International Journal of Advance Research in Science and Engineering
Vol. No.4, Issue No. 12, December 2015
www.ijarse.com
IJARSE
ISSN 2319 - 8354

A CRITICAL STUDY ON MUSCULOSKELETAL DISORDERS AND INJURIES IN AGRICULTURAL WORK

Sandeep Singh Kharb[1], R.M. Belokar[2], Suman Kant[3]

Research Scholar[1], Associate Professor[2], Assistant Professor[3]

Production Engineering Department, PEC University of Technology Chandigarh (India)

ABSTRACT

This paper contains the review of studies of musculoskeletal disorders and injuries in agriculture workers in various regions. It has been observed from the various studies of researchers that Geographical locations effects must have to be taken into account for the design of agriculture machines and machine tools to reduce the MSDs. From the various studies it has been observed that agriculture sector is very much prone area of MSDs and injuries for the workers so there must be ergonomic intervention in agricultural tool's design and also in agricultural tasks.

Keywords: Musculoskeletal Disorders (MSDs), Ergonomics, Agriculture Injuries and Ill Health.

1 INTRODUCTION

Agricultural sector which give the employment to a very big population(workforce) of the world. Total workforce (225 million) of only India was employed till 2004 (Nag et al.) and as per census 2001, 40 percent women and 60 percent are men of total workforce of India in agriculture industry.India is employing around 1/5th workforce of the total workforce of the world. In 1950-60 India had to beg the food from foreign countries, Now India has become the 2nd largest producer of wheat and rice, and transformed herself from a food importer to a food exporter today. From the various researches, Studies and surveys it is found that agriculture field is very much prone to Musculoskeletal Disorders (MSDs) and injuries which are very dangerous/hazardous for the health and life of agriculture workers. As we know the life of human is the most valuable in the nature so there is very much need of ergonomics intervention to avoid injuries and reduce MSDs to enhance the efficiency/working capacity of workers and also the medical cost will be reduced for the cure of injuries and MSDs. In this article several studies are reviewed to examine the safety and health of agriculture workers. Observations of various researchers of the world as well of Indian researchers are taken into account and shown for the easy comparison and information shown simultaneously using tables and charts/graphs.

1.1 Ergonomics

Ergonomics is a quite new branch of science which celebrated the 50th anniversary in 1999, but depends on research carried out in many older, established scientific areas, such as engineering, physiology and psychology.

To achieve the betterdesign of work system and work space, Ergonomists use the various techniques of several disciplines:

- anthropometry: human stature measurement, shapes; populations and variations
- biomechanics: Analysis of muscles, levers forces and strength
- environmental physics:radiation, noise, light, heat, cold, humidity, body systems: hearing, vision, sensations
- applied psychology: skill, learning, errors, differences
- Social psychology: groups, communication, learning, behaviours.

This term generallyconstitutes the improved design in comfortably, functionality and user-friendly systems. It is the practice of designingthe products, systems or processes to take proper consideration of the interaction between system, products and the people who use them. The various fields contributes from numerous disciplines such as psychology, physiology, engineering,industrial design,biomechanics, , and anthropometry. In essence, it is the study of designing equipment and devices that fit the human body and its cognitiveabilities.

1.2 Classification of Ergonomics

Domains of specialization within the various disciplines of ergonomics are explained following:

1.2.1 Physical Ergonomics

Mainly considers the"human anatomy, anthropometry, physiological and biomechanical"features as they relate to physical activity. (Pertinentareas are postures during work/task, materials handling, repetitive movements, work related musculoskeletal disorders, workplace design.)

1.2.2 Cognitive Ergonomics

It is concerned with mental processes, such as awareness, reasoning, and motor response, as they affect interactions among humans and different elements of the system. "Pertinent areas include mental workload, decision-making activities, skilled performance,interaction in human andcomputer, human reliability, work stress and training as these may relate to human-system design".

1.2.3 Organizational Ergonomics

Organizational ergonomics considersthe optimization of sociotechnical systems including their organizational structures, policies, and processes. "Pertinent areas include communication, crew resource management, work design, Work time standards, teamwork, participatory design, community ergonomics, supportive work, new work paradigms, virtual organizations, telework, and quality management".

1.3 Benefits of Ergonomics in Agricultural farm work

- MSDs and injuries reduced
- Working efficiency of workers enhanced in a long run.
- over all working cost reduction

II MUSCULOSKELETAL DISORDERS (MSDs)

Due to continuous work and long-time single posture causes severe pain in various muscles and skeletal joints of workers i.e.

Singh and Arora stated in review during wheat harvesting activities for a long period in a day from morning till evening women adapts a squatting and stooping posture due to which they reported severe pain in lower back and knees.

Meyers et al. stated that occupational MSDs might affect muscles, tendons, joints nerves and related soft tissues anywhere in the body because of repeated stress over the specific muscles and joints i.e. lower back pain, pain in upper extremity, neck pain, shoulder pain etc.

2.1 Back Pain

Any pain caused due to repeated stresses, heavy lifting, awkward posture lifting, and load carrying in L5-S1 or L4-L5 joints of lower back. In survey, it has been found that around 41% agriculture workers reports lower back pain (Gomez et al. 2003).

2.2 Neck Pain

It is caused due to over exertion, awkward posture lifting, lifting of weight overhead etc. Scutter et al. stated the survey that most of the agriculture workers reports neck pain once in week.

2.3 Tendonitis

It is caused due to continuous motion of joints and muscles in a same repetitive manner, tendonitis also may be caused due to small tears in tendons.

2.4 Shoulder disorders

This pain causes due to repetitive loading, lifting mainly overhead and carrying etc.

III INJURIES CASES SURVEYS AND STUDIES

Due to mismatch in between workers and their tools can cause MSD's and injuries. Survey of agriculture injuries has been done and shows following injury magnitude in U.S:

Crop class	Estimated percent of US Farms	Major type of work	Risk Factors	Body Region most affected
Oil, Seed and grain	24%	Driving farm machinery during cultivation and harvesting	Vibrations and prolonged vigilance	Whole body and lower back
Vegetable and melon	1.6%	Soil preparation, planting and cultivation	Extreme climates,vibration and noise	Whole body and lower back
Fruit and tree nut crops	3.5%	Harvesting	Climbing ladders with heavy load,excessive reaching and repetitive cutting	Whole body, shoulder, hand wrist and lower back
Green house, nursery	3%	Weeding and pruning, handling containers	Forceful use of hoe, repetitive cutting, repeated stooping	Shoulder, hand/wrist, lower back
Fresh market vegetables	1.6%	Harvesting	Forceful repetitive cutting, lifting & carrying loads	Hand, wrist and lower back

Table 1.Survey of MSDs in Agricultural Work in U.S

Richardson experimented using PATH work sampling method and provided quantified job activity estimates and time spent in various postures for workers in apple harvesting fields. He suggested a hip belt to carry apple basket after ergonomic intervention and again surveyed by questionnaire method. In survey it was found that 71.4 percent workers supported the new design in their comfort ability for field work. In this way he suggested the design of apple carrying basket to reduce MSD's.Litchfield et al. (1999)reviewed the occupational injuries and ill-health in agriculture world-wide and a survey of the attempts that have been made to estimate the resulting economic and social costs. Agricultural workers suffer a wide variety of disorders as a result of their occupation. These range from minor (cuts, bruises) to more severe (deep wounds, fractures), permanent (amputation, spinal cord injury) and fatal injury. Ill-health as a result of contact with animals, micro-organisms, plant material dusts or chemicals are associated with certain types of agriculture. There is an underlying but quantified incidence of pain, stress and injury as a result of ergonomic problems due to poor working procedures and conditions. Statistics from many countries or regions show that agriculture consistently has one of the highest accident and injury rates of the industrial sectors.

Distribution of traumatic accidents with different farm machinery and activities		
Sr. No.	**Machine tools or activities**	**Percentage of accidents**
1.	Tractor and implements	27.7
2.	Thresher	14.6
3.	Sprayer/Duster	12.2
4.	Sugarcane crusher	8.1
5.	Hand tools (spade, sickle etc.)	8
6.	Chaff cutters	7.8
7.	Electric motor / Diesel pumps	5
8.	Snake bites	4.8
9.	Drowning in wells	2
10.	Rice huller/ Grain mill	1
11.	Animal drawn puddler	1
12.	Agrochemicals	1
13.	Power tiller	Around 0.5
14.	Bullock Cart	< 0.5
15.	Others	7

Table 2 Accidents and injuries survey in Indian agriculture system

Adarsh Kumar surveyed about farm hand tool injuries in Northern India and Total injuries found 856 in 19273 observations where it was found that 58% injuries due to suggested the better design for various machine tools and hand tools on the basis of Anthropometry. He suggested the various hand tool diameters to reduce injuries and MSD's.

Sr. No.	Equipment/tools caused injuries	% Male	% Female
1	Tractor/Equipment	91	9
2	Others	81	19
3	Thresher	80	20
4	Hand Tools	72	28
5	Fodder Cutter	66	34

Table 3 Involvement of woman farm workers in hand tool injuries

Percentile	Grip Diameter	Middle finger palm diameter	Palm breadth
5th	3.7	1.9	7
50th	4.8	2.5	8
95th	5.5	3.3	9

Table 4 Hand anthropometric dimensions (N=40)

So above injuries and factors causing musculoskeletal disorders make the agricultural field work unsafe to the health of workers and also decrease the productivity and also make the dismal performance of workers.

IV CONCLUSION

As we have seen from above studies that agriculture area is very prone to injuries and MSDs and constitute a significant proportion of ill health and safety cases of agriculture workers. Agriculture work includes risk factors like during working in fields awkward positioning, continuous bend work, heavy lifting and carrying, kneeling and vibration effects on body due agriculture machine/machine tools(tractors). But unfortunately a very few research work is done in this field to reduce injuries and health issues. Today role of women participation is also considerable around 40% women of total agricultural work force are working in fields and filed works. So there is also need to do research considering women as well.

REFERENCES

1. Earle-Richardson Giulia, Jenkins Paul, Fulmer Scott, Mason Christine, Burdick Patrick, May John, "An ergonomic intervention to reduce back strain among apple harvest workers in New York State". Applied Ergonomics Vol. 36, pp. 327-334, 2005.
2. Fathallah A. Fadi, "Musculoskeletal disorders in labor-intensive agriculture". Applied Ergonomics Vol. 41, pp. 738-743, 2010.
3. Kumar Adarsh, Singh J.K, Mohan Dinesh, Varghese Mathew, "Farm Hand tools injuries: A case study from Northern India". Safety Science Vol. 46, pp. 54-65, 2008.
4. Litchfield Melville H. "Agricultural Work Related Injury and Ill-Health and the
5. Economic Cost".ESPR- Environ. Sci. &Pollut.Res. Vol. 6, pp. 175 - 182, 1999.

6. Mohan Dinesh, Patel Rajesh, "Design of safer agricultural equipment: Application of ergonomics and epidemology". International Journal of Industrial Ergonomics Vol. 10, pp. 301-309, 1192.
7. Nag Pranab Kumar, Nag Anjali, "Drudgery, Accidents and Injuries in Indian Agriculture". Industrial Health Vol. 42, pp. 149-162, 2004.
8. Patel.S.K, Verma M.R., Kumar Adarsh, "Agriculture injuries in Etawah District of Uttar Pradesh in India". Safety Science Vol. 48, pp. 222-229,2010.
9. Singh Surabhi, AroraRenu, "Ergonomic intervention for preventing musculoskeletal disorders among farm women". J AgriSci Vol. 1, pp. 61-71, 2010.