

Assessment of physical performance in postmenopausal desk based working women: A Cross-Sectional study of middle aged women in India.

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Abstract

Background and objectives: Physical performance is the functioning of upper and lower extremities that is tested by the ability of an individual to perform an activity. Menopause causes a reduction in physical performance by reducing the circulating estrogen levels with implications on age and is further affected in a working women with a desk based job. There is a dearth of literature about this association in low-income countries, where women differ substantially in terms of their reproductive histories with respect to age, race and ethnicity. So, the purpose of this study was to measure the physical performance amongst postmenopausal desk based working women and to compare their physical performance at different age groups in women.

Methods: An ethical clearance was obtained. Postmenopausal women of different ages between 45-55 years, who met the inclusion criteria, were tested for their physical performance. Physical performance was measured using short physical performance battery for lower limb and grip strength for upper limb.

Results: Normality of the data was checked using Shapiro Wilk test and was found that the data was not normally distributed. Hence Mann Whitney U Test was done and it was found that the scores in comparison of physical performance between the two groups (45-50 years and 50-55 years) had no significant difference in the left and right grip strength and the total short physical performance battery score ($p= 0.693$, $p= 0.463$ and $p= 0.581$ respectively). On conclusion the results do not show a decline in physical performance through the ages in desk based working women.

Keywords: Physical examination; Postmenopausal; Sedentary lifestyle; Muscle strength dynamometer.

Introduction

Menopause is a phase characterized by the cessation of the fertile period of a women’s life. It is typically seen in women in their midlife, during their late 40’s and early 50’s with an expected age range between 42-58 years. The average menopausal age of an Indian woman is 45 years.¹

Menopause represents a biological milestone in the female lifespan, signalling the transition phase from a reproductive to a non-reproductive phase that is primarily related to decreases in estradiol levels and symptoms from hormonal changes in this period.² Muscle mass in women tends to gradually reduce after the third decade of age, and displays an accelerated decline after the fifth decade, which is the average period of the occurrence of menopause.³ In addition to loss in muscle mass, a significant loss in muscular strength occurs during the menopausal period that reflects negatively on the functional capacity of these women.⁴

Muscle strength plays a widely recognized role in terms of functional status of the women. It begins to decline during the postmenopausal years and this phenomenon seems to be because of reduction in levels of estrogen. Acceleration in the loss of muscle mass and strength have been observed in women during postmenopausal years. The sudden decline in muscle performance coincides with the menopause because muscle mass and strength exert an impact on bone strength. Good muscle strength can prevent fragility fractures and lessen the burden of osteoporosis in postmenopausal women.⁵ In fact, it has been proposed that, in women, an accelerated loss of muscle mass and strength occurs at an earlier age than in men, around the time of menopause. A cross-sectional study showed a decline of 0.6 % per year of muscle mass after menopause.⁶

Clinically, the hormonal changes which are typical of this phase relate to the changes in the health status of women, such as negative implications on quality of life, emotional liability, interference in mood and sleep, and an increased risk of depression and cognitive difficulties. Together with these changes, some menopausal symptoms are related to lower physical activity levels, which could contribute to the worsen the physical

performance levels which is found among middle aged women.⁷

Menopause is associated with significant reductions in circulating estrogen levels in females. It plays an important role in the maintenance of many tissues and organs function including skeletal muscles, nerves and neural tissues in females.⁸ Estrogen receptors have also been found to exist in skeletal muscle. Deficiency in hormonal level affects the skeletal muscle function and cause decline in activities of daily living.⁹ In particular, a number of studies have suggested that estrogen play an important role in maintaining muscle strength, enhancing muscle repair and maintaining neurological function in females. Hence the postmenopausal reduction in circulating estrogen levels may have implications for age related decline in muscle strength and function, mobility, adaptations to training, tendency for falls and balance control. These changes may have profound implications for the long-term health, independence and quality of life for women.⁸

Physical performance is defined as the functioning of lower and upper extremities which can be tested by an individual's ability to perform an action or an activity, such as rising from the chair or walking. These tests are integrated markers of aging, influenced by many physiological and clinical characteristics, as well as the social environment.³

The difference in the physical performance can be analyzed clinically by hand grip strength, flexibility and balance. Grip Strength (GS) is an excellent outcome predictor of functionality, nutritional status, and mortality in elderly people.¹² It is related to upper and lower limb muscular strength so that it is considered an alternate measure of overall muscular strength. There is a role of hormonal component in the regulation of force production which has been indicated for hand muscles.

GS is a valid and most feasible bed side method, which makes it attractive and the most frequently used tool for clinical purpose.¹³

Short Physical Performance Battery (SPPB) and gait speed have good measurement properties with regard to the assessment of physical performance. The walking speed, chair rises, and standing balance, which are the components of SPPB, were all associated with mortality. Those studies add to the clinical importance of the frequently used physical performance tools, namely, gait speed and the SPPB.¹⁴

The Menopause Rating Scale (MRS) is a well-accepted instrument to measure the severity of menopausal symptoms. The MRS can be recommended for the clinical practice as a reliable scale both for the measurement and long-term surveillance of menopausal complaint dynamics.¹⁵

The 2011 Stages of Reproductive Aging Workshop+ 10 (STRAW) reviewed advances in understanding of the critical changes in hypothalamic-pituitary-ovarian function that occur before and after the final menstrual period. It provides a more comprehensive basis for assessing reproductive aging in research and clinical contexts.¹⁶

Muscular strength, flexibility, and balance are the key components of physical performance. Many literatures highlighted that an ability to perform a physical task at a desired level is decreased in postmenopausal women. Poor physical performance predicts frailty, disability and loss of independence among elderly.¹⁰ Physical Performance is lower in women compared to men and it is further decreased with age in women compared to men. It suggests that gender specific factors across life may influence maximum level of physical performance achieved and performance rate declines with age. Hence, there is a growing interest in studying the effects of the

deficit in estrogen in postmenopausal women's physical health and function. Maintaining good physical function with age is a vital component of independence in later stages of life, as poor physical functioning is associated with institutionalization, hospitalization, and mortality.⁶

There is a high prevalence of sedentary lifestyle among middle aged women working or non working with an increase in menopausal symptoms.¹⁹ An existing relationship is seen between sedentary behaviour and increased incidence of cardiovascular diseases and reduced quality of life in postmenopausal women.²⁰ The workers particularly in desk-based occupations are considered a key target group to showcase sedentary behaviour²¹. Hu et al. estimated that each 2-hour increase in occupational sitting time was associated with a 5–7% increase in risk for obesity and Type 2 diabetes.

Many women experience limitations in physical function during postmenopausal periods. Whether these limitations represent a decline in physical function due to aging, changes in hormonal status associated with menopause, or other factors are still controversial.¹⁸

Most of the studies about the association of physical performance on menopausal status in postmenopausal desk based working women were carried out in high-income countries and there is a dearth of literature found about this association in low-income countries where women differ substantially in terms of life course and reproductive histories with respect to age, race and ethnicity.¹⁷

So the purpose of this study is to measure the physical performance amongst postmenopausal desk based working women with a natural history of menopause.

Materials And Methods

Study Design: Cross-sectional Study.

Participants: General Population.

Source of participants: Physiotherapy outpatient department of Ramaiah Medical College and Hospitals, Government School, Banks, Offices.

Sample Size: 220 (Table 1)

Sampling Design: Convenience Sampling.

Material used: Handheld dynamometer (HHD)

Measuring tape

Stopwatch (Fig 1)

Scales (Menopausal Rating scale and Short Physical Performance Battery).

Table 1: Sample size calculation.

Mean	56
S. D	8.9
Frequency	15% ± 5

Based on the study conducted by Ramesh Narula, Mujtaba Tauseef et al the co-relation of postmenopausal women was found with a mean of 56 and SD of 8.9.²¹ Assuming a population size of infinity with a normal distribution and a hypothesized frequency of 15% ± 5 with a confidence limit of ± 5%. Random sample assumed is 197. A total number of 220 samples was taken considering dropouts (Table 1).

Inclusion criteria

- Postmenopausal Women.
- Age group: Postmenopausal women aged between 45-55 years.
- Women with desk based working job (>= 6hrs of sitting).

Exclusion criteria

- Women with Neurological Impairments.
- Middle aged Women undergoing vigorous physical activity training.
- Women with painful conditions, such as muscle and

joint pain that might compromise the physical performance measurement.

- Women underwent hysterectomy.

Procedure

An ethical clearance has been obtained from the ethical committee of Ramaiah Medical College and Hospitals. Purpose of the study was explained and informed consent was obtained from the subject (Annexure1). Women aged between 45-55 years with a desk based working job (>= 6 hrs of sitting in a day) were classified into the postmenopausal category by using Menopausal rating scale and Stages of Reproductive Ageing Workshop Classification (STRAW) (Annexure 2).

Women of different ages between 45-55 years who met the inclusion and exclusion criteria were tested for physical performance using the Short physical performance battery (SPPB) (Annexure 3).

GS was measured using the handheld dynamometer to measure the physical performance of upper limb (Fig 2). SPPB measurement has been done using three tests: Balance testing (Fig 3 a - 3 c), Chair stand test (Fig 4 and 4 b) and Gait speed test (Fig 5). The individual and total scores of these tests are taken to measure the lower limb physical performance in middle aged post-menopausal women. Participants were seated, with the elbow against the side of the body and the lower arm at a right angle to the body. For GS, the hand was parallel to the body and the wrist was bent slightly backward. Participants performed three grip tests with each hand.

The value of physical performance was estimated in middle aged postmenopausal women with a desk based working job at two age groups, of women in late 40's, with women aged between 45-50 and of women in early 50's, with women aged between 50-55 years.



Figure 1



Fig 2: Evaluation of GS with a HHD.



Fig 3 (a): Side-by-side stand.



Fig 3 (b): Semi-tandem



Fig 3 (c): Tandem stand.

Fig. 3 (a-c): Measurement of balance components in SPPB



Fig 4(a): Position for chair stand test.



Fig 4(b): Evaluation of single and repeated chair stand test.



Fig 5: Measurement of gait speed with a 3 meter walkway.

Statistical Analysis

The normality of the data was confirmed using Shapiro Wilk Test and non-normal distribution of data was observed (Table 2). Descriptive statistics of the independent variable (Age) and the dependent variables (Left and right GS, Total SPPB score) was done to find out the 25th and 75th percentiles along with Inter Quartile Range (IQR).

A Mann Whitney U test was run to compare the physical

performance in two groups, women aged between 45-50 and women aged between 51-55. The interaction was checked between one independent variable (Age) and three dependent variable (Left and right GS, Total SPPB score). Statistical software SPSS v16 was used for analysis and Microsoft Word and Excel were used to generate tables and graphs.

Table 2: Normality test

Shapiro Wilk test was run to see the distribution of data.

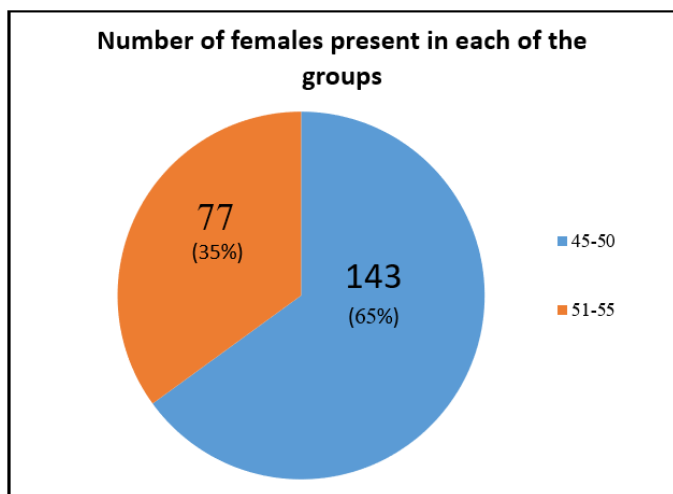
Age	0.00
Grip Strength Average Left	0.82
Grip Strength Average Right	0.00
SPPB	0.00

Non-Normal Distribution was observed.

Results

Descriptive Results

Fig 6: Number of females present in each of the ages. Group 1 (45 - 50) and Group 2 (51-55).



This pie chart shows that 65% of females fall in the age group of 45-50 years and 35% of them fall in the age group of 51-55 years.

Table 2: Descriptive statistics table of the independent variable (Age) and dependent variable (Left GS, right GS and total SPPB score)

Variable	Mean±SD	Median	25th	75th	IQR
Age (Years)	49.4±3.04	49.00	47.00	52.00	5.00
Left GS (Kg's)	15.6±2.2	15.87	14.23	15.87	2.98
Right GS (Kg's)	16.2±2.5	16.33	14.68	16.33	3.01
Total SPPB score (0-14)	8.47±1.36	9.00	8.00	9.00	1.00

Mean age calculated was found out to be 49.4±3.04 years. The minimum age of the participants was 45 and maximum was 55 years. Median of the age was 49.00 with an Inter Quartile Range (IQR) of 5.00.

Likewise, mean of the Left GS was 15.6±2.2 and that of the Right GS was 16.2±2.5. The median of Left GS was calculated to be 15.87 with an IQR of 2.98 and the median of Right GS was 16.33 with an IQR of 3.01. The mean of total SPPB score was calculated to be 8.47±1.36 with median of 9.00 and IQR of 1.00 (Table 2).

Comparison of Physical Performance In Postmenopausal Desk Based Working Women

To know the difference in physical performance between the two groups a Mann Whitney U test was run and the test showed no significant intergroup difference in the left GS, right GS and the total SPPB score (Table 3). The p value of left GS being 0.693, and right GS was found to be 0.463 and that of the total SPPB score was 0.581. All of which had a significance value of p>0.05.

Table 3: Mann Whitney U test done for intergroup comparison, group 1 (45-50) and group 2 (51-55) of physical performance in postmenopausal desk based working women.

Variable	Mann Whitney U	Z-Score	Significance (P value)
Left GS (Kg's)	5.328	-.394	0.693
Right GS (Kg's)	5.175	-.734	0.463
Total SPPB score (0-14)	5.263	-.552	0.581

Discussion

According to the results, the evidence that suggest age related decline in physical performance in postmenopausal women has not been found to have a statistically significant difference, since the grip strength values and SPPB scores of the women aged between 45-55 years remain the same.

Compared to the results of the previous studies that were conducted on physical performance using objective assessments among women in accordance with the postmenopausal status, this study presents some diverging findings. Da Câmara et al assessed the association between menopausal status and physical performance in middle aged women, using the hand grip strength and SPPB and had concluded a positive decline in physical performance at different stages of menopause in the women.¹ This study didn't take the lifestyle of the middle aged women into consideration or the sedentary or active status of the women, which could have reduced the power of analysis.

In contrast to the results in our study, the study by Cooper et al found that postmenopausal women did have weaker grip strength, but this difference was not statistically significant.¹⁰ However, the results from the study by Cheng et al found that muscle strength and balance ability were poorer in postmenopausal women. Their sample was composed of women living in a location where most people were engaged in farming activities or small businesses and had low education where as in our study the population included working women with a sedentary lifestyle. Also, the results of the

SWAN longitudinal study indicated that transition through menopause is associated with a decline in pinch strength.⁴ The results of which do not coincide in the intergroup different of physical performance in our study. Interestingly, although GS and chair stands were significantly associated with menopausal status, only GS remained significant after adjustment. These results suggest that the relation between menopause and physical performance occurs through the musculoskeletal system rather than other body systems.¹⁰

The chair stand test is considered an indirect measurement of lower limbs strength, but as is the case for the gait speed test, the integrity of the cardiovascular, respiratory and vestibular systems is also important to appropriately perform these two tasks and menopause may not exert a strong influence on these systems.

The relation between grip strength and menopause could be explained by the hypothesis that menopause transition and the subsequent decline in estrogen may play a role in muscle mass and strength loss.

On analyzing the results (Table 3) it is observed that there was no difference found in GS and SPPB between the two groups. As compared to the previous studies that have already reported positive relationships between estrogen levels and muscle mass and muscle strength. This attributes to the fact that in the present study only postmenopausal women included and the musculoskeletal changes have already taken place. Also the short age span could be another reason for no difference in physical performance in the two groups. These factors are more common among people living in lower income settings and may explain why changes during menopause are significant in our sample and the Taiwanese study, but non-significant in the British studies. This is in agreement with the overall lower

means of grip strength observed in this sample compared with the UK study of women around menopause.

It is possible that gait speed variance in the examined age group is not large enough to detect small changes with a relatively small sample. In older populations, inability or slowness to rise from a chair appears earlier than slowness in regular walking. Thus, it is not surprising to observe that changes in chair stand times are more variable than changes in gait speed around menopause.

In our study although we had adjusted the results for age, some residual confounding factor are possible to exist and this could be one reason for there being no difference in physical performance of woman between the ages of 45-55 years. A homogenous group of woman having similar working conditions and environment were included in the study. The age of the woman in the study spanned only between 45-55 years, the smaller age distribution of only 10 years could be one of causes for there being no difference in physical performance between the two groups.

Previous studies have reported associations between socioeconomic position during life course and health in adulthood with consistent evidence that the socioeconomically disadvantaged have poorer physical function than the more advantaged.^{10,4} Disability in older ages may begin early in midlife, especially for women with low socioeconomic position. Social inequalities are still strong in southern India, and factors such as personal health behaviour, health care access, environmental health exposures and psychosocial stressors may have affected these women across life. According to the life course epidemiology framework, working women may reach menopause with a poor physiologic reserve and their losses on muscle performance during menopause would be relatively larger compared to a non-working woman.

Strengths and Limitations

Objective and validated measures of physical performance were used in study.

Because of age group of women included in the study spanned between 45 – 55 years, the results of the study cannot be generalised to any other age groups.

Sample size of the study was small.

Future scope of the study

The future study can aim at having a structured assessment of post menopausal working women, taking into consideration the sedentary lifestyle of the women.

As this study was conducted on women aged between 45 to 55 years, which is short age span, the future studies can aim on exploring larger age groups.

Conclusion

There was no reduction in the physical performance in postmenopausal desk based working women that was observed in the women aged between 45-55 years in southern India.

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