

Correlation Between Cognition and Dual Tasking Activities in Postmenopausal Women Using Montreal Cognitive Assessment Scale & Timed Up and Go Cognitive Test

An observational study

¹Priyanka Shivkumar Pawar, ²Dr. Bhagyashri Badve

¹Intern, ²Assistant Professor
Community Physiotherapy Department
LSFPEF's College of Physiotherapy
Nigdi, Pune, India.

Abstract

Background - Menopause is one of the most significant events in women life and brings in a no. of physiological changes that affect the life of a women. After the menopause, the brain is deprived of the trophic effect of oestrogen, which may be selective on certain neuronal pathways. This may result in differential cognitive impairment. Daily life consists of numerous situations in which people perform a cognitive and a motor task simultaneously. Simultaneous performance of motor and cognitive tasks [dual tasking] places demand on attentional resources and reflects an increasing cognitive challenge for postmenopausal women and those with cognitive impairment. For this Montreal Cognitive assessment scale was designed to assess and evaluate cognitive status of postmenopausal women. And the TUG Cog test will check their dual task performance.

Methodology - An Observational study was done in which postmenopausal women between the age of 45 to 55 years in and around PCMC, Pune was selected by Convenient sampling as per inclusion criteria. Postmenopausal women who were on hormone replacement therapy, who were having any history of traumatic brain injury, stroke or depression and Postmenopausal women having any walking impairment were excluded. Consent from subjects were taken. The hard copies of MoCA scale were given to the subject and the subject was asked to fill up the form. Also, the hard copies of proforma were filled. Data was collected, a statistical analysis was performed, and results were tabulated.

Result - 100 postmenopausal women with naturally and surgically induced menopause between the ages of 45 to 60 years were included in this observational study. The value of correlation coefficient r is -0.8320 which is calculated from Pearsons's correlation coefficient calculator. The graph depicts a negative correlation which in itself showing a positive outcome of the study.

Conclusion - The study concludes that there is a positive correlation between cognition and dual tasking activities in postmenopausal women suggesting of impact on dual tasking activities with cognitive changes.

Keywords – Menopause, Postmenopausal women, Cognition, Dual tasking activities, Montreal cognitive assessment scale, TUG cognitive test.

INTRODUCTION

Menopause is a permanent cessation of menstruation resulting in the loss of ovarian follicle development^[1]. Menopause is one of the most significant events in women life and brings in a no. of physiological changes that affect the life of a women.^[1] The menopause occurs at some time between the age of 45 and 55 years for most women.^[2] Prior to the actual menopause, when periods are erratic, a woman may be referred to as being premenopausal and following the menopause as postmenopausal.^[2] However, in popular usage the word 'menopause' is synonymous with the phrase 'the change of life' and is a broad concept including the unpleasant symptoms some women experience around this time- The perimenopause.^[2] More correctly, the interrelated anatomical and physiological changes that occur as a woman proceeds from her fertile age to infertile years- Climacteric.^[2]

The menopausal transition is associated with numerous problematic symptoms including weight gain, anxiety, depression, sexual dysfunction, vasomotor irregularities, sleep disturbance, hot flashes and memory loss or cognition impairment.^[2] These changes occur because the ovaries become exhausted of viable follicles; they shrink and fail to produce estrogen.^[2]

Some researchers have suggested that decline in estrogen level may lead to deficits in cognitive ability of postmenopausal women, like Mitchell and Woods reported that 62% of the women in Seattle midlife women health study reported noticeable decline in cognitive performance following menopause.^[3] The most common complaints were difficulty recalling words/no., needing memory aids and forgetting why one was involved in a certain behavior.^[3]

Findings from basic neuroscience research have described mechanisms by which estrogen influences the cholinergic system and increases synaptogenesis in areas of the brain known to subserve memory. Findings from studies on postmenopausal women provide evidence that changes in brain function induced by a decrease in estrogen are manifested in women as hormone-dependent changes in aspects of cognitive functioning.

After the menopause the brain is deprived of the trophic effect of estrogen, which may be selective on certain neuronal pathways. This may result in differential cognitive impairment, with some skills becoming inadequate.

Brain and ovaries are part of the neuroendocrine system, hormone like estrogen is not only involved in reproduction, but also in brain function. Brain is the important target organ for estrogen. In addition to direct effects, estrogen influences brain function through effects on vasculature and the immune system. Many estrogen actions are potentially relevant to cognitive changes occurring after menopause. Estrogen influences several neurotransmitter systems, including acetylcholine, serotonin, noradrenalin and glutamate.

Acetylcholine is important in memory processes. Functional brain image studies demonstrate that estrogen modulates neural activity during performance of cognitive tasks.^[4] In post-menopausal women, the earliest change in the brain appears to be a fall in the amount of glucose used by brain, indicating reduced brain activity. This is due to falling estrogen levels, this hormone being vital for brain glucose metabolism. Hormone therapy can increase estrogen but is contraindicated for many women.^[4]

Symptoms of menopause can persist for up to 10 years, continuing with varying degrees of intensity for several years after menstruation has stopped. Most menopausal symptoms will eventually subside after an average of 7 to 9 years. Therefore, I have chosen this age spectrum in my inclusion criteria.^[5]

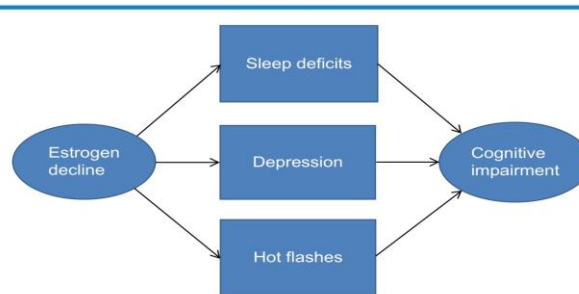


Figure 1. Factors influencing cognitive impairment in peri- and post-menopausal women.

The Montreal Cognitive Assessment (MoCA) Scale was developed as a brief screening test for mild cognitive impairment (MCI).^[6] This scale consists of a 30-point test on a single side A4 and can be administered in 10min. The score of 26 or above is considered as normal. The MoCA assesses several cognitive domains. These are Visuospatial / Executive, Naming, Memory, Attention, Language, Abstraction, Delayed Recall and Orientation (to time and place). The MoCA has been found to be superior to the Mini-Mental State Examination (MMSE) as a global assessment tool, particularly in discerning earlier stages of cognitive decline.^[7]

Dual tasking is the ability to perform two tasks simultaneously in order to compare performance. Dual tasking measures a component of executive function as participants are required to coordinate their attention to both tasks while they are being performed.^[8] Daily life consist of numerous situations in which people perform a cognitive and a motor task simultaneously. Simultaneous performance of motor and cognitive tasks [dual tasking] places demand on attentional resources and reflects an increasing cognitive challenge for postmenopausal women and those with cognitive impairment.^[9]

Physiologically, dual tasking encourages, compels and at times all out forces the brain to process motor tasks in one of four procedural memory centers: basal ganglia, cerebellum, supplementary motor area and premotor cortex.^[10]

Dual task actions challenge cognitive processing. The cognitive dual tasks included: walking while repeating words, walking while counting a 3-digit no. forward, walking while talking, walking while reciting a shopping list and walking while singing.^[9] The overlapping of motor and cognitive functions occurs every day during walking and while multitasking, when walking is accompanied by attention-demanding situations.

AIM

To study the correlation between cognition and dual tasking activities in postmenopausal women using Montreal cognitive assessment scale and timed up and go cognitive test.

OBJECTIVES

- To find out the cognitive status of the postmenopausal women using Montreal cognitive assessment test.
- To find out the impact of cognition changes on dual tasking activities using timed up and go cognitive test.

METHODOLOGY

- Type of study – Observational type of study
- Sample method – Convenient sampling method
- Sample size – 100
- Study area – Pune [Urban Areas]
- Study duration – 6 months

MATERIALS USED

- Montreal cognitive assessment scale hard copy
- Assessment proforma hard copy
- Consent form hard copy

- Pen
- Paper
- Standard height chair with armrests
- Measuring tape
- Stopwatch

INCLUSION CRITERIA

1. Postmenopausal women with age between 45 to 60 years
2. Willing to participate.
3. Women having natural menopause and surgical menopause.
4. The gap between age of menopause and current age should be between 10 years.
5. Literate postmenopausal women.

EXCLUSION CRITERIA

1. Postmenopausal women who are on hormone replacement therapy
2. Postmenopausal women having underlying neuromuscular disorders.
3. Any history of traumatic brain injury, stroke or depression.
4. Postmenopausal women having any walking impairment.

OUTCOME MEASURE

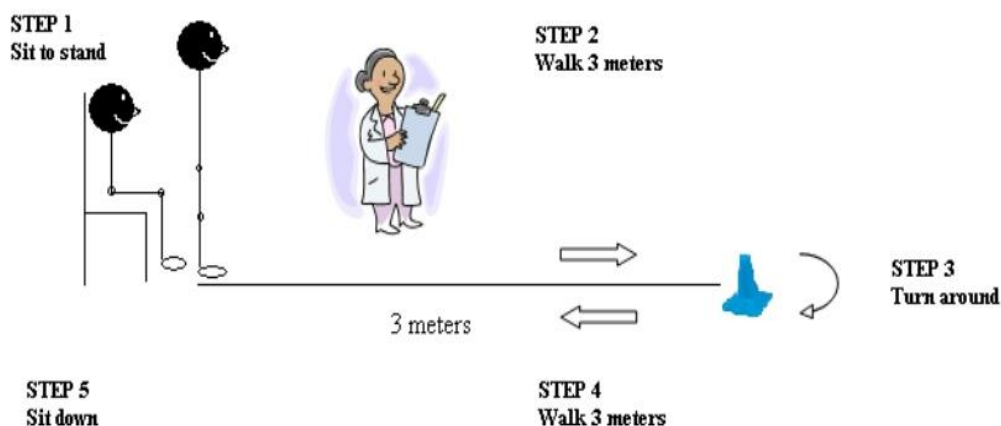
- Montreal cognitive assessment scale [MoCA]^[7]
- Timed Up and Go Cognitive Test [TUG cog]^[8]

PROCEDURE

Ethical approval was taken from the ethical committee. Written consent was taken from the volunteer subjects who fulfilled the inclusion criteria and who volunteered to participate in the study. Explanation about the topic was given and demographic data was taken. Montreal cognitive assessment scale was explained, and the score was noted. Later, Dual task activity was explained as explained below and best score of three readings was taken.

Timed Up and Go Cognitive Test –

The subject was seated comfortably in a firm standard height chair with armrests. The arms and the back were resting against the chair. The subject was then instructed to rise and walk as quickly and safely as possible 3m (10 ft), across a line marked on floor, turn around, walk back, and sat down on chair. The timing with a stopwatch began when the subject is instructing with “go” and ends when the subject returned to the start position seated in the chair.^[8] Subjects was asked to complete the test while counting backward by threes from a randomly selected number between 20 and 100. Healthy adults were able to perform the test in less than 10 seconds. Then the time was calculated using the stopwatch.



STATISTICAL ANALYSIS

A total of 100 postmenopausal participants aged between 45 to 60 years were included in the analysis. Data was collected and analyzed by Pearson's correlation coefficient statistical test. For statistical analysis, MedCalc software is used.

RESULT

	Σ	Mean
TUG COG TEST SCORE (X Variable)	1679	16.79
MOCA SCALE SCORE (Y Variable)	2020	20.2

P Value = 8.152e-27 [P<0.001]
Covariance = -8.2202

The above table shows that sum total of X variable is 1679 and its mean value is 16.79 and sum total of Y variable is 2020 and its mean value is 20.0

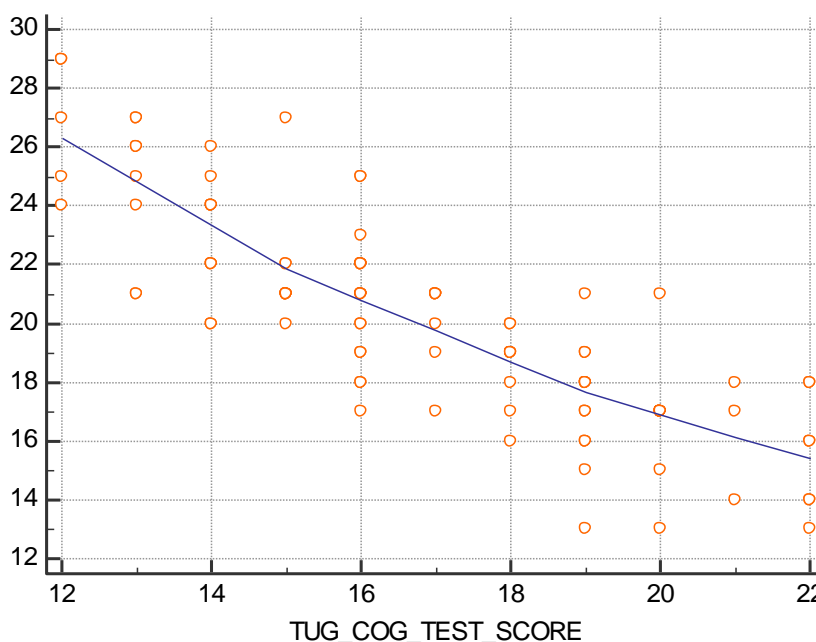
P value from Pearson (R) calculator is P < 0.0001. the result is significant at P < .05

The covariance range is unlimited from negative infinity to positive infinity. For independent variables, the covariance is zero. But here the covariance is -8.2202 i.e., negative

In negative covariance changes goes opposite direction, when one variable increases usually the second variable decreases, and when one variable decreases usually the second variable increases, as shown in below graph.

Sample size	100
Correlation coefficient r	-0.8320
Significance level	P<0.0001
95% Confidence interval for r	-0.8839 to -0.7597

The above table shows the value of correlation coefficient r is -0.8320 which is calculated from Pearsons’s correlation coefficient calculator.



This graph shows that the subjects who scored 22 and above in MOCA scale, completed the TUG COG test in lesser time. But subjects who scored 22 and lower in MOCA scale, needed more time for completing the TUG COG test. So, the result of this study shows that there is a positive correlation between cognition and dual tasking activities. The graph depicts a negative correlation which in itself showing a positive outcome of the study.

DISCUSSION

The aim of this study was to correlate the relationship between cognition and dual tasking activities in postmenopausal women. In this study we found out that changes in cognition is very common in postmenopausal women, the reason behind this is reduction in ovarian function. While conducting this study we observed that memory decline was more complaint by the study participants while doing any activities [E.g., Remembering where she has placed the objects].

The total participants in this study were 100, between the age group of 45 to 60 years. So, out of 100 postmenopausal women 48 women were having Surgical menopause and 52 women were having Natural menopause. The results show that, 67 the postmenopausal participants are suffering from Mild Cognitive Impairment [MCI] and 25 postmenopausal participants are suffering from moderate cognitive impairment according to the MOCA test. Out of 100 postmenopausal women only 08 women's cognition was normal i.e., MOCA Scale score 26 and above. According to the results we got, postmenopausal participants suffering from mild and moderate cognitive impairment were taking more time to complete the TUG Cog Test.

MCI represents a transition between normal cognition and dementia. Also, the MCI is related to a nine-fold increase in the risk of dementia compared to general population.^[10] Another study done in postmenopausal women, concluded that the incidence of MCI was 4.5% in 6376 postmenopausal women evaluated for 5.4 years in women's health initiative memory study [WHIMS].^[10]

According to the data analysis, the subjects who scored 22 and higher in MOCA scale, completed the TUG COG test in faster time. But subjects who scored 22 and lower in MOCA scale, took abnormally more time for completing the TUG COG test. So, the result of this study shows that there is a significant correlation between cognition and dual tasking activities in postmenopausal women. Therefore, this study indicates that decrease or decline in cognition have the adverse effect on dual tasking activities, as cognition decline interferes with performance while doing dual task activity. As proved in this study, the participants who were having MCI by scoring less in MOCA scale, those are taking more time in completing the TUG Cog test.

One study at the University of Rochester in New York looked at 117 middle-aged women and conducted a battery of neuropsychological tests for cognition. Researchers assessed their menopausal symptoms and measured their hormone levels, finding decreases in attention/working memory, verbal learning, verbal memory, and fine motor speed may be most evident in the first year after the final menstrual period. It has been shown that women who had a hysterectomy and their ovaries surgically removed at a younger age were more prone to the effects on the brain of the absence of hormones produced by the ovaries.^[11]

Surgical menopause at any age was associated with faster decline in verbal memory and processing speed, whereas early surgical menopause was further associated with faster global cognitive decline.^[12] Similarly in this study there were 48 postmenopausal women who had surgical menopause, showed decline in cognition by scoring less in MoCA scale. One postmenopausal participant had early surgical menopause at the age of 39 years and scored 22 in MoCA scale showing MIC and scored 16 sec in TUG Cog test.

As proved in this study, the participants who were having MCI scored less in MOCA scale and were taking more time in completing the TUG Cog test. Alternate hypothesis of this study was that there is a positive correlation between cognition & dual tasking activities in postmenopausal women was supported. So, the result of this study shows that there is a significant correlation between cognition and dual tasking activities in postmenopausal women.

CONCLUSION

The study concludes that, there is a positive correlation between cognition and dual tasking activities in postmenopausal women suggesting of impact on dual tasking activities with cognitive changes.

REFERENCES:

1. Nada L , Donna E. Stewart . "Psychological Aspects of Women's Health Care: The Interface Between Psychiatry and Obstetrics and Gynecology ," The American Journal Of Psychiatry, 2006, page no. 570.
2. Polden M, ScienceDirect (Online service). Physiotherapy in obstetrics and gynaecology. Mantle J, Haslam J, Barton S, editors. Edinburgh, Scotland: Butterworth-Heinemann; 2004 Apr. page no. 281
3. Sullivan Mitchell E, Fugate Woods N. Midlife women's attributions about perceived memory changes: observations from the Seattle Midlife Women's Health Study. *Journal of women's health & gender-based medicine*. 2001 May 1;10(4):351-62
4. Henderson VW. Cognitive changes after menopause: influence of oestrogen *Clinical Obsterics and Gynaecology* 2008 Sep;51(3):618-626.
5. Nicosia Dominic. "Stages and duration how long does menopause last?" responsumhealth.com/menopause/stages-and-duration-how-long-does-menopause-last/.
6. Dautzenberg G, Lijmer J, Beekman A. Diagnostic accuracy of the Montreal Cognitive Assessment (MoCA) for cognitive screening in old age psychiatry: Determining cut-off scores in clinical practice. Avoiding spectrum bias caused by healthy controls. *International journal of geriatric psychiatry*. 2020 Mar;35(3):261-9.
7. Hobson J. The Montreal cognitive assessment (MoCA). *Occupational Medicine*. 2015 Dec 1;65(9):764-5.
8. Sarah E, MacPherson. "Definition: Dual-tasking and multitasking. ," *Cortex : A Journal Devoted to the Study of the Nervous System and Behavior*, vol. 106, 2018, page no. 313-314.
9. Ehsani H, Mohler MJ, and et al. The association between cognition and dual-tasking among older adults: the effect of motor function type and cognition task difficulty. *Clin Interv Aging*. 2019 Apr 8;14. Page no. 659-669.
10. Conde DM, Verdade RC, Valadares AL, Mella LF, Pedro AO, Costa-Paiva L. Menopause and cognitive impairment: A narrative review of current knowledge. *World Journal of Psychiatry*. 2021 Aug 8;11(8):412.
11. Weber MT, Rubin LH, Maki PM. Cognition in perimenopause: the effect of transition stage. *Menopause (New York, NY)*. 2013 May;20(5). Schaefer S. "The ecological approach to cognitive-motor dual-tasking: findings on the effects of expertise and age." *Frontiers in Psychology*. 2014 Oct 14; vol.5
12. Georgakis MK, Beskou-Kontou T, Theodoridis I, Skalkidou A, Petridou ET. Surgical menopause in association with cognitive function and risk of dementia: A systematic review and meta-analysis. *Psychoneuroendocrinology*. 2019 Aug; 106:9-19.