

Effect of physical load on workers involved in grape cultivation

■ Savita Kumari* and Manju Mehta

Department of Family Resource Management, C.C.S. Haryana Agricultural University, HISAR (HARYANA) INDIA
(Email: jrozydhiman@gmail.com)

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*Author for correspondence

ABSTRACT

The aim of this study was to find out the effect of physical load on workers involved in grape cultivation. The research designs comprised on field study conducted on 15 respondents were engaged on grapes cultivation activities. Physical fitness was determined by calculating the physiological parameters *i.e.* blood pressure, body temperature, pulse rate and (VO_2 max). Occupational risk was assessed through physical load parameters *viz.*, Physical load. The results indicated that mean height and weight of workers involved grape activities was 159.9 cm and 64.2kg, respectively. BMI was observed as 21.8 kg/m², fat percentage was worked out to 29.9 per cent, and hence LBM was 44.1 kg with variation of ± 19.3 kg. VO_2 max was found to be 31.8 ml/kg x min exhibiting that the subjects were having good health. Conclusively there was no effect of grapes cultivation activities on body temp., pulse pressure of the workers. On the basis of physical load in the grape cultivation occupational risk was highest in pruning (178) followed by harvesting activity (153.05) and least was in plant protection activity (61.5).

INTRODUCTION

Grape (*Vitis vinifera* L.) is an important fruit crop in India. Major grape-growing states are Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and the north-western region covering Punjab, Haryana, Delhi, western, Uttar Pradesh, Rajasthan and Madhya Pradesh (Singh, 2010). Near about 75 per cent of grape produce is used for table purpose, 15- 20 per cent is dried for raisin production and 5 per cent is used for manufacturing of juice and wine. Grape cultivation is one of the agricultural activities. Grape cultivation involves various activities like land preparation, irrigation, manuring, pruning, harvesting, transportation etc. Grape production is very labor intensive operation *i.e.* Grape vineyard workers

faces high stress on the hands during pruning of the grapevines under highly repetitive conditions (8 to 10 week period of intense and fast-paced work) and also the cumulated duration of exposure over the entire day was high, *i.e.* approximately 8 to 10 hours per day over a 4-month period. Carrying totes or bins fully loaded in the fields were common problem with many vegetable and fruit crops (Duraj *et al.*, 2000). So keeping in mind the working pattern and working conditions the present study was under taken to study the effect of physical load in grape cultivation health status of workers.

MATERIAL AND METHODS

A sample of 15 respondents was selected

purposively from the randomly selected 2 grape orchards. Physical fitness of the workers involved in grapes cultivation activity was ascertained by measuring the parameters *i.e.* body height, body weight, body mass index (BMI), body composition, (VO_2 max). **BODY MASS INDEX:** The condition of the workers was assessed by specifying the different degrees of the underweight expressed as the body mass index (BMI), the weight and height measures was used to calculate the BMI of respondents. Weight in (kg)/ Height in (m²) (Garrow and Webster 1981). Estimation of body composition was determined from skin fold thickness at four sites *i.e.*, biceps, tricep, subscapular and supreilliac with the help of skin fold caliper by using the methods proposed by Durnin and Rahman (1967). Maximum aerobic capacity (VO_2 max) the maximum aerobic capacity is considered as the best measures for the individual cardio respiratory fitness or capability of doing work Varghese *et al.* (1994). Blood pressure and pulse rate was standardized through sphygmomanometer and stethoscope and digital blood pressure, body temperature was measured by using clinical thermometer. Occupational risk was assessed through physical parameters. Physical load was assessed on the basis of (AICRP, 2013). Score sheet was used to assess through the workload as per time in grape cultivation.

OBSERVATIONS AND ANALYSIS

The results obtained from the present investigation

as well as relevant discussion have been summarized under following heads :

Physical characteristics of workers involved in grape cultivation :

Mean height and weight of grape workers involved in grape was 159.9 cm and 64.2 kg, respectively. Body mass index (BMI) was observed as 21.8 kg/m². Fat percentage was worked out to be 29.9 per cent. Hence, LBM (Lean body mass) was 44.1 kg with variation of ± 19.3 kg. Aerobic capacity (VO_2 max) was found to be 31.8 ml/kg x min exhibiting that the subjects were having good health (Table 1).

Health status of workers involved in grape cultivation:

In order to avoid any experimental error and to maintain the uniformity in data, only those workers were selected for the experimental study that had high average to good health status. It was clear from the Table 2 that the mean body temperature was 98.6 ± 0.33 , blood pressure was systolic (mm/Hg) 125.6 ± 10.3 , diastolic (mm/Hg) 80.3 ± 4.8 , pulse rate was 86.8 ± 9.3 bpm and pulse pressure was 45.7 ± 4.2 mm/Hg. All the variables were in the normal range.

Occupational risks of workers involved in grape cultivation as per load rating :

The scrutiny of Table 3 reveals that land preparation

Table 1: Personal profile and health status of the selected respondents		(n=15)
Physical Characteristics		Mean \pm SD
Height (cm)		159.9 \pm 8.8
Weight (kg)		64.2 \pm 4.7
BMI (kg/m ²)		21.8 \pm 1.1
Body composition	Fat percentage (%)	29.9 \pm 5.9
	Lean body mass(kg)	44.1 \pm 19.3
VO_2 max (ml/kg x min)		31.8 \pm 6.3

Table 2 Health status of workers involved in grape cultivation			(n=15)
Variables of health status	Observed values	Recommended value	Category
Body temperature(^o F)	98.68 \pm 0.33	98.4degree F	Normal
Blood pressure :			
Systolic(mm/Hg)	125.69 \pm 10.36	120mm/Hg	Normal
Diastolic(mm/Hg)	80.38 \pm 4.89	80mm/Hg	
Pulse rate(bpm)	86.8 \pm 9.36	70-80bpm	Normal
Pulse pressure (mm/Hg)	45.7 \pm 4.2	30-50mm/Hg	Normal

was very heavy activity with score of 5. Pruning and harvesting got score 4 which means that these were heavy activity. Whereas handling and transportation activity scored 3 which implies that these were considered as

moderately heavy. Manuring, irrigation, plant protection got the score 2, so these were considered as low activity in terms of load rating.

Conclusively, land preparation was very heavy

Activity	Load rating	
	Score	Rating
Land preparation	Very heavy	5
Pruning	Heavy	4
Manuring	Low	2
Irrigation	Low	2
Plant protection	Low	2
Harvesting	Heavy	4
Handling and transportation	Moderate heavy	3

Load rating: Very heavy-5, Heavy-4, moderately heavy-3, Low-2, Very Low-1

Farm activity	Physical load / acre					Mean physical load factor
	Weight of the load (kg)	Distance carried (km)	Height lifted (mts)	Physical load rating ¹ (score)	Physical load factor (Total score)	
Land preparation						
Removing of stalks and stubbles and unwanted plants	2	0.02	1	2	5.02	5.42
Ploughing	0.75	0.08	2	3	5.83	
				Total =	10.85	
Pruning						
Cutting of undesirable vines	6	3	5	10	24	24
				Total =	24	
Manuring						
Transportation of manure	40	0.01	1.5	5	46.51	47.2
Mixing of manure	70	0	1.0	3	74	
Spreading of manure	2.8	14	1.5	3	21.3	
				Total =	141.8	
Irrigation						
Preparation of irrigation channels	12	7	1.5	4	24.5	24.5
				Total =	24.5	
Plant protection						
Spraying	2	14	0	3	19	13.5
Topping	0	7	0	1	8	
				Total =	27	
Harvesting						
Fruit picking	4	3	1.5	3	11.5	6.55
Gathering and heaping	0	0	0	1	1	
Packaging in polythene	.25	0	0	2	2.25	
Trimming	4	3	1.5	3	11.5	
				Total =	26.2	
Handling and transportation						
Loading of the product	2	0.05	1.5	3	6.55	6.55
				Total =	6.55	

activity as per load rating. (Duraj *et al.*, 2000) also reported that high stress on the shoulders when grape harvesters carried full bins of grapes above their head the fields and the truck or emptying bins into large collector (bulk) bins.

Physical load of workers in grapes cultivation :

Physical load of workers in grape cultivation was assessed and presented in Table 4 and Fig. 1.

Land preparation:

Physical load factor during various activities of land preparation *viz.* the removing of stalks and stubbles and unwanted plants was 5.02 for ploughing by country plough was 5.83. Mean physical load factor for land preparation was 5.42.

Pruning:

Pruning activity includes cutting of undesirable vines and physical load factor was 24.

Manuring:

During manuring activity transportation of manure got physical load factor of 46.51 and mixing of manure got 74, spreading of manure got 21.3. Mean physical load factor of manuring was 47.2.

Irrigation:

Irrigation activity includes preparation of irrigation channels and physical load factor was 24.5.

Plant protection:

Activities among plant protection were spraying and topping which got physical load factor of 19 and 8, respectively. Mean physical load factor of plant protection was 13.5.

Harvesting:

Under harvesting activity fruit picking got physical load factor of 11.5, gathering and heaping got 1, packaging in polythene got 2.25 and trimming got physical load factor of 11.5 and mean physical load factor of harvesting was 6.55.

Handling and transportation:

Physical load factor in handling and transportation for loading of the product was 6.55

Conclusively the physical load in grape cultivation was highest for manuring, followed by irrigation and pruning. Janowitz *et al.* (2000) reported that utilizing smaller and lighter weight bins during the harvesting of wine grapes. These intervention tubs reduced the weight by 12 per cent, reduced the horizontal moment of arm by

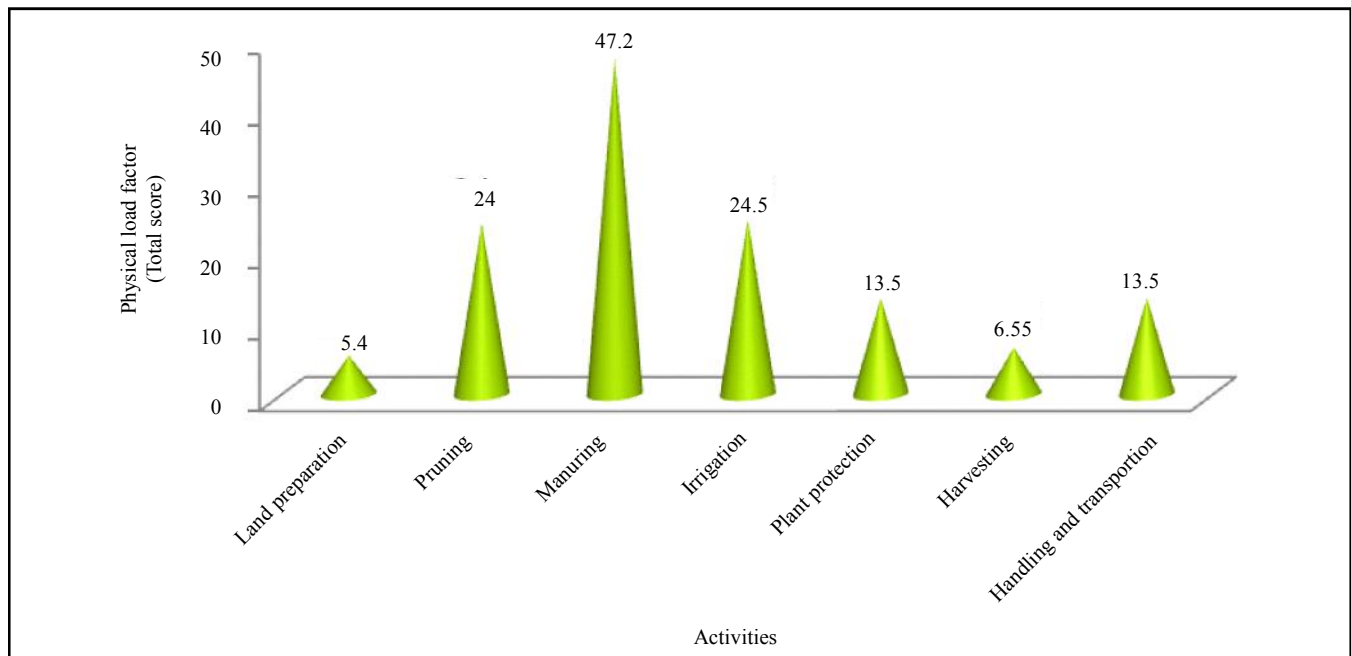


Fig. 1 : Grip fatigue of worker before and after performing the activities in grapes cultivation

reducing the depth of the bins, included handles, and had smooth bottoms that reduced the sliding forces by 32 per cent. Based on the NIOSH lifting guide, the lifting risk was reduced by 23 per cent for the intervention tubs versus traditional tubs with virtually no difference in productivity.

Conclusion :

– Mean height and weight of grape workers involved in grape cultivation was 159.9 cm and 64.2 kg, respectively. Body mass Index (BMI) was observed as 21.8 kg/m². Fat percentage was worked out to be 29.9 per cent. Hence, LBM (Lean body mass) was 44.1 kg with variation of ±19.3kg.

– Conclusively grapes cultivation activities viz., land preparation, pruning directly affects the weight, BMI, VO₂ max, body temp, pulse rate. Further in manuring, irrigation, plant protection activities changes affects the VO₂ max, body temp. As per harvesting and handling transportation were highly affects the weight, BMI, body temp. In manuring irrigation and plant protection there was no change in pulse rate and pulse pressure.

– On the basis of physical load various activities in grapes cultivation affects the health status of workers in terms of VO₂ max, body temp, weight and height.

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