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(Research/Review) Article

Relationship Between Adiponectin Levels and Cognitive Function in Elderly Patients with Obesity in RSUD Dr. Mohamad Soewandhie Surabaya

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Abstract: Obesity in the elderly is an increasingly prevalent condition and is associated with a higher risk of metabolic disorders and cognitive decline. Adiponectin, an adipokine with anti-inflammatory and neuroprotective properties, is thought to play a role in maintaining cognitive function through the regulation of metabolism and inflammatory responses. However, scientific evidence regarding the association between adiponectin and cognitive function among obese elderly individuals in Indonesia remains limited. This study aimed to describe adiponectin levels, cognitive function, and the relationship between the two among obese elderly patients at RSUD dr. Mohamad Soewandhie Surabaya. This study employed an analytic observational design with a cross-sectional approach and involved obese elderly respondents selected using a total sampling technique. Adiponectin levels were measured using the Enzyme-Linked Immunosorbent Assay (ELISA) method, while cognitive function was assessed using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina). Data analysis was performed using the Shapiro–Wilk normality test and Spearman's rho correlation test. The results showed a statistically significant relationship between adiponectin levels and cognitive function among obese elderly individuals ($p = 0.731$; $r < 0.01$). In conclusion, this study found that adiponectin levels were associated with cognitive function in the obese elderly population examined.

Keywords: Adiponectin; Cognitive Function; Elderly; MoCa-Ina; Obesity

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1. Introduction

Obesity is a condition of excessive accumulation of fat tissue in the body which can increase the risk of various health problems.(Gozukara Bag et al., 2023).Obesity is a complex global health problem affecting approximately two billion people worldwide. By 2030, it is estimated that 1 in 5 women and 1 in 7 men will be obese, totaling over 1 billion people worldwide. The global prevalence of obesity is also higher in women than in men, and the majority of sufferers come from developing countries facing a double burden of malnutrition.(Ministry of Health of the Republic of Indonesia, 2023)Indonesia is one of the

developing countries with a significant increase in obesity prevalence over the past decade. According to data from the Ministry of Health, the national obesity prevalence increased from 10.5% in 2007 to 21.8% in 2018.(Ministry of Health of the Republic of Indonesia, 2023)This upward trend continues, as reflected in the 2023 Indonesian Health Survey (SKI), which showed that the prevalence of obesity among people aged 18 and over had reached 23.4%. The three provinces with the highest obesity prevalence in 2023 were Jakarta (31.8%), Papua (31.3%), and North Sulawesi (30.6%). This surge in obesity rates indicates the need for more serious treatment, particularly considering its impact on metabolic health and the increased risk of comorbidities.(Ministry of Health of the Republic of Indonesia, 2024).

The prevalence of obesity in older adults varies markedly across regions of the world. A meta-analysis by(Khaleghi et al., 2025)showed that the highest rate was in South America (40.4%), followed by Europe (33.6%), while Asia recorded the lowest rate at 14.6%. This difference is likely influenced by variations in high-calorie food consumption patterns, physical activity levels, socioeconomic status, and cultural and genetic factors across populations. The study also highlighted that unhealthy diets, lack of physical activity, and socioeconomic conditions are major determinants of the increasing prevalence of obesity in the elderly population.(Khaleghi et al., 2025). The number of elderly people in Indonesia shows a consistent increasing trend from year to year. Data from the Central Statistics Agency (BPS) noted that the number of elderly people increased from 18 million people (7.6%) in 2010 to 27 million people (10%) in 2020, and is estimated to reach 40 million people (13.8%) in 2035. The 2016 Intercensal Population Survey (SUPAS) also reported that the number of elderly people had reached 22.6 million people, with a projection of increasing to 31.3 million people in 2022.(Ministry of Health of the Republic of Indonesia, 2022)The increase in the number of elderly people is in line with the World Health Organization's (WHO) predictions regarding the growth in the proportion of the elderly population globally, including in Indonesia.

Obesity in the elderly contributes to various complications, including cardiometabolic disease and cancer, and has an impact on the decline in physical function, cognitive impairment, and quality of life, which are already declining due to the aging process.(Henney et al., 2024)Other studies have shown that individuals with obesity tend to experience higher levels of cognitive dysfunction than those with a normal body mass index.(Tasnim et al., 2023)Adiponectin is the main adipokine hormone secreted by adipose tissue. Adiponectin plays a role in regulating glucose and fatty acid metabolism and has anti-inflammatory properties. Adiponectin is also known to have neuroprotective effects, potentially protecting cognitive function, especially in obese older individuals who are at higher risk of cognitive impairment. Therefore, adiponectin is considered a relevant biomarker in explaining the relationship between obesity and cognitive function.(Henney et al., 2024)Several studies have shown that decreased adiponectin levels or disruption of its signaling activity can accelerate the progression of Alzheimer's disease and lead to cognitive decline. These findings support the notion that adiponectin has the potential to act as a biomarker for cognitive impairment, particularly in the obese elderly population, which was the primary focus of this study.(Khoramipour et al., 2021).

In obesity, visceral fat tissue increases. Adiponectin is the most abundant adipokine with anti-inflammatory and antiatherogenic properties and is secreted by adipose tissue. However, plasma adiponectin levels are actually decreased in individuals with visceral obesity. Visceral fat accumulation also contributes to decreased adiponectin levels, which ultimately contributes to the development of insulin resistance.(Moon et al., 2019)Low adiponectin levels, such as those found in obese individuals, are associated with increased systemic inflammation and inflammation in the central nervous system. Adiponectin functions to suppress the release of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) from endothelial cells of the blood-brain barrier. This function helps control inflammatory signals that cross the blood-brain barrier (BBB). When adiponectin levels decrease, this ability is weakened, allowing cytokines to more easily enter brain tissue and trigger neuroinflammation.(Jian et al., 2019)Low adiponectin levels impact cellular immune responses in the brain. Increased neuroinflammation due to adiponectin deficiency leads to excessive microglia activation. This activation exacerbates neuroinflammation and leads to neuronal damage, particularly in the hippocampus and prefrontal cortex, two brain areas critical for memory and executive function.(Jian et al., 2019)Obesity can cause chronic inflammation that plays a role in nervous system damage and is an early sign of neurodegenerative disorders.(García-García et al., 2023a)In obese older adults, decreased adiponectin levels are associated with an increased risk of impaired memory, concentration, and executive function, which are early signs of dementia.

Several studies have found no significant association between adiponectin levels and cognitive function. These discrepancies suggest that adiponectin's role in cognitive function is not fully understood and requires further investigation in high-risk populations, such as obese older adults.(Sindzingre et al., 2024)Several previous studies have shown that adiponectin and ghrelin have potential as biomarkers associated with neurodegenerative disorders such as dementia and Alzheimer's disease. This study will focus on adiponectin, which currently requires further exploration to determine whether it can be used accurately to detect or predict cognitive decline, particularly in elderly populations with metabolic conditions such as obesity.(García-García et al., 2023a)However, to date, there is limited research in Indonesia specifically exploring the relationship between adiponectin levels and cognitive function, particularly in the elderly population with obesity. In healthcare facilities such as RSUD Dr. Mohamad Soewandhie Surabayain Surabaya, no studies have been found that assess the relationship between these two variables locally. Therefore, this study aims to fill this scientific gap with an appropriate approach based on local population characteristics.

2. Preliminaries or Related Work or Literature Review

Obesity

Obesity is a complex, multifactorial, chronic metabolic disease that arises from the interaction of various factors, including genetic, biological, environmental, behavioral, sociocultural, and economic factors. This condition carries a number of health risks, both direct and indirect. Direct impacts stem from excess fat accumulation and weight gain. Indirect impacts are associated with metabolic disorders such as hypertension, dyslipidemia, cardiovascular disease, type 2 diabetes, fatty liver disease (FAD), impaired kidney function, various types of cancer, and reproductive problems (Janić et al., 2025).

Obesity is a pathological condition characterized by an excessive increase in adipose tissue mass. This fat accumulation triggers metabolic and inflammatory responses that play a role in the development of various chronic diseases (Gupta et al., 2023).

According to the Obesity Medicine Association (OMA), obesity is a multifactorial and neurobehavioral condition that is chronic, progressive, recurrent, and treatable. In addition to BMI, waist circumference, body fat percentage, and visceral or android fat distribution are considered more accurate for assessing obesity on an individual basis (Fitch and Bays, 2022).

Obesity is determined by assessing the body mass index (BMI). According to the WHO Asia Pacific criteria, obesity is defined as a BMI of 25 kg/m² or more (WHO, 2000). A BMI <18.5 is considered underweight, a BMI of 18.5–22.9 is considered normal, a BMI of 23–24.9 is considered overweight, a BMI of 25–29.9 is class I obesity, and a BMI ≥ 30 is class II obesity. In addition to BMI, waist circumference is also used to identify central obesity. In Asian populations, central obesity is defined as a waist circumference >90 cm in men and >80 cm in women (Ministry of Health of the Republic of Indonesia, 2015).

Obesity is a condition of excessive body fat accumulation, identified by a BMI of ≥ 30 kg/m². It occurs when daily energy intake exceeds energy needs, leading to the accumulation of body fat, which can trigger metabolic disorders and chronic inflammation (Friedenreich, Ryder-Burbidge, and McNeil, 2021).

H.L. Blum's theory states that obesity is influenced by behavior, environment, healthcare, and genetics. Behavioral factors include a high-calorie diet and lack of physical activity. A family history of obesity also increases the risk (Saraswati et al., 2021).

Obesity occurs when the body receives more energy than it uses, so it is stored as fat. This storage occurs in subcutaneous adipose tissue (SAT) and organs. White adipose tissue (WAT) acts as an endocrine organ, while brown adipose tissue (BAT) generates heat through adaptive thermogenesis. WAT is divided into visceral adipose tissue (VAT) and subcutaneous adipose tissue (SAT). BAT accounts for approximately 1–2% of total adipose tissue (Jin et al., 2023).

Visceral fat accumulation triggers the activation of adipokines and cytokines such as leptin, resistin, IL-6, MCP, IL-1β, IL-18, and TNF-α, which contribute to systemic inflammation, insulin resistance, endothelial dysfunction, thrombosis, and atherosclerosis. Increased aldosterone plays a role in intravascular volume expansion and fibrotic tissue formation (Jin et al., 2023).

Obesity triggers insulin resistance, hypertension, dyslipidemia, and type 2 diabetes mellitus. Chronic systemic inflammation is the basis of various degenerative diseases such as atherosclerosis, cancer, kidney disorders, depression, and cognitive decline (Jayanama et al., 2022).

Elderly

The elderly are those aged 60 and above. As they age, they become more susceptible to various health problems due to declining physiological and immune function (Tuwu and La Tarifu, 2023).

According to the classification of the World Health Organization, the age of 45–59 years is classified as middle age, the age of 60–74 years is classified as elderly, the age of 75–90 years as old, and over 90 years as very old (Fadhilah et al., 2024).

Several health conditions are common in older adults, such as hearing loss, cataracts, refractive errors, back and neck pain, osteoarthritis, chronic obstructive pulmonary disease, diabetes, depression, and dementia. Elderly individuals often experience more than one health problem simultaneously (World Health Organization, 2024).

The aging process is characterized by physiological and psychological changes that affect the structure and function of the body and are accompanied by an increased risk of chronic and degenerative diseases such as heart disease, diabetes, cancer, obesity, osteoporosis, and malnutrition (Mabiama et al., 2022).

Cognitive function

Cognition refers to the mental processes involved in acquiring information and understanding through experiences, ideas, and observations of the surrounding environment. Cognition is divided into two main categories: nonsocial cognition and social cognition (Srinivas et al., 2021).

Cognitive function is an important marker related to health status, mortality risk, and the ability to live independently. Factors associated with cognitive function in the elderly include age, female gender, education level, marital status, physical activity, social interactions, mental and physical health conditions, and the apolipoprotein E gene (Min, Kim, and Min, 2023).

Cognitive functions include perception, memory, learning, attention, decision making, and language skills (Kiely, 2024).

Assessment and Cognitive Function Disorders

Cognitive function was measured using the Mini-Mental State Examination (MMSE), a standard screening tool for evaluating general cognitive status, including orientation to time and place, memory, attention, calculation ability, language use, and following simple commands (Gilbert et al., 2018). The MMSE consists of 11 questions, takes 5–10 minutes, and is recommended by the American Academy of Neurology (AAN). A score of 24–30 indicates normal cognitive function, 17–23 indicates probable cognitive impairment, and 0–16 indicates significant cognitive impairment (Zara, 2021).

The Montreal Cognitive Assessment (MoCA) is a cognitive screening tool for evaluating mild to moderate cognitive impairment with high sensitivity and specificity (Rambe and Fitri, 2017). The MoCA-Ina assesses eight domains, including visuospatial and executive function, naming, memory, attention, language, abstraction, delayed recall, and orientation (Akbar, Effendy, and Camellia, 2019). The maximum score is 30, with a score of ≥ 26 considered normal cognitive function (Utami, Effendy, and Amin, 2019).

Approximately 50 million people worldwide suffer from cognitive impairment, and this number is expected to double in the coming decades (Chen et al., 2024). As the brain ages, morphological and physiological changes can affect cognitive function, emotional control, and behavior, and can be exacerbated by comorbidities such as metabolic diseases (Latino and Tafuri, 2024).

Mild Cognitive Impairment (MCI) is a condition of cognitive decline that exceeds the normal aging process but does not yet reach dementia. It includes impairments in memory, language, attention, and executive abilities (Kim et al., 2023). In mild stages like MCI, symptoms include decreased memory, language, reasoning, and decision-making, without disrupting daily activities. Decreased hippocampal volume and the accumulation of amyloid beta and tau proteins contribute to the neurodegenerative processes associated with dementia, particularly Alzheimer's disease (Rizzo, Fasano, and Paolisso, 2020).

Adiponectin

Adiponectin, also known as Adipocyte Complement-Related Protein of 30 kDa (AdipoQ), Adipose Most Abundant Gene Transcript 1 (apM1), or Adiponectin C1q and Collagen Domain-Containing Protein (Acrp30), is a major adipokine produced by white adipose tissue. This protein is composed of 247 amino acids and shares structural similarities with collagen types VIII and X and Complement Component 1q (C1q). Physiologically, adiponectin plays a crucial role in maintaining metabolic homeostasis through regulation of glucose and lipid metabolism, increased insulin sensitivity, and anti-inflammatory and antioxidant effects. Normal plasma adiponectin levels range from 3–30 μg/mL, and its decrease is known to be associated with various metabolic diseases such as diabetes mellitus and cardiovascular disorders (Foula et al., 2020; Han et al., 2024).

In obesity, particularly visceral obesity, adiponectin levels decrease despite increased fat tissue volume. This reflects adipose tissue dysfunction due to adipocyte enlargement, which leads to hypoxia, oxidative stress, and chronic low-grade inflammation. Adipose tissue hypoxia inhibits the expression of Peroxisome Proliferator-Activated Receptor Gamma (PPARγ) and increases the production of Reactive Oxygen Species (ROS), ultimately suppressing adiponectin production and stability. Adiponectin depletion contributes to insulin resistance, impaired lipid and glucose metabolism, and increased production of proinflammatory cytokines such as TNF-α and IL-6, thus exacerbating metabolic and systemic complications (Han et al., 2024; Rubino et al., 2025).

In addition to its role in the metabolic system, adiponectin also plays a crucial role in central nervous system function. Although not synthesized in the brain, adiponectin can cross the blood-brain barrier and acts through the AdipoR1 and AdipoR2 receptors distributed in the hypothalamus, hippocampus, brainstem, and cerebral cortex. Activation of these receptors plays a role in supporting neurogenesis, improving synaptic function, and providing neuroprotective effects by increasing insulin sensitivity and suppressing the inflammatory response. Adiponectin is known to reduce the production of pro-inflammatory cytokines such as TNF-α and IL-6 and increase anti-inflammatory mediators such as IL-10, thus playing a role in maintaining cognitive function (Rizzo, Fasano, and Paolisso, 2020; Gorska-Ciebiada and Ciebiada, 2024).

With aging, fat distribution shifts toward visceral fat accumulation, accompanied by decreased brown adipose tissue activity and sex hormone levels, which in turn lowers adiponectin levels. Low adiponectin levels in obese and elderly individuals are associated with increased neuroinflammation and cognitive decline, including impaired memory and synaptic function (Begum et al., 2023; Liu et al., 2022). Thus, adiponectin plays a central role in the link between obesity, metabolic disorders, and cognitive decline through metabolic, inflammatory, and neuroprotective mechanisms.

3. Materials and Method

This study is a quantitative study with an analytical observational approach and a cross-sectional design. The study was conducted from July to October 2025 at the internal medicine clinic of RSUD Dr. Mohamad Soewandhie Surabaya. The study population was obese elderly patients undergoing outpatient treatment at RSUD Dr. Mohamad Soewandhie Surabaya. The sample was all patients who met the inclusion and exclusion criteria during the study period using a total sampling technique. The sample included patients aged ≥ 60 years with a BMI ≥ 25 kg/m² who were willing to participate in the study, with a minimum number referring to the provisions of quantitative research. The research instruments included an informed consent form, scales and a height measuring tool for BMI calculation, serum adiponectin level examination using the Enzyme-Linked Immunosorbent Assay (ELISA) method, and cognitive function assessment using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina). Data collection techniques were carried out through medical record searches, anthropometric measurements, venous blood sampling, and direct cognitive function examination. Data analysis was carried out quantitatively using IBM SPSS Statistics version 26 which included descriptive analysis, Shapiro–Wilk normality test, and Spearman Rho correlation test to assess the relationship between adiponectin levels and cognitive function.

4. Results and Discussion

Results

Sampling was carried outin August 2025inRSUD Dr. Mohamad Soewandhie Surabaya, with patients who met the inclusion and exclusion criteria were sampled using the total sampling method. Researchers collected primary data in the form of Body Mass Index (BMI) measurements and cognitive function examinations using the MoCA-INA questionnaire. The serum blood samples were sent to the Ciputra University Laboratory in Surabaya for adiponectin level examination using the ELISA method. Data analysis in this study was carried out quantitatively using IBM SPSS Statistics software version 26.

Descriptive Analysis of Variables

Table 1. Results of Descriptive Analysis of Variables

Patient Characteristics		n	%	Mean ± SD
Gender	Man	23	52.3	
	Woman	21	47.7	
Age	All	44	100	65.93 ± 5.27
	60-67	27	61.4	
	68-75	15	34.1	
	76-82	2	4.5	
BMI	Normal	3	6.8	28.13 ± 2.70
	Obesity	41	93.2	
Cognitive Disorders				18.34 ± 4.07
Adiponectin				28.8 ± 5.69

The descriptive analysis results in Table 1 show that the age variable for the 44 respondents ranged from 60 to 82 years, with a mean of 65.93 years and a median of 65 years. A standard deviation of 5.27 indicates a moderate age variation within this group, although the majority of respondents tended to be in the early stages of old age. This distribution indicates that the study involved an elderly population that was still relatively physically and cognitively active, but still within the risk range for health problems.

For the body mass index variable, BMI values ranged from 22.80 to 34.40, with an average of 28.13 and a median of 27.90. A standard deviation of 2.70 indicates relatively low weight variation, but the majority of respondents were in the normal to obese category. This is important to note because a high body mass index can potentially impact the metabolic and cognitive health of the elderly, so the relationship between the variables in this study may be related to the respondents' nutritional status.

For the adiponectin variable, the minimum value was 14.98 and the maximum value was 38.55, with an average of 28.8 and a median of 29.62. The standard deviation of 5.69 indicates a fairly wide distribution of data, indicating significant variation in adiponectin levels among respondents. These differences in levels may reflect variations in metabolic conditions within the body, given that adiponectin is a hormone that plays a role in regulating insulin sensitivity and inflammation.

The cognitive function variable showed a range of values from 9 to 24 with an average of 18.34 and a median of 20. A standard deviation of 4.07 indicated that cognitive performance among respondents had significant variations, although most were at relatively similar levels of function. The average value that was in the middle of the scale range indicated that the elderly group in this study had varying levels of cognitive ability, but tended not to be in the very low or very high category.

Data Normality Test

Table 2. Data Normality Test Results

Variables	Significance Value ***Shapiro–Wilk***	Information
Adiponectin	0.193	Normally Distributed
Cognitive	0.023	Not Normally Distributed

Based on the results of the Shapiro–Wilk normality test, the adiponectin variable showed a significance value of 0.193, indicating a normally distributed data. Conversely, the cognitive function variable had a significance value of 0.023, thus failing to meet the assumption of a normal distribution. Therefore, the analysis of the relationship between adiponectin levels and cognitive function was conducted using the Spearman rho correlation test as a non-parametric method.

Spearman rho test

Table 3. The Relationship between Adiponectin Levels and Cognitive Function in Obese Elderly Patients at RSUD Dr. Mohamad Soewandhie Hospital, Surabaya in 2025.

Variables	n	Median (Min-Max)	r	***p-value***
Adiponectin Level (μg/mL)	44	29.6 (14.9–38.5)	0.731	< 0.01
Cognitive Function	44	20 (9–24)		

In Table 3 related to the results of the correlation analysis*Spearman rho*showed that the relationship between adiponectin and cognitive function resulted in a correlation coefficient of 0.731. This value indicates a positive relationship, meaning that the higher the adiponectin levels, the better the respondents' cognitive function scores. This strong positive relationship indicates that adiponectin levels are related to cognitive function in respondents, where variations in adiponectin levels are followed by changes in cognitive function scores. This finding indicates that adiponectin may play a role as a factor related to cognitive function in obese elderly people in this study.

A significance value of <0.01 indicates that the relationship between adiponectin levels and cognitive function is statistically significant. Therefore, it can be concluded that there is a strong and significant relationship between the two variables.

A total of 44 respondents were analyzed, and this sample size was sufficient to conduct a correlation test using Spearman's rho. The results showed a relationship between adiponectin levels and cognitive function in the respondents. Overall, these findings suggest that adiponectin is significantly associated with cognitive function, thus supporting the hypothesis that a relationship exists between the two variables.

Discussion

In this study, adiponectin levels showed a fairly wide range. This variation reflects differences in metabolic conditions among respondents, as adiponectin is a hormone influenced by insulin sensitivity, inflammation levels, body composition, and physical activity. Differences in adiponectin levels among individuals in the elderly population with overweight and obesity are common, as adipose tissue in this age group tends to undergo functional changes. The range of adiponectin levels in this study was slightly higher than the range generally reported in the adult population, as described in the study.Foula et al., (2020)The presence of respondents with relatively high adiponectin levels is still physiologically acceptable in the elderly because adiponectin is known to increase with age as a compensatory mechanism for metabolic changes and insulin sensitivity. Thus, the variation in adiponectin levels found remains consistent with common physiological patterns in the elderly population.

Other research by Walowski et al. (2023) showed that higher adiponectin levels are associated with lower muscle and bone mass in the elderly. Increased adiponectin in this condition may reflect a tendency for decreased muscle mass. Furthermore, adiponectin has also been reported to be associated with decreased IGF-1 levels, which play a role in maintaining muscle and bone mass. The decrease in IGF-1 that accompanies increased adiponectin reflects a catabolic metabolic state, a state in which muscle and bone mass decrease. These findings align with the results of this study, which showed variation in adiponectin levels among respondents. This variation is likely influenced by differences in body composition, age, and individual metabolic conditions, resulting in varying metabolic profiles for each respondent.

Other research bySudarsono et al. (2023) reported that physical exercise plays a role in increasing adiponectin levels and decreasing leptin, especially in overweight and obese individuals. This suggests that adiponectin responses may differ between individuals depending on physical activity levels and weight status. These findings support the possibility that the variability in adiponectin levels in this study was influenced by the respondents' physical activity habits, given that most participants were overweight to obese.In addition, researchSenkus et al. (2022)emphasize thatThe adiponectin to leptin ratio is an important indicator of adipose tissue function. This ratio has been reported to increase after interventions such as exercise and weight loss, indicating improvements in adipose tissue metabolism. In this study, wide variations in adiponectin levels may reflect differences in adipose tissue function among respondents.

Overall, previous research findings support this study's findings, which show wide variation in adiponectin levels in the elderly population. This variation reflects heterogeneous physiological conditions, particularly in overweight and obese elderly individuals. Therefore, differences in adiponectin levels in this study reflect variations in adipose tissue function and individual metabolic conditions in the elderly population.

The cognitive function of respondents in this study showed variation, although most were at relatively similar levels of functioning. Overall, cognitive function levels were in the intermediate category, indicating that the elderly group had varying cognitive abilities, but neither fell into the very low nor very high functional categories. This variation in cognitive function can be influenced by various factors that contribute to the aging process.

Furthermore, conditions at RSUD Dr. Mohamad Soewandhie Surabayain Surabaya indicate that the daily activities of the obese elderly respondents in this study are quite varied. Some still perform jobs that require significant physical activity, such as lifting or moving heavy objects.Meanwhile, some others are no longer working and only perform light activities at home. The majority of respondents have primary to secondary education, and some have limited access to information, such as not using a mobile phone. This condition, combined with variations in physical activity and daily routines, may limit the cognitive stimulation received each day and contribute to the differences in cognitive function seen in this study.

This finding is in line with researchJeong et al. (2024) analyzed longitudinal data on an elderly population in Korea. The study showed that cognitive function was influenced by age, employment status, depression levels, and gender. Although the study did not specifically analyze these factors, the patterns of variation in cognitive function found may reflect the influence of these general factors.StudyMin, Kim and Min, (2023) also supports that age, employment status, and depression have distinct effects on cognitive function in older adults. In men, these factors are more consistently associated with the risk of cognitive decline, while in women, the effects are more pronounced in groups with lower cognitive function. Both studies confirm that demographic and psychosocial characteristics play a significant role in variations in cognitive function in older adults. Therefore, variations in cognitive function in this study are likely influenced by these factors, although they were not directly analyzed.

The results of this study indicate that adiponectin levels are significantly associated with cognitive function in obese elderly people. The positive direction of the relationship indicates that increased adiponectin levels are followed by improved cognitive function in respondents. This finding indicates that adiponectin plays a role as a factor related to cognitive function in the obese elderly population. Therefore, the results of this study need to be compared with previous research findings to assess the consistency of the relationship between adiponectin and cognitive function and to understand other factors that may contribute.

The results of this study are in line with(García-García et al., 2023)showed a significant relationship between adiponectin levels and cognitive function in obese elderly people. Biologically, adiponectin is an adipokine produced exclusively by adipose tissue and plays a crucial role in increasing insulin sensitivity and inhibiting inflammation. Adiponectin is known to suppress the activity of pro-inflammatory cytokines, such as tumor necrosis factor-α (TNF-α), thereby playing a role in reducing systemic inflammation. Chronic inflammation is one of the mechanisms contributing to neuronal dysfunction and cognitive decline in elderly people.

These findings are reinforced by research(Rizzo, Fasano and Paolisso, 2020)which reported a relationship between adiponectin levels and cognitive performance in postmenopausal women. All subjects in this study were in the elderly age group and had physiologically entered postmenopause, a phase characterized by metabolic changes, including decreased adiponectin levels, particularly in individuals with obesity and insulin resistance. Adiponectin reduction in these conditions is known to be associated with an increased prevalence of metabolic syndrome and systemic inflammation, which may subsequently contribute to cognitive decline.

FindingsCezaretto et al., (2018)also showed a relationship between adiponectin levels and memory function in individuals with a history of diabetes, indicating that adiponectin remains associated with cognitive function, particularly in conditions of metabolic disorders. This suggests that the presence of diabetes may strengthen the relationship between adiponectin and cognitive function, although the relationship may also be found in other populations. Similar results were reported byGorska-Ciebiada and Ciebiada, (2024)who found that diabetic patients with MCI had lower adiponectin levels accompanied by increased inflammation, thus adiponectin plays a role as a marker associated with cognitive function in complex metabolic conditions. Overall, comparisons with previous studies indicate that adiponectin is associated with cognitive function, with the strength of the association being influenced by comorbidities, levels of inflammation, and the metabolic state of the respondents. Therefore, in the obese elderly population in this study, adiponectin continues to be associated with cognitive function, although the magnitude of the association may differ compared to populations with more severe metabolic disorders.

5. Conclusion

a) There is a significant variation in serum adiponectin levels between respondents, where this difference in levels can reflect variations in metabolic conditions in the body, considering that adiponectin is a hormone that plays a role in regulating insulin sensitivity and inflammatory processes. b) Cognitive function between respondents has significant variations, although most are at a relatively similar level of function where the elderly group in this study has varying levels of cognitive ability, but tends not to be in the very low or very high category. c) Based on the analysis using the Spearman rho correlation test, it can be concluded that there is a strong and statistically significant relationship between adiponectin levels and cognitive function in obese elderly patients at RSUD Dr. Mohamad Soewandhie Surabaya. The relationship found was positive, indicating that higher adiponectin levels were associated with better cognitive function scores. This indicates that adiponectin levels are significantly associated with cognitive function in obese elderly patients studied at RSUD Dr. Mohamad Soewandhie Surabaya.

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