

Physiological study on mopping the floor with cloth and basket mop

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■ **ABSTRACT** : The study was conducted in Parbhani city of Marathwada region in Maharashtra state. Thirty women involved in mopping activity were selected for this study. They were surveyed and grouped between the age ranges from 25-35 years. For assessment of physiological cost in squatting posture traditional cloth mop was selected and for standing posture based on the market survey during the study the new handle mop with basket was used. Selected static and dynamic anthropometric measurements was recorded by the use of anthropometer and flexible measuring tape. For measuring the heart rate the polar sport tester heart rate monitor was used. Heart rate was recorded while performing activity of mopping. Physiological cost of work was assessed by calculating the energy expenditure. The mean stature of homemakers was 155.7, elbow height 98.4, Shoulder height 125.43, Mid shoulder height 127.9, Span 155.7 and Mid position arm reach height 122.3. Mean arm reach height at mid and lower position was 122.3 and 63.6 and mean arm reach length at mid and lower position was 60.75 and 59.9. Palm length, Hand length, Thumb tip reach height, Grip strength and weight was 17.17, 69.13, 110.73, 2.91 (kg) and 51.76 (kg). The mean normal squatting height of home makers was 93.3 cm, eye height 88.06 cm, knee to knee distance 31.9 cm, arm reach forward 72.3 cm, Squatting side arm reach of left and right hand was observed same as 70.4 cm and arm reach length for lower position and mid position were 67.13 cm and 61.36 cm. The physiological cost of mopping the floor with cloth mop was more as compared to basket mop. Statistical analysis revealed the significant results, which indicated that the average working heart rate, average recovery heart rate, average peak heart rate and average total cardiac cost of work was reduced significantly when the mopping the floor was carried out with basket mop.

■ **KEY WORDS**: Cloth mop, Basket mop, Mopping

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It is believed that where cleanliness is maintained, there purity, health and goodness prevail. Cleanliness of house includes sweeping, washing and mopping of the floor, dusting of surfaces, removal of cobwebs

and tidying up objects etc. To whatever region a family may belong it is a common practice to complete cleaning of the house on every festival day.

Cleaning requires both dynamic and static muscular

work, which is usually done with the use of various types or pieces of manual tool. It is considered a physically demanding job, resulting in high cardiovascular load; high frequency of awkward postures; and as such rated as a strenuous job (Kumar and Narayan, 2005).

The measurement of physiological parameters such as heart rate, energy expenditure, postural deviation and perceived exertion which helps to assess workers inputs is of great importance for making work safe, productive and healthy. Keeping this observation in mind a physiological study has been attempted among the women to study the operations of mopping in both traditional and improved methods.

Objectives:

- To record the selected static and dynamic anthropometric measurements of women.
- To assess the physiological cost while mopping the floor in squatting and standing posture of selected women.

RESEARCH METHODS

The study was conducted in Parbhani city of Marathwada region in Maharashtra state. Purposive random sampling was followed to select thirty women involved in mopping activity. The selected women were healthy and without any physical deformities and illness. They were surveyed and grouped between the age ranges from 25-35 years.

For assessment of physiological cost in squatting posture traditional cloth mop was selected and for standing posture based on the market survey during the study the new handle mop with basket was used. A Basket having pedal at the base and revolving squeezer inside the basket. Mop have round base having wicks and handle to hold.

Selected static and dynamic anthropometric measurements was recorded by the use of anthropometer and flexible measuring tape. The anthropometric measurements of women for standing and squatting posture were recorded while mopping floor.

For measuring the heart rate the polar sport tester heart rate monitor was used. Heart rate was recorded while performing activity of mopping. The resting heart rate was recorded in the sitting position without doing any work. Working heart rate was recorded for 15 minute while performing activity of mopping. Average peak

heart rate (b.m^{-1}) was noted down during performance of task. Then after completion of the activity recovery heart rate was recorded after every minute till a period of normal heart rate.

To assessment of physiological cost of work: The energy expenditure was calculated from the heart rate response of the subjects using following formula (Varghese *et al.*, 1989).

$$\text{Energy expenditure (Kj.m}^{-1}\text{)} = 0.159 \times \text{Average working heart rate (b.m}^{-1}\text{)} - 8.72$$

The total cardiac cost of work was calculated from the heart rate response of subjects using formula given by Varghese *et al.* (1989).

$$\text{Total cardiac cost of work (TCCW)} = \text{Cardiac Cost of Work (CCW)} + \text{Cardiac Cost of Recovery (CCR)} \times \text{Duration}$$

where,

Cardiac cost of work = (Average Working Heart Rate - Average Resting Heart Rate) x Duration of work

Cardiac cost of recovery = (Average Recovery Heart Rate - Average Resting Heart Rate) x Duration of work

The physiological cost of work was calculated from the heart rate response of subjects using formula given by Varghese *et al.* (1989).

$$\text{Physiological cost of work (PCW)} = \frac{\text{Total cardiac cost of work (TCCW)}}{\text{Total time of work (min)}}$$

't' test was used for assessing the differences in variables related to ergonomic assessment of ironing activity in existing and improved method of mopping.

RESEARCH FINDINGS AND DISCUSSION

It is observed that majority of women were from the age group between 20-30 yrs. (53.3 %). Only 33.3 per cent homemakers were from the age group of 30-40 yrs. and very few homemakers were from the age group of 40-50 yrs. (13.3). The highest percentage of homemakers were college educated (66.6 %). The percentage of school educated and illiterate homemakers was found same (16.6 % each).

Majority of the respondents were having monthly income of Rs. 30,000-40,000 (45%). The percentage of women belonging to the family with income of Rs. 10,000-20,000 and Rs. 20,000-30,000 was 30 and 25,

respectively. Majority of the women were from nuclear family (86.6 %) and remaining 13.4 per cent of home makers were belonging to the joint family. The percentage of homemakers having 1-4 members in the family was 80, whereas 20 per cent homemakers were having 5-8 members in the family.

Information on static and dynamic anthropometry of selected homemakers in standing position is presented in Table 1. It is clear from the table that mean stature of homemakers was 155.7 cm, ranging from 146-166 cm. Mean elbow height of homemakers was recorded as 98.4 cm in the range of 80 to 110 cm.

The average mid shoulder height and span was recorded as 127.9 cm and 155.7 cm, respectively with correspondong ranges of 117-137 cm and 146-163.5 cm. The mean arm reach height at mid position and lower position were 122.3 cm and 63.3 cm, respectively and ranged between 63-140 cm and 50-100 cm. The mean arm reach lengths at mid and lower position were 60.7 cm and 59.9 cm, respectively. The mean palm and hand length were 17.1 and 69.1 cm and ranged between 15.5 - 19 cm and 61 -77 cm, respectively. The average thumb tip reach height and grip strength were 155.89 cm and 2.91 kg. The mean weight of homemakers was as 56.7 kg within the range of 46-76 kg.

Thus it can be concluded that the mean stature of homemakers was 155.7, elbow height 98.4, Shoulder height 125.43, Mid shoulder height 127.9, Span 155.7 and Mid position arm reach height 122.3. Mean arm reach height at mid and lower position was 122.3 and

63.6 and mean arm reach length at mid and lower position was 60.75 and 59.9. Palm length. Hand length, Thumb tip reach height, Grip strength and weight was 17.17, 69.13, 110.73, 2.91 (kg) and 51.76 (kg), respectively.

The selected anthropometric measurements of homemakers in squatting position are presented in Table 2. It is clear from the table that mean normal squatting height of homemaker was 93.3 cm in the range of 80-101 cm, eye height was 88.06 cm with wide range of 72-99 cm, knee to knee distance was 31.9 cm with range from 20-40 cm and maximum arm reach forward was 72.3 cm within the range of 61-90 cm. Squatting side arm reach of left and right hand were observed to be the same in mean value of 70.4 cm and in the range 62-90 cm. Arm reach length for lower position and mid position were 67.13 cm and 61.36 cm within the range of 59 - 86 and 43-82, respectively.

It is concluded that mean normal squatting height of home makers was 93.3 cm, eye height 88.06 cm, knee to knee distance 31.9 cm, arm reach forward 72.3 cm, Squatting side arm reach of left and right hand was observed same as 70.4 cm and arm reach length for lower position and mid position were 67.13 cm and 61.36 cm, respectively.

Physiological work load of mopping floor by cloth and basket mop was carried out and the results are shown in Table 3. It is apparent from the table that physiological parameters of homemakers such as average working heart rate (112.5 b.m⁻¹), average recovery heart rate (81.1

Table 1 : Static and dynamic anthropometry of selected women in standing position

Anthropometric variables	Measurements (centimeters)		
	Minimum	Maximum	Mean ± SD
Stature	146	166	155.7± 9.70
Elbow height	80	110	98.4± 6.77
Shoulder height	101	143	125.43 ± 9.33
Mid shoulder height	117	137	127.9 ± 6.55
Span	146	163.5	155.7± 6.66
Mid position arm reach height	63	140	122.3±15.28
Lower position arm reach height	50	100	63.6±14.24
Mid position arm reach length	51	81	60.75±9.8
Lower position arm reach length	52	82.5	59.9±19.3
Palm length	15.5	19	17.17± 0.93
Hand length	61	77	69.13± 5.79
Thumb tip reach height	92	130	110.73± 10.32
Grip strength (kg)	2.5	3.5	2.91 ± 0.34
Weight	40	60	51.76± 4.56

Table 2 : Anthropometric measurements of women in squatting position

Anthropometric variables	Measurements (centimeters)		
	Minimum	Maximum	Mean ± SD
Normal squatting height	80	101	93.3± 5.120
Eye height	72	99	88.06± 5.63
Knee to knee distance	20	40	31.96 ± 5.93
Maximum arm reach forward	61	90	72.3± 5.99
Side arm reaches left hand	63	90	70.46± 6.08
Side arm reaches right hand	62	90	70.4±6.15
Lower position arm length	59	86	67.13± 6.76
Mid position arm reach length	43	82	61.36± 10.45

Table 3 : Physiological workload of mopping floor by traditional and improved method

Physiological parameters	Traditional method	Improved method	Reduction/increase traditional vs improved	' t ' values
Average working heart rate (b.m ⁻¹)	120 ± 7.44	1124 ± 8.8	2 (1.8)	3.9*
Average resting heart rate (b.m ⁻¹)	77.6±2.3	77.6±2.3	0	0.00NS
Average recovery heart rate (b.m ⁻¹)	82.2±3.5	81.1±2.9	-1(-1.1)	1.37NS
Average peak heart rate (b.m ⁻¹)	126.6 ±6.2	123.2 ±5.8	2 (1.7)	2.26NS
Physiological cost of work	44.70 ±10.48	35.8±7.15	2 (8)	4.0*
Cardiac cost of recovery	22.9±16.2	20.81±2.0	1(3.2)	0.7NS
Cardiac cost of Work	662.7±138.2	483±160.9	35(9.8)	4.4*
Average peak energy expenditure (kj.m ⁻¹)	11.3 ±1.1	10.6±0.8		2.9NS
Total cardiac cost of work	675.6 ±138.2	546.66 ±116.36	36 (9.3)	5.4**

NS=Non-significant

beats), average peak heart rate (123.5 b.m⁻¹), average peak energy expenditure (10.6 kh.m⁻¹), physiological cost of work (35.8 beats), cardiac cost of work (20.8) and total cardiac cost of work (517.5) were less while mopping with basket mop as compared to mopping with cloth mop.

Statistical analysis with “t” test manifested significant reduction in Average Working Heart Rate (t=3.9). Physiological Cost of Work (t=4*), Average Cardiac Cost of Work (t=4.4*) and Total Cardiac Cost of Work (t=5.4**) of homemakers when the mopping was carried out with basket mop. The results are inline with the results of Savant (2012) for washing the clothes in existing and improved method.

On the whole it can be concluded that the physiological cost of mopping the floor with cloth mop was more as compared to basket mop. Statistical analysis revealed the significant results, which indicated that the average working heart rate, average recovery heart rate, average peak heart rate and average total cardiac cost of work was reduced significantly when mopping the floor was carried out with basket mop.

Conclusion :

Thus it can be concluded that the mean stature of homemakers was 155.7, elbow height 98.4, Shoulder height 125.43, Mid shoulder height 127.9, Span155.7 and Mid position arm reach height 122.3. Mean arm reach height at mid and lower position was 122.3 and 63.6 and mean arm reach length at mid and lower position was 60.75 and 59.9. Palm length. Hand length, Thumb tip reach height, Grip strength and Weight was 17.17, 69.13, 110.73, 2.91 (kg) and 51.76 (kg), respectively.

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■ REFERENCES

Kumar, S. and Narayan, Y. (2005). Cumulative spinal load among X-ray technologist: A field study of techniques, frame

rate and prediction. *Internat. J. Industrial Ergonomics*, **35** : 889-903.

Savant, Vaishali (2012). Ergonomic assessment of washing clothes. M. Sc. Thesis, Mrathwada Krishi Vidyapeeth, Parbhani, M.S. INDIA.

Varghese, M.A., Atreya, N. and Bhatnager, A. (1989). Studies on workload and perceived exertion in household work. Department of Family Resource Management. DRS. (UGC). Department of Post Graduate Studies and Research in Home Science, SNDT Women's University, Bombay, M.S. (INDIA).

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