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Postural Problems Faced by Farmers in Cole Crop Production

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ABSTRACT

Vegetable production is a physically demanding occupation with several work-related issues in which musculoskeletal disorders (MSDS) happen most commonly. Work related musculoskeletal disorders have become a major problem in vegetable production due to lack of ergonomically designed instruments and the wrong postures occupied by the farmers. This review paper give main emphasis on identifying the working postural problems faced by the farmers in different farm activities and to analyze the specific body regions of farmers that are affected from MSDs in vegetable production activities with traditional methods. The agriculture sector have major role in Indian economy and for high productivity and also it is that place where analysis of work postural problems of the farmers is mostly neglected.

Keywords Cole crop, Farmers, Posture, Problems, Musculoskeletal disorder.

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INTRODUCTION

The term "cole crops" refers to waxy–leaved brassicas of European origin, of the species *Brassica oleracea*.It include broccoli, cabbage, cauliflower and Brussels sprouts. Both brussels sprouts and cauliflower are the hardest to grow, while broccoli and cabbage are the easiest. It is botanical classified as a variety of *Brassica oleracea* species, grown during cool-season for its green flowering head. Cole crop production is generally recognized as the nation's most hazarduous and challenging occupation in which farmers suffered from various musculoskeletal disorders. The high prevalence of musculoskeletal disorders in agriculture sector may be attributed to various types of repetitive awkward movements and poor working postures. Awkward movements (i.e., frequently working with the flexed back area, lifting and bringing heavy loads) and poor working postures (i.e., squatting and kneeling) sustained by workers for long working hours. In performing different kinds of farm operations, farmers are extensively involved in various activities such as land preparation, nursery raising, transplanting, weeding, pest management, manuring and fertilizing, watering, harvesting and transportation in which they adopt poor working postures. Borah and Borah (2021) revealed that most of rural farm women participated in several activities such as manure application, forming ridges and furrow, planting/sowing, hand weeding, harvesting, transporting under vegetable production along with household chores and animal husbandry work which was very tedious, repetitive and full of drudgery. And they were using some primitive type

of agricultural tools which were not suitable for their body and face difficulties in different parts of body. So, some ergonomically designed women friendly tools like khurpi, sickle, standing pick axe, spade, standing rake, improved kokcheng were modified and tested by women farmers in the field and recommended to farm women for using so that drudgery can be reduced.

In India, farmers are predominantly associated with agricultural work in rural areas. Nearly two-third of Indian population lives in the villages and depends mainly on agriculture for their livelihood. Farmers work very hard but live a poor life because of poor village community facilities and resources. Due to their poor socio- economic conditions, they always forced to carry out a considerable number of manual and rigorous tasks in agricultural fields. In agriculture sector, both men and women do many of the most difficult tasks in India such as transplanting, weeding, harvesting and post-harvest processing of cole crop production. While performing these difficult manual tasks for an extended period of time different agricultural workers are suffering with high work related musculoskeletal disorders. Huge majority of farmers were mainly using primitive type of agricultural tools hoe, pick axe and spade in land preparation (i.e. ploughing, manure application and forming ridges and furrow) they were having discomfort in lower back, upper back, lower arm and upper arm which was severe to very severe. The root cause of farmers's suffering is ignorance, age old methods of doing the work, inappropriateness of the technology. They perform different agricultural tasks with the age old traditional tools rather than gender friendly appropriate tools. Therefore, the present study was to identify the postural and musculoskeletal problems faced by the farmers in cole crop production.

Objectives of the study

The objectives of the study are as follows :
•To give emphasis on identifying working postural problems faced by farmers in different farm activities of cole crops.
•To analyze the specific body regions of farmers that are affected from MSDs in vegetable production activities.

Research methodology

This review paper is descriptive in nature.This paper is based on a review and analysis of the published scientific literature addressing the linkages of postural and musculoskeletal problems faced by farmers in vegetable production system.The secondary data and information have been analyzed for preparing the paper extensively and have been collected from different scholars and researchers, published books, articles published in different journals and from different websites.

Procedures for production of cole crops

Land preparation

Cole crops do best in full sunlight when grown in sandy loam soils. Add a 3 inch layer of organic matter like compost, leaves or grass clippings- to the garden soil and turn it in a few weeks before planting.This will give the leaves or grass clippings time to decompose and release nutrients into the soil before planting. Usually these crops prefer soils with a pH of 6 to 6.5, yield will be reduced if the soil pH is below 6.

In broccoli, land plowed is done for 3-4 times, then add compost or well rotten farmyard manure 25–30 tons/ hectare and mix thoroughly at the time of land preparation. A study conducted by Verma and Singh (2019) found that huge majority of farmers were mainly using primitive type of agricultural tools such as hoe, pick axe and spade in land preparation and were having discomfort in lower back, upper back, lower arm and upper arm which was severe to very severe.

Nursery raising

For nursery raising, first prepared raised bed and a well rotten farmyard manure or compost mix with soil at the rate of 4 kg/meter square. Make raised bed 1m wide and 15 cm in height. After that add fungicide like captan or thiram to prevent fungal infections. Then sowing of seed should be done at a distance of 8-10 cm between seedlings and 1.5-2 cm in the rows and should be properly covered with sand and farm yard mixture. During monsoon season, nurseries

should be created under polyhouse.Weeding and intercultural operation should be done from time to time. And nursery beds should always be irrigated according to the needs and requirements.

For broccoli, most of the nurseries don't create broccoli seedlings due to less demand. And farmers create broccoli plant seedlings on their own field and sale broccoli seeds. For creating broccoli plant seedlings, prepare 1 m wide and 3m long and 30 cm wide soil bed is raised. Then mix 10 kg of good farmyard manure into the soil in each bed. After that add 50 g of foret and 100 g of bavistin powder and mix properly in the soil. Make 5 cm parallel to the 2 cm deep line 's width on the bed and sow broccoli seed and then covered the seeds with fine compost material. Provide water with the help of sprinkler. Then seed germination starts after 5-6 days and seedlings ready for transplantation within 35 days. At this time transplantation of broccoli plant must have 4-5 leaves. Calcium nitrate and potassium nitrate should be given to the plants mixed with 1.5 liters of water in one liter of water.

Manuring and fertilizing

Manuring and fertilizing is depend upon the fertility of the soil. And to determine the fertility of the soil, soil testing must be carried out before start cauliflower farming. Before transplanting cauliflower crop, apply farmyard manure in the soil and mix thoroughly in the field. The cauliflower crop almost requires 200 kg of nitrogen, 75 kg of phosphorous and 75 kg of potassium per hectare for optimum yield. Nitrogen 200 kg, phosphorous 75 kg and potassium75 kg per hectare should be applied when transplanting cauliflower seedlings.The remaining half of nitrogen should be given 30 and 45 days after transplanting.

In fertilizing activity of broccoli, first the soil must be analyzed and then decide fertilizer dose quantity. Broccoli requires 150 kg of nitrogen, 100 kg of phosphorous and 170 kg of potassium per hectare. Nitrogen 120 kg, phosphorous 80 kg and potassium 60 kg per hectare should be applied when transplanting broccoli seedlings. The remaining half of nitrogen should be given 30 and 45 days after transplanting. Khalid *et al.* (2019) results depicted that the better performance of poultry manure compared to cow manure in terms of development and production parameters of the experimental crops. Dynamics of the chlorophyll content across the crop growth period revealed that all the tested crops (cabbage, cauliflower, broccoli and lettuce) responded significantly to the poultry manure treatments. Among the tested crops, the chlorophyll content, curd or head sizes and crop yields were quite better in poultry manure applied plots. This study investigated that crop yield was significant with poultry manure than cow manure using the OSAVI and m NDVI, respectively.

Transplanting

In cauliflower, seedlings become ready for transplanting after 4-5 weeks. During planting, the distance between the two plants depends on the soil's fertility, season of cultivation and market demand. For early season distance between plant to plant is 45 cm × 45 cm and for the main and late season it should be maintained 60 cm × 60 cm. For higher productivity, more cauliflower curds can be obtained by reducing planting distance. And drip irrigation method will be used for improving cauliflower yield.

For, broccoli plants grow on a raised bed in rows and distance between row to row is 30 cm and plant to plant is 30–45 cm. Plantation was made in the afternoon. Before planting the seedlings, seedlings should be dip into the solution of fungicide 12ml in 10 liters of water. And drip irrigation is very beneficial for broccoli crop. It improves crop yields and quality. Tripathi and Kwatra (2016) results revealed that long working hours, awkward body postures, repetitive work and physical load were the main reason of physiological discomforts among farm workers during manual transplanting and land preparation activities.

Weeding

When plants are set in the field then weeding should be started as soon as possible. And it should be shallow so as not to disturb he root system. To produce solid and best curds, cauliflower plants should be earthened up about 56 weeks after transplanting.

In broccoli, after 30 days of transplanting, remove the weeds. This weed competes for food, sunlight and air with the main crop and maintaining the crop weed free. Also, rake the soil on the bed which helps to increase the oxygen level to the root zone. Burman *et al*. (2020) aimed to assess and quantify the drudgery with weeding activity by rural women in which physiological ergonomics evaluation was done for traditional method and with improved tools. And investigated that there was reduction in human physiological parameters, viz., heart rate, energy expenditure rate, total cardiac cost of work, physiological cost of work, blood pressure and oxygen saturation by traditional method of weeding by khurpi, pusa wheel hoe and four wheel weeder with 0.05 and 0.01 level of significance. As the drudgery caused due to bending is reflected in terms of postural discomfort experienced by the workers and concluded that a good, natural and effortless posture is required to reduce the drudgery of work experienced by the worker.

Harvesting

The harvesting period of cauliflower crop is between 90–120 days after planting. For sale purpose, harvest full white colored matured cauliflower immediately. If it is delayed, then the curds' color is becoming yellowish and its thickness and charm disappear. So, it is important to harvest cauliflower at right maturity time. Cauliflower at normal temperature can be stored for 3-4 days and below to 0 with 85–90% humidity in 30 days. Cauliflower mature heads,6 inches (15 cm) or larger, are hand selected and trimmed of excess wrap-per leaves, making a crown –cut shape and placed on a harvesting platform, sorted, covered with plastic wrap and packed in size. These heads are harvested with more jacket leaves than carton –packed cauliflower to prevent curd damage.

Broccoli harvesting is done after 80-90 days of transplanting. That time the broccoli crop is ready to harvest. It head become 3-6 inches in size.This crop is harvested before small flower open present on the broccoli crop heads. Head weight of broccoli crop is around 250–300 g.

Similarly different cole crops like cabbage, brussels sprouts, kale, kohlrabi and other brassica crops have different procedures for the production activities.

Working postural problems faced by farmers

Farmers often work in awkward postures for long duration in different agricultural activities and do repetitive work in single position. The increasing static muscular efforts and incorrect posture if sustained for a long period of time can give rise to various types of health and musculoskeletal problems. If the body fails to maintain the equilibrium while doing work, it adds to the human energy cost and physiological dynamics such as energy expansion, physiological cost of work, muscular effort. It may also lead to major risk like cervical and back disorders because of poor postures and eye strain due to extended concentration. Awkward positions force the muscles to work harder and stress ligaments and wear and tear of muscles, tissues and ligaments can harm the neck, shoulders, arms, legs, wrists, and back. Such type of awkward postures cause pain in knees due to disturbed blood circulation in performing different type of agricultural activities. Ojha and Kwatra (2016) experienced that while performing the uprooting and transplanting operations in traditional method majority of the women complained "very severe" and "severe" pain in different body regions where they adopted bending and squatting body posture for long duration and performed the tasks in repetitive motions. Whereas, in another study given by the Devi *et al.* (2019) found that vegetable transplanting operation is a laborious, time consuming and drudgery prone field operation task when performed manually by farm women for almost all crops grown. And women traditionally carried out transplanting operation by using fingers in squatting and bending position which decrease the work efficiency to a greater extent. Tripathi *et al.* (2020) conducted a study on 70 workers who are engaged in various activities of vegetable production and found that final scores of Rapid Upper Limb Assessment during various working activities were found to be high. And also revealed that there are ergonomic deficiencies in the planning and work methods. A significant proportion of the workers are working in high risk postures.

Body regions of farmers affected from MSDs in vegetable production system

Agricultural work is one of the highly physically demanding occupations as compared to other occupations. The farming occupations in agricultural sector is not an organized sector due to various uncertainties such as changing weather, ergonomics stress, and viruses associated with weather and new forms of chemical fertilizers and insecticide. Different activities in agriculture brings about certain stress and strain on bones and muscles leading to work-related musculoskeletal disorders (WMSD) which affect the different body regions of the farmers and their occupational work. For e.g., disorders in the lower back is related to lifting and carrying of loads, upper-limb disorders (at fingers, hands, wrists, arms, elbows, shoulders, neck) may result from repetitive or long-lasting static force exertion. In agricultural works, the most common musculoskeletal disorder is low back pain. Major low back pain is associated with chest discomfort, dyspepsia, skin problems, work related fever attacks and primary care for digestive disorders. A study conducted by Gupta and Bisht (2018) revealed that majority (33%) of the respondents were in the age group of 40–50 years and performed the activities of planting /sowing, hand weeding, cutting/plucking, sorting and cleaning in bending, sitting or squatting postures. Mean scores of intensity of pain felt by respondents in different body parts revealed that respondents felt very mild (score-1) to very severe pain (score-5) in various body parts due to working in awkward postures for long durations. Hand weeding and cleaning of vegetables were rated as very demanding (mean score- 4.6) and planting/sowing, hand weeding and cleaning activities were very exhausting (mean score- 4.7, 4.6 and 4.8 respectively). Respondents adopted very difficult posture while planting/sowing, hand weeding, cutting/plucking and cleaning (mean score- 4.7, 4.6, 4.7 and 4.8 respectively).

Another study conducted by Mushayi *et al.* (2014) found that lower back was the most frequently affected body site. Commonly performed activities included working prolonged periods in the same posture and working prolonged periods squatting or kneeling. Pal and Dhara (2018) concluded that lower back problem was highly prevalent (91.96%) followed by hip (91.07%), wrist (83.04%), upper back (81.25%), shoulder (81.25%), neck (73.21%) and knee (66.07%). Higher prevalence of MSDs among the cultivators may be because of prolonged working hours and awkward postures. And recommended that workers should avoid awkward work postures as far as possible and take adequate rest during their work for reducing job related back problems and awkward postures. Widyanti (2018) reported that high risk activities are manual hoe for land clearing, manual plow, grass cutting for land clearing and threshing. And also concluded that Indonesian agriculture is in a poor ergonomics condition and is associated with high musculoskeletal symptoms which was mainly found in the shoulder and lower back. The postural analysis also reveals a high risk of farmer activities. Borah and Borah (2020) revealed that both male and female were having pain in neck, trunk and upper limb due to prolonged squatting position at the time of weeding operation which may results in musculoskeletal disorders.

From the analysis of review of literature, it can be concluded that there is a lack of awareness and knowledge about ergonomics practices and principles in the working methods in vegetable production. Poorly designed traditional tools and working methods adopted by the workers leads them awkward postures involving frequent squatting, twisting, bending, and over-reaching. Old traditional tools or equipments and improper working methods is a big cause which increases the overall discomfort and pain at the lower back, legs, thighs, neck and shoulders. In different agricultural activities, the workers are under moderate to high risk of work related musculoskeletal disorders. By proper implementation and application of ergonomic principles, biomechanical and engineering principles can be effective in reducing the risks and occurrence of awkward and work related musculoskeletal disorders.

CONCLUSION

Postural and musculoskeletal problems have become endemic in agricultural work. The workers usually complain about pain in various parts of the body and the maximum was reported very severe to severe pain

in low back while performing agricultural activities because they are untrained, uneducated, unaware about different innovative agricultural practices. Lifting heavy loads, overexertion, long hours of work, continuous and forceful motions, bending awkward postures are some of the main causes which attribute to many occupational musculoskeletal disorders in different agricultural activities. They usually do not use any safety measures while work. The use of improper and unergonomic tools and equipment for work and improper and awkward posture usually bring about body discomfort and musculoskeletal problems that have significant effect on their health. To increase the productivity per unit area of small or large scale land holdings and considering the economic condition of agricultural farmers, it is quite necessary to give training and education of agricultural workers for prevention of MSDs has become vital today. The improvement can be done through knowledge regarding safe work methods, work practices, proper postures, improved agriculture tools and equipments. Which can help to reduce the risk of postural and musculoskeletal related aches and pains. This is the only effective way of empowering the farming community and to mitigate the postural and musculoskeletal related hazards in different activities of vegetable production system.

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