**ORIGINAL RESEARCH** 

# Evaluating the relationship between body mass index and cognitive status in postmenopausal females in tertiary healthcare

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## ABSTRACT

**Introduction:** Cognition is a scientific synonym for thinking.Cognitive decline is a recurrent complaint during the menopause transition and among the post-menopausal women. Body Mass Index (BMI) is an important indicator of obesity status and its relation with cognitive performance in post-menopausal women needs exploration. **Aim:** To assess the relation between menopause, cognitive status and BMI. **Materials and Method**: The study was carried out in GMC, Jammu. A total of 100 women with natural menopause attending the Gynae and Obs OPD were included in the study. Mini-Mental Status Examination (MMSE) was employed to assess their cognitive status. BMI of each subject was calculated as per the standard formula. **Results:** Mean MMSE test score of the subjects was 24.63±4.77. Mild Cognitive Impairment (MCI) was seen in 44% while severe cognitive impairment was seen in only 8% of the subjects. 4% of our subjects were underweight, 44% were of normal weight, 38% were overweight and only 14% were obese. Statistically there was no significant impact of BMI on their cognitive status as measured by MMSE scale. **Conclusion:** Mild Cognitive Impairment was present inpostmenopausal women, however, significant association between the BMI and cognitive function was not seen. **Keywords:** Menopause, cognition, BMI, MMSE

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# **INTRODUCTION**

Cognition encompasses many aspects of intellectual functions and processes such as attention, formation of knowledge, memory and working memory, evaluation, reasoning judgement and and computation, problem solving and decision making, comprehension and production of knowledge. Cognitive functioning incorporates mental processes that involve symbolic operations e.g. perception, memory, ability to learn new information, speech, creation of imagery and thinking<sup>1</sup>.Menopause is a major but normal biological event in a woman's life. WHO defined natural menopause as the "permanent cessation of menstruation resulting from the loss of ovarian follicular activity". Postmenopause denotes the years after menopause. Data about relationships between menopause, weight gain and cognitive function is conflicting<sup>2</sup>.

Mini Mental State Examination (MMSE) was originally introduced by Folstein*et al.* in 1975<sup>3</sup>. It is a simple pen-and-paper test used to screen for cognitive impairment, to estimate the severity of cognitive impairment at a given point of time, to follow the course of changes in cognition in an individual over time and to document an individual's response to the treatment<sup>4</sup>.MMSE is validated test, its scores highly correlated with those from other tests of cognitive function<sup>5</sup>.

## MATERIALS AND METHOD

This studycovering a total of 100 post-menopausal women, was carried out over a span of one year in the Department of Physiology, Government Medical College, Jammu. The subjects were from those attending OPD of the Department of Obstetrics and Gynaecology, SMGS Hospital and Super-Speciality Hospital, Government Medical College, Jammu.

Due sanction for this project was obtained from the Institutional Ethics Committee vide their No. IEC/GMC/2021/687.

The purpose and methodology were explained to the subjects. Written consent was obtained from those who volunteered to participate. The eligible women were interviewed regarding their personal history and relevant physical examination was carried out.

## Inclusion criteria

- 1. Healthy postmenopausal women (12 consecutive months of amenorrhea).
- 2. Minimum school education of 8th grade

Exclusion criteria: Subjects were excluded if they:

- 1. were more than 55 years in age.
- 2. gave history of receiving prescription tranquilizers or antipsychotics.
- 3. weretaking dietary supplements.
- 4. had history of chronic diseases related to liver and kidney.
- 5. weresuffering from obvious psychiatric disorders.
- 6. were smokers or consumed alcohol.
- 7. on HRT or surgical menopause.
- 8. did not cooperate or refused to give consent.

#### Anthropometric parameters

Height: It was measured to the nearest cm using a vertical measuring rod.

Body weight: Digital weighing scale (BPL Medical Technologies PWS-01 Personal Weighing Scale, India) was used and weight was recorded to the nearest kilogram (kg).

BMI: It was calculated as per the standard formula: BMI = Weight (kg)/Height (metres<sup>2</sup>). Subjects were categorised into normal, underweight, overweight and obese as per the WHO classification<sup>6</sup>.

#### **Cognitive status**

**MMSE** was used in the study. It comprises elevenquestions that measure cognitive functions, orientation, registration, attention, calculation, recall and language. In beginning, the subjects were instructed regarding the use of the MMSE test. For each section, the answers were elicited from the subjects and accordingly the score achieved was recorded. A maximum score of 30 points is possible in MMSE test if every answer is correct: Orientation-10 points, registration-3 points, attention and calculation-5 points, recall-3 points, language and praxis- 9 points. Individual test item scores were recorded in the test form.

#### **Statistical Analysis**

The data obtained was compiled in the form of an excel sheet. Statisticalanalysis was performed by using SPSS (version 23). Student t test (unpaired) was used to compare mean data of two groups while across the groups analysis was done using ANOVA. A p-value <0.05 was taken to be significant.

# RESULTS

Mean age of the subjects was  $50.53\pm3.62$  years and majoritybelonged to age group 47-50 years (37; 37%), followed by 51-54 years (24%), more than 55 years (22%) and 43-46 years (17%).

# Table 1: Distribution of BMI among the study subjects

BMI category	Ν	Percent (%)
Underweight (BMI< 18.5 kg/m <sup>2</sup> )	4	4%
Normal (BMI= 18.5 – 24.9 kg/m <sup>2</sup> )	44	44%
Overweight (25.0 – 29.9 kg/m <sup>2</sup> )	38	38%
Obese ( $\geq$ 30kg/m <sup>2</sup> )	14	14%
Total	100	100%

BMI was  $25.51\pm3.81$ . While a majority (44%) of study population had normal BMI, the obese postmenopausal women accounted for just 14% of the study population.

#### Table 2: Distribution of cognitive status of the study subjects

MMSE group (score)	N	Percentage
Severe Cognitive Impairment (0-17)	8	8%
Mild Cognitive Impairment (18-23)	44	44%
No Cognitive Impairment (24-30)	48	48%
Total	100	100.0%

# Table 3: Comparison of MMSE scores among different age groups

Age group (years)	Ν	MMSE scores (Mean <u>+</u> SD)	<i>p</i> -value
43-46	17	26.65 <u>+</u> 4.92	0.015*
47-50	37	25.65 <u>+</u> 3.95	

51-54	24	22.61 <u>+</u> 4.85
≥55	22	23.45 <u>+</u> 5.01

\*statistically significant

Table 4: Distribution of MI	<b>ISE scores in</b>	different BMI	categories
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BMI category	Ν	Mean ± SD	<i>p</i> -value
Underweight	4	25.25 <u>+</u> 6.29	
Normal weight	44	24.63 <u>+</u> 4.98	0.851
Overweight	38	25.92 <u>+</u> 4.82	
Obese	14	23.64 <u>+</u> 3.79	

Mean MMSE score of our subjects was  $24.63 \pm 4.77$ . Statistically non-significant difference was found between BMI and the MMSE scores of the study subjects (**Table 4**).

## DISCUSSION

The present work was carried out to assess the effect of menopause and BMI on cognitive function. 100 females with natural menopause (12 consecutive months of amenorrhea) were included in the study.

Menopause is associated with many symptoms that adversely affect the quality of life. They include hot flushes, mood swings, depression, insomnia, dry vagina, mental confusion, incontinence, osteoporosis, and vasomotor symptoms<sup>7</sup>.

The MMSE is a screening tool used to evaluate cognitive deficits. 5 to 10 minutes are required to administer the test. Standard MMSE is scored on a scale of 0-30 whereinsevere cognitive impairment score is 0-17, Mild cognitive impairment: 18-23 and, no cognitive impairment: 24-30. Mean MMSE score in our study was  $24.63 \pm 4.77$ ; similar to that reported by Fernandes R de C et al<sup>8</sup>.

Mild cognitive impairment (MCI) was seen in 44% while severe cognitive impairment was seen in only 8% of the subjects. The former includes individuals with objective cognitive deficits in neuropsychological tests (usually defined as a performance of 1.5 standard deviations below the mean established for age and education) and preserved functional independence for activities of daily life<sup>9</sup>. MCI is a prodromal stage of dementia. Therefore, it is important to monitor such cases.

Mean age of our cohort of the postmenopausal women was  $50.53\pm3.62$  years which matches the observations of Yahya Set al and Neslihan CS etal<sup>10,11</sup>.In contrast Ahuja M have reported a lower age of menopause ( $45.59\pm5.59$  years) in their subjects<sup>12</sup>.Although menopause is a universal phenomenon among women, the timing of the onset and the duration of the menopausal transition and the timing of the final menstrual period are not<sup>13</sup>.

Menopause, a normal physiologic process in aging women, typically occurs between 49 and 52 years of  $age^{14}$ . The mean menopausal age of the Indian women has been reported to be  $45.59 \pm 5.59$  years which is much less than their Western counterparts<sup>12</sup>. The transition from regular ovulatory cycles to the menopausal state is not instantaneous. Rather, there occur a series of hormonal and clinical alterations that reflect declining ovarian function.

Mean BMI of the subjects participating in the present study was  $25.51\pm3.81$  kg/m<sup>2</sup>. Normal BMI was the finding in 44% subjects. Underweight were 4%, overweight 38% and percentage of obese subjects was 14%.

In our study, BMI did not have any significant association with cognitive performance, in healthy, post-menopausal women. Kim S et al (2016) used the Korean version of the Mini-mental state examination (K-MMSE) to investigate the relationship between obesity and cognitive impairment. Interestingly, their results show a slower decline of cognitive function in obese, mid- and old-age women<sup>15</sup>. According to Driscoll et al. (2011), postmenopausal women who maintained their weight or gained weight performed comparably on cognitive tests, but the women who lost weight during the study period had a poorer performance, compared to either of the other two groups<sup>16</sup>.

It is known that estrogen alters brain activation patterns in postmenopausal women in specific brain regions viz. inferior parietal lobule and superior frontal gyrus during performance of memory functions<sup>17</sup>.Approximately 60% of middleaged women reported cognitive changes in the Seattle Midlife Womens' Health Study<sup>18</sup>, and 42% of the postmenopausal women reported a negative change in cognition in SWAN (Study of Women Across the Nation)<sup>19</sup>.Estrogen plays an essential role in the neurobiology of cognitive processing and neuronal function, and the menopausal transition is associated with subtle cognitive decline<sup>20</sup>. This can be attributed to the fact that estrogen influences neural function and neurological disease directly, through effects on neurons and glia, and indirectly through effects on oxidative stress, inflammation, cerebral vasculature and the immune system<sup>21</sup>. Subjective cognitive performance complaints with normal on neuropsychological tests are related to a two-fold increase in the risk of dementia compared to the general population<sup>22</sup>.

# Limitations

Comprehensive neuropsychiatric and neuropsychological assessment would be required to confirm the diagnosis of MCI. Body fat distribution was not assessed due to nonavailability of Dual-

energy X-ray absorptiometry (DEXA) or Computed Tomography (CT).

No follow-up was done to assess the pattern of change in cognitive function with BMI over the years.

## CONCLUSION

Among postmenopausal women, varying degrees of cognitive impairment exist. Being at greater risk of developing dementia, the focus in future has to be on development of preventive strategies that can reduce the risk of dementia in these women.

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