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## Ergonomics assessment of drudgery among rural women in farm activities

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**Abstract** Agriculture is the main source of livelihood for the majority of the population in India. Many believe that women's involvement in agriculture is a source of heavy burden of drudgery on them (Verma and Sinha, 1991). An experimental study to compute drudgery of rural women was done and it was found that wheat harvesting was the most drudgerious farm activity by women while performing various tasks. Women maintain their own convenient postures without realizing the physiological cost of work and physiological damages to the body in that particular way of working. Thus a capron was designed for wheat harvesting. It was found significantly effective in drudgery reduction of rural women.

**Keywords** Ergonomics, Drudgery, Rural Women, Farm Activities

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### 1. Introduction

It is widely recognized that women are the major work force in agriculture who predominantly sustain the life support system of rural India. Because since dawn to dusk, they share abundant responsibilities and perform a wide spectrum of activities related to agriculture, house hold chores and allied.

Rural Haryana provides an excellent example of the importance and magnitude of women through their active participation in agriculture development and farm management. Women play a prominent role in crop cultivation and post-harvest operations. All the women in rural areas irrespective of age, size of family, size of land holding, caste and community performing major agriculture tasks.

Many agricultural operations seem to be simple not too tedious with a relative less level of energy expenditure rate. But the activities may pose a threat to the worker because of the arduous and unnatural posture adopted by the worker throughout the task. Unfortunately, the long unrecognized hours spent by women on arduous, unhealthy and unpleasant tasks are rarely perceived as a central issue in today's situation.

Therefore, it is important to find out the amicable solution to the problems faced by rural families in order to improve their quality of life. In light of the above facts, the present study was conducted to find out the most drudgery-prone activities among farm activities and determinants of variability in drudgery along with the assessment of the impact of improved technology in drudgery reduction of the most drudgery-prone activities of rural women.

### Materials and Methods

#### Selection of the subject

Twelve nuclear families were selected purposively from the selected village. Three women from each category i.e. landless laborers, small farmer, medium farmer and large farmers were selected for a representative sample. Women with average health status were selected purposively. Thus the total sample consisted of twelve rural women.

#### Ergonomic cost of activities

Ergonomic cost of day-to-day activities was calculated by measuring the physiological, cardio-vascular and muscular stress of women while performing the activities.



**Energy Expenditure:**

It was calculated from the values of heart rate using the following formula:

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

**Rating of perceived exertion (RPE):** RPE scale developed by Varghese et al (1994) was used to study the exertion perceived by the women during and after the activity. It was measured at five point continuum i.e.1, 2, 3, 4 & 5 for very light, light, moderately heavy, heavy and very heavy exertion respectively.

**Grip Strength:** Grip dynamometer was used to measure the strength of the grip muscles before, during and after activities. The percentage change in grip strength was measured using the following formula:

$$\text{Percentage change in grip strength} = \frac{Sr - Sw}{Sr} \times 100$$

Where, Sr = Strength of muscles at rest

Sw = Strength of muscles at work

Decreased grip strength with the performance of the activity was interpreted as grip fatigue of the muscles.

**Postural analysis:** Postural analysis of the cervical and lumbosacral region during the performance of the activity was measured and compared with the normal bend of the back and the angle of deviation was determined by subtracting the normal angle of bend during the bending posture.

**Musculo-skeletal Problems:** Incidence of musculo-skeletal problems was identified using the Body Map indicating pain in different parts of the body after the completion of the activity. Five-point scale was used to record the intensity of pain in the various body parts viz. 5, 4, 3, 2 & 1 for the intensity of pain as very severe, severe, moderate, mild and very mild respectively.

**Result and Discussion**

Table 1 describes the average time spent by rural women for farm activities. Maximum time was spent (133 min morning and 137 min in evening) followed by time spent in winnowing (131 min in evening). Least time 15 min were required for transportation of bundling and bundling needed 35 min.

**Table 1:** Average time spent per day for farm activities during wheat harvesting (Peak season)

Sr. No.	Activities	Time spent (min.)			
		Morning	N	Evening	N
1.	Wheat harvesting	133	9	137	6
2.	Bundling	-	-	35	6
3.	Transportation	-	-	15	6
4.	Winnowing	-	-	131	3

It is evident from the table 2 that bundling, winnowing and transportation were done in evening only and wheat harvesting was performed in morning as well as in evening. Average heart rate (132), peak heart rate (142), average energy expenditure (12.3), peak energy expenditure (13.8) and physiological cost of work (82) all the parameters were highest for bundling activity. All the farm activities performed in evening were classified as heavy and rating of perceived exertion was ranging in between 4.5 - 5.0. Wheat harvesting was graded as moderately heavy activity in morning and in evening it is classified as heavy activity. Rating of perceived exertion also increased for wheat harvesting in evening. The reason behind it may be that as day progresses: fatigue increases and work efficiency decreases. Thus, it may be concluded that time of day when activity is being done also affects the physiological and psycho-physiological stress.



**Table 2:** Physiological and psycho-physiological stress of farm activities during peak season

Sr. No.	Farm Activities	AHR (bpm)		PHR (bpm)		AEE (kJ/min)		PEE (kJ/min)		PCW (bpm)		Classification of work load		RPE Mean score	
1.	Wheat harvesting	118	127	133	137	10.8	11.5	12.4	13.3	70	78	MH	H	3.6	4.0
2.	Bundling	-	132	-	142	-	12.3	-	13.8	-	82	-	H	-	5.0
3.	Transportation	-	129	-	141	-	11.7	-	13.7	-	80	-	H	-	4.5
4.	Winnowing	-	126	-	136	-	11.3	-	12.9	-	78	-	H	-	5.0
t* values						5.84*						5.57*			

\* Significant at .000% level; (n=9)

Data in Table 3 discuss about the grip strength of right and left hand before, during and after doing the farm activities in peak season. It is clear from the data that there was minimum fluctuation in the grip strength of both the hands before the activity but decreased significantly after the activity. Reason may be that even though they had done farm activities before doing animal husbandry activity they took some rest in the form of tea break due to which their work capacity might have recovered. Grip strength further decreased at very fast rate. Reason for this may be that muscular strength was more after rest but grip strength decreased quickly because they were tired after whole day's work. Thus it may be concluded that small breaks in between the work help to regain work power and improve work out-put and decreases muscular stress.

**Table 3:** Grip strength of women before during and after farm activities for both hands during peak season

Sr. No.	Farm Activity	Left hand (kg)						Right hand (kg)					
		Morning			Evening			Morning			Evening		
		B	D	A	B	D	A	B	D	A	B	D	A
1.	Wheat harvesting	17.0	15.0	13.0	15.0	13.0	10.0	18.0	15.0	13.0	16.0	13.0	9.0
2.	Bundling	-	-	-	15.0	12.0	10.0	-	-	-	16.0	11.0	12.0
3.	Transportation	-	-	-	14.0	12.0	9.0	-	-	-	14.0	12.0	8.0
4.	Winnowing	-	-	-	13.0	11.0	9.0	-	-	-	12.0	11.0	9.0

n=9; B=before, D= During, A=After

The table 4 further showed that in farm sector bundling and wheat harvesting scored highest on drudgery (22) followed by transportation (19). Thus it may be concluded that in farm sector wheat harvesting and bundling was the most drudgery prone activity.

**Table 4:** Scoring of farm activities based on various parameters to determine drudgerious activities

Sr. No.	Farm Activity	AHR	PCW	GS	RPE	MSP	Spinal deviation		Total score	Rank
		Cervical		Lumbar						
1.	Wheat harvesting	II	III	I	II	II	II	I	22	
2.	Bundling	III	II	III	II	I	III	II	19	I
3.	Transportation	IV	III	II	I	IV	IV	III	14	II
4.	Winnowing									III

For farm sector: An overview of the data and observations; need was felt to have some aid during wheat harvesting. It was reported that main drudgery causing factor was movement in squatting position, environmental temperature along with dust and straws which some-times cause serious injuries. Women were using their duppatta /chundari to cover the head and nose. They were not satisfied with this option but there was no other substitute for them. A capron developed by AICRP FRM Unit was first brought to the field. The results were not quite satisfactory as it was not providing any shade for eyes, mask to nose and fastening was also not comfortable. Keeping in view the problems felt by respondents; a modified capron with flap, mask and easy to fasten was designed and developed. It was tested in field and then introduced to rural women. It was found



effective in all the activities of wheat harvesting i.e. wheat wheat harvesting, bundling, transportation and winnowing.

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