

## COMPARATIVE EVALUATION OF COGNITIVE FUNCTION AMONG INDIAN OBESE AND NON - OBESE MIDDLE-AGED SUBJECTS

### **Abstract:**

**Background:** Obesity has become one of the common problems encountered by people of the present day. This condition is often accompanied by cardiovascular problems like hypertension, hyperlipidemia, ischemic heart disease. Also, that the relationship between obesity and cognitive impairment plays an important role in the development of neurodegenerative disorders. But reports on the association between obesity and working memory lack scientific evidence. So, the present study planned to assess the influence of obesity on cognitive functions and compare among obese and non - obese individuals

### **Objective:**

This study evaluated the changes in cognitive functions comparative between samples of obese and non-obese individuals from INDIA.

### **Methods:**

Based on the Body Mass Index (BMI), the participants were classified into 2 groups. Cognitive screening was done using MINI MENTAL STATE EXAMINATION and the parameters like level of orientation, registration, recall, language, copy art skills were analyzed and scores were calculated. The data was statistically analyzed using SPSS version 23 and the independent sample t test was used to analyze the differences in cognitive functions.

### **Results:**

The study reported that there was statistically significant decline in language, recall and copy art skills in obese individuals compared to non-obese group.

**Conclusion:**

The study concluded an innovative finding that obesity is associated with impaired cognitive performance pertaining to recall, language and copy art and overall decreased MMSE scores indicating that accelerated cognitive decline and neurodegenerative pathologies such as dementia in later life is influenced by changes in body weight. Interventions that target mid-life obesity may be helpful in reducing the cognitive risks associated with obesity.

**Keywords:** obesity, cognitive loss, risk, innovative finding, MMSE score

**Introduction:**

Obesity is a disease involving an excessive amount of fat in the body. Obesity is a serious community concern in today's global world. This problem progressively affects all kinds of income states, especially the urban population.[1] All over this global world 1.9 billion are overweight in 18 years and 650 million are obese.[2] 41 million under the age of 5 are over-weight and adolescent aged 5 - 19 are overweight globally.[3,4]

When a person's body mass index is 25 or greater then, it leads to obesity. Causes for obesity are genetic, behavioral, metabolic and hormonal influences on body weight. Certain aspects of personality are associated being obese[5,6]. Neuroticism, impulsivity and sensitivity are more common in people who are obese while conscientiousness and self-control are less common in people who are obese. Loneliness is also a risk factor.[7,8] Obesity is also found in hypothyroidism, hypogonadism and Cushing's syndrome which are known as endocrine factors of obesity[9]. Obesity is also common during puberty, pregnancy, menopause, suggesting endocrine glands must be a factor. An injury to the hypothalamus after a head injury may lead to obesity as the hypothalamus cannot regulate the satiety center[10,11]. It is a medical problem that increases risk of serious health problems including

heart disease, strokes, diabetes, certain cancers, sleep apnea.[12]. A period of strenuous growth because of greater amount of activity and the development of physical and cognitive functions requires a balanced nutrition.[13]

A major change in lifestyle of families with eating habits , environment , genetic changes and increasing hours in playing video games , social media and computers has played a vital role in increasing body weight among people[14].Obesity is classified based on the body mass index - NON - OBESE : [ BMI >25] and OBESE : [ BMI >30] (5) . There are 3 types of obesity. BMI is 30.0 to 34.9 in low-risk obesity.[15]BMI is 35.0 to 39.9 in moderate risk obesity[16] . BMI is equal to or greater than 40.0 in high-risk obesity. The best way to treat obesity is to eat a healthy, reduced calorie diet and exercise regularly[17,18].Our team has extensive knowledge and research experience that has translate into high quality publications[19–23]

Obesity is a preventable disease that leads to the cause of death worldwide with increasing rates in adults and children[24,25] . In 2015, 600 million adults (12%) and 100 million children were obese in 195 countries[16,26]. Obesity is one of the more common diseases in women than in men. In 2013 , including the American Medical Association and several medical societies classified obesity as a disease.[27]Obesity is often accompanied by cardiovascular problems like hypertension, hyperlipidemia, ischemic heart disease , but reports on the association between obesity and working memory were not reported and lack scientific evidence[28]. So, the present study planned to assess the influence of obesity on cognitive functions and compare among obese and non - obese individuals[29,30].

### **Materials and methods:**

Normal healthy adults (sample = 20) (sample size is based on the cost, time, or convenience

of collecting the data and this sample size was used to represent the whole population) in the age group of 45 to 55 years of both genders with no history of neurological conditions or Alzheimer's disease were chosen for the study. The method of sampling is random sampling. The participants were categorised into two groups.

Group 1 - obese (BMI - 30 to 39.9)

Group 2 - non-obese (BMI - 18.5 to 24.9).

The cognitive assessment was made using MINI MENTAL STATE EXAMINATION and the parameters like orientation, registration, recall, copy art, language was evaluated, and scores were calculated. calculated scores were tabulated in the excel sheet and analysed. Higher the score of MMSE indicates good level of cognition. Data entered in the SPSS software and the results were analysed using an independent sample test and represented in the bar graphs.

## **Results:**

The present study reported that level of orientation was lower in population of obese than

non - obese. It is statistically non - significant ( $p < 0.05$ ) (Fig 1). Level of registration was lower in population of obese than non - obese. It is statistically non - significant. ( $p < 0.05$ ) (Fig 2). Level of recall was lower in population of obese than non - obese. It is statistically significant. ( $p < 0.05$ )

(Fig 3). Level of language was lower in population of obese than non - obese. It is statistically significant ( $p < 0.05$ ) (Fig 4). Level of copy art was lower in population of obese than non - obese. It is statistically significant. ( $p < 0.05$ ) (Fig 5). The total MMSE scores was significantly lower in obese than non - obese. It is statistically significant. ( $p < 0.05$ ) (Fig 6) (Table 1)

Table 1 represents the scores of Mini mental state examination on obese and non-obese individuals

<b>MMSE</b>	<b>Groups</b>	<b>Mean</b>	<b>P value</b>
Orientation	Obese	10.50 $\pm$ 1.080	P value = 0.54 (p<0.05)
	Non - obese	13.70 $\pm$ 0.949	
Registration	Obese	4.80 $\pm$ 0.789	P value = 0.80 (p>0.05)
	Non - obese	8.50 $\pm$ 0.707	
Recall	Obese	11.50 $\pm$ 1.080	P value = 0.12 (p>0.05)
	Non - obese	14.40 $\pm$ 0.699	
Language	Obese	4.50 $\pm$ 0.850	P value = 0.02 (p<0.05)
	Non - obese	7.80 $\pm$ 0.422	
Copy art	Obese	1.50 $\pm$ 0.527	P value = 0.03 (p<0.05)
	Non - obese	2.80 $\pm$ 0.422	

MMSE score	Obese Non - obese	32.80 $\pm$ 2.898 47.20 $\pm$ 1.476	P value = 0.04 (p<0.05)
BMI	Obese Non - obese	35.43 $\pm$ 2.561 22.22 $\pm$ 2.113	P value = 0.03 (p<0.05)

The values are expressed as mean  $\pm$  standard deviation representing the scores of mini mental state examination in obese and non- obese middle-aged subjects

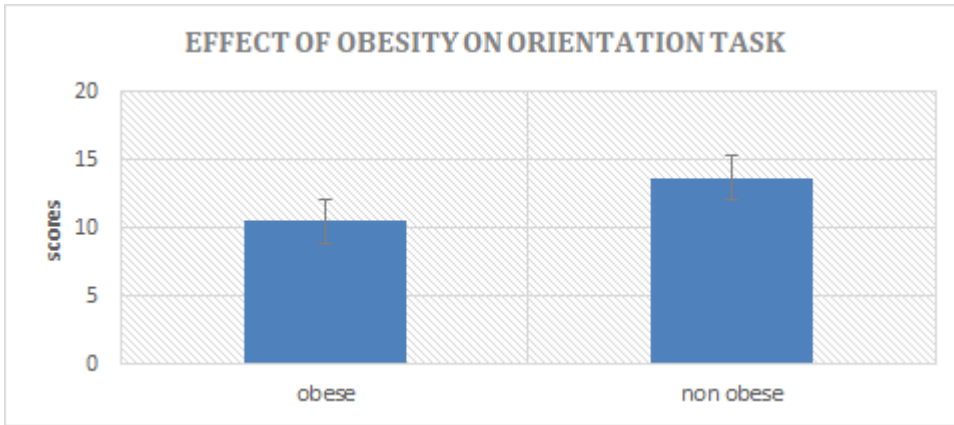


Figure 1. Scores obtained for level of orientation in obese and non obese groups

Figure 1: Bar graph depicts the association between the obese and non-obese. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups. It is observed that there is non-obese subjects had a better level of orientation compared to obese groups but the value was not statistically significant as in independent t test. P value = 0.54 ( $p > 0.05$ )

Figure 2. Scores obtained for the level of registration in obese and non-obese groups



Figure 2: Bar graph depicts the association between the obese and non-obese. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups.

It is observed that there are non-obese subjects had a better level of registration compared to obese groups but the value was not statistically significant as in independent t test. P value = 0.80 ( $p > 0.05$ )

Figure 3. Scores obtained for the recall task in obese and non-obese groups

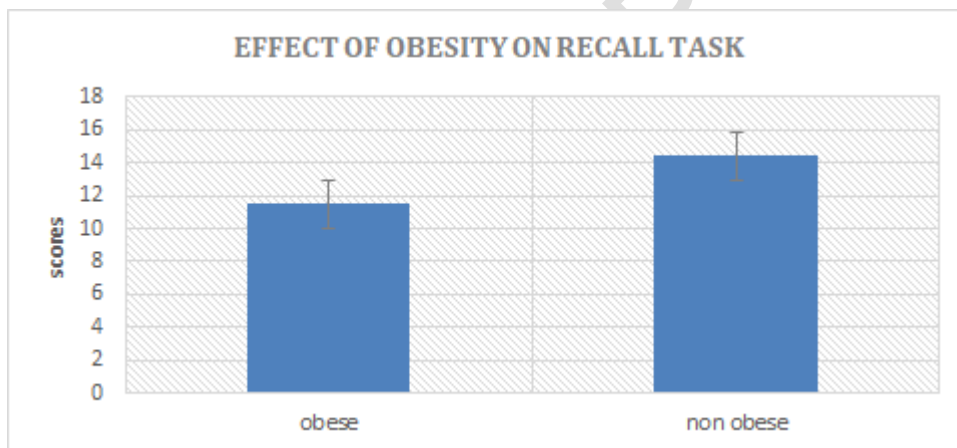


Figure 3: represents the scores obtained for Level of recall in obese and non-obese groups. Bar graph depicts the association between the obese and non-obese. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups. It is observed that there is non-obese subjects had a better level of recall compared to obese groups but the value was not statistically significant as in independent t test. P value = 0.12( $p > 0.05$ )

Figure 4. Scores obtained for the language task in obese and non-obese groups



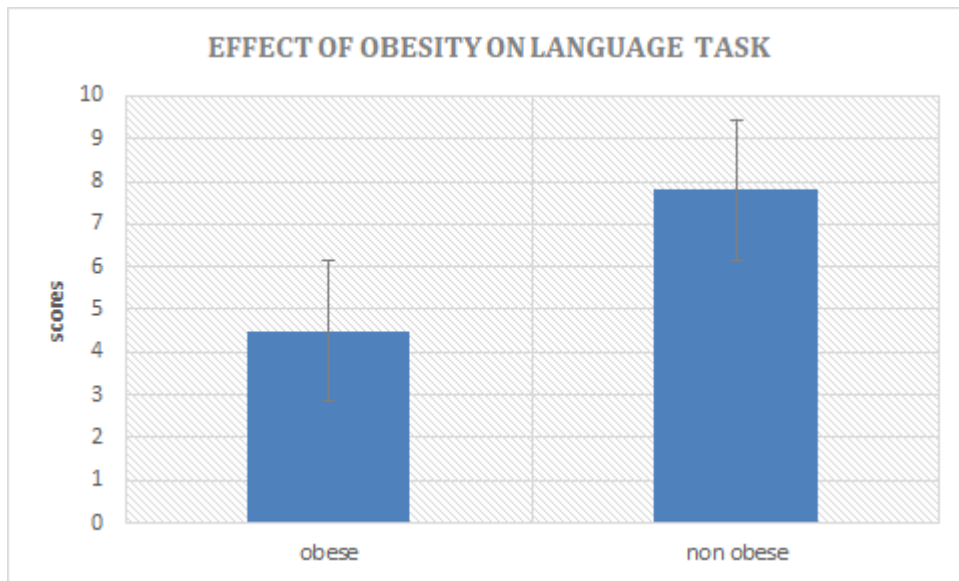


Figure 4: represents the scores obtained for Level of language in obese and non-obese groups. Bar graph depicts the association between the obese and non-obese. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups. It is observed that there are non-obese subjects had a better level of language compared to obese groups and the value was statistically significant as in independent t test. P value is 0.02 ( $p < 0.05$ )

Figure 5. Scores obtained for the copy art task in obese and non-obese groups

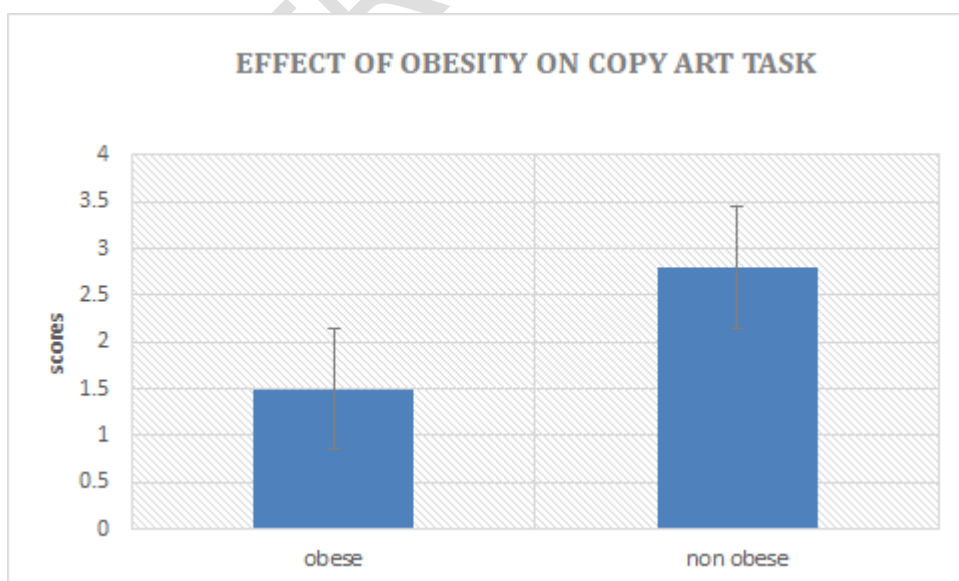


Figure 5: represents the scores obtained for Level of copy art in obese and non-obese groups.

Bar graph depicts the association between the obese and non-obese groups. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups. It is observed that there are non-obese subjects had a better level of copy art compared to obese groups and the value was statistically significant as in independent t test. P value is 0.03 ( $p < 0.05$ )

Figure 6. Scores obtained for the total MMSE in obese and non-obese groups

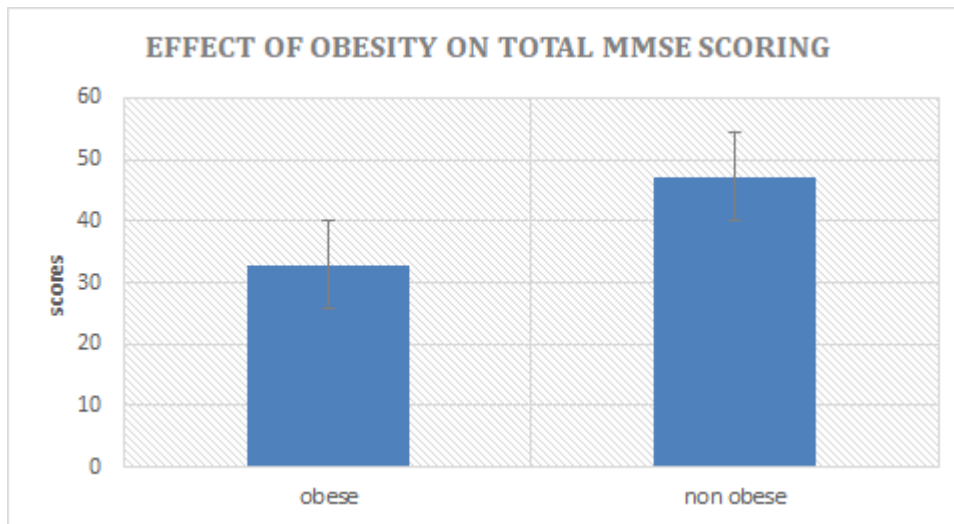


Figure 6 represents the scores obtained for total MMSE scoring in obese and non-obese groups. Bar graph depicts the association between the obese and non-obese. X axis represents obese and non - obese groups and Y axis represents scores obtained by obese and non - obese groups. It is observed that non-obese subjects had a better level of MMSE scoring compared to obese groups and the value was statistically significant as in independent t test. P value is 0.04( $p < 0.05$ )

### Discussion:

Ageing is a process accompanied by significant changes in cognitive decline and is the main risk factor for the development of neurodegenerative disorders, including Alzheimer's disease.[31,32]

Previous research reports also showed that early to mid-adulthood obesity might have an

immediate detrimental negative impact on cognitive functioning.[33,34]

In the present study, Obesity is associated with impaired cognitive performance pertaining to recall, language and copy art and overall decreased MMSE scores indicating that accelerated cognitive decline and neurodegenerative pathologies such as dementia in later life is influenced by changes in body weight.[18,35]

Reports suggested a negative association between anthropometric measures of obesity like BMI with a number of cognitive domains.[27,35] Obesity is related to impaired performance on tasks that relate to episodic memory, Verbal learning, followed by delayed recall and recognition of words.[36][37]

Few studies also reported that Impaired working memory performance has been exhibited in overweight and obese young adults compared with healthy weight controls.[38]

Certain studies also stated that decrease in executive functions of concept formation and set shifting was more predominant when measured using Wisconsin card sorting test in obese subjects relative to normal weight subjects.[39][40]/ Research reports suggest that Obesity has been associated with increase in brain age, particularly in respect to cerebral white matter atrophy[41]. This area has shown more atrophy in middle-age[42](38)

#### **Limitations of the study:**

The study population was confined only to a small group. If more sample size is added the results would have been statistically significant.

#### **Conclusion:**

Our study concluded that obese individuals showed a moderate decline in cognitive functions, and based on that we emphasize the importance of proper and personalized interventions that are targeting mid-life obesity may be helpful in reducing the risk for these conditions by focusing on reducing the level of obesity through a healthy lifestyle.

Ethical Approvals: we conducted our research after obtaining proper IEC approval.

## Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

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