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Research Paper :

Physiological indices and physical performance capacity of farm women

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ABSTRACT

The study was planned to assess the health status and the physical performance capacity of farm women by using motorized electronic tread mill under laboratory conditions. Thirty subjects selected for the study were healthy non-pregnant women, agricultural workers, without any cardio-respiratory complaints and within the working age range of 25-45 years. Maximum percentage of the women (43.33%) were in the normal range body mass index range. The estimation of aerobic capacity revealed that 53.33 per cent women were in good fitness range. Highly significant correlation was observed between the exercise time and the independent variables like body weight, body mass index and blood pressure. Age and body weight showed highly significant correlation with the working heart rate during the exercise on the tread mill. It is evident from the study that the selected women were healthy having a good physical endurance capacity.

Key words : Physical fitness, Body Mass Index, Aerobic capacity, Physical endurance capacity

Almost 45.3 per cent of the agricultural labour force consists of women in the countries of south and Southeast Asia. Women are involved in most of the farming and farm related activities, besides their exclusive involvement in domestic chores. Women do the extremely tedious, time consuming and labour intensive activities like sowing, transplanting, weeding, intercultural operations, harvesting, threshing, transport and post harvest management like, shelling, cleaning, grading and processing etc.(Annonymous, 1997). The rural women do almost all jobs manually. Growing scarcity of energy resources in rural areas and its impact on women's workload, health, nutritional status and productive capacity of women are the important areas, which have not received adequate attention from policy planners and related ministries (Kalia, 2004).

Productivity in agriculture is always referred to the crop yield and the quality of inputs required. Human productivity and human performance, especially in women specific activities is the most neglected area in agriculture in developing and under developed countries. The work efficiency and productivity of women are directly related to the health condition and physical work capacity of women, which is specially true when they perform various activities manually in the field of agriculture.

The physical and physiological indices are the most important factors for the work station design and with appropriate technologies for increasing the efficiency and productivity of women in Indian agriculture. The physiological indices or the anthropometric data are most useful in equipment design, furniture design, work area and work station design with regard to height, reach, clearance and adjustability. The physiological indices are applicable for the design of the work, equipment etc. with regard to energy expenditure and work output. The physiological indices will also assist in assessment of the general health condition of the population. Very few studies have ben conducted by various scientists like Gite and Singh (1995), Oberoi *et al.*(1996), Rao *et al.* (2002) etc. which throw some light on the physical characteristics of women in agriculture. The physical performance capacity is the maximum aerobic capacity of the person while performing any activity, which can be measured by using different types of ergometers (Andersen and Rutenfranz, 1987).

The present study has been planned to assess the health status based on anthropometric data and the physical performance capacity of farm women through the use of motorized electronic tread mill under the laboratory conditions.

METHODOLOGY

Sample selection :

The subjects selected for the study were healthy non-pregnant women, agricultural workers, without any cardio-respiratory complaints. The total sample selected for the study was 30 women in the age group of 25 to 45 years.

Equipment used for the study:

The equipment used for the study were anthropometer, human weighing balance, electronic blood pressure measuring apparatus, polar heart rate monitor and the electronic treadmill with already programmed Bruce protocol model (Royal Track XL).

Experiment design and procedure:

The experiment was conducted in two replications for each sample. Care was taken to administer the experiment only once a day. The experiment was avoided during the menstrual period of the sample.

The subjects were prepared by asking them to sit in a relaxed position. All physical parameters like age, height, weight and blood pressure were recorded by using appropriate equipments. Then the subjects were made to walk on the tread mill along with changing the grade and speed to acquaint them for the tread mill and the experiment. The subjects were asked to sit comfortably and relax for few minutes.

Through the heart rate monitor, the resting heart rate for five minutes was recorded. Immediately after the rest of five minutes, the subjects were put on the tread mill administering the Bruce protocol mode. The subjects were asked to perform the exercise till they are exhausted. Immediately after termination of the exercise, they were asked to sit and relax for five minutes to record the recovery heart rate. After recording the recovery heart rate, the monitor was switched off. The duration of the experiment, speed, grades and stages of the experiment were simultaneously recorded.

Data analysis:

The physiological parameters like body type, body mass index and aerobic capacity were estimated by using the data of physical characteristics as per the methodologies given by Garrow (1987), Saha *et al.*(1979) and Varghese *et al.*(1994) The physical endurance capacity and physical fitness were assessed by using the heart rate data during the exercise period. The relationship between physical and physiological characteristics and the endurance capacity was found out to assess the physical fitness of the farm women. The test of correlation was used to find out the relationship between the physical and physical characteristic and the physical endurance capacity.

OBSERVATIONS AND DISCUSSION

Physical characteristics of the sample:

The physical characteristics of the farmwomen selected for the tread mill experiment are presented in the Table 1. The mean age of the respondents selected for the experiment was 35.77 years, with the mean height of 152.28 cm and the weight of 48.70 kg. The blood pressure and pulse rate of the selected sample were found to be normal *i.e.* 102.73/69.47 and 80.63, respectively.

Table 1 : Physical characteristics of the subjects selected for experiment (N=30)

Sr. No.	Physical characteristics	Mean	Tandard deviation
1.	Age (yr)	35.77	± 5.8
2.	Height (cm)	152.28	± 4.89
3.	Weight (kg)	48.70	± 6.58
4.	Blood pressure	102.73/69.47	± 14.43/9.28
5.	Pulse	80.63	± 13.16

Body composition:

The mean body density was 1.05. Based on the skin fold measurements, the mean per cent fat and fat weight of the respondents was found to be 21.13 per cent and 12.35 kg. The lean body mass was found to be 39.73 kg. (Table 2). Giuseppe *et al.* (1995) found that the body fat content of women below the age of 50 years was 30 per cent in USA, where as Brock and Legg (1997) found that the body fat content of females in British army recruits was around 27 per cent.

Table 2 : Body composition of the subjects selected for tread mill experiment (N=30)

Sr. No.	Physical characteristics	Mean	Standard deviation
1.	Body density	1.05	± 0.01
2.	Per cent fat	21.13	± 6.02
3.	Fat weight (kg)	12.35	± 10.41
4.	Lean body mass (kg)	39.73	± 8.88

Physical fitness of the farm women:

The physical fitness according to various parameters are presented in Table 3. Equal percentage of the women (43.33%) were having ectomorph and endomorph body type followed by 13.34 % having mesomorph body type.

The body mass index data of the sample depicted that maximum percentage of (43.33%) of the women were in the Normal Body Mass Index range followed by Low Weight Normal range. None of them belonged to CED grade III- Severe and Obese Grade II range.

The estimation of maximum oxygen consumption capacity based on height and weight revealed that 53.33 per cent women were in good fitness range followed by 30.00 per cent falling in the high average range and 16.67 per cent in very good range as per the classification given

Table 3 : Distribution of the respondents selected for tread mill experiment according their physical parameters (N=30)

Parameters	Frequency	Percentage
Body type		
Ectomorph (<20)	13	43.33
Mesomorph (20-25)	04	13.34
Endomorph (>25)	13	43.33
Body Mass Index		
CED grade III-Severe (<16.0)	0	0.00
CED grade II–Moderate (16.0-17.0)	1	3.33
CED grade I – Mid (17.0-18.5)	4	13.34
Low weight normal (18.5-20.0)	8	26.67
Normal (20.0-25.0)	13	43.33
Obese grade I (25.0-30.0)	4	13.34
Obese grade II (>30.0)	0	0.00
VO_2 max. (l/min.)		
Poor (<5.0)	0	0.00
Low average (15.0-22.5)	0	0.00
High average (22.6-30.0)	9	30.00
Good (30.1-37.5)	16	53.33
Very good (37.6-45.0)	05	16.67
Excellent (>45.0)	0	0.00

by Varghese *et al.* (1994).

Physical endurance capacity:

Table 4 presents the the performance of the exercise by the selected subjects on the electronic tread mill at various grades, speed, distance and the exercise time. Maximum percentage of farm women (63.33%) showed the endurance capacity up to 16 % inclination grade and 6.7 km/hour speed. The average distance they covered was between 0.6 – 1.0 and the average time of performance was between 9.1 – 12.0 minutes.

Highly significant correlation was observed between the exercise time and the independent variables like weight, body mass index and blood pressure. The body density showed positive significant correlation with the exercise time and distance covered, where as, the body fat percentage showed negatively significant correlation as presented in Table 4a.

Table 4 : Grade, speed, exercise time and distance covered by the farm women on Tread mill (N=30)

Grade (%)	Speed (km/hr)	Exercise time(min.)	Distance (kms.)	Percentage of women
14	5.4	<9.0	<0.6	18.33
16	6.7	9.1-12.0	0.6-1.0	63.33
18	8.0	12.1-15.0	>1.0	18.33

Table 4a : Correlation between exercise time, grade, speed, time, distance and independent variables

Independent variables	Exercise time	Grade	Speed	Distance
Age	0.126	0.163	0.163	0.149
Weight	-0.522**	-0.458**	-0.458**	-0.545**
Height	-0.179	-0.031	-0.031	-0.151
BMI	-0.433**	-0.437**	-0.437**	-0.471**
Vo2 max (ml/kg.min)	-0.0139	-0.057	-0.057	-0.021
Body density	0.396*	0.301	0.301	0.342*
Per cent fat	-0.394*	-0.299	-0.299	-0.340*
Blood pressure	-0.516**	-0.540**	-0.540**	-0.591**

* and ** indicate significance of value at P=0.01 and 0.05, respectively

Circulatory stress and physiological work load:

The details of the circulatory stress and physiological work load while performing the tread mill experiment are shown in the Table 5a. The average resting heart rate before performing the tread mill experiment of the farm women was 85.76 beats/min. The average working heart rate of was 124.38 beats/min. After performing the tread mill experiment, the recovery heart rate of the respondents was observed to be 100.11 beats/min. Where as the average peak heart rate was observed to be 165.06 beats/min. as presented in Table 5a.

Table 5a : Circulatory stress and physiological work load while performing the tread mill experiments (N=30)

Physiological parameters	R1	R2	Mean
Heart rate parameters (beats/min.)			
Average rest heart rate	86.38	85.15	85.76
Average working heart rate	124.01	124.75	124.38
Average recovery heart rate	98.25	101.97	100.11
Average peak heart rate	161.53	168.60	165.06
Average physiological cost of work (beats/min.)	56.21	65.61	60.91
Energy parameters (Kj/min.)			
Average rest energy expenditure	5.01	4.82	4.91
Average energy expenditure	11.00	11.12	11.06
Average recovery energy expenditure	6.90	7.49	7.19
Peak energy expenditure	16.96	18.09	17.52

Accordingly the average rest, working and recovery energy expenditure were found to be 4.91kj/min ,11.06kj/min and 7.19kj/min, respectively. The average peak

energy expenditure was found to be 17.52 kj/min. The average physiological cost of work was found to be 60.91 beats/min. which is still within the acceptable work load limits among the women. The independent variables age and weight showed highly significant correlation with the working heart rate during the exercise. The blood pressure had a highly significant relationship with the physiological cost of work as depicted in Table 5b.

Table 5b : Correlation between independent variables and physiological variables

Independent variables	Work Heart Rate	Recovery Heart Rate	Physiological cost of work
Age	-0.433**	-0.297	0.087
Weight	0.0614**	0.005	0.194
Height	-0.063	-0.202	-0.147
BMI	0.076	0.081	0.250
Vo2 max (ml/kg.min)	0.377*	0.264	-0.106
Body density	-0.018	-0.022	0.088
Per cent fat	0.017	0.023	-0.087
Blood pressure	0.068	-0.016	0.431**

* and ** indicate significantly of values at P=0.01 and 0.05, respectively

Based on the heart rate and energy expenditure while performing the tread mill experiment, the activity is classified according to the classification given by Varghese *et al*. (1994). Maximum percentage of the respondents (56.67%) fell in the heavy work load classification followed by Moderately heavy (21.67 %) and Very heavy (15%). None of them fell in the Very light and Extremely heavy work load classification (Table 6).

Table 6 : Distribution of the respondents selected for the tread mill experiment according to physiological workload classification (N=30)

Physiological workload classification	Energy expenditure	Frequency	Percentage
Very light	Up to 5	0.00	0.00
Light	5.1-7.5	2.00	6.67
Moderately heavy	7.6-10.0	6.50	21.67
Heavy	10.0-12.5	17.00	56.67
Very heavy	12.6-15.0	4.5	15.00
Extremely heavy	<15.0	0.00	0.00

Conclusion:

Physical fitness and the physical endurance capacity are the important factors in performance of any physical activity. They are especially important in achieving better work performance and work output. Women in rural India are the major work force in agriculture and the Indian agriculture is a highly labour intensive activity. This research throws light on the physical endurance capacity of the women in agriculture. It is evident for the study that the selected women performing the agricultural activities regularly are healthy and have a good physical endurance capacity. For better efficiency and work output, they should be trained to use the improved technologies.

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