

## Occupational Health Hazards among Rural Women in Selected Animal Husbandry Operations

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### ABSTRACT

A field experiment was done with 60 rural women selected from 6 different villages within the age group of 20-45 years to determine their occupational workload and muscular stress based on their physiological responses while performing selected six drudgery prone/strenuous animal husbandry activities with the use of existing tool, equipments and techniques. The study revealed that physiological workload, total cardiac cost of work, physiological cost of work of rural women, their perceived exertion and reduction in the grip strength while performing the activities was very high for all the selected activities. The highest drudgery oriented activity was the chaffing followed by collection and disposal of dung and making of cowdung cakes revealing the fact that all the activities taken under the study were highly drudgery prone. There is a need to aware and motivate the rural women to adopt the improved tools, techniques and equipments to reduce physiological cost of work and drudgery in animal husbandry operations which in turn will influence work efficiency and work productivity.

**Key words:** Animal husbandry, drudgery, ergonomics, health hazards, rural women

### INTRODUCTION

The study has been initiated with the objective of assessing the occupational workload and the muscular stress among rural women based on their physiological responses while performing various animal husbandry operations. It focused on the ergonomic issues of rural women in order to ensure better health and safety, to improve work efficiency and to reduce their drudgery in animal husbandry operations. The study possibly may help in modifying the jobs of rural women by designing the ergonomically sound tools and equipments so that women can be persuaded to use the effective tools and equipments to ensure correct work posture with least body fatigue and discomfort and reduced injuries with ultimate aim of improving work performance and productivity.

### METHODOLOGY

The field experiment was done on 60 rural women selected from 6 different villages within the age group 20-45 years to determine their occupational workload and muscular stress based on physiological responses while performing six selected drudgery prone/strenuous activities with the use of existing tool, equipments and techniques. Suitability of experimental women was ascertained by measuring body temperature (not more than 99° F), blood pressure (120:80 ± 10) and heart rate (70-90 bpm).

Ten rural women were identified for each field experiment, to assess ergonomic cost in the activities of milking, harvesting of fodder-berseem, chaffing of

fodder, cleaning of cattle shed, collection and disposal of dung and making of cowdung cakes by calculating average heart rate, energy expenditure, total cardiac cost of work (TCCW), physiological cost of work (PCW), grip strength and perceived rate exertion. Heart rate was measured with the heart rate monitor and other parameters were determined from heart rate values. Rate of perceived exertion was determined by using a modified 5 point scale ranging from 1-5 (1-Very light, 2-Light, 3-Moderately Heavy, 4 Heavy and 5-Very heavy) of perceived exertion scale developed by Varghese *et. al.*, (1994). Energy expenditure was calculated from the average heart rate (AHR) by using the formula given by Varghese *et. al.*, 1994. (Energy Expenditure (kj/min.)=0.159 x HR - 8.72). Physiological workload was classified based on the heart rate and energy expenditure. TCCW and PCW were determined by using the average heart rate during rest, at work, recovery and duration of work. The strength of grip muscles was measured using grip dynamometer before and after the activity. Body map developed by Corlette and Bishop (1976) was used for studying the musco-skeletal problems. Besides the drudgery index was also calculated for all the selected activities based on linear combination method using the scores obtained from degree of difficulty, body posture difficulty, handling difficulty, time spent on activity and frequency of operation. The respondents were asked to rate their answers on the three point continuum of scores 1, 2 and 3, respectively indicating easy, moderate and difficult. The mean scores were calculated based on the total scores of the respondents on each item divided by the total number of respondents.

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## RESULTS AND DISCUSSION

The study revealed high physiological workload of rural women in performing all the selected animal husbandry activities due to use of traditional/existing tools and techniques. The drudgery index for the selected activities ranged between 2.10-2.72 due to difficult body posture, difficult handling, more frequent and time taking activity and other physical health hazards perceived by the respondents. The highest drudgery oriented activity was the chaffing followed by collection and disposal of dung and making of cow dung cakes revealing the fact that all the activities taken under the study were highly drudgery prone when performed with the existing traditional tools. The classification of workload on the basis of average and peak heart rate and energy expenditure for most of the selected activities was graded between moderately heavy to extra heavy. Highest reduction in grip strength after completion of the activity with the traditional tools was found for collection and disposal of dung followed by cleaning of shed and making of cow dung cakes. More the reduction in grip strength, more was taken as grip fatigue for the selected activities. Total cardiac cost of work (TCCW) was also found highest for the activity of collection and disposal of dung followed by making of cowdung cakes and chaffing of fodder.

### Activity wise occupational health hazards among rural women in animal husbandry due to use of traditional tools and techniques

#### Milking of animals

Milking was classified as a moderate to heavy activity. The workload varied on the basis of workload of the number and type of animals owned by the women. The long squatting position of the women during the entire milking activity took more time and energy in milking leading to physical drudgery. Respondents complained for pain in low back, knees, ankles and calf muscles. The average and peak heart rate during the milking was 110.6 and 129.9 beats per min. which consumed an average of 8.86 kj and 11.93 kj per min, respectively. The reduction in the grip strength was 14.9 per cent after milking 4.6 liters of milk from a buffalo (Table 1). The total cardiac cost in milking a buffalo came to 292.81 beats and cardiac cost came to 52.46 beats per unit of work. The drudgery in milking activity was the least as compared to the rest of the selected activities and the RPE was found to 3.7. (Table 2). Vinay and Sharma (2000) recorded that the average and peak heart rate while performing the milking activity was 108.16 beats/ min and 129.7 beats/ min, respectively. Oberoi and Gupta (2006) studied muscular stress of rural women in milking

of animals through studying the frequency of postural change, decrease in grip strength, angle of deviation of back bone and incidence of musculoskeletal problems. They found that women stood seven times, bended five times and changed squatting position three times during the milking of animal. Angle of deviation was 13 degree from the normal bending and reduction in grip strength was 20.1 per cent. Besides the major body parts affected during milking were pain in upper thighs, ankle /feet, low back and shoulder. Based on the results it is recommended to introduce the use of revolving stool (Pirhi), an improved tool for milking an animal developed in various agricultural universities of India. Women should be motivated to use this pirhi in order to reduce the cardiac cost per unit of out put. The productivity of the workers can also be increased over the traditional method of sitting in squatting position while milking an animal thus may also save the reduction in physical drudgery, grip strength, perceived exertion and total cardiac cost of work.

**Table 1: Physical workload of farm women while performing drudgery prone activities with traditional tools**

Activities	Working heart rate beats /mt		Energy Expenditure kj/mt		Classification of work load		Decrease in grip Strength	Drudgery Index	Output
	Average	Peak	Average	Peak	Average	Peak			
Milking of animal	110.6	129.9	8.86	11.93	Moderate	Heavy	14.9	2.10	4.6 lit/animal
Harvesting of berseem as fodder	101.9	113.4	7.48	9.31	Light	Moderate	9.39	2.36	144.6 m <sup>2</sup> /h
Chaffing fodder - berseem	149.60	162.3	15.06	17.08	Very heavy	Extra heavy	14.45	2.72	43.6 Kg/h
Cleaning of cattle shed	119.4	128.2	10.26	11.66	Moderate	Heavy	12.88	2.30	200 m <sup>2</sup> Area /h
Collection & disposal of dung	139.6	153.7	13.47	15.71	Very heavy	Very heavy	17.39	2.56	15 Kg at 30 m distance /10 min
Making cow dung cake	121.6	135.6	10.61	12.84	Heavy	Heavy	14.12	2.48	74 cakes/h

**Table 2: Ergonomic data for drudgery prone activities using traditional/local tools and techniques**

Activities	AHR	CCR	CCW	TCCW	PCW	CC (beats per unit of work)	Rate of perceived exertion
Milking of animals	24.4	51.5	241.31	292.81	29.60	52.46	3.7
Harvesting of fodder-berseem	16.0	17.0	66.4	83.40	20.09	6.64	2.7
Chaffing fodder - berseem	52.2	84.0	287.1	371.1	67.47	71.77/ Kg	4.8
Cleaning of cattle shed	28.9	31.0	173.4	204.4	34.07	8.67/ m <sup>2</sup>	3.5
Collection & disposal of dung	47.2	84.0	472.0	556.0	55.60	31.46/kg	4.4
Making cow dung cake	25.2	54.5	408.49	462.99	28.56	20.42/cake	3.4

### Harvesting of fodder- *Berseem*

Women were using the non serrated local sickles of varied size, shape and handle length for harvesting of all type of fodder. Though *berseem* was quite soft and tender, required not much energy thus fell between light to moderate activity as perceived by the women based on the average working heart rate and energy expenditure. Still they complaint the frequent incidence of hand injury, pain in lower arm, wrist, fingers and shoulders. The decrease in grip strength was 9.39 per cent after the completion of the activity. Women could harvest 144.6m<sup>2</sup> area per hour. The average working heart rate was 101.9 beats /min consumed 7.48 kj energy / min. (Table 1). Thus total cardiac cost and physiological cost in harvesting of different type of fodder will be different The TCCW for harvesting of berseem was 83.40 and rate of perceived exertion was 2.7 (Table 2). Sutjana (2000) also reported that the use of non-serrated sickle in harvesting of paddy stalks took more time yielded reduction in work productivity. Average and peak heart rate responses while cutting and collecting fodder was recorded 118.74 beats/min and 140.98 beats/ min with an energy expenditure of 10.1- 13.69 kj/min. According to Rana *et. al.*, (2005) the average heart rate of rural women while performing wheat harvesting activity was found to be 121.5 beats/min, which increased upto 126.7 beats /min at the end of the activity. Similarly energy expenditure was found to be 10.5 Kj /min which increased up to 11.2 kj per workload on the basis of average and peak heart rate and energy indicating that the wheat harvesting was graded between moderately heavy and heavy while bundling activity was graded between heavy and very heavy work . Thus, there is a need to introduce the serrated sickle called *Naveen daranti* developed in the Universities and CIAE, Bhopal which may reduce the incidence of injury and pain. Serrated sickle also does not need sharpening of cutting edge, provide better grip, more stable, may reduce the perceived exertion, workload, time loss and total cardiac cost of work. There is a need to aware and motivate the rural women regarding availability of serrated sickle for harvesting of crops to reduce the drudgery.

### Chaffing fodder (*berseem*)

Rural women were using the traditional chaff cutters of traditional designs and classified it as very heavy to extra heavy activity and consumed more heart beats per minute and energy in chaffing per Kg of fodder. The drudgery index for chaffing was also found highest *i.e.* 2.72 as compared to the other activities studied due to difficult body posture, handling difficulty, prone to physical injury and high energy consumption and also characterized by drudgery experienced at work and uneconomical use of energy. The reduction in grip strength was recorded to 14.45 per cent after the

completion of activity with the use of the manual chaff cutter (Table 1). The score of rate of perceived exertion was also found highest ie 4.8. Total cardiac cost of work (TCCW) and Cardiac cost of work (CCW) were calculated as 371.1 bpm and 71.77 beats per Kg of berseem (Table 2). The TCCW and CCW may vary as per the kind and variety of fodder to be chaffed. Crushing of hand and fingers between the rollers of chaff cutter were the most common injuries found among the children below 15 years of age in an epidemiological study done in North India conducted by Mohan *et. al.*, in 2004. Thus there is a need to design simple and safe fodder cutter with effective engineering interventions to prevent injuries, bending and other drudgery hazards. These features could easily be introduced at the time of manufacturing and retrofitted in the existing designs to augment the output per unit of time and to reduce the working cardiac cost and saving in terms of heart beats and energy.

### Cleaning of cattleshed using local broom

The activity fell under moderate to heavy category based on the results of average working heart rate (119.4 bpm) and energy (10.26 Kj/min). The peak heart and the corresponding energy expenditure reached upto 128.2 bpm and 11.66 kj / min, respectively. The strength of grip reduction after the activity was 12.88 per cent as compared to the strength of grip before starting the activity. The brooms used by the women had small handles and were made of different materials of agriculture waste thus they experienced physical exertion and could clean only an average of 200 m<sup>2</sup> area in one hour. The score of drudgery index for cleaning of cattle shed was 2.30 revealed difficulties in use, continuous bending while cleaning and highly frequent activity leading to physical health hazards (Table1). The body part affected /ailment experienced by the respondents was pains in low back, lower arm, and neck and hand grip. The TCCW (bpm) and PCW for cleaning of cattle shed found to be 204.4 and 34.07, respectively and consumed 8.67 beats extra for cleaning of one meter square area. Oberoi and Gupta (2006) studied muscular stress of rural women in cleaning of cattle shed through studying the frequency of postural change, decrease in grip strength, angle of deviation of back bone and incidence of musculoskeletal problems. They found the women stood seven times, bended five times and changed squatting position two times during the cleaning of animal shed. Angle of deviation from the normal bending was 10.25 degree; reduction in grip strength was 15.3 per cent. Rural women experienced pain in neck, shoulder, knees, calf muscles and low back.

There is an urgent need to develop the improved /long handle broom for cleaning of animal shed based on the ergonomic characteristics of rural women to reduce the

ergonomic cost of work to a significant extent in terms of heart rate, energy expenditure, TCCW, PCW and RPE. A comparative study may be undertaken to study the % saving in cardiac cost when the work is performed with improved broom over the existing one. Rural women should also be motivated to use the improved tools and technologies for performing the activity of cleaning of cattle shed so the activity may be performed with low ergonomic cost and drudgery and in comfortable standing posture instead of strenuous bending, and sometimes squatting posture.

#### **Collection and disposal of dung**

This activity was categorized as very heavy activity based on average heart rate (139.6 bpm) and peak working heart rate (153.7) with corresponding average energy expenditure of 13.47 kj /min and 15.71 kj /minutes. The body part affected /ailment experienced by the respondents was pain in low back, lower arm, upper arm and neck, legs, knees, ankles and hand grip. The strength of grip reduction after the activity reduced 17.39 per cent after completion of the activity as compared to the strength of grip before starting the activity. The drudgery index was found to be 2.56 out of 3.00 (Table 1). The score of perceived rate of exertion revealed by the respondents for collection and disposal of dung was also found high after chaffing ie 4.4 out of 5.0. TCCW and cardiac cost was also found highest (556 beats) among all the activities studied which needed 31.46 beats for collection of one Kg of dung to dispose to an average distance of 30 meter. (Table 2). Borah and Oberoi (2007) also revealed that average and peak heart rate during collection of dung was found to be 138.84 and 153.27 bpm with corresponding energy expenditure of 13.36 and 15.65 kj/min. The TCCW and PCW in collection of dung were calculated as 1188.05 beats and 65.01 beats per min. They also studied the average and peak heart rate during disposal of dung which was found to 142.95 and 159.09 bpm and consumed 14.01 and 16.58KJ/min. The workload of this activity was classified as very heavy to extra heavy. TCCW in disposing off dung was 129.90 beats and PCW was 69.93 beats per minute. Thus there is an urgent need to develop the improved tools for collection and disposal of dung like dung collector, spade and double wheel barrow/trolley to carry the dung to a collection place to reduce the ergonomic cost of work to a significant extent in terms of heart rate, energy expenditure, TCCW, PCW and RPE.

#### **Cow dung cake making**

Women were asked to prepare the cow dung cakes and readings related to heart beats and other parameters were taken. An average was calculated. The workload of preparing cow dung was classified as a heavy activity due

to high consumption of heart beat and energy per unit of time. The average and peak heart rate during the activity were 121.6 and 135.6 bpm which expended 10.61 and 12.84 kj energy per min for preparing 20 cakes in 16.21 min. The drudgery index score was also found higher ie. 2.48 out of 3.0 due to continuous squatting posture, time consuming and highly frequent activity. The affected body part/ ailment reported by women were pain in lower back, hand grip, palm and upper arm. The grip strength also reduced to 14.12 per cent after the completion of activity (Table 1). The score for perceived exertion was 3.4 out of 5.0. The TCCW in completion of activity was 462.99 beats which consumed 20.42 beats extra as cardiac cost per cake (Table 2). Thus a briquette machine for making cow dung cakes is needed to be developed to augment the output per unit of time and saving in the cardiac cost per cake. This machine will definitely cut in severing physical health hazards which are caused due to the long squatting postures in preparing cow dung cakes.

On the basis of the results of the study, it is concluded that total cardiac cost of work and physiological cost of work load of rural women in performing the activities with the existing traditional tools and equipment was very high for all the selected six activities. Introduction of improved tools and techniques may reduce the ergonomic cost viz heart rate (bpm), energy expenditure (kj/min), TCCW, grip strength and also RPE. Thus there is a need to aware and motivate the rural women regarding availability and adoption of improved tools and equipments to perform the drudgery prone activities which need higher ergonomic cost, uncomfortable posture and strenuous bending and squatting positions.

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