working Posture Analysis System (OWAS) (Karhu et al., 1977) was carried out with the aid of digital photography (Sony Handycam 360X). Later on, stick diagrams were drawn from freezed frame video records and eventually subjected to analysis. The most frequent postures adopted by the workers were taken into consideration.

#### *Questionnaire Study:*

A detailed study based on the modified Nordic Musculo-Skeletal-Disorder Questionnaire (Dickinson et al., 1992) was performed on the experimental group or Meendhara. In the original questionnaire of Dickinson et al. (1992), the subjects were asked about the discomfort feeling during the last 12 months and during the last 7 days. In this study, the above questionnaire has been modified wherein the feeling of discomfort of the prawn seed collectors at different times (during work, after work, during sleep at night and during 24 hours after work) has been incorporated to make the study more authentic and precise.

The questionnaire constituted a series of objective questions with multiple-choice responses. The questions were arranged and grouped into the following major sections dealing with:

- 1) General working processes;
- 2) Subjective symptoms associated with work-related discomfort and pain, etc.

#### *Discomfort scale:*

The intensity of pain feeling/discomfort feeling was measured by utilizing the body part discomfort (BPD) scale (Jacquelin et al., 1994) (Figure 5). The workers having no such discomfort feeling are not included in this rating. The prawn seed collectors performed the task and rated their own exertion after completion of the task (prawn seed collection) in a 10-point scale, where 1 indicated just noticeable pain, 5 represented moderate pain and 10 demonstrated intolerable pain.

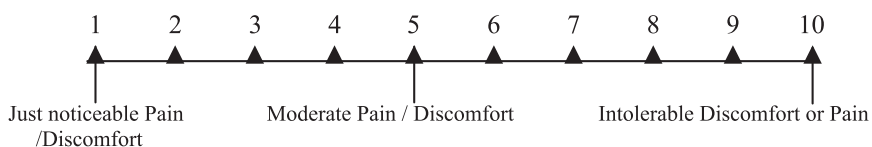


Fig. 5. Body part discomfort (BPD) scale (Jacquelin et al., 1994).

*Statistical analysis:*

Student “t” test was performed among the male and female prawn seed collectors to find out whether there is any significant difference between the physical parameters for the chosen level of significance ( $p < 0.05$ ). A two-tail chi square test of independence was applied to determine whether or not the test item had any significant association with discomfort feeling. The computed  $\chi^2$  was next compared with the critical  $\chi^2$  values for the chosen level of significance ( $p < 0.05$ ) (Das and Das, 1993).

## RESULTS

The questionnaire results were tabulated for conducting their analysis. The mean values of age and physical parameters (height, weight, BSA and BMI) of male and female subjects are shown in Table 1. From the questionnaire study, it was observed that all the prawn seed collectors complained of discomfort feeling at different parts of the body. The subjects complained of the maximum discomfort feeling (pain) before or after sleep at night (Table 2).

Table 1. Physical characteristics of the prawn seed collectors.

Parameters	Mean		±SD		t	Remarks
	Male	Female	Male	Female		
Age (years)	31	35.6	12.19	11.78	1.29	NS
Height (cm)	161.9	150.3	6.13	6.17	9.18	S
Weight (kg)	50.6	43.3	6.37	5.98	3.68	S
BSA (m <sup>2</sup> )	1.5799	1.40052	0.114	0.115	0.85	NS
BMI (kg/m <sup>2</sup> )	19.3	19.2	2.06	1.96	0.24	NS

Table 2. Discomfort feeling (pain) at different time among the prawn seed collectors.

Discomfort feeling (pain) at different times	Male (n=21)		Female (n=25)		$\chi^2$	Remarks (p < 0.05)
	Discomfort feeling		Discomfort feeling			
	Number	Percentage (%)	Number	Percentage (%)		
Pain felt during work	2	9	3	12	0.07	NS
Pain felt after work	5	24	9	36	0.80	NS
Pain felt before or after sleep at night	13	62	10	40	2.19	NS
Pain felt during 24 hours after work	1	5	3	12	0.75	NS

In this study 62% of male prawn seed collector and 40% of female prawn seed collector suffered from severe pain before and after sleep at night. The low back region of the body was the most affected part (95% male and 92% female were suffering from low back pain). This was followed by the neck region (76% male and 84% female). The upper back was the third most affected region (67% male and 76% female) (Table 3). The workers of both sexes reported separately about pain in the wrists and pain in the hands. They also reported about the ankles and feet problem separately. In view of the obtained responses from the questionnaire analysis, these regions have been tabulated separately. Similarly as there was no such response of the workers of both the sex regarding pain or

Table 3. Discomfort feeling (pain) at different body parts among prawn seed collectors.

Body parts	Male (n=21)	Female (n=25)
Neck	16 (76%)	21 (84%)
Shoulder	13 (62%)	15 (60%)
Elbows	6 (29%)	4 (16%)
Wrists	13 (62%)	10 (40%)
Hands	10 (48%)	9 (36%)
Upper back	14 (67%)	19 (76%)
Lower back	20 (95%)	23 (92%)
Knees	12 (57%)	21 (84%)
Ankles	10 (48%)	19 (76%)
Feet	13 (62%)	16 (64%)

discomfort feeling in the hips/thighs/buttocks regions, hence the above regions were not shown in the table.

The statistical analysis by the chi-square test (Table 4) was done to evaluate the effect of gender on the discomfort feeling during different prawn seed collecting activities. It was observed that the lower part of the body (knee, ankle and legs) has a significant association with gender division. The lower part of the body was mainly involved during walking through 1.5 feet depth sticky mud for 60 minutes at a stretch. Table 5 presents the discomfort feeling according to the BPD scale (Jacquelin et al., 1994). It was revealed from the BPD scale that the male and the female prawn seed collectors rated their discomfort as 6.5 and 7.5 respectively. This indicates that female collectors suffered from more strong body part discomfort feeling than male collectors (Table 5). Although the males were affected more than females, the intensity of pain feeling was higher in the female than in the male prawn seed collectors.

Table 4. Association of discomfort and no discomfort feeling between male and female prawn seed collectors.

BODY PARTS	SEX	Subjects without discomfort feeling	Subjects with discomfort feeling	Total					$\chi^2$	Remarks
				A+B	C+D	N	B+D	A+C		
Neck	Male	5 (B)	16 (A)	21	25	46	9	37	0.44	NS
	Female	4 (D)	21 (C)							
Shoulders	Male	8 (B)	13 (A)	21	25	46	18	28	0.01	NS
	Female	10 (D)	15 (C)							
Elbows	Male	15 (B)	6 (A)	21	25	46	36	10	10.60	S
	Female	21 (D)	4 (C)							
Wrist	Male	8 (B)	13 (A)	21	25	46	23	23	2.19	NS
	Female	15 (D)	10 (C)							
Hands	Male	11 (B)	10 (A)	21	25	46	27	19	0.63	NS
	Female	16 (D)	9 (C)							
Upper Back	Male	7 (B)	14 (A)	21	25	46	13	33	0.49	NS
	Female	6 (D)	19 (C)							
Lower Back	Male	1 (B)	20 (A)	21	25	46	3	43	0.19	NS
	Female	2 (D)	23 (C)							
Knee	Male	9 (B)	12 (A)	21	25	46	13	33	4.06	S
	Female	4 (D)	21 (C)							
Ankles	Male	11 (B)	10 (A)	21	25	46	17	29	3.94	S
	Female	6 (D)	19 (C)							
Feet	Male	8 (B)	13 (A)	21	25	46	17	29	0.02	NS
	Female	9 (D)	16 (C)							

S, significant; NS, not significant

Table 5. Discomfort feeling (pain) according to body parts discomfort (BPD) scale.


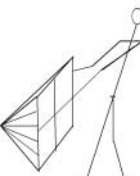
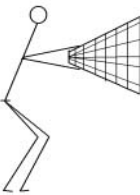
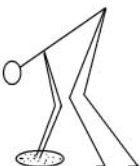
Sex	No. of Subjects	Average results of discomfort feeling (pain)	Remarks
Male	21	<p>1 2 3 4 5 6 7 8 9 10</p> <p>Just noticeable Pain / Discomfort      Moderate Pain / Discomfort      Intolerable Discomfort or Pain</p>	$t = 4.00$ So female subjects has significantly higher discomfort ( $p < 0.001$ ) feeling than male subjects.
Female	25	<p>1 2 3 4 5 6 7 8 9 10</p> <p>Just noticeable Pain / Discomfort      Moderate Pain / Discomfort      Intolerable Discomfort or Pain</p>	

## DISCUSSION

The prawn seed collectors felt discomfort (pain) in different parts of the body due to constant forward and backward bending postures for a prolonged period of time. According to Gangopadhyay et al. (2004) musculoskeletal disorder (MSD) were been positively associated with constant awkward bending postures for prolonged period of time. It was also evident that lower limbs and low back were affected more than other parts of the body. The prawn seed collectors have to travel a long distance during forward and backward dragging of net through 1.5 feet thick sticky mud and salty water. This may be responsible for their discomfort feeling (pain) at the lower limbs and the low back region. Both male and female prawn seed collectors suffered from severe pain in the upper extremities, primarily involving shoulders and wrists, as they drag their net forward and backward. It was observed from the BPD scale that the intensity of discomfort or pain feeling is higher among the female prawn seed collectors. The reason behind this may be that the female workers, apart from their regular work activity, have to perform numerous household chores that further enhanced their discomfort feeling. It was evident from the analysis of posture (Table 6) that most of the postures adopted during prawn seed collection activities needed corrective measures as soon as possible.

According to Kivi and Mattila (1991) awkward working posture is mainly associated with the development of musculo skeletal disorders (MSD). Haslegrave (1994) stated that, specific postures are adopted for workers executing movements and exerting forces to perform specific tasks in working environments. Such postures are related to injuries that are incurred during tasks that are static in nature and relatively long lasting, and during tasks that demand the exertion of force. Thus it was clearly evident that by remaining in awkward postures for prolonged period of time, the prawn seed collectors suffered from discomfort feeling affecting different body parts. This result corroborates with the work of Gangopadhyay et al. (2005) and Punnett et al. (1991). According to Chaffin and Anderson (1984) and Leskinen (1993), the amount and quality of forward-bent work postures influence the compressive forces on the vertebral discs and the erector spinae muscles. In this study the forward and backward bent posture of the prawn seed collectors during dragging of net through muddy and saline water may also be responsible for the development of musculoskeletal disorders

Table 6. Analysis of working posture of the prawn seed collectors.

Activity	Figure	Duration (mins./day)	Distance covered	Frequency	Description of posture	OWAS code	Action Category	Remark
Forward dragging of a net through out 1½ feet sticky mud and salty water		240 min / day	4 miles/ day	2 times / day	Back bent forward , both arms are below shoulder level, legs are walking or moving, weight/force needed 10 kg but less than 20 kg	2172	3	Corrective measures as soon as possible
Backward dragging of a net through out 1½ feet sticky mud and salty water		240 min / day	4 miles/ day	2 times / day	Back bent backward , both arms are below shoulder level, legs are walking or moving, weight/force needed 10 kg but less than 20 kg	2172	3	Corrective measures as soon as possible
Spreading and setting of a net		40 mins / day	-----	2 times / day	Back bent forward and twisted , both arms are below shoulder level, legs are bent forward, weight or force 10 kg or less.	4121	2	Corrective measures in near future
Collection of seed		150 mins / day	-----	2 times / day	Back bent forward , both arms are below shoulder level, both knees bent, weight/ force needed 10kg or less.	2141	3	Corrective measures as soon as possible.

(MSD) in different parts of the body including the low back.

In order to improve the efficiency of the workers, the following suggestions have been put forward. The working period should be modified with short rest pauses in their work schedule. The separation of prawn seeds is an important process done from the big petri dish in a forward bending and kneeling posture for a prolonged period of time. This awkward posture should be avoided by placing the petri dish in an adjustable platform for the separation of prawn seeds.

#### ACKNOWLEDGEMENT

Authors express their sincere gratitude to all those prawn seed collectors who rendered immense co-operation during the completion of this study.

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