



AGRICULTURE  
ARCHIVES

OPEN ACCESS JOURNAL



Check for updates

**Citation:** N. Pavani, M. Gayatri Devi, D. Ratna Kumari and V. Vijaya Lakshmi (2023). Assessment of Physiological Workload of Female Workers by Heart Rate Monitor. Agriculture Archives: An International Journal. V02i01.09-12. DOI: <https://doi.org/10.5281/zenodo.7722435>

**DOI:**  
<https://doi.org/10.5281/zenodo.7722435>

**Corresponding Author:**  
N. Pavani  
[nunepavani@yahoo.com](mailto:nunepavani@yahoo.com)

Received on: November 23, 2022  
Revised on: January 17, 2023  
Accepted on: January 28, 2023

**Copyright:** © 2023 N. Pavani.  
Published under a [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/) (CC BY 4.0) license.

## ORIGINAL RESEARCH ARTICLE

# Assessment of Physiological Workload of Female Workers by Heart Rate Monitor

N. Pavani\*, M. Gayatri Devi, D. Ratna Kumari and V. Vijaya Lakshmi

Department of Resource Management and Consumer Sciences, College of Home Science, Professor Jayashankar Telangana State Agricultural University, Saifabad, Hyderabad-500004 (Telangana), India

## ABSTRACT

*The physiological workload is a personal monitoring device that allows one to measure one's heart rate in real-time or record the heart rate for later analysis. It is important to note that heart rate fluctuates easily and is affected by multiple elements such as work, stress, hydration, nutrition, smoking, caffeine, exercise, and health conditions. In the current study, the heart rates of two different sector female workers were assessed i.e., weeding activity under agricultural sector and packaging activity under industrial sector. An exploratory research design was adopted to conduct the study in which heart rate monitor was used to assess physiological workload of the workers. Weeding and packaging are two different activities that require different levels of energy expenditure, different working postures, and physical resources. The findings showed that the cost of physiological workload was more for weeding activity compared to packaging activity which implies that weeding activity is laborious.*

**Keywords:** *Physiological Workload, Heart Rate, Task, Posture.*

## INTRODUCTION

Physiological workload is the measurable portion of physical resources expended when performing a given task and is affected by a range of factors, which include nature of work, training, motivation and environmental factors. Physiological workload can be assessed by heart rate monitor which is a personal monitoring device that allows one to measure one's heart rate in real time or record the heart rate for later analysis.

Heart rate is a measure of the number of heart beats occurring over a 60 second period and can be measured at rest and during exercise. Resting heart rate is measured to get a baseline that can be used to assess and monitor a person's cardiovascular fitness. It is important to note that heart rate fluctuates easily and affected by multiple elements such as stress, hydration, nutrition, smoking, caffeine, and exercise and health conditions.

The study on 'Assessment of Physiological Workload of Different Sector Workers through Heart Rate Monitor' is an attempt to elicit information on physiological workload of weeding activity under agricultural sector and packing activity under industrial sector.

Weeding refers to the removal of weeds, an important time consuming and drudgery prone task. Weeding only affects the soil minimally, which is beneficial to plant growth, soil life, reducing the spawn of weeds, Primary weeding is done to clear huge amounts of plants, weeds i.e.,

with new agricultural fields or just after winter when the soil needs to be loosened anyway. By contrast, weeding is done manually rather than with mechanized equipment and is also done regularly.

When plants are kept on the ground, workers must bend completely forward to weed them, risking low-back problems. Worker must stoop and stay in bent position to weed. Worker fatigue and pain can lead to lower work quality. Hence, they get backaches and pains in the shoulders, arms, and hands more than any other health problem. These are typically a result of chronic exposure to physical stresses related to working in a stooped position, carrying heavy weights in awkward positions, kneeling often, working with arms above shoulder level, moving hands and wrists repetitively. In general, any work performed with high force or in a position that feels awkward may put a worker at risk of injury, especially if it's repeated a lot.

Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale and end use. A package provides protection, tampering resistance and special physical, chemical or biological needs. Packaging contains, protects, preserves, transports, informs, and sells. The packing work is composed of physical elements such as machinery and equipment, tools, and most importantly people. In addition, the packing workers are particularly prone to problems related to discomfort, ensuring production quality and increases in training costs and absenteeism.

Caliskan and Caglar (2010) studied on 'An assessment of physiological workload of forest workers in felling operations' examined the physical strain experienced by chainsaw operator and the applicability of heart rate indices for measuring physical strain in forest felling operations in north eastern region of Turkey. All physiological measures placed the task of chainsaw operations in the heavy workload categories. Average hourly production decreased from 8.5 m<sup>3</sup> in the morning to 7 m<sup>3</sup> in the afternoon. The cutting-felling phase accounted for 30% of the hazards, with the remaining 70% occurring during branch cleaning. This study also shows that heart rate indices can be used as an effective means of determining the physiological strain of

subjects in applied field situations.

Kalita, *et al.*, (2015). Reported that in developing countries like India the workers suffer from assorted health problems due to awkward postures and carrying heavy loads. The study is an attempt to assess physical fitness, physiological workload, muscular and postural stress involved in storage of paddy grains. Heart rate was recorded with heart rate monitor and postural stress in different region was measured with inclinometer. The physiological workload of farm women in storing paddy was categorized as 'heavy' activity. It was found that work postures have a distinctly harmful effect on musculoskeletal system of the farm women. The angles of average flexion was highest in upper arm (90.620) and extension was in thoracic and it was observed to be 115.300 indicating deviation of body parts.

By the above given evidences, it is clear that the physiological workload causes strain to the worker. This physiological workload can be measured or assessed by heart rate monitor, which is further discussed in the paper.

## MATERIALS AND METHODS

An exploratory research design was adopted to conduct the study. It is a process of gathering facts and doing research that later allows the team to create the best research design or data collection method available for specific subjects. A well known Agricultural University was purposefully selected for the study. The college farm for the workers performing weeding activity and the processing unit for the workers performing packing activity were randomly selected based on the activities they perform at their work.

Structured interview schedule was developed to collect the data regarding the general information of the worker which includes age, gender, experience, etc. The schedule also focused on collecting the information about the type of posture workers adopt while working and the type of musculoskeletal disorders workers are facing due to their work. A total of 10 female respondents, 5 from agricultural sector and 5 from industrial sector were selected. The respondents were personally interviewed. The data collected was coded, consolidated and interpreted and presented in appropriate tables.



**Picture 1:** Heart rate monitor

The data thus collected was coded and interpreted with the help of the following expression:

$$\text{Physiological cost of work} = \frac{TCCW}{\text{Total time of work}}$$

Where,

$$TCCW = CCW + CCR$$

$$\text{Total Cardiac Cost of Work} = \text{Cardiac Cost of Work} + \text{Cardiac Cost of Recovery}$$

$$CCW = AHR \times \text{Duration of activity}$$

$$AHR = \text{Average recovery heart rate} - \text{Average resting heart rate}$$

$$CCR = (\text{Average recovery heart rate} - \text{Average resting heart rate}) \times \text{Duration of recovery}$$

$$\text{Energy expenditure (Kj/min.)} = 0.159 \times \text{Average heart rate (beats/min.)} - 8.72$$

## RESULTS AND DISCUSSIONS

The respondents were females, aged between 20-50 years. Most of them were literates and primary school drop outs in agricultural sector, where as secondary school passed outs in industrial sector. Their body types are endomorph and mesomorph in agricultural sector while endomorph and ectomorph in industrial sector was observed.

Heart rate monitor was used to assess the physiological cost of work, while performing weeding and packing activity. Heart rate monitor records the physiological workload of the workers.

Weeding and packaging are two different activities which require different levels of energy expenditure, different working postures, and different physical resources. For example, during weeding activity, the worker has to bend forward and pick up the weeds with one hand and hold them in the other hand. During this process, the worker may put their arm on the knee to balance the posture as shown in the picture 1. But while performing the packaging activity, the worker will sit on the floor to carry on with the activity as shown in the picture 2.



**Picture 2:** Weeding activity



**Picture 3:** Packaging activity

The cost of physiological workload was more for weeding activity while compared to packaging activity as given in the Table 1. This wide difference might be due to their posture while performing the activity and the work environment. As the weeding activity was performed in farm field with a forward bending posture while, the packaging

activity is performed in interiors of the millet unit with sitting on a floor.

**Table 1:**The Physiological Workload Monitored By Heart Rate Monitor

Specifications	Weeding activity	Packaging activity
Average heart rate	96	96
Duration of activity	4398sec.	4398sec.
Duration of recovery	1800sec	1800sec
Cardiac cost of work	422208	422208
Cardiac cost of recovery	21600	3600
Energy expenditure	6.54	-8.4
Total cardiac cost of work	443808	425808
Physiological cost of work	101	96.8

**CONCLUSION**

Weeding refers to the removal of weeds, an important time consuming and drudgery prone task. It is done manually rather than with mechanized equipment and is also done regularly. Hence, they get backaches and pains in the shoulders, arms, and hands more than any other health problem. Worker must stoop and stay in bent position to weed. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. The packing workers are particularly prone to problems related to discomfort, ensuring

production quality and increases in training costs and absenteeism. Weeding and packaging are two different activities which require different levels of energy expenditure, different working postures, and different physical resources. The cost of physiological workload was more for weeding activity while compared to packaging activity. Ergonomic Interventions is essential for reducing physiological workload and improving productivity and comfort.

**REFERENCES:**

[1.] Caliskan, E. and Çağlar, S. 2010. An assessment of physiological workload of forest workers in felling operations. *African Journal of Biotechnology*. 9(35): 5651-5658.

[2.] Kalita M., Borah R. and Bhattacharyya N. 2015. Physiological Workload of Farm Women in Paddy Storage Activity of Assam. *HWWE Conference Proceedings*. 105- 111.

[3.] Lasota, M.A. 2014. Analysis of Packers' Workload on the Packing Line - A Case Study [https://www.researchgate.net/publication/265794660\\_ANALYSIS\\_OF\\_PACKERS%27\\_WORKLOAD\\_ON\\_THE\\_PACKING\\_LINE\\_-\\_A\\_CASE\\_STUDY](https://www.researchgate.net/publication/265794660_ANALYSIS_OF_PACKERS%27_WORKLOAD_ON_THE_PACKING_LINE_-_A_CASE_STUDY).

[4.] [https://www.google.co.in/search?q=body+types&rlz=1C1GGRV\\_enIN752IN754&oq=body+types&aqs=chrome..69i57j0l5.6839j0j8&sourceid=chrome&ie=UTF-8](https://www.google.co.in/search?q=body+types&rlz=1C1GGRV_enIN752IN754&oq=body+types&aqs=chrome..69i57j0l5.6839j0j8&sourceid=chrome&ie=UTF-8)

[5.] <https://www.uvm.edu/vtvegandberry/factsheets/ergonomics.html>

[6.] [https://en.wikipedia.org/wiki/Packaging\\_and\\_labeling](https://en.wikipedia.org/wiki/Packaging_and_labeling)