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Body Mass Index and Cognition: A Scoping Review

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Abstract: Body mass index (BMI) is a measure of body fat calculated by dividing weight in kilograms by height in meters squared. Cognition refers to various intellectual functions like memory, reasoning, and problem-solving. The connection between BMI and cognition is complex. Some studies suggest that having a higher BMI is linked to cognitive decline and an increased risk of dementia, while others have found no clear correlation or even suggest that being overweight or obese may have a protective effect later in life. The impact of obesity on cognition may involve factors such as vascular health, inflammation, insulin resistance, and nutrition. It is important to note that lower BMI is associated with an increased risk of dementia in older adults, while midlife obesity is linked to cognitive decline. Sedentary lifestyles can contribute to obesity, which can affect both cognition and motor performance. To counteract these effects, exercise is proposed as a treatment regimen that can help alleviate obesity-related cognitive and motor impairments. The link between obesity and reduced cognitive functions has significant implications for an ageing population. More research is needed to understand the interventions like exercise which improves cognitive functions in the context of BMI variations.

Keywords: BMI, Cognitive functions, Obesity, Exercise

Body mass index (BMI) is a measure that helps to determine the amount of body fat of an individual based on their height and weight. To calculate BMI, one should divide their weight in kilograms by height in meters squared. Cognition refers to the mental process of acquiring knowledge and understanding through thought, experience, and the senses [1]. It encompasses various cognitive functions such as attention, memory, reasoning, problem-solving, language, and abstract thinking.

The relationship between BMI and cognition is complex and not fully understood. While some studies suggest a correlation between high BMI and cognitive decline or dementia, others find no correlation or even a protective role of overweight or obesity in later life. Widely accepted BMI values are depicted in Table 1 [2].

Table 1: Body Mass Index

Categories	BMI
Underweight	<18.5kg/m^2
Normal weight	18.5–25kg/m^2
Overweight	25–30kg/m^2
Obesity	BMI of 30 kg/m^2 or greater.

There are various potential reasons for the connection among BMI and cognition. Being obese can increase the chances of developing cardiovascular disease, which can reduce blood flow to the brain leading to cognitive decline. Chronic inflammation associated with obesity can damage brain cells and hinder cognitive function. Obesity can cause insulin resistance, which can affect brain metabolism and impair cognitive function [1, 2]. Individuals who follow an unhealthy diet or have inadequate intake of essential nutrients may be at a higher risk of experiencing a decline in cognitive function. Interestingly, a lower BMI is associated with an increased incidence of dementia, particularly in elderly people [3]. However, in midlife, a higher BMI was linked with an increased incidence of dementia. Because of an inactive lifestyle, the prevalence of obesity is increasing in individuals nowadays. Besides health issues, obesity can also affect cognitive and motor functions due to an imbalance of insulin/leptin levels and inflammatory changes [4].

The link between obesity and cognitive problems is increasing significantly, especially with the increasing number of ageing individuals worldwide who may experience neurological conditions. This review aims to analyse the research on the correlation between obesity and cognitive performance, including its short-term impact on cognitive functions or long-term effects on cognitive ageing and the likelihood of dementia. As people reach middle age, there is notable changes are observed in BMI values and cognitive abilities of the individual [5]. Obesity, as measured by anthropometric means, can cause a reduction in neural integrity that leads to atrophy of both grey and white matter. Both obesity and poor metabolic functions like type 2 diabetes in the advanced age group can cause poor cognitive abilities and a high incidence of dementia. Stress is a contributing factor to abdominal obesity and impaired cognitive abilities [5].

A recent study has examined the impact of adiposity and metabolic dysfunction on cognitive decline. The study found that both obesity and poor metabolic activity are associated with a higher prevalence of cognitive impairments. Therefore, understanding this relationship could help target psychological services and public health strategies more effectively [6]. The results suggest that increased adiposity and poor metabolic functions may affect the execution of functions, memory deficits, and impairments of medial temporal lobes. These changes result mainly from physiological changes related to inflammatory markers, neoangiogenesis, and oxidative stress, among others [7].

Several studies have shown that obesity negatively affects cognitive abilities among school adolescents. To avoid complications associated with obesity, it is recommended that school adolescents be involved in an active lifestyle or recreational activities to maintain healthy body weight and keep their cognitive functions within the normal range [8,9]. In 2015, Kirton and Dotson conducted a study to investigate the combined impact or correlation of age, education, and body mass index on cognitive abilities. Their results suggested that the relationships between cognitive reserve as defined by education and BMI vary across ages. Additionally, they found that obesity may facilitate the cognitive ageing process [10].

Recent evidence has suggested that being overweight can lead to a decrease in cognitive performance, even when medical conditions are not considered. This is due to a neurological predisposition characterized by reduced executive function. Additionally, obesity can cause low-grade systemic inflammation, elevated lipids, and insulin resistance which can negatively impact the brain [11,12]. In this regard, cognitive remediation treatment strategies could be considered to prevent and/or treat obesity [13].

A study was conducted to investigate the impact of adiposity and poor metabolic functions on cognitive abilities. The research revealed that obesity and metabolic dysfunction can affect cognition and motor behaviours by changing neuromuscular systems, respectively. Substantial evidence suggests that exercise is an effective method to improve obesity and related cognitive and neuromuscular changes [13].

However, the potential protective effects of obesity against cognitive decline in older age need more research. Addressing obesity through surgical and dietary interventions may improve cognitive functions and protect against cognitive decline. Understanding this relationship can help inform public health strategies and psychological services.

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