



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2018; SPI: 1369-1372

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## Assessment of occupational health hazards among farm workers involved in agricultural activities

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### Abstract

Indian Farm workers are highly involved in various agricultural operations. They perform a sequential work through manual efforts. In the present investigation efforts have been made to assess the occupational risk related to various agriculture activities and to compare the physical strength of male and female farm workers, during manual method to perform agricultural operations. For the study, twenty female and twenty male subjects were selected. From this study, it has been recommended that there is dire need to create awareness among the farm workers about the low cost improved technologies related to flower cultivation which can significantly improve the livelihood security and working conditions of farm workers. It will also reduce the level of occupational risk and enhance the physical strength of the workers.

**Keywords:** Occupational risk, Physical strength, Agricultural Workers, Agricultural Activity

### Introduction

In the context of occupational safety and health, the term 'agriculture' is generally used in a broad sense including all activities directly related to cultivating, growing, harvesting and primary processing of agricultural products, animal and livestock breeding including aquaculture, and agroforestry. Agricultural work is dangerous; workers in this industry have among the highest rates of fatalities (BLS, 2014 and Liabman *et al.* 2013). Furthermore, Wang *et al.* (2013) also mentioned that work in agriculture involves exposures to a variety of hazards, including dust, noise, thermal stress, pesticides and other chemicals, and ergonomic risk factors. As a result, agricultural workers have elevated rates of injuries and illnesses. Das *et al.* (2011) also supported that agricultural works are associated with several occupational disorders among the farmers and agriculture farming involves several types of hazardous activities including prolonged and awkward postures. Agriculture workers perform many strenuous activities. These are: spading, carrying seeds, uprooting, transplanting saplings, harvesting or cutting crops, sheafing, carrying crops, threshing, sweeping and winnowing. Therefore, the main aim of this investigation was to know the level of occupational health hazards among agriculture workers and an attempt was made to compare the physical strength of male and female farm workers during the performance of work.

### Materials and Method

#### Selection of subject and field

From Faizabad district of Uttar Pradesh state, India, twenty male and twenty female subjects with normal health, without any major illness or cardio-vascular problems were purposively selected because only without illness or cardio-vascular problems, agricultural workers can perform the activities more efficiently. This study was conducted in the month of February-August in the year of 2016. The age range of the selected subjects was 20-55 years. Care was taken to select the female farm workers who were non pregnant and who can perform the agricultural activities regularly. The agricultural operations were performed for 7:00 A.M to 12:30 P.M. and 2:00 P.M. to 5:30 P.M. Agriculture workers performed the continuous agriculture operations for 50 minutes and taking 10 minutes break.

**Calibration of subjects:** The subjects were calibrated with the Body Mass Index to determine their physical fitness index. The body mass index of subjects was calculated by dividing square of height (m<sup>2</sup>) to weight (kg).

#### Quantification of safety and Health Hazards

Semi quantitative observational tool to characterize safety and health hazards developed by Neitzel *et al.* (2014) has been used to quantify the level of safety and health hazards among

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agriculture workers. The observational tool consisted of 10 sections: (1) musculoskeletal factors; (2) mechanical hazards; (3) pesticides; (4) chemical hazards; (5) falls; (6) noise; (7) dust and pollen; (8) thermal and weather conditions; (9) clothing and use of personal protective equipment (PPE); and (10) other factors. Exposure frequency to each of the assessed factors was assigned into one of three categories: “frequent” (worker performed the action for more than half of the observation period); “occasional” (worker performed the action for less than half of the observation period); and “never” (worker did not perform the action during the observation period).

**Statistical analysis:** Two-sample t-test assuming unequal variances was performed among the agriculture workers to find out whether there is any significant difference in ergonomic parameters of workers for the chosen level of significance ( $P < 0.0001$ ). Statistical analysis was performed using the statistical package IBM SPSS statistics (Version = 20).

## Result and Discussion

It was observed from the results that there was a significant difference ( $p < 0.0001$ ) in physiological characteristics of male and female respondents (Table 1). The mean HR max of male and female farm workers was found  $181.35 \pm 9.67$  beats/min and  $188.2 \pm 7.27$  beats/min respectively. The  $VO_2$  max of male workers was  $2.17 \pm 1.67$  l/min whereas it was observed  $1.82 \pm 0.41$  l/min of female workers. The average height was  $166 \pm 2.95$  cm of male farmers and  $151.62 \pm 3.60$  cm of female agricultural workers. The mean value of body weight of male and female farm workers was  $65.32 \pm 3.95$  kg and  $51.11 \pm 3.34$  kg respectively whereas the average rate of BMI was calculated  $24.66 \pm 2.75$  kg/m<sup>2</sup> of male workers and  $22.05 \pm 1.45$  Kg/m<sup>2</sup> of female workers. Both, male and female farm workers have the normal range of Blood pressure i.e.  $119.3/82 \pm 10.93/8.39$  mmHg and  $117.5/80 \pm 10.60/14.14$  mmHg respectively.

**Table 1:** Comparison of physical characteristics between male and female agriculture workers

Parameters	Male (n= 20)	Female (n=20)	t value
Height (cm)	166±2.95	151.62±3.60	13.81**
Weight (kg)	65.32±3.95	51.11± 3.34	12.28**
Body Mass Index (Kg/m2)	24.66±2.75	22.05±1.45	3.75**
Blood Pressure (mmHg)	119.3/82±10.93/8.39	117.5/80±10.60/14.14	0.52**/0.54**
HR rest, beats/min	74.69±2.78	72.96±1.91	2.29**
HR max, beats/min	181.35±9.67	188.2±7.27	2.53**
VO <sub>2</sub> rest (l/min)	0.20±1.26	0.16±0.03	0.14**
VO <sub>2</sub> max (l/min)	2.17±1.67	1.82±0.41	0.91**

**Table 2:** Various parameters for the Observation (N=40)

Variable	Category	Agriculture workers
Work area	Farm	25 (62.5)
	Market	3 (7.5)
	Confined Space	7 (17.5)
	Storage	5 (12.5)
Worker Type	Adult	40 (100)
	Child	-
Working Alone		18 (45)
Clothing	Long sleeved pants	38 (95)
	Long sleeved shirt	38 (95)
	Hat	18 (45)
	All of the above	25 (62.5)
Personal Protective Equipments	Work Boots	28 (70)
	Gloves	20 (50)
	Dust mask	1 (2.5)
	Bandanas	4 (10)
	All of the above	31 (77.5)
Whether	Rainy	5 (12.5)
	Sunny	25 (62.5)
	Overcast/cloudy	11 (27.5)

Overall results as shown in Table 2 revealed that the vast majority of observations i.e. 62.5 percent were made on farms. All observed workers were adults, and about 66 percent of observed workers were performing the activity alongside others. More than 90 percent of observed workers were wearing long pants, a long-sleeved shirt; whereas only 45 percent observed workers were wearing hat for performing

the operation. Besides this 62.5 percent workers were wearing all of the above mentioned clothing. In context of Personal Protective Equipments, half of the population was wearing gloves to perform the activity by hand in safer manner. However, only 2.5 percent worker were wearing a dust mask, and very few i.e. 10 percent workers were wearing bandanas over their faces, although whether this was for sun protection or an attempt to reduce dust exposure was unclear. A slight majority of observed days (about 62.5 percent) featured sunny weather.

Variety of hazards in various working areas were observed and mentioned in Table 3. The most common hazards observed to occur “frequently” were musculoskeletal in nature: bending (about 55 percent of all observations, with the vast majority of these being bending at the back). Other common hazards that we observed “frequently” were use of sharp blades and lifting <50 pounds (about more than 50 percent of observations each) and awkward postures (about 55 percent of observations). We observed many participants using a tool traditionally used for cutting the crops, and adapted for cutting flower stems. This cutting tool is popular because it is efficient, but it also presents a substantial laceration hazard, particularly when cutting woody stems, which require the application of a great deal of force. It was observed that 22.5 percent workers using chemicals or pesticides, although 35 percent observations were noted potential exposures from nearby pesticide application or residual pesticide on crops.

**Table 3:** Distribution of Observed Hazards (N=40)

Hazard Type	Factor	Frequency	
		Frequent	Occasional
Musculoskeletal	Awkward Posture	22 (55)	8 (20)
	Repetitive hand motion	12 (30)	1 (2.5)
	Lifting > 50 pounds	4 (10)	5 (12.5)
	Lifting < 50 pounds	23 (57.5)	9 (22.5)
	Constant Hand grip	30 (75)	7 (17.5)
	Bending	29 (72.5)	2 (5)
	Knee	16 (40)	3 (7.5)
	Back	25 (62.5)	24 (60)
	Neck	15 (37.5)	4 (10)
	All of the above	20 (50)	-
	Squatting or kneeling	18 (48)	3 (7.5)
	Pushing or Pulling	7 (17.5)	13 (32.5)
	Mechanical	Hand tool	
Sharp Blade		21 (52.5)	29 (72.5)
Small power equipment		5 (12.5)	-
Pesticide and chemicals	Used nearby	9 (22.5)	-
	Potential residue contact	14 (35)	-
Fertilizers		5 (12.5)	-
Potential for falls		7 (17.5)	-
Noise		4 (10)	-
Dust and pollen		12 (30)	17 (42.5)

**Table 4:** Distribution of Observed hazards by work area (N=40)

Hazard Type	Factor	Confined Space (n=7)	Farm (25)	Market (3)	Storage area (5)
Musculoskeletal	Awkward Posture	5 (71.4)	12 (48)	2 (66.7)	
	Repetitive hand motion	2 (28.5)	5 (20)	2 (66.7)	
	Lifting > 50 pounds	4 (57.1)	6 (24)	1 (33.3)	
	Lifting < 50 pounds	3 (42.8)		2 (66.7)	5 (100)
	Constant Hand grip	1 (14.2)	10 (40)	2 (66.7)	
	Bending	7 (100)	13 (52)	3 (33.3)	5 (100)
	Knee	1 (14.2)	22 (88)		
	Back	3 (42.8)	8 (32)	3 (33.3)	
	Neck	1 (14.2)	24 (96)		
	All of the above	5 (71.4)	2 (8)		5 (100)
	Squatting or kneeling		5 (20)	2 (66.7)	
	Pushing or Pulling		3 (12)		
	Mechanical	Hand tool		19 (76)	
Sharp Blade		2 (28.5)	15 (60)		
Small power equipment		4 (57.1)	4 (16)		
Pesticide and chemicals	Used nearby		3 (12)		
	Potential residue contact		9 (36)		
Fertilizers			4 (16)		
Potential for falls			2 (8)		
Noise			1(4)		
Dust and pollen		4 (57.1)	9 (36)		

Table 4 depicts that hazards observed to occur “frequently” or “occasionally” in the observed type of work areas (e.g. farm, market, confined space or storage). In the category of musculoskeletal hazards, total 71.4 percent awkward postures of the workers were observed in confined space area followed by 66.7 percent awkward postures of the workers at market area and 48 percent awkward postures of the workers in farm area. At market area 66.7 percent workers were engaged in repetitive hand motion, total 28.5 percent workers were found involved in same activity at confined space area whereas only 20 percent workers were found with repetitive hand motion at farm area. At confined space, more than half of the population were lifting the weight more than 50 pounds. Besides this, cent percent workers were involved in the activity of lifting of weight which is less than 50 pounds. Further it was observed that workers of all work area were performing the activity in bending position. At confined space and storage area cent percent population were adopting bending posture whereas at

farm area 52 percent and at market place only 33.3 percent workers were performing the activity in bending position respectively. In context of squatting or kneeling position, at market area 66.7 percent workers were adopting the squatting or kneeling position followed by 20 percent of the workers at farm area. Including this, very few workers (only 12 percent) of farm area were engaged in pushing and pulling activity. In the field of mechanical hazards, total 3 factors were included i.e. Hand Tools, Sharp Blades and Small Power Equipments. More than 75 percent workers at farm area were using hand tools for the planting of crops and weeding activity. At confined space and farm area 28.5 percent and 60 percent workers were using sharp blades to cut the stem of crops respectively and 57.1 percent workers at confined space and 16 percent workers at farm area were using small power equipments. Dust and pollen were noted in two areas i.e. confined space and farm are. Total 57.1 percent workers were reported the problem of dust and pollen at confined space

whereas 36 percent workers were revealed the presence of dust and pollen at farm area.

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