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Technological need of women workers involved in turmeric cultivation: An exploratory study

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Abstract
Turmeric is one of the most important spice mostly used in the every households. It is the major ingredient in Indian cuisine and used for coloring and flavouring. It also has high medicinal values and also significantly used in religious activities. Turmeric is considered as one of the women dominated crop in which women's participation is more than the men counterparts. Both of them perform harvesting, boiling, transporting and marketing whereas the other activities such as sowing, mulching, weeding, harvesting, transporting, boiling, drying, polishing, cleaning, grinding, sieving, packaging, sealing and marketing are extensively done by women. They used traditional tools and equipment which are not suitable for them. These activities with existing technologies demand heavy activities in the form of awkward posture, repetitive movements of body parts, application of static and dynamic force and contact force while working at indoor and extreme outdoor environments. Keeping these in view an attempt has been made with objectives to study the existing practices and extent of involvement of women workers in harvest and post harvest activities of turmeric crop in Punjab and Odisha and to identify the technological needs of women workers in harvest and post harvest activities. It was found that there are some of traditional tools and equipment used by the women workers manually during harvesting, boiling, polishing, cleaning etc which were used repetitively and forceful use of upper and lower limbs. They have lack of knowledge and skill about improved tools and technology. Most of the women from rural back ground cannot avail improved technology because of their poor socio economic status. All of these factors cumulatively affect the work life, occupational health and livelihood status. These lead to drudgery and health hazards among women workers involved in turmeric cultivation. Hence, this study suggested for further suitable ergonomic interventions of women friendly technologies to reduce drudgery of women workers in turmeric cultivation.

Keywords: Technological need, women workers, turmeric, cultivation

Introduction
Turmeric is one of the most important spices predominantly used by the households in day today life. Turmeric plant of the *Zingiberaceae* family is known as haldi and recognized as 'golden spice'. The powder from dried rhizomes is being used in food, cosmetics and textiles as a flavoring and an insect repellent agent. It also has high medicinal values and also used in various religious and ceremonial functions. India is by far the leading producer and exporter of turmeric (*Curcuma longa)* in the world i.e 80 per cent (Turmeric Outlook, June 2020) [12]. Turmeric is being cultivated commercially with an annual production of 6,59,000 tonnes. Indian turmeric is considered the best in the world.
Turmeric is considered as one of the women dominated crop in which women's participation is more than the men counterparts. Men generally perform land preparation work like ploughing, preparation of bed and irrigation, whereas harvesting, boiling, transporting and marketing are done by both men and women. The other activities such as sowing, mulching, weeding, harvesting, transporting, boiling, drying, polishing, cleaning, grinding, sieving, packaging, sealing and marketing are extensively done by women. These activities demand heavy use of physical energy in the form of awkward posture, repetitive movements of body parts, application of static and dynamic force, contact force while working at indoor and extreme outdoor environments.

There are some of traditional tools and equipment used by the women workers which are not suitable with their work perspective. They have lack of knowledge and skill about improved tools and technology. Most of the women from rural back ground cannot avail improved technology because of their poor socio economic status. All of these factors cumulatively affect the work life, occupational health and livelihood status. These lead to drudgery and health hazards of women workers involved in turmeric cultivation. Keeping these in view an attempt has been made with objectives to study the existing practices and extent of involvement of women workers in harvest and post harvest activities of turmeric crop in Punjab and odisha and to identify the technological needs of women workers in harvest and post harvest activities

Materials and Methods

The locale of study was selected purposively on the basis of the production and processing of turmeric in large quantity from Punjab and Odisha. The three major turmeric grower districts such as Hoshiarpur, Jalandhar and Ludhiana districts of Punjab and Kandhamal, Koraput and Nayagarh districts of Odisha were selected for carrying out the study. The sample size of 150 women workers from each state thus making a total of 300 women workers were selected randomly. Structured interview schedule developed and used for survey work. Data related to the traditional practices followed in turmeric, extent of participation of women turmeric cultivation, their perception on existing tools and equipment used for different activities in turmeric cultivation activities and technological needs from both the states was also recorded. The Ergonomic Checkpoints in Agriculture, published by the ILO in collaboration with the IEA in 2012 was modified with the present research context and used for collecting data. After receiving the responses, the data were analyzed and calculated accordingly.

Results and Discussion

The results of the study are further treated through summarized tables and analyzed. The findings of the study have been presented under following headings

General Background of the women workers while performing turmeric cultivation activities in Punjab and Odisha

The back ground information of the selected sample population was collected. It was found that about 36.67 per cent women workers belonged to the age group of 40 to 49 years followed by 50 and above (33.33 %), 30 to 39 years (20.67%) and 20 to 29 years (9.33%) in Punjab. The data from Odisha revealed that about 32.00 per cent women workers belonged to the age group of 40 to 49 years followed by 50 to 59 years (26.67 %) 30 to 39 years (23.33%) and 20 to 29 years (18%). In Punjab, about 58.00 percent women workers had primary and middle school and 12.00 per cent women were illiterate and 22.67 were functionally literate. In case of Odisha, about 38.67 per cent women workers were functionally literate who were able do the signatures only. About 28.67 per cent women workers had primary education and 11.33 percent completed middle school examinations. There were 16.67 per cent illiterate women workers among them. In Punjab, data revealed that 56 per cent of the women workers were landless and 38.67 per cent were marginal farmers. Similarly it was observed that about 37.33 per cent of the women workers were land less followed by 58.00 per cent were marginal farmers in Odisha. There were very less number of women workers belonged to the small, medium and large farmers' category in both the states. There were major per centage of women workers who were there annual income below Rs 80 000/- in both the states.

Work profile of the women workers while performing turmeric cultivation activities in Punjab and Odisha

The work profile of the women workers in turmeric cultivation at Punjab and Odisha were collected by interviewing the women workers. It was found that most of the workers were agricultural labourers (56%) followed by cultivator (38.00 %) and land owners (6.00 %) in Punjab. It was also found that majority of the workers were cultivators (59.33%) followed by agricultural labourers (37.33%) and land owners (3.33 %) in Odisha. All of the women workers were working seasonally whereas about 56 per cent from Punjab and 52.67 per cent from Odisha were working in the daily basis at processing centres. All of the women workers were working from 9 am to 5pm at both the states and they were doing overtime of 2 hours during peak period. Women workers from Punjab were getting two breaks whereas women from Odisha were getting one break for lunch. In Punjab they were getting two breaks ranging 30mins to 45 minutes (40%) more than 45 minutes (60%). Whereas about 76.00 per cent women workers had break of 30 minutes in Odisha.

Existing harvest and post harvest practices by the women workers while performing turmeric cultivation activities in Punjab and Odisha

The data pertaining to existing harvest and post harvest practices in turmeric cultivation and involvement of women workers were collected through structured interview schedule. It was found that gathered rhizome entails a number of steps, including boiling, drying, polishing, and colouring. The data revealed that in case Punjab, all of the women workers (100.00%) participated in harvesting, separating finger rhizome from mother rhizome, drying, cleaning, grading & sorting, packaging (packing and sealing) and storage activities. In Punjab, about 56.67 per cent of them were doing boiling in traditional process whereas 45.33 per cent women workers carry turmeric from field to storage place. In case Odisha, all of the women workers (100.00%) participated in harvesting, separating finger rhizome from mother rhizome, drying, polishing, sieving, cleaning, grading & sorting, packaging (packing and sealing), storage and also marketing which were mostly done manuallyMost of the tasks were seasonal and take lots of time and physical effort responsible for drudgery and health hazards. Some of the women workers involved in large production of turmeric did polishing, grinding etc in daily/ weekly basis. Maximum time consumed in separating rhizomes harvesting, gathering, drying (8 to 10 hrs/day) followed by rest of the activities took 6 to 8 hours except boiling and marketing (2-4 hrs/day) in Punjab. In Odisha Maximum similar trend was observed in separating rhizomes, harvesting, gathering and drying (8 to 10 hrs/day) followed by rest of the activities took 6 to 8 hours except boiling and marketing (2-4 hrs/day) respectively. They were doing it manually in their traditional chulha and different sizes of vessels. After boiling rhizomes were dried at open ground or harvesting ground. Polishing and colouring are the very heavy tasks which were done manually. Grading and storage were the seasonal activities mostly done manually. This also includes cleaning and packaging in large size sacs or packets. Value addition such as making powders and packaging were the regular activities done on daily basis by the group members. It was evident that in most of the activities static awkward postures

and repetitive movements were adopted by the women workers by adopting sitting, squatting, bending and twisting of body parts. These prolonged awkward posture leads to musculoskeletal problem among the women workers. Zend *et al.* (2019) [14] confirmed that in turmeric cultivation, women workers participated in planting of rhizomes, weeding, harvesting and cleaning activities. Most of the procedures such as planting, earthing up, harvesting in turmeric production system were manually done. Lack of awareness on the manually operated machines available for earthing up task was also noticed.

Table 1: Existing harvest and post harvest practices by the women workers while performing turmeric cultivation activities in Punjab and Odisha

	Punjab(n=150)			Odisha (n=150)		
Activities	**(f)**	**(%)**	**Work Duration (h/d)**	**(f)**	**(%)**	**Work Duration (h/d)**
Harvesting	150	100.00	8 to 10	150	100.00	8 to 10
Post harvest activities						
Separating finger rhizome from mother rhizome	150	100.00	8 to 10	150	100.00	8 to 10
Collection of rhizomes	150	100.00	8 to 10	150	100.00	8 to 10
Carrying Produce from farm to home	68	45.33	6 to 8	150	100.00	6 to 8
Boiling/ curing	85	56.67	4	150	100.00	2 to 4
Drying	150	100.00	8 to 10	150	100.00	8 to 10
Polishing	20	13.33	2 to 4	150	100.00	6 to 8
Cleaning	150	100.00	6 to 8	150	100.00	8 to 10
Coloring	-	-	-	9	6	6 to 8
Grading and sorting	150	100.00	8 to 10	150	100.00	8 to 10
Storage	150	100.00	2	150	100.00	2 to 4
Grinding	105	70.00	6 to 8	150	100.00	6 to 8
Sieving	105	70.00	6 to 8	150	100.00	6 to 8
Packaging	105	70.00	6 to 8	150	100.00	6 to 8
Marketing	72	48.00	2 to 4	150	100.00	2 to 4

Technology used by women workers while performing turmeric cultivation activities in Punjab and Odisha

The data related to technologies used and available with women workers were collected. It was observed that they were doing traditional practices by using traditional manually operated tools and equipment. In both the states all of the women workers were using spade and khurpi for harvesting. Only14.66 per cent of women workers from Punjab using tractor for harvesting. Similarly all of the women workers were separating rhizomes manually and also used small knives. In case of boiling activities all of the women were using traditional chulha and different sizes of vessels for boiling where as 13.33 per cent were having turmeric boiler and 10.66 percent were having steamer for boiling of rhizomes and rest of them were doing traditionally. Polishing was very tiresome activities mostly done manually by women workers of Odisha where as in Punjab very less number of women workers were doing with power operated polishing machine. For cleaning they were using various types and sizes of sieves in Punjab (70.00%) and in Odisha (63.33%). Women were facing difficulties while using these manually operated tools as these were not suitable with women's perspective. The length, width or diameter of handles, parts of the tools were not made by considering anthropometric parameters of women involved in turmeric cultivation. Babu *et al.* (2015) [2] also revealed that harvesting of turmeric was done with the help of small spade by the farm families. Mostly the land was ploughed by men and the rhizomes were gathered by hand by women workers. The fingers rhizomes were separated from the mother rhizomes by both men and women workers manually.

Satisfaction of women while using technologies in turmeric cultivation activities in Punjab and Odisha

The data pertaining to technology usage satisfaction of women workers in turmeric production were collected and the mean score was calculated as per their comfort level ranging from high-4, moderate-3, low-2, very low-1. In Punjab, it was seen that the women workers were less comfortable while using traditional technology while doing boiling /curing with mean score (2.13) followed by harvesting (2.29) and sieving (2.59) and polishing(0.36). In Odisha, it has been observed that the women workers were less comfortable while using traditional technology while doing polishing with mean score(1.35) followed carrying produce (1.70), harvesting (1.71) by boiling /curing (1.82) , sieving (1.89) separating rhizomes (2.15) and packaging (2.43). The reasons behind low level of satisfaction were due to the unsuitability of technologies with women perspective. This implied heavy weight, large sizes of old and used tools which were being repeatedly used by the women workers. In the long run this is responsible for occupational health hazards. Kuijt-Evers (2004) [7] also confirmed that the functionality is an important aspect to comfort in using hand tools, followed by physical interaction and appearance which can further help in the design of comfortable hand tools.

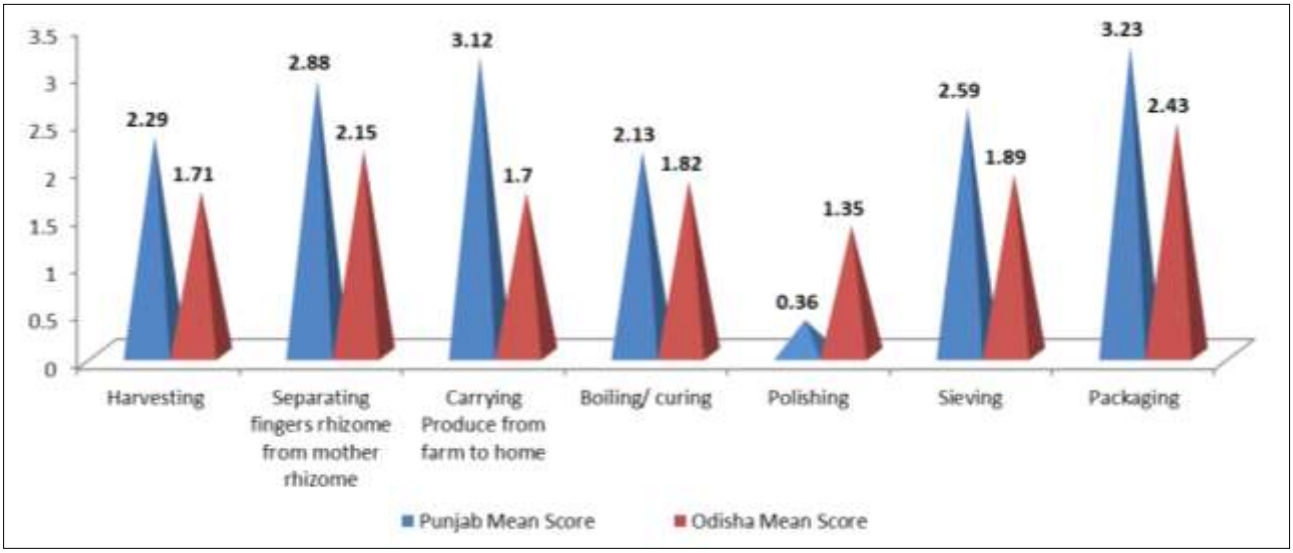

Fig 1: Satisfaction of women while using technologies in turmeric cultivation activities in Punjab and Odisha

Rate of exertion perceived by the women workers while performing turmeric cultivation activities at workplace in Punjab and Odisha

The rate of Perceived Exertion Scale was measured by using of the scale developed by Varghese *et al.* (1994) [13]. The data related to Rate of Perceived Exertion (RPE) was calculated in the form of mean score and ranked accordingly (scores ranging from 1 to 5). In case of Punjab, the data revealed that rate of Perceived Exertion was highest mean score in lower back (4.54) followed by shoulder (3.87), upper back (3.74), calf muscles (3.51) and ankle/feet(3.46). The lease exertion was felt in the neck (2.19). Similar trend was also observed in Odisha. The rate of Perceived Exertion was highest in lower back (4.11), calf muscle (3.49), shoulder (3.39), upper back (3.22) and ankle/ feet (3.13) . The lease exertion was also felt in the neck was 2.55. The exertion in body parts indicated that women were not comfortable while using the traditional tools and performs the activities manually in the turmeric cultivation. Borah *et al.* (2009**)** [3] also confirmed that in fetching water average rating perceived exertion (RPE) ranged from 2.2 to 3.2 in 5 point scale.

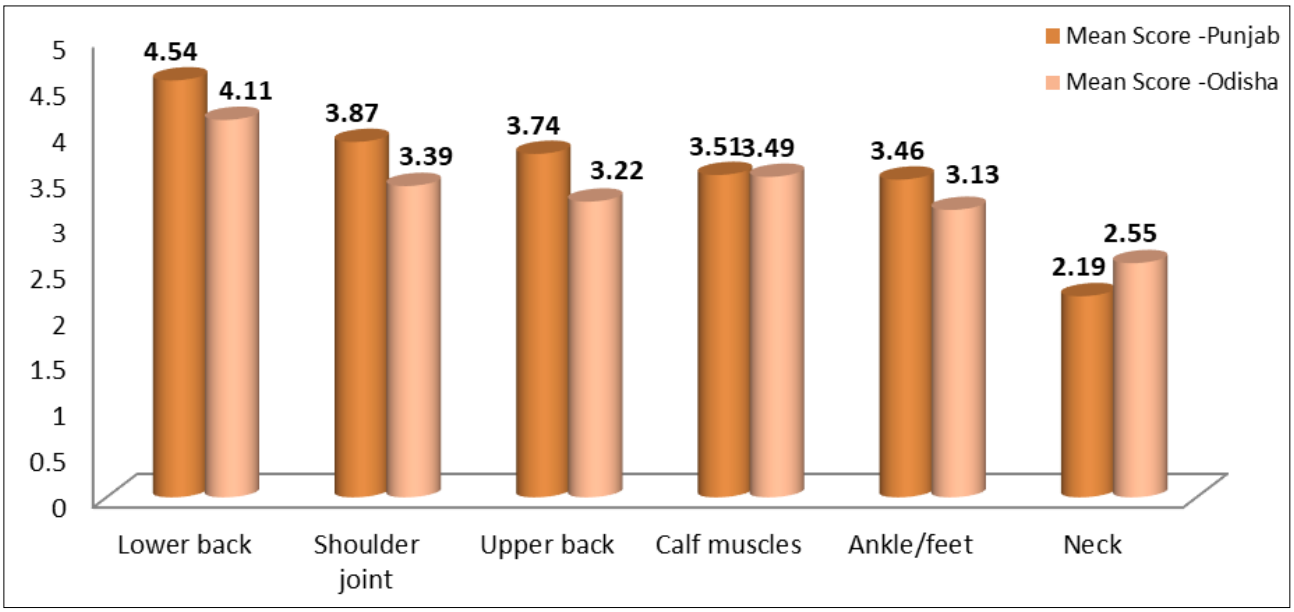

Fig 2: Rate of perceived exertion in body parts

Analysis of the tools used by women workers while performing turmeric cultivation activities in Punjab and Odisha

The Ergonomic Checkpoints in Agriculture checklist based on the selected checkpoint items were considered for analyzing the tools used by women workers in turmeric cultivation at both the states. This can help women workers in prioritizing immediate actions to be taken. They may choose both short-term and long-term priorities. This format (answering the question "Do you propose action?" with no or yes, and pointing out whether the action is Priority or not) is beneficial, as it helps the users propose priority improvements in the local context.

The data from table 2 revealed that In Punjab, about 87.67 per cent women workers proposed action and also prioritized for providing a place for each tool which they need for post harvest activities of turmeric. About 78.67 per cent of them demanded for keeping frequently used tools and materials within easy reach. All of the women said that there is a need to change arrangements of the tools in the field to avoid strenuous working postures as much as possible whereas about 80.67 per cent prioritized it. About 90.67 per cent of the women proposed and prioritized for choosing work methods that alternate standing

and sitting, and try to avoid bending and squatting as much as possible. All of the women workers asked and prioritized for providing tools and technologies that can be operated with minimum force. There was need and priority of providing tools with appropriate grips that have adequate friction as told by 61.33 percent women workers. About 72 per cent women desired and prioritized for attachment of labels, signs and symbols that are easy to understand, in order to avoid mistakes. In Odisha, all of the women workers proposed action and also prioritized for providing a place for each tool which they need for post harvest activities. About 82.67 per cent of the women demanded for keeping frequently used tools and materials within easy reach and there was priority for this action. All of the women said that there is a need to change farming arrangements in the field to avoid strenuous working postures as much as possible and gave priority to it. All of the women proposed and prioritized for choosing work methods that alternate standing and sitting, and try to avoid bending and squatting as much as possible. All of them demanded and prioritized for choosing tools that can be operated with minimum force. There was need of providing tools with appropriate grips that have adequate friction as told by 75.33 percent women workers and about 72 per cent said for priority. All of the women workers desired and prioritized for attachment of labels, signs and symbols that are easy to understand, in order to avoid mistakes. Similar kind of study was conducted by Fathimahhayati *et al* (2023) [4] revealed that there was not ergonomic work environment at the Nursery and that require attention are providing welfare facilities and organization and work schedules. It is beyond the doubt that activities performed in these four areas demand a high degree of physical effort, leading fatigue. The major causative factors responsible for this were the static muscular effort and unnatural postures, mainly due to faulty designed workstation. Working for several hours within adverse working environment also affects the working efficiency of the worker. Therefore application of ergonomics principles, which should concern with the design of work station, design of equipments and environmental condition, is necessary.

Table 2: Workstations and tools analysis

S. No	Statements	Punjab (n=150)				Odisha(n=150)			
	Proposing Action	Yes		Priority		Yes		Priority	
		f	%	f	%	f	%	f	%
1.	Provide a place for keeping each tool	130	86.67	130	86.67	150	100	150	100.00
2.	Keeping frequently used tools within reach	118	78.67	110	73.33	124	82.67	124	82.67
3.	Changing arrangements of the tools in the field to avoid strenuous postures	150	100.00	121	80.67	150	100.00	150	100.00
4.	Choosing alternate work methods to avoid awkward postures	136	90.67	136	90.67	150	100.00	150	100.00
5.	Choosing tools that can be operated with minimum force	150	100.00	150	100.00	150	100.00	150	100.00
6.	Providing tools with appropriate grips	92	61.33	92	61.33	113	75.33	109	72.67
7.	Attaching labels, signs and symbols to understand easily	108	72.00	108	72.00	150	100.00	150	100.00

Conclusion

It can be concluded that women involved in various turmeric cultivation activities demanded very tedious tasks and repetitive movements of upper and lower limbs. They adopted awkward postures such as static squatting, bending, sitting, stooping postures which create musculoskeletal problems in the long run. In addition to these problems, it is also observed that farm women have less access to improved tools and equipment, harvester, boiler, dryer and polishing equipment. They are used to work with traditional equipment or the rejected tools/ equipment by men. These tools are not suitable according to women's anthropometry as well as in terms of their structure and size. This leads to drudgery and occupational health hazards in the long run. Therefore, intervention of women friendly technologies can be done by considering the anthropometric parameters of women workers of Punjab and Odisha. This study suggested for suitable interventions of women friendly technologies which can help women to overcome the time-consuming and physically demanding activities by reducing drudgery.

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