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Constraints perceived by the rural women in collection and storage of biomass fuel in rural areas

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Abstract

India, with its extensive agricultural base, generates substantial biomass from crop residues. Additionally, biomass is produced as a by-product in numerous agro-based industries. Biomass fuel remains a crucial energy source for many rural households in India, with women playing a central role in its collection, procurement, and storage. Despite its importance, the process of managing biomass fuel presents significant challenges that impact rural women's daily lives and livelihoods. The collection of biomass fuel often involves strenuous physical labor, including gathering firewood, crop residues, or animal dung. This labor is typically performed by women and is often characterized by time-consuming and physically demanding activities. Based on this rationale, an exploratory research was carried out to study the Musculo Skelton problems, procurement problems and storage problems faced by respondents in using the biomass fuels. Research conducted in Hisar state on women who were using biomass as fuel. Data were collected by the personal interviewed method. Results show that 'most severe' discomforts faced by the respondents were in low back (4.8), upper back (4.1), mid back (4.0), knees (4.00), upper leg (3.8) and shoulder joint (3.5). It also found that injury and distance related problems were experienced by the respondents as 'most severe' with weighted mean scores of 3.45 and 3.22 respectively. It can be concluded that women faced women faced Musculo-skelton problems while collection and storing the fuel.

Keywords: Fuel, musculo-skeletal problems, residues/twigs, store

Introduction

Energy is essential to most industrial and commercial growth and is the key to enhancing a country's social and economic well-being. Biomass fuel remains a cornerstone of energy access for many rural households in India. It encompasses a variety of materials, including firewood, crop residues, and animal dung, which are crucial for cooking and heating. The collection, procurement, and storage of these biomass fuels are labor-intensive processes that predominantly involve women in rural areas. Despite their central role, the constraints faced by rural women in managing biomass fuel are often significant and multifaceted, influenced by socio-economic, environmental, and gender-specific factors. The collection of biomass fuel typically involves physically demanding work, which is a primary responsibility of women in many rural communities (Kumar & Tiwari, 2018) [2]. Women often have to walk long distances to gather firewood or crop residues, which can be particularly strenuous during dry seasons when resources are scarce (Mishra & Singh, 2020) [3]. This process is compounded by a lack of modern tools and technology that could alleviate the physical burden (Bhatia & Ghosh, 2013) [1]. Traditional collection methods not only consume significant time but also increase the physical strain on women, contributing to their overall workload and affecting their health. The procurement of biomass fuel is another

area fraught with challenges. Local availability of biomass can be highly variable, influenced by seasonal changes and competition with other uses, such as fodder for animals or soil fertilization (Reddy & Kameswara Rao, 2015) [4]. Women often have limited control over procurement practices and may face difficulties in securing adequate fuel due to fluctuating availability and rising competition (Sharma & Rao, 2017) [5]. Additionally, women may encounter barriers related to land access or ownership, which can further complicate their ability to procure biomass resources effectively. Once collected, the storage of biomass fuel presents its own set of challenges. Proper storage is essential to maintain the quality of the fuel, but rural women often struggle with issues such as limited space, inadequate facilities, and difficulties in controlling moisture and pests (Sharma & Rao, 2017) [5]. Poor storage conditions can lead to fuel degradation, which affects its efficiency and usability, exacerbating the challenges faced in collection and procurement. These storage issues are often compounded by a lack of access to modern storage solutions and infrastructure. The constraints faced by rural women in biomass fuel management are deeply intertwined with broader socio-economic and gender dynamics. Women are typically responsible for managing household energy needs, which places an additional burden on their already heavy workloads (World Bank, 2012) [6]. Gender-specific

roles and responsibilities often limit women’s access to resources and support systems that could alleviate these burdens (Mishra & Singh, 2020) [3]. Furthermore, socio-economic factors such as poverty and lack of education exacerbate these challenges, creating a cycle of disadvantage that impacts women’s well-being and efficiency in managing biomass fuel. Therefore, a present study was planned to find out the problems faced by rural women using the biomass fuel.

Methodology

The present study was conducted in a randomly selected village of Hisar district in Haryana state of India. To select the sample, a total of 100 rural women was selected randomly as the sample who were using biomass as fuel. Baseline data on fuel use pattern were collected personally by the researcher with the help of a structured interview schedule which had been duly pretested and finalized. Data regarding problem faced by rural women in collection, fetching, procurement and storage of fuel were also collected with the help of interview schedule. The collected data, were suitably analyzed with the help of appropriate statistical methods i.e., frequencies, percentages and weighted mean scores.

Results

Personal and social profile of the respondents

Distribution of the respondents according to their age group reveals that nearly half of the respondents (47.00%) belonged to middle age group (27-35years), followed by the respondents (42.00%) from old age group (36-44 years).

Table 1: Personal, socio- economic and communication profile of the respondents (n=100)

Sr. No.	Characteristics	Percentage
1.	Age	
	18-26 yrs	11
	27-35 yrs	47
	36-44 yrs	42
2.	Education of the respondent	
	Illiterate	43
	Primary	26
	Middle	18
	High School	13
3.	Occupation of the respondent	
	House wife	75
	Animal husbandry	6
	Agricultural labour	6
	Construction labour	3
	Aanganwaadi worker	2
	Self employed	4
4.	Mass media exposure	
	Low (upto 7)	24
	Medium (8-14)	45
	High (15-21)	31
5.	Extension personal contact	
	Low (upto 10)	74
	Medium (11-20)	17
	High (21-30)	9

More than forty percent of the respondents (43.00%) were illiterate. Nearly one-fourth of the respondents (26.00%) were educated upto primary level, 18.00 per cent

respondents had middle level of education and 13.00 per cent respondents were matriculate. It is evident from the Table (4.1.1) that majority of the respondents were housewives (75.00%). Very few respondents were involved in other occupations like animal husbandry and agricultural labour (6.00% each), shop keeping (4.00%), construction labour (3.00%) and *aanganwadi* worker (2.00%). Regarding mass-media exposure, 45.00 per cent respondents had medium level of mass media exposure, followed by high level (31.00%) and low level (24.00%) of mass media exposure. For extension contact, it was observed that majority of the respondents (74.00%) had low level of extension contact while only 17.00 and 9.00 percent of the respondents had medium and high level of extension contact respectively.

Table 2: Musculo-skeletal problems faced by the respondents in collection and fetching of fuel (n=63)

Body parts	Collection of fuel		Fetching of fuel		
	WMS	Rank	Rank	WMS	Body parts
Low back	4.8	I	I	4.6	Head
Upper back	4.1	II	II	4.4	Low back
Mid back	4.0	III	III	4.3	Upper back
Knees	4.0	III	IV	4.2	Upper leg
Upper leg	3.8	IV	V	4.1	Neck
Shoulder joint	3.5	V	V	4.1	Knees
Head	2.7	VI	V	4.1	Mid back
Upper arm	2.3	VII	VI	4.0	Upper arm
Feet	2.1	VIII	VII	3.8	Shoulder joint
Elbow	1.6	IX	VIII	3.7	Buttock
Neck	1.4	X	IX	3.4	Elbow
Lower arm	1.3	XI	X	3.0	Feet
Buttock	1.3	XI	XI	2.1	Lower arm
Ankle	1.2	XII	XII	1.8	Ankle
Wrist	1.1	XIII	XIII	1.7	Wrist
Fingers	1.1	XIV	XIV	1.5	Fingers

Musculo-skeletal problems faced by the respondents in collection and fetching

Musculo-skeletal problems faced by the respondents in collection and fetching of crop residues / twigs were identified by using the body map. Problems were recorded on five point continuum scale i.e., very severe discomfort, severe discomfort, moderate discomfort, mild discomfort and very mild discomfort. Weighted mean scores were calculated for these problems and these were further analyzed as most severe, severe and least severe.

Scrutiny of data in Table 2 indicates the incidence of pain in collection and fetching of fuel. Regarding discomfort during collection of fuel, ‘most severe’ discomforts faced by the respondents were in low back (4.8), upper back (4.1), mid back (4.0), knees (4.00), upper leg (3.8) and shoulder joint (3.5). Respondents felt ‘severe’ discomfort in head (2.7), upper arm (2.3) and feet (2.1) while collection of biomass. In remaining body parts, respondents expressed ‘least severe’ discomfort i.e., elbow (1.6), neck (1.4), lower arm (1.3), buttock (1.3), ankle (1.2), wrist (1.1) and fingers (1.1) in collecting biomass fuel. As far as fetching of fuel was concerned, respondents felt ‘most severe’ discomfort in majority of the body parts i.e., head (4.6), low back (4.4), upper back (4.3), upper leg (4.2), neck (4.1), knees (4.1), mid back (4.1), upper arm (4.0), shoulder joint (3.8), buttock (3.7) and elbow (3.4). Respondents reported ‘severe’

discomfort in feet (3.0), lower arm (2.1), ankle (1.8) and wrist (1.7). ‘Least severe’ discomfort (1.5) was felt by the respondents in fingers only.

Problems in procurement of crop residues/twigs as headload

Only 63.00 per cent respondents carried crop residues/twigs on head. Problems faced by these respondents in procurement of crop residues/twigs were categorized into two groups i.e., health related problems and miscellaneous problems.

Table 3: Problems in procurement of crop residues/twigs as headload n=63

Sr. No.	Problems	WMS
1.	Health	
i.	Carrying of heavy load on head	3.77
ii.	Causes pain in body parts	3.68
iii.	Causes fatigue/headache	3.58
iv.	Collection and binding of biomass causes injuries/bites/cuts	3.20
v.	Thorn pricking	2.69
vi.	Causes allergic problems	2.52
vii.	Stress of being caught	1.36
	Rank I	(2.97)
2.	Miscellaneous	
i.	Consumes lot of time	3.14
ii.	Not easily available	2.69
iii.	Walking long distance	2.61
	Rank= II	(2.81)

Problems faced by these respondents were recorded on a four point continuum scale i.e., most severe, severe, least severe and no problem to compute weighted mean scores. Both health and other miscellaneous problems were found to be ‘severe’ in nature, though health problems ranked higher with weighted mean score (WMS) of 2.97. Among the health problems, most severely felt problems were heavy head load of crop residues/twigs (3.77), feeling of pain in various body parts (3.68) and fatigue/headache (3.58). Respondents also faced the problem of injuries in the form of insect bites/cuts while collecting and binding crop residues/twigs (3.20) as ‘most severe’. Problem of thorn pricking while collecting and binding crop residues/twigs and skin related allergic problems were ‘severe’ in nature with weighted mean scores of 2.69 and 2.52 respectively. Stress or fear of being caught while collecting crop residues/twigs from the land/farm of other people was reported as ‘least severe’ problem (1.36) by the respondents. Under miscellaneous problems the ‘most severe’ problem reported by the respondents was the fact that procurement of crop residues/twigs consumes a lot of time (3.14). Other miscellaneous problems were found to be ‘severe’ in nature viz. crop residues/twigs were not easily available (2.69) and walking long distances in search of crop residues/twigs (2.61).

Conclusively, maximum health and other miscellaneous problems were ‘most severe’ in nature, though health problems ranked higher in comparison to other miscellaneous problems.

Problems in storage of crop residues/twigs

Problems faced by the respondents in storage of crop

residues/twigs are presented in Table 4. These problems were categorized under various heads i.e., injury related problems, problems related to distance, space and season. These problems were recorded on four point continuum scale i.e. most severe, severe, least severe and no problem. Severity of these problems was analyzed with the help of weighted mean scores.

Table 4: Problems in storage of crop residue/twigs (n=100)

Sr. no.	Problems	WMS
1.	Injury	
i.	Fear of insect bite	3.66
ii.	Fear of cuts/ thorn pricking	3.25
	Rank=I	(3.45)
2.	Distance Problems	
i.	Depend on male member for bringing in late hours/evening	3.25
ii.	Can’t bring in late hours/evening	3.23
iii.	Storage space is far away	3.18
	Rank=II	(3.22)
3.	Spatial Problems	
i.	Lack of adequate space	3.66
ii.	Difficult to store big pieces	3.26
iii.	Make the place untidy	2.30
iv.	Takes the space needed for other things	2.19
	Rank= III	(2.85)
4.	Seasonal Problems	
i.	Causes bad smell when wet	21
ii.	Wetting in rainy season	13
iii.	Lack of adequate covered space for storage in rainy season	22
	Rank = IV	(2.22)

Injury related problems and problems related to distance were found to be ‘most severe’ with weighted mean score of 3.45 and 3.22 respectively. This was followed by problems related to space (2.85) and season (2.22) which were reported as ‘severe’. Among injury related problems, respondents reported that fear of insect bite and cuts or thorn pricking while taking out the twigs from the stored stock of crop residues/twigs were ‘most severe’.

All problems related to distance were reported as ‘most severe’ like dependence on male members for bringing fuel in late hours (3.25) or can not fetch it on her own in late hours (3.23) and that the place where these were stored was far away from their home (3.18). Among the problems related to space, ‘most severe’ problems reported by the respondents were lack of adequate space for storage of fuel (3.66) and difficulties in storing big pieces of wood/fuel (3.26). Space related problems which were experienced as only ‘severe’ in nature were untidy storage space (2.30) and storing of fuel in places meant for other purposes (2.19). season related problems were also found to be ‘severe’ viz., foul smell (2.30), wetting of fuel in rainy season (2.19) and lack of adequate covered place for storage of crop residues/twigs in rainy season (2.18).

Thus, it can be concluded that injury and distance related problems were experienced by the respondents as ‘most severe’ with weighted mean scores of 3.45 and 3.22 respectively. These problems were followed by other problems related to space and season which were found to be ‘severe’ in nature with weighted mean scores of 2.85 and 2.22 respectively.

Summery and Conclusion

It is concluded that most of the respondents faced 'most severe' musculo-skeletal problems in collection and fetching of crop residues/twigs, especially in head, neck, upper back, mid back, low back, shoulder joints, knees and upper leg. Respondents, who carried crop residues/twigs as headload, also faced 'severe' problems related to health (WMS- 2.97) and other miscellaneous problems (WMS- 2.81). Problems faced in storing crop residues/twigs were related to injury, distance, space and season. Therefore, it is recommended that educational institutes can come forward and organize seminars, workshops, campaigns, and exhibitions etc. from time to time to create awareness and to promote adoption of clean green fuel energy.

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