
ORIGINAL ARTICLE

Assessment of Working Posture of Food Growers: A Study in a Southern District of West Bengal

Ayan Chatterjee^{1,2*}, Sandipan Chatterjee¹, Neepa Banerjee¹, Shankarashis Mukherjee³

¹Human Performance Analytics and Facilitation Unit

University of Calcutta, WB

²School of Health Care, Rishihood University, Haryana - 131021

³Public Health Analytics Unit,

Department of Food and Nutrition, West Bengal State University

* Email: ayan4189@yahoo.com

ABSTRACT

Paddy cultivation involves in various processes, some of the postures were very harmful. Some of the works are dominated by static muscular contraction and some other works are involved with repeated dynamic activity. In this backdrop the present study has been undertaken to assess the musculoskeletal disorders and overall postural stress in 41 male food growers during transplanting of paddy seedlings in southern area of West Bengal. Different working postures of the agricultural workers analyzed with the ovako working posture analysis system (OWAS), rapid upper limb assessment (RULA), and rapid entire body assessment (REBA) methods. The food growers adopt awkward postures at work and suffer from musculoskeletal disorders because they remain in such awkward postures for a prolonged period of time. From the result of the present study, it was observed that those food growers worked continuously in awkward postures during certain agricultural activities. Consequently, they suffered from discomfort in different parts of their body.

Keywords: Musculoskeletal disorders, REBS, RULA, OWAS

Received 04.06.2021

Revised 22.06.2021

Accepted 19.08.2021

How to cite this article:

A Chatterjee, S Chatterjee, N Banerjee, S Mukherjee. Assessment of Working Posture of Food Growers: A Study in a Southern District of West Bengal. Adv. Biores. Vol 13 [3] May 2022. 08-13

INTRODUCTION

Rice is one of the major food crops of the world. It provides the bulk of daily calories; moreover, rice is also one of food which is considered to be a potential food vehicle for the fortification of micronutrients because of its regularly consumption. It is a good source of thiamine (vitamin B1), riboflavin (vitamin B2) and niacin (vitamin B3). On the other hand, rice cultivation is an important sector of earning opportunity for the human resources engaged in agricultural task; 58.4% of the human resources are engaged in the different agricultural task during the paddy cultivating time in India. And 43.5% of male and 46.3% of the female human resources are engaged in different agricultural work during the paddy cultivating time in WB. The area under paddy cultivation is about 44.79 million hectares, the largest in the world. Yet, the agricultural sector in the rural villages of India is still dependent on non-mechanized technique i.e., dependent on the physical effort of the human resources involved [1-4]. During the paddy cultivating time the agricultural workers have to carry out different tasks - ploughing, transplanting, reaping, threshing and parboiling throughout the year even in a single day too. Earlier studies report that, drudgery is generally conceived as physical and mental strain, agony, monotony and hardship experienced by human beings [5-8]. While all these results in decline in living and working conditions affecting men and women [9-11]. Therefore, in order to ensure health, wellbeing and thereby improving the work performance, the assessment of occupational health status is considered as an essential factor for the human resources engaged in outdoor occupations especially those who are engaged in different types of tasks during the period of paddy cultivating time [12-14]. Paddy cultivation involves in various processes, some of the postures, which were taken by the food growers were very harmful. Some of the works are dominated by

static muscular contraction and some other works are involved with repeated dynamic activity. In this backdrop the present study has been undertaken to assess the musculoskeletal disorders and overall postural stress in 41 male food growers primarily engaged in manual transplanting task (Transplanting is the most common and elaborative method of crop establishment. Rice seedlings grown in a nursery are pulled and transplanted into puddle and levelled fields 15 to 40 days after seeding) of paddy seedlings during 'Boro' (Also known as summer paddy. The sowing time of summer rice is November to February and harvesting time is March to June) type of paddy cultivating time in southern area of WB.

MATERIAL AND METHODS

Human resources engaged in paddy cultivation, with no known chronic disease history (self - reported) and having a minimum working experience of three years, regularly working on an average for at least a period of six to six and half hours in the agricultural field in Arambagh subdivision in the district Hooghly [(latitude (23⁰01'N to 22⁰39'N) and longitude (88⁰30'E to 87⁰ 39'E)] were approached for participation in the study. The study was carried out on 34 adult Bengalee male food growers (age range 21 - 30 years) occupationally engaged in paddy cultivation. After obtaining necessary human ethical clearance, along with initial consents from the individuals, the names of volunteers were enlisted and the procedural requirements were explained elaborately. Basic information regarding participants' age (year), working experience (year) and average working time (hr.day-1) recorded in a pre-designed schedule. Socio-economic status (SES) was assessed by using Kuppaswami's scale [15]. Stature (cm) and body weight (BW) (kg) were measured using anthropometric measurement set and weighing scale respectively. Body mass index (BMI) was calculated from the measured stature (cm) and body weight (kg) data. The pre working heart rate (HR Pre-work) (beats. min-1), systolic and diastolic blood pressure (SBP Pre-work) and (DBP Pre-work) (mm Hg) were recorded in the morning hours before the individuals started working using an automated blood pressure monitor in sitting condition. Prevalence of work-related musculoskeletal disorders among the agricultural workers were obtained using standardized Nordic questionnaires [16]. Different working postures adopted by the paddy cultivators during the manual paddy transplanting task was analysed with the rapid upper limb assessment (RULA) [17] and rapid entire body assessment (REBA) [18] methods. The whole-body centre of gravity (CG) of the workers were determined by segmental method in normal erect posture, which was taken as reference posture and in other postures adopted by agricultural workers during traditional manual transplanting task [19]. Obtained data were statistically analysed. P value lower than 0.05 (P<0.05) was considered significant.

RESULTS AND DISCUSSIONS

Results and Discussions:

The basic profile including age (year), ethnic background, SES, working experience (year), average working time (hr.day-1) of the male food growers are presented in Table 1.

Table 1: Basic profile of the study participants

Variables	Values
Age (year)	26.8 ± 2.15
Ethnic Background	Bengalee
SES	Lower middle
Working Experience (year)	7.1 ± 1.19
Working time (hr.day-1)	6.5 ± 1.05

Data were presented in AM ± SD

The physical and physiological variables of the study participants in terms of stature (cm), body weight (kg), BMI, HR Pre work (beats.min-1), SBP Pre work (mm Hg), and DBP Pre work (mm Hg) have been presented in table 2. The mean values of BMI of the study participants were 20.7 kg.m-2]; which indicated that, the participants were in 'normal weight' category as per the classification given by WHO (WHO, 2000) [20]. This finding is not surprising as the human resources participating in the present study were carrying out manual transplanting tasks during paddy cultivation time, as earlier studies also reported that, individuals regularly practicing different form of recreational physical activity in a planned and systematic way have beneficial role in achieving favorable body composition, enhancing fitness and hence facilitate maintaining a normal BMI [21-26].

Table 2: Physical and Physiological profile of the study participants

Variables	Values
Stature (cm)	153.3 ± 4.21
BW (kg)	56.0 ± 5.11
BMI	20.7 ± 4.71
HR Pre work (beats.min-1)	72.0 ± 3.26
SBP Pre work (mm Hg)	118 ± 8.51
DBP Pre work (mm Hg)	78 ± 8.11

Data were presented in AM ± SD

Prevalence of work-related musculoskeletal disorders among the paddy cultivators were obtained using standardized Nordic questionnaires [16]. It was divided in to two parts - one part was associated with the various working manifestations and the other part consisted of the queries about human physiological health. The body parts with discomfort (head, neck, shoulder, wrist, upper back, lower back, waist, knee and ankle) were recorded according to the responses of the human resources. In the present study the occurrence of finger pain was reported by 52% of paddy cultivators. The occurrence of pain occurs in greater number of subjects with the progress of the working hours and it became highest after finishing the job. It was also interesting to note that the transplantation of paddy seedlings is made by piercing the fingers in to the mud, which caused friction with solid and hard materials present in the mud causing the problem in fingers. In case of binding of straws, the fingers have frictions with the straws during making knot in the bundle, which might be the reason for developing pain in the fingers. This finding is in tune with the findings of earlier study carried out among male paddy cultivators [27]. Whereas 86 % and 70% of the human resources have lower back pain and middle back pain respectively and the least prevalent musculoskeletal symptom was foot pain with 7%. The findings of the present study consistent with an earlier study carried out among the food growers when the primarily engaged in manual transplanting task during 'Aman' (Winter paddy) type of paddy cultivating time. An earlier study [28] reported that, lower back pain was the most common MSDs among agricultural workers followed by upper and then lower extremity MSDs. Long term adoption of bend and twist posture was associated with postural strain. Paddy transplanting task performed by the food growers were analyzed with the RULA and REBA methods to determine the postural load and to categorize the potential harmfulness of the work posture. The posture codes of RULA and REBA indicate that, postures in different phases of transplanting tasks, demand immediate attention. Thus, it is clear that the paddy cultivators adopt awkward postures at work and suffer from musculoskeletal disorders because they remain in such awkward postures for a prolonged period of time. The findings of the present study regarding the assessment of work posture score with RULA and REBA method in agreement with the findings of an earlier study [29]. It can be concluded that the occurrence of musculoskeletal disorder (MSD) is very common among the male paddy cultivators.

Table 3(a): Analysis of working posture with RULAA method during the transplantation task

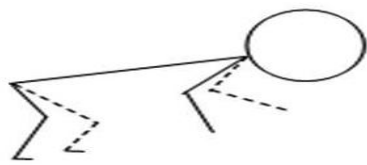
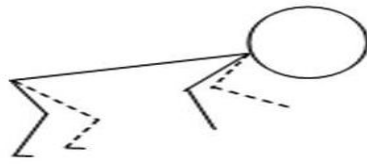
Task	RULA Score	Action Category	Remarks
	7	High	Investigate and implement change

Table 3(b): Analysis of working posture with REBA method during the transplantation task

Task	REBA Score	Action Category	Remarks
	11	Very high	Necessary urgent - Work must cease until a safer solution can be found.

The result of the present study shows that the manual transplanting task is strenuous for the food growers as indicated from the postural scores during the different task in paddy cultivating time. The high ambient temperature in the working environment [30-32] and the heaviness of the workload [33-

37] another important thing in this context is posture, a good working posture is one which can be sustained with a minimum static muscular effort and in which it is possible to perform the task more effectively and with least muscular effort [38-40].

The location of CG of paddy cultivators is very important for maintaining the postural stability. Normal standing posture which was taken as reference posture and in three various working postures i.e. standing, bending and sitting during the manual transplanting was analyzed. In the present study it was observed that the position of CG of the food growers was in normal standing posture was 59.5 ± 1.87 . During the period of manual transplanting, paddy cultivators adopt standing and bending postures for longer duration of time and perform the task in repetitive motion. In standing body posture the deviation of CG was observed as 4.87 percent (55.4 ± 1.65). During the bending position the location of CG was $22.5 (43.2 \pm 4.49)$; this finding was in consonance with the finding of earlier studies carried out among male and female human resources occupationally engaged in agricultural sector in Odisha engaged in manual transplanting task [19, 41]. From the observation, it may be concluded that in manual transplanting task paddy cultivators adopt traditional sitting, bending and squatting body postures with folded legs. This is directly associated to high postural stress and work performance of the paddy cultivators. As body joint angles and the location of center of gravity had lesser degree of deviation from the reference position during manual transplanting task, a lesser degree of postural strain was imposed in reference postures.

CONCLUSION

From the present study it may be concluded that manual transplanting task is very strenuous as indicated from the working posture score. Lower back region mostly affected due to prolonged awkward posture during the paddy cultivating time.

ACKNOWLEDGEMENT

We are thankful to all volunteers for their participation.

REFERENCES

1. Chatterjee A, Chatterjee S, Banerjee N, Chatterjee S, Santra T, Mukherjee S. (2016). Seasonal Distribution of Thermal Comfort: A Study to Assess Physiological Strain in Male Paddy Cultivators in Southern Bengal. In: Proceedings of the International Conference on Humanizing Work and Work Environment (ISBN: 978-93-83006-81);p157-162.
2. Chatterjee A, Chatterjee S, Banerjee N, Chatterjee S, Santra T, Mukherjee S. (2016). Assessment of Physiological Strain due to Work and Exposure to Heat of Working Environments in Male Paddy Cultivators. *Advances in Applied Physiology* (ISSN 2471-9692- Print, 2471-9714 - Online);1: 8-11. DOI: 10.11648/j.aap.20160101.12.
3. Goswami S, Pal A, Dhara PC. (2012). Evaluation of Work-Related Musculoskeletal Disorder and Postural Stress among Female Cultivators Engaged in Post Harvesting tasks. *Indian Journal of Biological Sciences* (ISSN 0972-8503); 18: 16-25.
4. Singh D, Vinay D. (2014). Ergonomics Assessment of Traditional and Improved Methods of Paddy Threshing for Drudgery Reduction of Hill Region. *Journal of Food, Agriculture and Environment*; 12: 244-250.
5. Chatterjee A, Chatterjee S, Chatterjee S, Santra T, Bhattacharjee S, Mukherjee S. (2015). Exposure to Heat from Natural Working Environment and Cardiovascular Strain: A Study in Male Agricultural Workers in southern Bengal. In: *Caring for People* (ISBN 978-93-5258-836-7);p166-171.
6. Mohanty SK, Behera BK, Satapathy GC. (2008). Ergonomics of Farm Women in Manual Paddy Threshing. *Agricultural Engineering International: the CIGR E Journal*; 10: 1-14.
7. Kar SK, Ghosh S, Pal R, De S, Dhara PC. (2012). Ergonomically Evaluation of Occupational Problems of Women Workers in Agricultural Tasks. *International Journal of Basic and Applied Physiology*; 1: 103-108.
8. Ojha P, Kwatra S. (2016). Development of MSD among the Farm Women Involved in Traditional and Mechanized Methods of Rice Cultivation of Northern India. *Indian Journal of Traditional Knowledge*; 16: 162-166.
9. Chatterjee A, Chatterjee S, Chatterjee S, Santra T, Banerjee N, Mukherjee S. (2015). Musculoskeletal Discomfort in Computer Operators of Organized Sector: Tracing the Link with Obesity Status. *International Physiology* (ISSN: 2347-1505); 3: 23 – 28. DOI:10.21088/ip.2347.1506.3115.3.
10. Chatterjee A, Chatterjee S, Santra T, Mukherjee S. (2014). The Influence of Anthropometric Variables for Development of Musculoskeletal Discomfort among Computer Operators in Organized Sectors. In: *User Centered Design and Occupational Wellbeing*, McGraw Hill Education (ISBN 978 – 93- 392 – 1970 -3);p499 – 503.
11. Chatterjee A, Chatterjee S, Banerjee N, Mukherjee S. (2020). Assessment of Physiological Strain in Male Food Crop Cultivators Engaged in Manual Threshing Task in a Southern District of West Bengal. *The Holistic Approach to Environment* (ISSN: 1848-0071); 10 (4): 100-108. DOI: <https://doi.org/10.33765/thate.10.4.2>.

12. Chatterjee A, Chatterjee S, Chatterjee S, Bhattacharjee S, Banerjee N, Mukherjee S. (2017). Work Place Heat Exposure and Cardiovascular Status: A Study in Male Paddy Cultivators. In: *Molecular Physiological and Nutritional Responses during Pathological Alteration of Cell Function* (ISBN: 81-89169-33-5);p110-124.
13. Chatterjee A, Banerjee N, Chatterjee S, Santra T, Agrawal KM, Mukherjee S. (2015). Assessment of Physiological Strain in Male Paddy Cultivators due to Work and Exposure to Fluctuation in Thermal Conditions in Working Environments. *Survey* (ISSN: 0586-0008); 55: 91-98.
14. Chatterjee A, Chatterjee S, Chatterjee S, Bhattacharjee S, Santra T, Banerjee N, Ghosh K, Mukherjee S. (2018). Assessment of Physiological Strain in Male Cultivators Engaged in Mechanized Threshing Task Using Two Different Types of Threshers. *Science and Culture* (ISSN 0036 8156); 84: 191-197.
15. Ravikumar BP, Dudala SR, Rao AR. (2013). Kuppaswamy's Socio-Economic Status Scale – A Revision of Economic Parameter for 2012. *International Journal of Research and Development of Health*; 1: 2 - 4.
16. Kuorinka I, Jonsson B, Kilbom A, Viterberg H, Biering SF, Andersson G, Jorgensen K. (1987). Standardised Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms. *Applied Ergonomics*; 18: 233.
17. McAtamney L, Corlett EN. (1993). RULA: a Survey Method for the Investigation of Work-Related Upper Limb Disorders. *Appl. Ergon.*; 24: 91-99.
18. Hignett S, McAtamney L. (2006). Rapid Entire Body Assessment (REBA). *Applied Ergonomics*; 31: 201- 205.
19. Ojha P, Kwatra S. (2017). Comparative Ergonomic Assessment of Male and Female Farm Workers Involve in Rice Cultivation. *International Journal of Current Microbiology and Applied Science*: 6: 3439-3446.
20. WHO. (2000). Obesity: Preventing and Managing the Global Epidemic, Report of a WHO Consultation on Obesity, Technical Report Series, No. 894. World Health Organization, Geneva, Switzerland; 256.
21. Banerjee N, Santra T, Chatterjee S, Mukherjee S. (2015). Prevalence of Overweight in Rural Sedentary Human Resources in Southern Part of West Bengal. In: *Ergonomics for Rural Development* (ISBN 978-93-5174-905-9);p89 - 96.
22. Banerjee N, Chatterjee S, Chatterjee S, Ghosh K, De S, Mukherjee S. (2015). Impact of Indian Traditional Recreational Activity on Novel Anthropometric Markers of Diabetes in Bengali Females. *International Physiology* (ISSN: 2347-1505); 3: 11 – 15. DOI:10.21088/ip.2347.1506.3115.1.
23. Mukherjee S, Banerjee N, Chatterjee S, Chatterjee S. (2014). Effect of Practicing Select Indian Classical Dance Forms on Body Composition Status of Bengalee Females an Anthropometric Study. *Indian Journal of Biological Sciences* (ISSN 0972-8503); 18: 9-15.
24. Mukherjee S, Banerjee N, Chatterjee S, Chatterjee S. (2014). Effect of Kathak Dancing on Obesity Indices in Women of Sedentary Avocations. *Science and Culture* (ISSN 0036 8156); 80: 279-282.
25. Mukherjee S, Banerjee N, Chatterjee S, Chakraborti B. (2013). Impact of Bharatnattyam Dancing Exercise on Reducing Central Obesity in Adult Bengalee Females. *Science and Culture* (ISSN 0036 8156); 79: 503-506.
26. Chatterjee A, Chatterjee S, Banerjee N, Santra T., Mondal P, Mukherjee S. (2014). Evaluation of Body Composition and Somatic Profile in Male Individuals: A Comparison between Tribal and Non-Tribal Agricultural Human Resources. In: *Proceedings of the National Conference on Agriculture and Rural Development Issues in Eastern India*; ISI Giridih:p 25-26.
27. Osborne A, Blaken C, Fullen BM, Meredith D, Phelan J, McNamara J, Cunningham C. (2012). Prevalence of Musculoskeletal Disorders among Farmers: A Systematic Review. *Am. J. Ind. Med.*; 55: 143-158.
28. Chatterjee A, Chatterjee S, Chatterjee S, Santra T, Banerjee N, Mukherjee S. (2021). Assessment of Physiological Strain in Male Food Crop Cultivators Engaged in Manual Reaping Task. In: *Ergonomics for Improved Productivity* (ISBN: 978-981-15-9053-5). Design Science and Innovation. Springer, Singapore, 931-937, 2021. DOI: https://doi.org/10.1007/978-981-15-9054-2_108.
29. Choudhary MK, Pareek CM, Meena SS., Mehta AK. (2018). Ergonomic Assessment of Pedal Operated Maize Dehuskar-Sheller for Male Agricultural Workers. *Advances in Research*;14: 1-5.
30. Chatterjee A, Chatterjee S, Chatterjee S, Banerjee N, Banerjee N, Mukherjee S. (2018). Diurnal Variation in Thermal Working Environment, Workload and Physiological Strain in Women Workforces Engaged in Manual Parboiling Task. In: *Advance Technologies in Agriculture for Doubling Farmers' Income* (ISBN: 978-93-86453-61-7); New Delhi Publisher: p199-210.
31. Chatterjee A, Chatterjee S, Mukherjee S. (2021). Assessment of Body Composition and Cardio Vascular Health Status in Male Food Crop Cultivators in a Southern District of West Bengal, Hooghly, In: *International Edited Book on Human Movement Volume I* (ISBN: 978-93-90461-00-4); Khel Sahitya Kendra, 87-95. <https://online.flippingbook.com/view/110653230/>.
32. Chatterjee, A, Chatterjee S, Mukherjee, S. (2021). A Study to Evaluate Cardiac Strain in Male Agricultural Workers Engaged in Manual Ploughing Task in Hooghly, West Bengal, *International Journal of Biology, Pharmacy and Allied Sciences* (ISSN: 2227 4998); 10 (2): 371-385. DOI:<https://doi.org/10.31032/IJBPAS/2021/10.2.5338>.

33. Chatterjee A, Chatterjee S, Banerjee N, Chatterjee S, Mukherjee S. (2019). Climate Change and Human Performance: A Study in Bengalee Male Agricultural Workers. *International Journal of Innovative Knowledge Concepts* (ISSN: 2454-2415);7 (Special Issue 1): 72-80.
34. Chatterjee A, Banerjee N, Chatterjee, S, Chatterjee S, Mukherjee S. (2019). A Study to Assess Cardiac Response Indices in Food Crop Cultivation Task in West Bengal. *International Journal of Innovative Knowledge Concepts* (ISSN: 2454-2415);7: 238-243.
35. Chatterjee A, Banerjee N, Chatterjee S, Chatterjee S, Mukherjee S. (2019). Impact of Variation in Working Environmental Condition on Cardiac Response Profile in Bengalee Male Crop Cultivators of a Southern District of West Bengal. *Journal of Emerging Technologies and Innovative Research* (ISSN: 2349-5162); 6: 438-443. DOI: <http://doi.one/10.1729/Journal.21469>.
36. Chatterjee A, Chatterjee S, Banerjee N, Chatterjee S, Mukherjee S. (2019). Assessment of Cardiac Strain in Male Paddy Cultivators Using Two Different Type of Paddy Thresher: A Comparison. *Indian Agriculturist* (ISSN: 0019-4336); 63: 49-55.
37. Chatterjee A, Chatterjee S, Chatterjee S, Banerjee N, Mukherjee S. (2018). A Comparative Study on the Impact of Thermal Working Environmental Factors and Workload on Cardiac Response Indicators in Male Food Crop Cultivators of Two Ethnic Groups. *Indian Journal of Biological Sciences* (ISSN 0972-8503); 24: 31- 44.
38. Chatterjee A, Chatterjee S, Banerjee N, Mukherjee S. (2020). A Study to Assess Relationship between Different Obesity Indices and Musculoskeletal Discomfort Score in Agricultural Workers in Southern Bengal, India. *Open Access Journal of Complementary and Alternative Medicine*, (ISN: 2644 1217); 4: 186-190. DOI: 32474/OAJCAM.2020.02.000142.
39. Chatterjee A, Chatterjee S, Banerjee N, Mukherjee S. (2020). A Study to Assess Cardiac Response Profile in Paddy Cultivators Engaged in Manual Paddy Transplanting Task in Hooghly, West Bengal. *NeBIO* (ISSN: 2278-2281(Online) | ISSN: 0976-3597(Print); 11 (1): 27-34.
40. Chatterjee A, Chatterjee S, Banerjee N, Mukherjee S. (2020). Impact of Variation in Thermal Working Environmental Condition on Cardiac Response Indices in Male Human Resources Engaged in Food Crop Cultivation Task. *Journal of Climate Change* (ISSN: (Print): 2395-7611, ISSN: (Online): 2395-7697); 6 (1): 59-66, DOI: 10.3233/JCC200007.
41. Ojha P, Kwatra S. (2014). An Ergonomic Study on the Assessment of Work-Related Musculoskeletal Disorder Risks among Agriculture Workers of Uttarakhand India. *International Journal of Scientific and Engineering Research*; 5: 188-191.

Copyright: © 2022 Society of Education. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.