EFFECT OF ABDOMINAL OBESITY AND SERUM LIPID MARKERS ON COGNITIVE FUNCTIONS IN POSTMENOPAUSAL INDIAN WOMEN

Nayanatara AK, Sheila R Pai*, Sneha B Shetty, Bhagyalakshmi K, Anupama N, Rekha D Kini, Vinodini NA, Ramesh Bhat, Pratik Kumar Chatterjee

1Departments of Physiology, Center for Basic Sciences, Kasturba Medical College, Bejai, Mangalore, Manipal University, Karnataka, India.

ABSTRACT
Dementia is a major public health concern in aging populations. Cognitive performance is predictive of subsequent dementia. Declining cognitive functions is one of the hallmark changes that occur during and after menopause. Physical effects of obesity on health are well-documented. Variations in the serum lipid profiles have been implicated in various diseased conditions. The assessment of risk factors might have a protective effect on cognitive performance in menopausal women. The main objective of the present study was to elucidate the effect of abdominal obesity and serum lipid profile on cognitive function parameters in menopausal women. The present study included a total of 60 healthy women (45-65 years). Participants were categorized into control group and overweight/obese groups based on the body mass index (control group, BMI of 18.5-24.9; overweight/obese group, BMI ≥ 25.0; n=30 in each group). Waist circumference, waist hip ratio and serum lipid profile was analyzed. Cognitive function was evaluated by ADDENBROOKE’S COGNITIVE EXAMINATION-ACE-R. Waist circumference, waist hip ratio, serum cholesterol, serum triglyceride and serum LDL showed a significant increase (P<0.001) in the overweight/obese group when compared to the control group. Further, cognitive parameters such as Mini Mental Scale examination (MMS-E), Orientation, Attention, Memory and Visuo Spatial ability showed a significant decrease (P<0.001) in the overweight/obese group. Verbal fluency and language did not show any significant changes in between the control group and...
the overweight/obese group. In conclusion the present study suggests that the lipid markers and the increased abdominal obesity might be the independent risk factor for cognitive impairment in post-menopausal women as the age advances.

**Key words:** Abdominal obesity, Post menopause, cognitive functions, Serum lipid profile.

**INTRODUCTION:** Obesity is the most prevalent nutritional disorder in which there is excessive storage of energy in the form of fat as per height, weight, race and gender. In both developed and developing countries obesity is prevalent among all age groups and is on the rise among adults especially the women\(^1\). Menopause is one of the critical periods of a women’s life during which weight gain and onset or worsening of obesity are favored. At this period the prevalence of obesity is the highest\(^2\). The transition from pre- to post-menopause is often associated with the emergence of metabolic syndrome features. These risk factors may be due to direct result of ovarian failure or an indirect result of the metabolic consequences of central fat redistribution with estrogen deficiency\(^3,4\). Studies also show the In deregulation of energy metabolism in postmenopausal age\(^5, 6\). Intra-abdominal and abdominal subcutaneous fat has more significance than subcutaneous fat in the buttocks and lower extremities\(^5, 6\). A number of changes that occur in the lipid profile after menopause are associated with increased risk factors\(^7,8\). Physical effects of obesity on health are well-documented and have been consistently found to be negative and large\(^9, 10\).

Cognitive dysfunction has increased in menopausal women which indicate the initiation of dementia. Body mass index have been shown to influence brain development in relationship to early and late measures of cognitive function\(^11, 12\). A strong interaction between brain areas are involved in cognitive, emotional, and metabolic regulatory functions controlling body weight\(^13\). The prevention of cognitive impairment through the identification and management of risk factors is important in woman. As life expectancy increases, women in general experience a longer life after menopause. 60 million women in India are above the age of 55 years. Hence, there is a need to understand the effect of abdominal obesity, serum lipid parameters on cognitive function. The objective of the present study was to elucidate the effect of abdominal obesity and serum lipid markers on cognitive functions in postmenopausal Indian women. The cognitive function parameters included in the present study are Mini Mental Scale examination (MMS-E), Orientation, Attention, Memory, Visuospatial ability, Verbal Fluency and Language in post-menopausal age women.
MATERIAL AND METHOD
The postmenopausal state in the present study was defined as age above 45 years and the absence of a menstrual cycle for the last 12 months. This cross sectional study included a total of 60 post-menopausal women (45-65 years). During orientation each subject was briefly explained the purpose, procedure and confidentiality prior to their written informed consent. Participants were categorized into control group and overweight/obese groups based on the body mass index (control group, BMI of 18.5-24.9; overweight/obese group, BMI ≥ 25.0; n=30 in each group) in accordance with World Health Organization Criteria. After detailed enquiry of the medical history of the subjects, those with history of smoking, alcoholism, medical illness were excluded. Subjects on oral contraceptive pill, hormonal replacement therapy, drugs that alter the cardiovascular functions were also excluded from the study. Informed written consent was obtained from all participants, and the experiment protocol was approved by Ethics committee of the college. Cognitive function was evaluated by ADDENBROOKE’S COGNITIVE EXAMINATION-ACE-R. Addenbrooke’s Cognitive Examination (ACE) and its revised version (ACE-R) were developed as a brief test of cognitive functions. This includes the MMSE (Mini mental scale examination), consists of five domains, each representing a specific cognitive function: (1) attention and orientation (18 points), (2) memory (26 points), (3) fluency (14 points), (4) language (26 points), and (5) visuospatial ability (16 points). The total score of ACE-R is 100 points, which includes the MMSE score (30 points). Higher scores indicate better cognitive functioning. Fasting venous samples (10ml) were collected in heparinized bottles. Sample was centrifuged and plasma was separated and stored in plastic tubes at 4°C. Samples were analyzed spectrophotometrically. Total cholesterol (TC) was estimated by CHOD-PAP method. Triglyceride (TG) was estimated by GPO-POD method. High density lipoproteins (HDL) were analyzed by kits (supplied by Roche Diagnostic Gmbh D-68298 Mannheim). The concentration of Very low density lipoprotein cholesterol (VLDL-C) was estimated according to the Fridewald’s equation. According to Fridewald, low density lipoprotein cholesterol (LDL-C) can be calculated as follows: LDL-C = Total cholesterol - (HDL-C) - (VLDL-C). log (TG/HDL-C).

STATISTICAL ANALYSIS
Parameters was analyzed statistically using SPSS (Statistical Package for Social Sciences) version 11.5. “Student t test was done to compare between the control group and overweight/obese group. P- Value< 0.05 was considered as statistically significant.
RESULTS
Waist circumference, waist hip ratio, serum cholesterol, serum triglyceride and serum LDL showed a significant increase (P<0.001) in the overweight/obese group when compared to the control group. Further, cognitive parameters such as Mini Mental Scale examination (MMS-E), Orientation, Attention, Memory and Visuo Spatial ability showed a significant decrease (P<0.001) in the overweight/obese group. Verbal fluency and language did not show any significant changes in between the control group and the overweight/obese group.

Table 1: Comparison of BMI, Waist hip ratio, Waist circumference and serum lipid profile in between the control group and the obese group (n = number of subjects); “Values are expressed in Mean ±SD”

<table>
<thead>
<tr>
<th>Parameters</th>
<th>CONTROL GROUP (n=30)</th>
<th>OVER WEIGHT / OBESE GROUP (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>24.32±2.04</td>
<td>32.50±2.59**</td>
</tr>
<tr>
<td>WAIST HIP RATIO</td>
<td>0.50±1.12</td>
<td>0.89±0.01**</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>64.04±3.30</td>
<td>96.02±1.12*</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>137.10±5.36</td>
<td>246.2±1.01**</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>60.2±2.22</td>
<td>125.8±7.9**</td>
</tr>
<tr>
<td>HDL-C</td>
<td>40.6±1.22</td>
<td>41.2±2.2; NS</td>
</tr>
<tr>
<td>LDL-C</td>
<td>85.2±1.1</td>
<td>147.4±2.7**</td>
</tr>
</tbody>
</table>

P<0.001*** - control group versus overweight/obese group
NS- Non significant

Table 2: Cognitive function analysis in control group versus Overweight/ obese group.
Values are expressed as Mean ± SD. (n= number of subjects in each group)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control group (n=30)</th>
<th>Overweight / Obese group (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMS-E</td>
<td>25.69±0.54</td>
<td>20.2±3.0 *</td>
</tr>
<tr>
<td>Orientation</td>
<td>8.47±0.52</td>
<td>6.22±0.28*</td>
</tr>
<tr>
<td>Attention</td>
<td>7.30±0.72</td>
<td>4.42±0.96 *</td>
</tr>
<tr>
<td>Memory</td>
<td>21.76±1.82</td>
<td>17.60±1.66 *</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>10.90±0.92</td>
<td>9.7±1.7</td>
</tr>
<tr>
<td>Language</td>
<td>21.9±0.92</td>
<td>21.5±0.8</td>
</tr>
<tr>
<td>Visuospatial Ability</td>
<td>12.9±10.7</td>
<td>10.32±2.1*</td>
</tr>
<tr>
<td>ACE-TOTAL</td>
<td>83.3±1.11</td>
<td>70.3±9.51 *</td>
</tr>
</tbody>
</table>

* P<0.05; Control group versus Overweight/Obese group
DISCUSSION

The prevalence of obesity is rising in this modern era. Body composition changes become evident as women transition through menopause. Previous studies show that, central adiposity in postmenopausal women is an independent risk factor for various diseases\textsuperscript{21, 22}. In the present study, post-menopausal obese woman had a significant increase in the waist hip ratio and waist circumference when compared to control group. Literature survey shows that, decrease in resting metabolic rate, decreased physical activity, and an increase in insulin levels due to associated insulin resistance might be the contributing factors\textsuperscript{21}. Further, lack of ovarian hormones, particularly estrogen which plays a significant role in body composition regulation and fat tissue distribution in women might be a potentiating factor\textsuperscript{22}. In premenopausal women the main hormone is estradiol, while the main postmenopausal estrogen is estrone. Following the cessation of hormonal production in the ovaries, they are produced exclusively from suprarenal androstenedione and aromatized to estrone in the process of peripheral extraglandular conversion. This transformation takes place mainly within fatty tissue, which explains the greater adiposity in postmenopausal women. Our study suggest that, post-menopausal obese women are at increased risk and a need for menopausal health promotion is very important.

Obesity alters the lipid profile\textsuperscript{24}. Estrogen plays an important role in lipid metabolism, which directly affects the serum cholesterol and lipoprotein levels\textsuperscript{24}. The increase in the LDL cholesterol level after menopause might be caused by decreased LDL receptor activity. Poor performance on memory tasks is common among obese individuals across the adult life span. Our study suggests that obesity is associated with decreased cognitive function in postmenopausal women. The present findings are consistent with studies demonstrating the decrements in cognitive functions in adults with increased body weight\textsuperscript{21, 25}. Larger body mass requires more blood flow for optimal functioning, the brain is deprived of blood flow that it normally receives under circumstances when the body is not as large. In turn, this lack of essential blood flow could be a contributing factor to poor cognitive performance in individuals with a larger body mass index.

CONCLUSION

Obesity parameters are directly associated with decreased cognitive abilities. Womans should be trained with the proper life style modifications to maintain normal BMI and abdominal obesity during the young and middle ages to prevent complications in the later life. Early
detection of dementia will improve the quality of life by proper medication and lifestyle modification.

REFERENCES


