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Physiological work load of rural women in fuel wood collection and carrying activity with conventional and improved method

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Abstract

Indian women play a very important role in all the aspects, and became life line of family, back bone of society, and pioneer of all the civilization. In India, about 70 per cent of the people are living in rural areas pay most of their time in meeting the fundamental needs of the family and traditionally responsible to search, collect, and carrying of fuel wood regularly to full fill their fuel requirements. Fuel wood collection and carrying is one of the common manual load handling tasks performed regularly by the rural women. The present study was conducted during the year 2020-21. A total of 250 rural women involved in fuel wood collection and carrying activity were purposively selected for the study. For experimental study 30 physically rural women were selected under the study. This study was conducted to determine the physiological work load, rate of perceived exertion and musculoskeletal problems experienced by the women respondents. The same procedure was followed for both traditional and improved method and then impact was studied. The results revealed that the traditional method of carrying fuel wood was found to be heavy while with the improved method, the physiological work load and rate of perceived exertion was moderately heavy.

Keywords: Physiological work load, head load manager, conventional method, improved method, musculoskeletal pains

Introduction

Manual load handling is widespread and indispensable in all spheres of human activity, whether industrial, agricultural, commercial, domestic or recreational. Manual material handling is one of the most physically demanding operations performed without the aid of mechanical devices. In this activity people are exposed to repetitive movements, awkward postures, lifting, lowering, pushing, pulling, carrying or moving the load with hands or by the body force, contacted stresses and forceful exertion.

In most developing countries, lack of technological solutions leads to prevalence of manual material handling. Material handling is very common activity and mostly found in rural areas. According to the reports of Sen and Nag (1975) more than 70% of the total population of India is engaged directly in manual material handling. Even though there is high degree of advancement in technology, people still perform manual material handling tasks either by necessity or by choice. With the prevalent practice in rural areas people carry nearly 30 kg of loads or more on their head, shoulders and back for long distances (Dufault 1998) [4]. The mode of carrying and lifting heavy loads remains necessary and unavoidable by the rural women. Women in rural area mostly use traditional means for carrying heavy loads like water, cow dung, fuel wood, crop residue, fodder, bricks, sand, pesticides, grains and vegetables. One of the common loads carried by rural women regularly is fuel wood. Though there is substitutions are available at villages but people still preferred fuel wood as their major energy source for preparing local dishes. This is mainly due to economic and social causes, cultural beliefs, easily available, cheap and increasing cost of liquid fuel (LPGs and Kerosene).

Fuel wood collection and carrying is an everyday activity performed regularly by the rural women. Thus continuous collection and carrying of fuel loads on head over long distances is physically demanding and drudgery prone. In later years this affects the health of the women and enhances risk of back strains, lower-back pain, fractures, chronic and leg related problems, damage to the knees, menstrual disorders, miscarriage, stillbirth and other problems. To reduce such drudgery, ergonomically designed technologies in manual load carrying are quit necessary.

Hence, efforts are required to provide technological solution to reduce drudgery of rural women. The present study is planned for experimental computation of physiological work load among rural women in carrying fuel wood with following the objective.

- To assess the physiological work load of rural women with improved and conventional method.

Methodology

The present study was conducted in five taluks of Dharwad district, namely Kalaghatagi, Kundagoal, Navalgund, Dharwad and Hubballi during the year 2020-21. Further two villages from each taluka were randomly selected for the study. Thus, a total of 10 villages and from each village proportionate of 25 rural women were selected for the study. For experimental study 30 physically fit, healthy, having normal blood pressure and who are regularly involved in fuel wood collection and carrying activity were selected as sub samples under the study. Stratified random sampling method was adopted for selection of samples. Pre-structured personal interview schedule was administered on 250 rural women to collect the required information from the respondents. The head load manager was introduced in improved method. The impact was studied for conventional method and improved method.

Results and Discussion

Fig. 1 Shows demographic profile of rural women involved in fuel wood collection and carrying activity. Majority of the respondents in Kalaghatagi and Kundagol taluk belonged to more than 46 years of age i.e. (38%, and 54%) respectively whereas in Navalgund and Hubballi taluk majority of the respondents belonged to 35-46 year of age, while in Dharwad taluk 42 per cent of the respondents belonged to less than 35 years of age. The results are in line with the findings of Farida and Indira (2011) they also found that the majority of the respondents belonged to 36-45 years of age. With respect to the education, majority of the respondents were illiterate and

only few of them had completed their SSLC education and graduation. Similar findings were found by Chaudhary *et al.* (2017) [3] that higher per cent of the respondents were illiterate. With respect to the marital status that maximum percentage of the respondents in Kalaghatagi taluk (96%), Dharwad taluk (92%), Hubballi taluk (98%) and cent per cent of the respondents of Kundagoal and Navalgund taluk were married. The findings were on par with results of Farzana *et al.*, (2017) [5] that more than 90 per cent of the respondents were married.

With respect to the religion cent per cent of the selected respondents of Kalaghatagi taluk, Navalgund taluk, Hubballi taluk and maximum percentage of Kundagol taluk (66%) and Dharwad taluk respondents were belonged to Hindu religion further more than one third of the of respondents (34%) in Kundagol taluk and very few per cent of respondents (2%) in Dharwad taluk belonged to Muslim religion. The results are in line with the results of James *et al.*, (2020) that majority of the respondents (91.8%) belonged Hindu region. The maximum percentage of the respondents in Kalaghatagi (72%), Kundagoal (76%) and Hubballi taluk (86%) were belonged to the nuclear family followed by joint family. Equal per cent of the respondents in Navalgund and Dharwad taluk were living in both joint as well as nuclear family. Hussain *et al.* (2017) [6] and Farzan *et al.* (2017) [5] revealed that majority of the respondent's in the study area belonged to nuclear family followed by joint family. With respect to the occupation of the family, highest percentage of the respondents in all the taluks were agriculture labours and construction labours. The similar results were found by Moonty and Borah (2013) [9] that majority of the respondents in the study area were agriculture labours. With respect to the monthly family income majority of the respondents of Kalaghatagi (58%), Kundagoal (42%) Navalgund (48%), Dharwad (64%) and Hubballi (46%) taluk had monthly family income between Rs1000-2499. The findings are in line with the findings of Chitagubbi *et al.* (2016) [2] that majority of the respondents monthly family income was less than 3000 rupees.

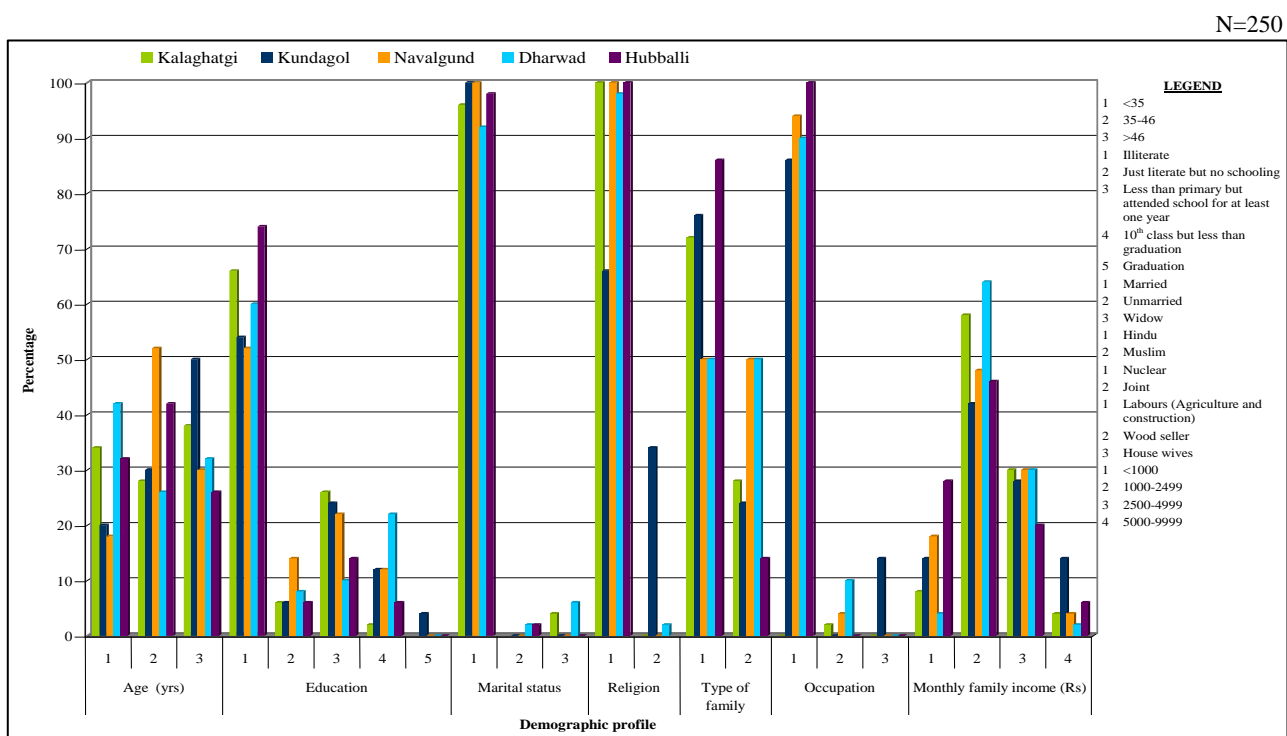


Fig 1: Shows demographic profile of rural women involved in fuel wood collection and

Table 1 Depicts physiological response of women respondents involved in fuel wood carrying activity with traditional method and improved method. The conventional method of carrying fuel wood is manually mode of carrying

of fuel wood on their head. Whereas in improved method (head load manager) it was observed from the table that an average working heart rate was 134 beats/min followed by recovery heart rate 83 beats/min.

Table 1: Physiological response of women respondents in fuel wood carrying activity

n=30

Physiological Parameters	Traditional method	C method	't' test
Average Resting Heart rate (beats/min)	68.8	67.3	-
Average Working Heart Rate (beats/min)	134.13	128.03	7.492**
Average Recovery heart rate (beats/min)	83.2	77.3	9.420**
Cardiac Cost of Work	2065	2019	1.488 ^{NS}
Cardiac Cost of Recovery	447	267	3.422**
Total Cardiac Cost of Work (beats)	2469	2325	3.588**
Physiological Cost of Work (beats/min)	83.73	76.2	3.577**
Average Energy Expenditure (KJ/min)	12.60	11.63	7.492**

**significant at 1 percent level

The total cardiac cost of work (2065 beats) and physiological cost of work (83.73 beats/min) was estimated by considering the cardiac cost of work (2065 beats) and cardiac cost of recovery (447 beats). Further total cardiac cost of work (2469 beats) and average energy expenditure (12.60 kJ/min) was found highest in case of traditional method of carrying fuel wood than with use of head load manager in improved method. The highly significant difference was found on average working heart rate, average recovery heart rate, cardiac cost of work, cardiac cost of recovery, physiological cost of work of respondents and average energy expenditure in both conventional method and improved method of carrying fuel wood.

Table 2 depicts physiological work load of women respondents involved in fuel wood carrying activity. Physiological work load was classified based on energy expenditure (kj/min) and heart rate (beats/min). It is clear from the table that majority of the respondents (70%) belonged to the very heavy work load category followed 30 per cent of the respondents had experienced heavy work load

in conventional method of carrying of fuel wood.

Where in improved method higher percentage of the respondents (76.6%) belonged to heavy work load category followed by 23.3 per cent of them were found to be in moderately heavy category.

Table 3 unfolds opinion on perceived exertion. It was recorded for fuel wood carrying activity on five point scale such as very light, light, moderately light, heavy and very heavy. Further, it is revealed that, equal per cent of the respondents (56.6%) in both traditional method and improved method rated fuel wood cutting and collection activity as heavy and moderately heavy.

Further more than half of the respondents (53.3%) opined that fuel wood loading activity in conventional method was found to be light followed by moderately heavy (36.6%) and only three per cent of the respondents rated as heavy. The similar results were found by Rondla *et al.* (2019) [10] that the physiological cost of work (PCW) was observed to be less with improved method of carrying load as compared to the traditional method of carrying load.

Table 2: Physiological work load of women respondents involved in fuel wood carrying activity

n=30

Physical work load	Physiological Variables		Traditional method	Improved method
	Energy expenditure (Kj/min)	Heart beats (beats/min)		
Very light	Up to 5.0	Up to 90	-	-
Light	5.1-7.5	91-105	-	-
Moderately heavy	7.6-10.0	106-120	-	7 (23.3)
Heavy	10.0-12.5	121-135	9 (30.0)	23 (76.6)
Very heavy	12.6-15.0	136-150	21 (70.0)	-
Extremely heavy	<15.0	Above 151	-	-

Table 3: Opinion on perceived exertion of the women respondents for fuel wood carrying activities

n=30

Classifications	Traditional method				Improved method			
	Cutting & Collection	Loading	Carrying	Unloading/Landing	Cutting & Collection	Loading	Carrying	Unloading/Landing
Very Light	-	-	-	9 (30.0)	-	-	-	-
Light	-	16 (53.3)	-	21 (70.0)	-	11 (36.6)	-	30 (100)
Moderately Heavy	13 (43.3)	11 (36.6)	-	-	13 (43.3)	16 (53.3)	11 (36.6)	-
Heavy	17 (56.6)	3 (10.0)	1 (3.3)	-	17 (56.6)	3 (10.0)	15 (50.0)	-
Very heavy	-	-	29 (96.6)	-	-	-	4 (13.3)	-
Mean score	3.56	2.56	4.96	1.56	3.56	2.56	3.76	2.0

It is clear from the table that more than 90 per cent of the respondents (96.6%) opined that fuel wood carrying activity was found to be very heavy (96.6) followed by very few per cent of the respondents rated as heavy (3.3%) where in improved method half of the respondents (50%) rated that fuel wood carrying activity as heavy followed by moderately heavy (36.6%) and very few per cent of the respondents were rated as very heavy. With regard to the unloading/landing activity majority of the respondents rated as light activity followed by very light in both traditional and improved method.

Table 4: Comparison of musculoskeletal problems experienced by women in traditional and improve method

n=30

Body parts	Mean score of musculoskeletal problems		
	Traditional	Improved	't' test
Upper extremities			
Head	4.47	2.20	8.928**
Eye	2.20	2.00	12.04**
Neck	3.57	4.56	8.64**
Shoulder	4.20	4.57	6.233**
Upper arm	4.20	3.53	12.042**
Lower arm	4.23	3.90	10.56**
Finger/palms	3.17	3.23	1.758 ^{NS}
Upper back/Cervical	3.87	4.30	7.82**
Lower extremities			
Lower back	4.37	3.60	9.92**
Thigh/muscles	3.90	3.73	9.92**
Calf/leg	3.30	3.13	10.56*
Knee	3.60	3.40	8.58**
Ankles	3.90	3.47	4.64**
Feet	3.80	3.73	1.981 ^{NS}

** - Significant at 1% level NS – Non-significant

Table 4 depicts comparison of musculoskeletal problems experienced by women respondents in traditional and improved method.

It is clear from the table that in traditional method the highest mean score was given to head (4.47) followed by lower back (4.37), upper arm (4.20) and lower arm (4.23), shoulder (4.20). Equal mean score (3.90) was given to thigh/muscles and ankles, feet (3.80), calf (3.60) and least mean score (2.20) was eyes given by the respondents.

It is evident from the table that in improved method highest mean score (4.57) was given to shoulder pain followed by neck (4.56), upper back/cervical (4.30), lower arm (3.90) while equal mean score (3.73) was given thigh muscles and feet. Further the mean score of 3.60 was given to lower back which was less as compared to mean score given in traditional method and less mean score was given to head (2.20) and eyes (2.20). It is noticed from the table that incidence of pain in head (2.20), upper arm (3.53) and lower arm (3.90) was reduced in improved method but the pain was increased in shoulder joint (4.57) and neck (4.56). The significant difference was found between in all the body parts except feet, finger and palm. The study of Aprajita *et al.* (2019) [1] and Krishnendu *et al.* (2016) [7] revealed that women respondents in manual material handling activity were at high prevalence of musculoskeletal problems in traditional mode of carrying load on head as compared to the improved method

and also majority of the respondents reported that they had severe pain at neck region, shoulder joint, lower back and at knee level.

Conclusion

It was observed from the study that, cent per cent of the respondents in the study area were used fuel wood as primary fuel energy source. For collection and carrying of fuel wood women have to walk for miles with heavy on head and spent most of their time.

In traditional method of carrying fuel wood respondents having heavy work load and faced more drudgery. Then in improved method (Head load manager) of carrying fuel wood was found to be moderately heavy as compared to the traditional method of carrying fuel wood on head. Further women respondents expressed that the use of head load manager for carrying fuel wood reduces head heaviness and physiological cost of work only at some extent but the pain was increased at shoulder and back region. Hence this is clearly establishes that the modified tool was found to be better than traditional way of carrying fuel wood but still there was few modification are required to the tool as explained by the women respondents such as it should be adjustable, easy to operate, should hold the fuel wood bundles and cushions should be provided at head, shoulder and back region.

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