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A Study on Occupational Health and Safety Practices on Construction Site Workers for Finding Discomfort Level

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ABSTRACT

Both physical and mental comfort is essential in every workplace for improving productivity. Work environment distress is exceptionally normal for laborers utilized in proactive tasks; especially the specialists occupied with building locales in India are occupied with various kinds of active work in inconvenient conditions in outrageous environment dust, and so on. So, research should be crucial for concentrating on distress levels. Along these lines, the specialists need to consider sufficient security the executives rehearse notwithstanding appropriate working stances. Consequently, an endeavor was made in this review to distinguish the potential assignment execution-related danger factors and the related uneasiness levels for the specialists occupied with building destinations with the plan to give conceivable ergonomic arrangements, to such an extent that the exhibitions of laborers' can be improved to an ideal level. In this article, an effort is taken to measure both physical and mental (psychological) discomfort levels of construction site workers.

KEYWORDS

Construction Site Workers, Occupational Health, Safety

INTRODUCTION

As per Chief Labour commission, Construction and development assumes a significant part in public economies, representing somewhere in the range of 3 and 7% of gross public item. It is an area of the economy that has for some time been reprimanded for its absence of continuous advancement and usefulness improvement. This reactions are not confined to a couple of nations, however are boundless across the created world.

Construction development comprises of an expansive arrangement of connections inside it (e.g., between house manufacturers and among manufacturers and building workers).In building and other development works in excess of 8,000,000 specialists are locked in all through the country. These specialists are quite possibly the most weak fragments of the sloppy work in Indium. Their work is

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of brief nature, the connection among manager and the worker is impermanent, working hours are unsure. Fundamental conveniences and government assistance offices gave to these specialists are lacking. Hazard to life and appendage is likewise intrinsic. Without even a trace of satisfactory legal arrangements to get the imperative data in regards to the number and nature of mishaps was very troublesome and because of this to fix liability or to go to remedial lengths was not a simple work. .It is assessed that around 8.5 million specialists in the nation are occupied with building and other development works. Building and other development laborers are perhaps the most various and weak fragments of the chaotic work in Indium. The structure and other development works are portrayed by their innate danger to the life and appendage of the laborers. The work is additionally described by its relaxed nature, brief connection among business and worker, unsure working hours, absence of fundamental conveniences and deficiency of government assistance offices. Without a trace of satisfactory legal arrangements, the essential data in regards to the number and nature of mishaps is likewise not approaching. Without a trace of such data, it is hard to fix liability or to make any restorative move. Being an emerging nation development work has consistently request in India. Starting from street, dam, plants shopping centers up-to lofts structures development work is needed in each field in India. Although it is an enormous area still the specialists of this area works in dust like sand soil fly debris, chemical, cements, colors tar, extreme environment and in dangerous situation. As per ILO, the death rate because of mishap and peril is extremely high for building site workers. To get consistent cash Many agrarian specialists of town decides to be a development work .To get great way of life and city life poor and youthful town man joins building site work with entire family yet when gone along with they are neither instructed or prepared on well-being component and moved to unsafe positions by project workers .These positions are opportune positions and when one site over they needed to move to other project worker to other city. Working in the development business remains somewhat perilous contrasted with working in different ventures. Development working environments are Speedily powerful conditions where various exchanges work simultaneously with substantial hardware, instruments, and chemicals. As per the U.S. Agency of Labor Statistics (2019), in excess of 12,500 specialists lost their lives while dealing with building destinations in the US between 2003-2016. A large number of the development laborers don't know about the principles and guidelines, even they have no clue about plans sponsorship gave to them. Maximum have no id confirmation to get advantages of proportion card and94 percent of workers didn't have BOCW cards. These traveler laborers hazard their lives to make country developing. Health dangers in building site laborers is additionally very high. The reasons for well-being hazards are because of Asbestos, noise, vibration, repetitive work, weighty burden and residue and substance aggravates to skin. Commotion and vibration in building site hurts ear and apprehensive system. The residue of asbestos, rocks tiles, marbles makes eye contamination and respiratory diseases. Heavy repetitive work makes MSD issues and synthetic compounds responds with skin and makes skin problems. In apparatus works like Welding hurts eye and skin. Carpentry and Machinery work devices are profoundly hazard and gives cuts and twisted close by and leg. Construction work is brimming with risk and hazardous. The financial existence of building site works are likewise bad.

In the developing development industry, very little examination has been found in the space of the word related well-being and security issues of the development works in India. So, a review is led to track down the Occupational well-being and security issues of Workers in India and ergonomic investigation is done to observe working environment distress level in building site of India by discomfort question in Ergo fellow software.

LITERATURE REVIEW

Normally, with the assistance of ergonomic changes, better fit among the work or undertaking requests and the works abilities can be obtained (Wood side 1997).Abdul-Tharim et al. (2011) have recommended of improvement of ergonomics executions in the working environments through better

correspondence just as the executives controls, which should be trailed by appropriate ergonomics-plan, coordinated schooling and preparing. In addition, various investigations have been directed to evaluate the stances of the specialists in an assortment of building-development undertakings. (Koningsveld and Van der Molen 1997) have investigated about physical constrains of the worker's body to fit the work . Shin and Mirka (2004) have uncovered in a review that incline point of ground impacts the lifting energy and kinematics, and thus it needs due consideration while the assessment of dangers should be finished lower back wounds under such working conditions. Business related outer muscle issues have been uncovered as a boundless word related medical condition for development laborers (Stattin and Järvholm 2005), which is around 16% higher than other modern specialists (CPWR 2013). The decrease of the danger of outer muscle problems among the development laborers might be accomplished through ergonomic arrangements (CPWR 2013; van der Molen et al. 2005). As a rule, ergonomists have the assessment that for development laborers, the decrease in the actual responsibility ought to be worked with by the utilization of ergonomic measures (Dale et al. 2012; Kramer et al. 2010) Nath et al. (2017) have utilized inherent advanced mobile phone sensors for checking laborers body stances and for recognizing potential business related ergonomic dangers. It was seen by PDA sensors information that, estimations of trunk and shoulder flexion of laborers were exceptionally near relating estimations through perceptions. Julitta et al. (2015) have assessed the utilization of ergonomic measures related with outer muscle issues among development laborers. The reaction rate was acquired as 63% for example 713 out of 1,130. Kratzenstein et al. (2019) have explored the shoulder muscles' neuro-strong reactions at different connection statures during arm development of a conveying framework. A hip belt was utilized to defeat muscle wounds, and tallness changes alleviating the shoulder muscles. It was seen that expanding in connection tallness helped in assuaging the muscles. Purnomo and Apsari (2016) have utilized REBA technique; Kulkarni and Devalkar (2018) have utilized RULA and REBA as ergonomic instruments; Zengin and Asal (2020) have utilized three ergonomic danger appraisal strategies like REBA, OWAS and QEC, etc.Ozkaya et al. (2018) have utilized "Ovako Working Posture Analysis System (OWAS)", to find the jobs just as the danger of business related outer muscle problems, by thinking about the dumping and stacking elements of laborers, frequencies of stances and functional occasions.

METHODOLOGY

Few housing construction site was selected in the district of Khorda in Odisha (India) where some housing projects like apartments, independent houses were going on by a group of laborers, masons etc. By using video recording as well as still photography, different actions and postures of the 38 workers engaged in different construction activities were recorded and captured for subsequent analysis of the obtained data through discomfort and ergonomic risk assessment tools like the discomfort questionnaire tool, respectively, Ergo fellow software is used for the assessment of workers, who are continuously performing a task for 8hrs everyday.

RESULT AND DISCUSSION

During a construction project work, different workers were found performing various tasks with a variety of postures. From their still photography, personal interactions and type of action performances, the discomfort questionnaire is designed and scores along with the necessary recommendations were obtained.

By considering 17 workers performing the loading and 21 carrying tasks, as per Figure 1 and Figure 2 at construction sites . Based on the still pictures, the questionnaires on discomfort levels' (Figure 3 and Figure 4) obtained, shows the frequency of the workers engaged, the hours and their score. The discomforts were reported (Table 1 and Figures 5 and 6).

Table 1 shows Workers' reported of discomforts in different body p during loading arts (n= 17).

Figure 1. During loading

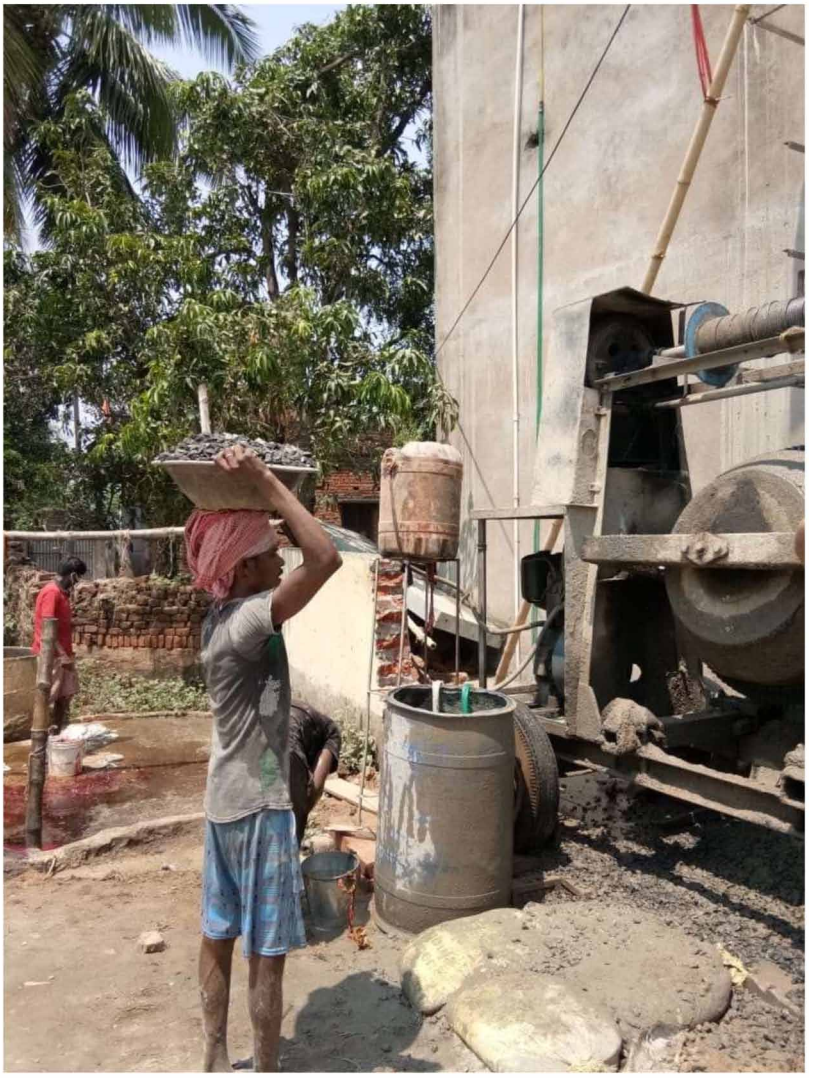

Table 2 shows Workers' reported of discomforts in different body p during Rod carrying arts (n= 21).

Figures 5 - 9 are the discomfort frequency graph and discomfort graph respectively, that shows the discomfort level of body parts individually during the loading of mixtures and rod carrying posture.

Table 3 shows Dass score of construction site workers during loading

Table 4 shows DASS-21 analysis.

The worker during loading, their depressions, anxieties and stresses levels were measured by the use of DASS-21 parameters-scale as shown in Table 4 questionnaire and score is measured by Table.3 respectively. It was found that, for the depression sub-scale, the normal depression was among 8 (20.19%) workers, mild depression was among 12 (10.3%) and, moderate depression was among 03 (11.38%) workers found. Whereas severe depression was among 10 (2.52%), and extremely severe depression with scores of ≥28 was observed among 02 (4.27%) construction workers observed.

Figure 2. During rod carrying

Similarly the anxiety and stress level of construction workers calculated. Table 5 shows questionnaire based on DASS-21 parameters-scale.

Similarly Table 5 explains about mental work load of construction site worker during rod carrying. From the above ergonomic and psychometric analysis it is found that the work place discomfort gives physical sickness and mental load. Hence steps must be taken to avoid physical discomfort to reduce mental sickness.

CONCLUSION AND RECOMMENDATION

By considering 38 workers performing the piping and water related tasks at construction sites and based on the questionnaires on discomfort levels, the following discomforts were reported: 8 (20.19%) workers, mild depression was among 12 (10.3%) and, moderate depression was among 03 (11.38%)

Figure 3. Questionnaires on discomfort levels during loading

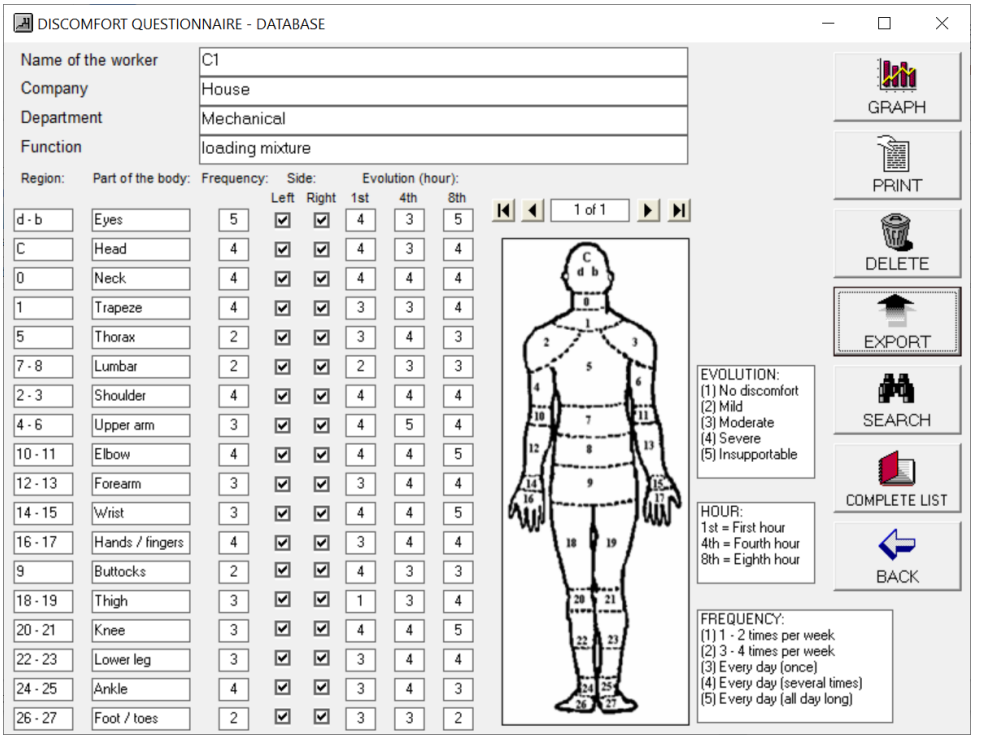

Figure 4. Questionnaires on discomfort levels during rod carrying

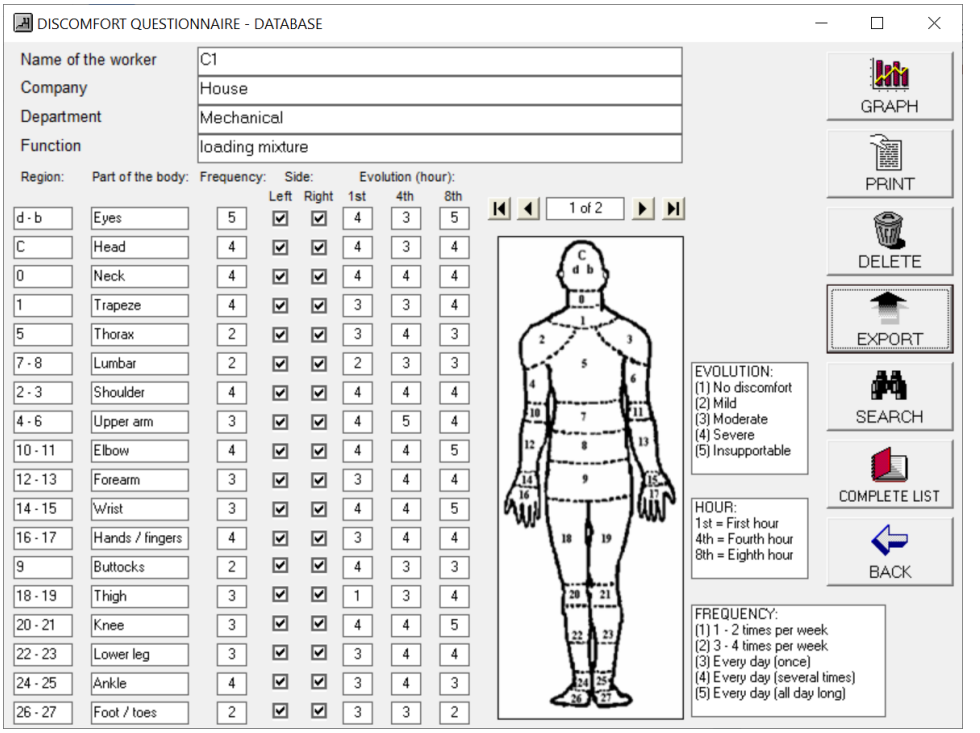

Table 1. Workers' reported of discomforts in different body p during loading arts (n= 17)

Body Parts	Number of workers' with discomfort levels (%)
Eyes	00 (00)
Heads	24 (82)
Necks	08(67.3)
Trapezes	01 (1.20)
Thoraxes	01 (.92)
Lumbar	02 (1.12)
Shoulders	21 (75.62)
Upper-arms	19 (72.50)
Elbows	8 (71.87)
Forearms	11 (61)
Wrists	19 (55.02)
Hands & fingers	09 (11.5)
Buttocks	03 (8.87)
Thighs	09 (20)
Knees	05 (11.53)
Lower legs	12 (23.10)
Ankles	00 (00)
Foots & toes	02 (1.70)

*n= Total number of workers

Table 2. Workers' reported of discomforts in different body p during rod carrying arts (n= 21)

Body Parts	Number of workers' with discomfort levels (%)
Eyes	00 (00)
Heads	8 (27)
Necks	18(72.1)
Trapezes	01 (1.00)
Thoraxes	01 (1.22)
Lumbar	00 (00)
Shoulders	21 (78.69)
Upper-arms	8 (32.10)
Elbows	10 (51.55)
Forearms	10 (50.1)
Wrists	12(65.02)
Hands & fingers	07 (31.5)
Buttocks	02 (1.66)
Thighs	03 (10)
Knees	05 (5.34)
Lower legs	2 (9.10)
Ankles	01 (1.020)
Foots & toes	02 (1.61)

*n= Total number of workers

Figure 5. Measured discomfort graphs loading

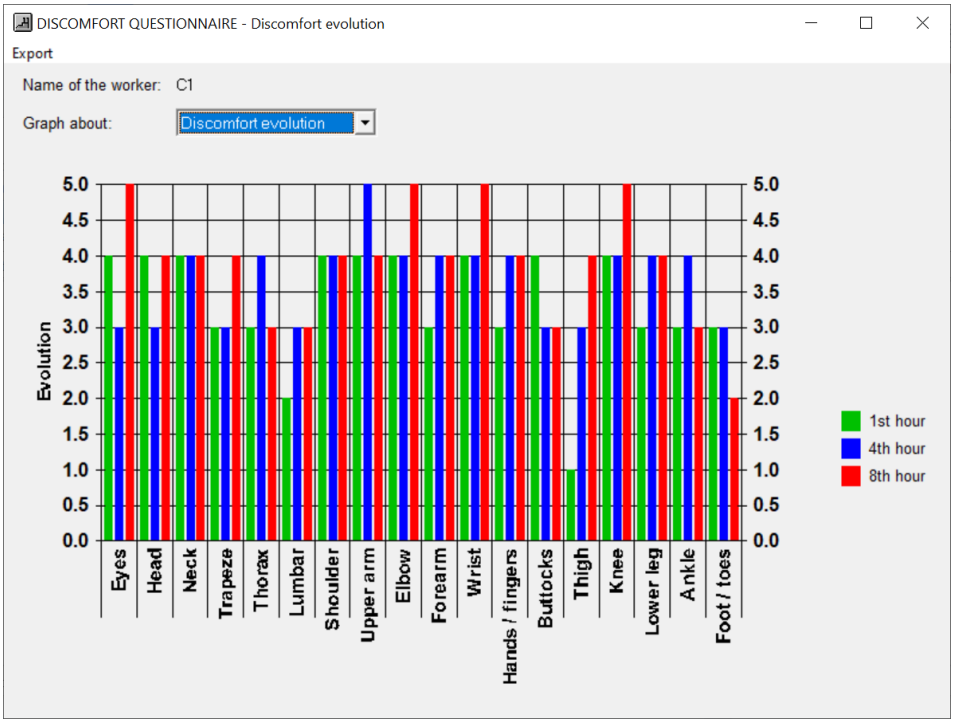

Figure 6. Measured discomfort graphs in rod carrying

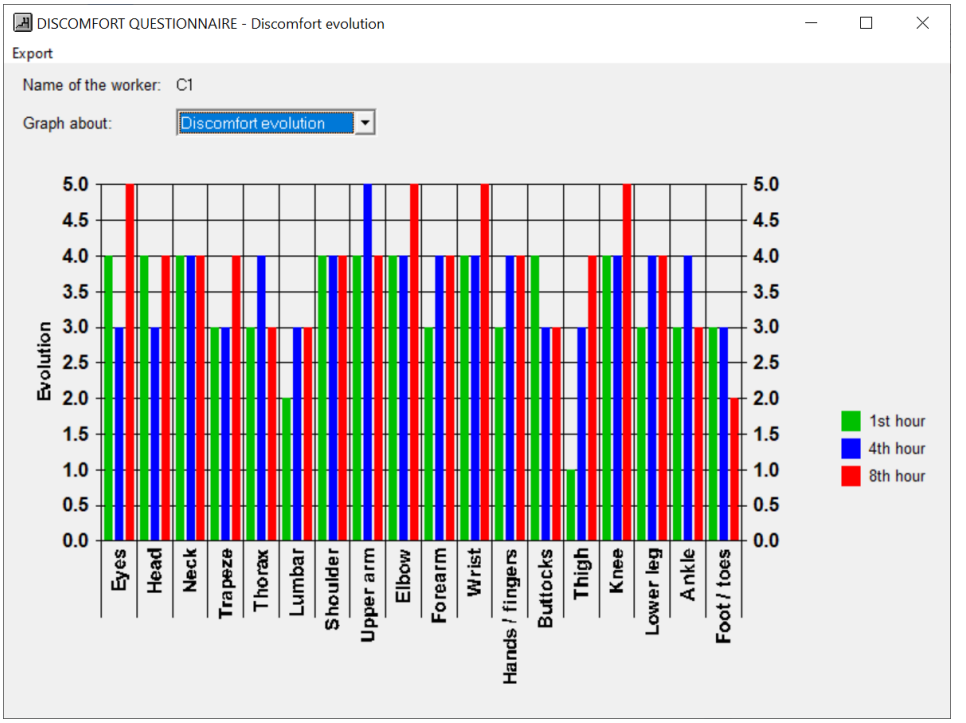

Figure 7. Measured discomfort frequency graphs loading

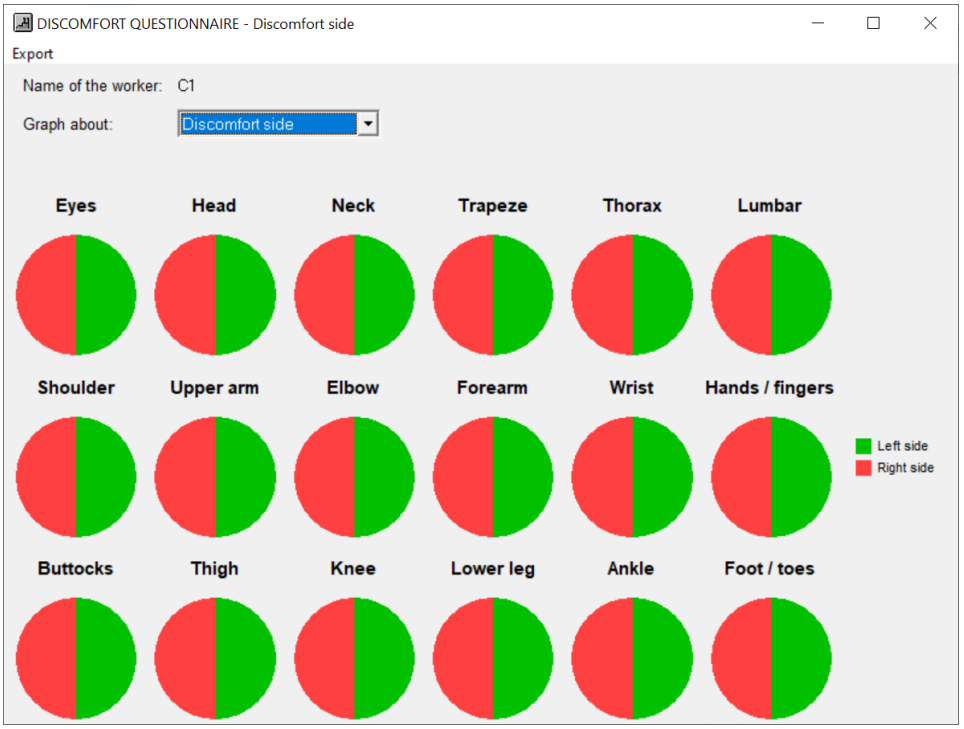

Figure 8. Measured discomfort frequency graphs in rod carrying

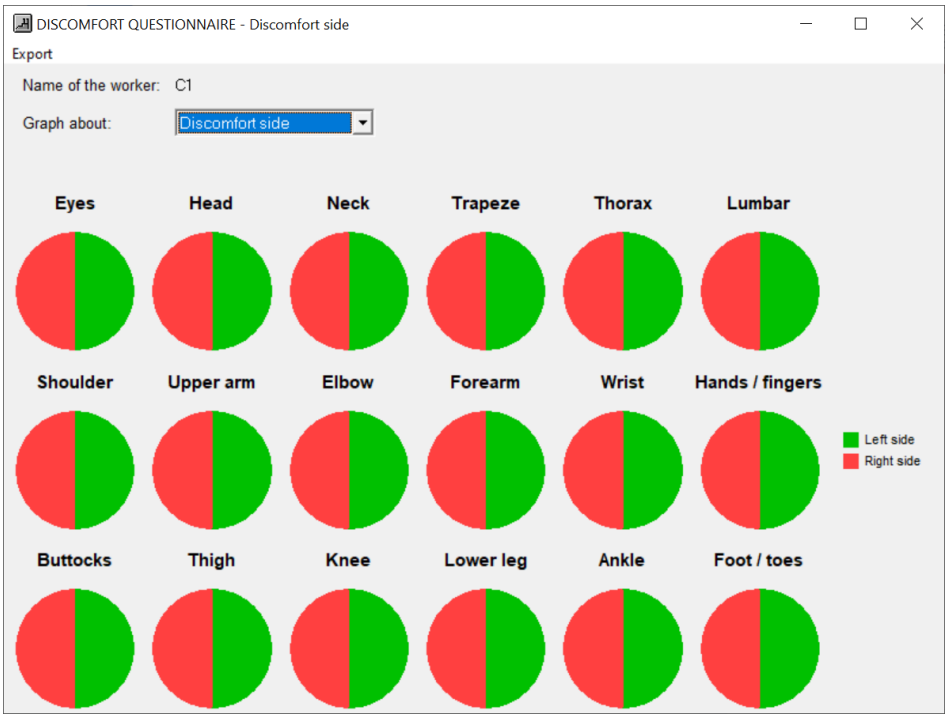

Figure 9. Measured discomfort frequency graphs in loading

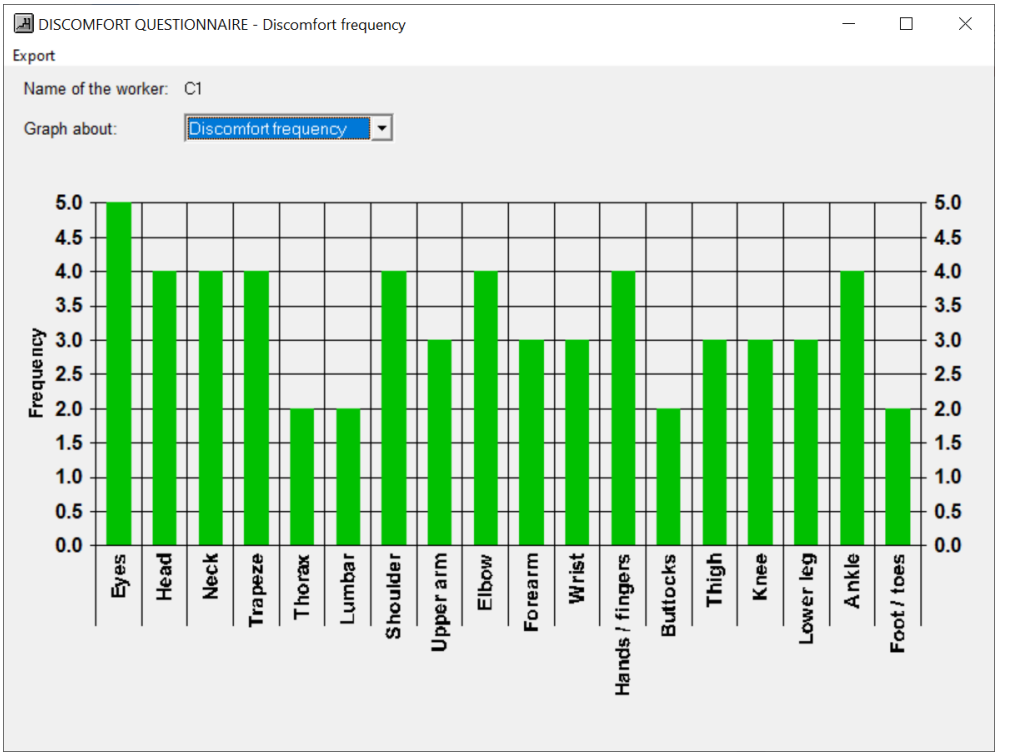

Table 3. Dass score of construction site workers during loading

Mental Stress	Normal	Mild	Moderate	Severe	Extremely severe
Depression	**0-9**	**10-13**	**14-20**	**21-27**	**≥28**
Number of farmers responded (%)	8 (20.19)	12 (10.3)	03 (11.08)	10 (2.52)	02 (4.27)
Anxiety	**0-7**	**8-9**	**10-14**	**15-19**	**≥20**
Number of farmers responded (%)	7 (12.75)	10 (13.28)	8 (22.62)	02 (11.20)	03 (8.33)
Stress	**0-14**	**15-18**	**19-25**	**26-33**	**≥34**
Number of farmers responded (%)	726.05)	05 (19.1)	8(23.39)	03 (19.1)	02 (1.03)

workers found. Whereas severe depression was among 10 (2.52%), and extremely severe depression with scores of ≥28 was observed among 02 (4.27%). However, through ergonomic design of tools and equipment, the workers health and safety can be improved in the construction projects. In order to reduce the accidents and injuries to workers in construction projects, the work assignments need to be structured properly with due consideration to the ergonomic aspects for the improvement of the worker's safety. With the help of domain-experts, the following recommendations were obtained for the significant development in the construction sectors.

The activities need to be re-designed. Proper elevation of the necessary platforms in order to reduce unnecessary movements of trunk. For materials' transportation, trolleys and/or conveyor-belts need to be used for the minimization of lifting-actions as well as external-loads on worker's body. In order to avoid in unnecessary bending, adequate platforms need to be provided to the workers for keeping their

Table 4. DASS-21 analysis

Sl. No.	Parameters	Rating-scale (Please put √ mark whichever is applicable)			
		0 (Not-applicable)	1 (Applicable to some-degree)	2 (Applicable to a considerable-degree or a good-part of time)	3 (Applicable to very-much or most of the time)
1	I am not having any positive feeling	√			√
2	I am finding difficulty in doing things with any initiative work-up				
3	I am feeling of not look-forward to anything			√	
4	I am feeling disappointed as well as assure			√	
5	I am feeling of incapable to become enthusiastic on anything				√
6	I have the feeling of worthless as an individual	√			
7	I am feeling of a meaningless life				√
8	I have the awareness of dryness of my mouth			√	
9	I am experiencing difficulties in breathing like a feeling of breathlessness and extremely rapid breathing, in the absence of physical exertions				√
10	I am experiencing wavering in the hands and other body parts			√	
11	I am anxious about the situations that is putting me in panic and making me a fool			√	
12	I am feeling as if getting nearer to panic		√		
13	I have the awareness of my heart actions during physical exertions' absence like the sense of increasing in heart rates, missing in heart beats				√
14	I am feeling scared without any suitable reason		√		
15	I am finding harder in winding-down			√	
16	I am over-reacting to situations			√	
17	I am feeling as if utilizing lots of nervous energy				√
18	I am finding me of getting agitated			√	
19	I am finding relax difficulties			√	
20	I am feeling of getting narrow-minded of anything that is keeping me away from my activities				√
21	I am feeling of becoming sensitive				√

Table 5. Scores of the DASS-21 parameters-scale (n=21) during rod carrying

Mental Stress	Normal	Mild	Moderate	Severe	Extremely severe
Depression	**0-9**	**10-13**	**14-20**	**21-27**	**≥28**
Number of farmers responded (%)	10 (12.11)	8 (18.4)	05 (9.08)	5 (6.43)	06 (3.43)
Anxiety	**0-7**	**8-9**	**10-14**	**15-19**	**≥20**
Number of farmers responded (%)	9 (22.12)	11(13.58)	8 (26.62)	04 (6.23)	02 (1.33)
Stress	**0-14**	**15-18**	**19-25**	**26-33**	**≥34**
Number of farmers responded (%)	12(14.05)	12 (8.1)	6(13.39)	13 (12.1)	05 (3.03)

Note: Depressions include questions numbers 1 to 7; Anxieties include questions numbers 8 to 14; and Stresses include questions numbers 15 to 21; respectively

load-carriages or buckets to load the excavated materials. In order to avoid in unnecessary upper-limb movements, appropriate height-levels should be maintained to perform the necessary tasks. Keeping of all the necessary materials in reach of the workers for the reduction in unnecessary movements.

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CONFLICT OF INTEREST

The authors declare of having no conflict of interest.

ETHICAL APPROVAL

All studies were conducted in accordance with principles for human experimentation as defined in the declaration of Helsinki and its later amendments or comparable ethical standards.

INFORMED CONSENT

Informed consent after explaining the nature of investigation was obtained from each participant in this study.

ANIMAL STUDIES

No animal studies were carried out by the authors for this article.

REFERENCES

Abdul-Tharim, A. H., Jaffar, N., Lop, N. S., & Mohd-Kamar, I. F. (2011) Ergonomic risk controls in construction industry–a literature review. *Proc 2nd Int Build Control Conf 20*, (pp. 80-88). IEEE. doi:10.1016/j.proeng.2011.11.141

Ansari, N. A., & Sheikh, M. J. (2014). Evaluation of work Posture by RULA and REBA: A Case Study. *IOSR Journal of Mechanical and Civil Engineering*, *11*(4), 18–23. doi:10.9790/1684-11431823

Budhathoki, N. K., & Zander, K. K. (2019). Socio-Economic Impact of and Adaptation to Extreme Heat and Cold of Farmers in the Food Bowl of Nepal. *International Journal of Environmental Research and Public Health*, *16*(9), 1578. doi:10.3390/ijerph16091578 PMID:31064089

Çakıt, E. (2019). Ergonomic Risk Assessment using Cornell Musculoskeletal Discomfort Questionnaire in a Grocery Store. *Ergonomics International Journal*, *3*(6), 000222. doi:10.23880/EOIJ-16000222

Center for Construction Research and Training (CPWR). (2015). *The Construction Chart Book*. CPWR. https://www.cpwr.com/publications/chart-book-hazards-and-exposures

Cremasco, M. M., Giustetto, A., Caffaro, F., Colantoni, A., Cavallo, E., & Grigolato, S. (2019). Risk Assessment for Musculoskeletal Disorders in Forestry: A Comparison between RULA and REBA in the Manual Feeding of a Wood-Chipper. *International Journal of Environmental Research and Public Health*, *16*(5), 793. doi:10.3390/ijerph16050793 PMID:30841494

Dale, A. M., Jaegers, L., Buchholz, B., Welch, L., & Evanoff, B. A. (2012). Using process evaluation to determine effectiveness of participatory ergonomics training interventions in construction. *Work (Reading, Mass.)*, *41*, 3824–3826. doi:10.3233/WOR-2012-0684-3824 PMID:22317304

Erdinc, O., Hot, K., & Ozkaya, M. (2011). Turkish version of the Cornell Musculoskeletal Discomfort Questionnaire: Cross-cultural adaptation and validation. *Work (Reading, Mass.)*, *39*(3), 251–260. doi:10.3233/WOR-2011-1173 PMID:21709361

Geoffrey, D., Woods, V., & Buckle, P. (2005). *Further development of the usability and validity of the Quick Exposure Check*. Prepared by University of Surrey for the Health and Safety Executive.

Gupta Dr, N., & Pandya, E. (2019). Assessing Modular Kitchen through an Ergonomic Lens: A Case Study. *International Journal of Engineering and Science Invention*, *8*(8), 64–72.

Habibi, E., Taheri, M. R., & Hasanzadeh, A. (2015). Relationship between mental workload and musculoskeletal disorders among Alzahra Hospital nurses. *Iranian Journal of Nursing and Midwifery Research*, *20*(1), 1. PMID:25709683

Hignett, S., & McAtamney, L. (2000). Rapid entire body assessment (REBA). *Applied Ergonomics*, *31*(2), 201–205. doi:10.1016/S0003-6870(99)00039-3 PMID:10711982

Jaffar, N., Abdul-Tharim, A. H., Mohd-Kamar, I. F., & Lop, N. S. (2011). A literature review of ergonomics risk factors in construction industry. *Procedia Engineering*, *20*, 89–97. doi:10.1016/j.proeng.2011.11.142

Julitta, S. Boschman, M., H.W., F., &, van der Molen, H.F. (2015). Use of Ergonomic Measures Related to Musculoskeletal Complaints among Construction Workers: A 2-year Follow-up Study. Safety and Health at Work, 6, 90-96. doi:10.1016/j.shaw.2014.12.003

Karwowski, W., & Marras, W. S. (1998). *The Occupational Ergonomics Handbook*. CRC-Press.

Khan, I. A., & Deb, R. K. (2019). Postural Analysis Through RULA, REBA And QEC Of Vendors Selling Edible Items At Railway Stations And In The Trains. *International Journal of Engineering and Advanced Technology*, *9*(1), 7269–7277. doi:10.35940/ijeat.A9878.109119

Koningsveld, P., & Van der Molen, F. (1997). History and future of ergonomics in building and construction. *Ergonomics*, *40*(10), 1025–1034. doi:10.1080/001401397187586 PMID:9339140

Kramer, D. M., Bigelow, P. L., Carlan, N., Wells, R. P., Garritano, E., Vi, P., & Plawinski, M. (2010). Searching for needles in a haystack: Identifying innovations to prevent MSDs in the construction sector. *Applied Ergonomics*, *41*(4), 577–584. doi:10.1016/j.apergo.2009.12.003 PMID:20170903

Kratzenstein, S., Wanstrath, M., & Behrenbruch, K. (2019). Height adjustments on backpack- carrying systems and muscle activity. *Applied Ergonomics*, *74*, 172–176. doi:10.1016/j.apergo.2018.08.022 PMID:30487097

Kulkarni, V. S., & Devalkar, R. V. (2018). *Postural analysis of building construction workers using ergonomics*. International Journal of Construction Management. doi:10.1080/15623599.2018.1452096

Lasota, A. M. (2014) A REBA-based analysis of packers workload: a case study. *Log Forum 10,* 1.

McAtamney, L., & Corlett, E. N. (1993). RULA: A survey method for the investigation of world-related upper limb disorders. *Applied Ergonomics*, *24*(2), 91–99. doi:10.1016/0003-6870(93)90080-S PMID:15676903

Meyers, A. R., Gerr, F., & Fethke, N. B. (2014). Evaluation of Alternate Category Structures for the Strain Index: An Empirical Analysis. *Human Factors*, *56*(1), 131–142. doi:10.1177/0018720813492548 PMID:24669548

Mishra, D., & Satapathy, S. (2019a). An assessment and analysis of musculoskeletal disorders (MSDs) of Odisha farmers in India. *Int J Syst Assur Eng Manag*, *10*(4), 644–660. doi:10.1007/s13198-019-00793-x

Mishra, D., & Satapathy, S. (2019b). Ergonomic risk assessment of farmers in Odisha (India). *Int J Syst Assur Eng Manag*, *10*(5), 1121–1132. doi:10.1007/s13198-019-00842-5

Motamedzade, M., Ashuri, M. R., Golmohammadi, R., & Mahjub, H. (2011). Comparison of ergonomic risk assessment outputs from rapid entire body assessment and quick exposure check in an Engine Oil Company. *Journal of Research in Health Sciences*, *11*(1), 26–32. PMID:22911944

Nath, N. D., Akhavian, R., & Behzadan, A. H. (2017). Ergonomic analysis of construction worker's body postures using wearable mobile sensors. *Applied Ergonomics*, *62*, 107–117. doi:10.1016/j.apergo.2017.02.007 PMID:28411721

Occhipinti, E. (1998). OCRA: A concise index for the assessment of exposure to repetitive movements of the upper limbs. *Ergonomics*, *41*(9), 1290–1311. doi:10.1080/001401398186315 PMID:9754032

Ozkaya, K., Polat, O., & Kalinkara, V. (2018). Physical Workload Assessment of Furniture Industry Workers by Using Owas Method. *The Ergonomics Open Journal*, *11*(1), 11–19. doi:10.2174/1875934301811010011

Purnomo, H., & Apsari, A. E. (2016) REBA ANALYSIS FOR CONSTRUCTION WORKERS IN INDONESIA. *Journal of Built Environment, Technology and Engineering, 1*, 104-110.

Qutubuddin, S. M., Hebbal, S. S., & Kumar, A. C. S. (2013). An ergonomic study of work related musculoskeletal disorder risks in Indian Saw Mills. *Journal of Mechanical and Civil Engineering*, *7*(5), 7–13.

Restuputri, D. P., & Gangguan, P. R. (2018). Musculoskeletal Disorder Pekerja Batik Dengan Menggunakan Metode Strain index. *Jurnal Teknik Industri*, *19*(1), 97–106. doi:10.22219/JTIUMM.Vol19.No1.97-106

Schneider, S. P. (2001). Musculoskeletal injuries in construction: A review of the literature. *Applied Occupational and Environmental Hygiene*, *16*(11), 1056–1064. doi:10.1080/104732201753214161 PMID:11757902

Sharan, D., & Ajeesh, P. (2012). Correlation of ergonomic risk factors with RULA in IT professionals from India. *Work (Reading, Mass.)*, *41*(Supplement 1), 512–515. doi:10.3233/WOR-2012-0205-512 PMID:22316775

Shin, G., & Mirka, G. (2004). The effects of a sloped ground surface on trunk kinematics and L5/S1 moment during lifting. *Ergonomics*, *47*(6), 646–659. doi:10.1080/00140130310001653066 PMID:15204292

Stattin, M., & Järvholm, B. (2005). Occupation, work environment, and disability pension: A prospective study of construction workers. *Scandinavian Journal of Public Health*, *33*(2), 84–90. doi:10.1080/14034940410019208 PMID:15823968

Steven, M. J., & Arun, G. (1995). The Strain Index: A Proposed Method to Analyze Jobs for Risk of Distal Upper Extremity Disorders. *American Industrial Hygiene Association Journal*, *56*(5), 443–458. doi:10.1080/15428119591016863 PMID:7754975

Tee, K. S. Low, E., Saim, H., Zakaria, W., Khialdin, S., Isa, I., M.I., A., S., C. (2017) A study on the ergonomic assessment in the Workplace. *AIP Conference Proceedings*. AIP. doi:10.1063/1.5002052

van der Molen, H. F., Sluiter, J. K., Hulshof, C. T., Vink, P., & Frings-Dresen, M. H. (2005). Effectiveness of measures and implementation strategies in reducing physical work demands due to manual handling at work. *Scandinavian Journal of Work, Environment & Health*, *31*, 75–87. PMID:16363450

Vieira, L., Balbinotti, G., Varasquin, A., & Gontijo, L. (2012). Ergonomics and Kaizen as strategies for competitiveness: A theoretical and practical in an automotive industry. *Work (Reading, Mass.)*, *41*, 1756–1762. doi:10.3233/WOR-2012-0381-1756 PMID:22316967

Vijay, K., & Kumar, S. M. (2018). Ergonomic Evaluation of Maize Seed Sowing Method in Small Holdings and its Impact on Musculoskeletal Disorders by Using Digital Human Model and Virtual Ergonomics Techniques. *International Journal of Agricultural Sciences*, *10*(2), 5056–5060.

Weichelt, B., Ray, W., & Keifer, M. (2019). Development of an Occupational Health Safe Return to Work Prototype Application and Ergonomics Data set for Agricultural Tasks. *Safety (Basel, Switzerland)*, *5*(2), 40. doi:10.3390/safety5020040

Welch, L. S., & Hunting, K. (2003). Injury surveillance in construction: What is an "injury", anyway? *American Journal of Industrial Medicine*, *44*(2), 191–196. doi:10.1002/ajim.10250 PMID:12874852

Woodside, G. (1997). Environmental, Health, and Safety Portable Handbook. Mc Graw Hill.

Zengin, M. A., & Asal, Ö. (2020). Evaluation of employee postures in building construction with different ergonomic risk assessment methods. *Journal of the Faculty of Engineering and Architecture of Gazi University*, *35*(3), 1615–1630. doi:10.17341/gazimmfd.548028

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