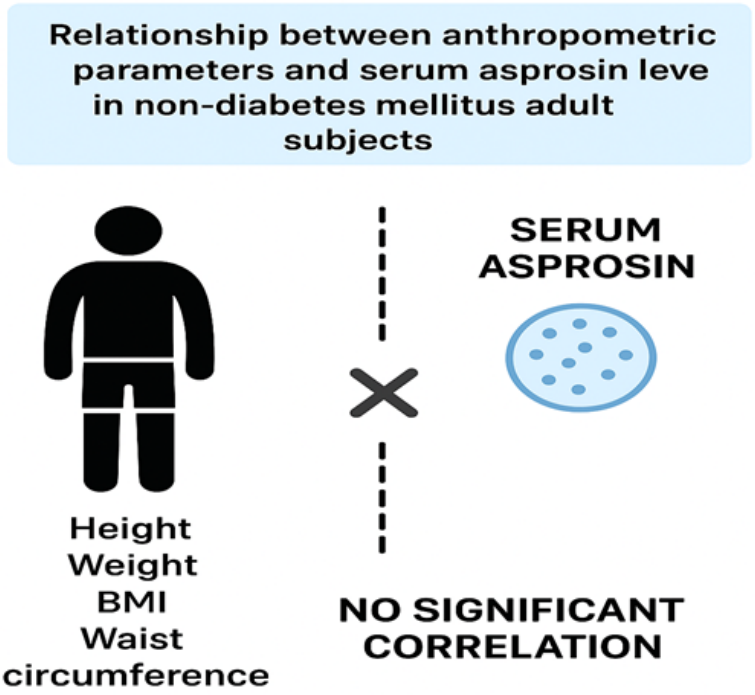
Ceylon Journal of Science 55 (4) 2026: 1744-1751

RESEARCH ARTICLE

Relationship Between Anthropometric Parameters and Serum Asprosine Levels in Non-Diabetes Mellitus Adult Subjects with A Cross Sectional Study Design

A. N. Safaruddin, L. B. Kurniawan, Nurahmi, A. A. Zainuddin and S. Tawali

Graphical Abstract



Highlights

- To investigate the relationship of anthropometric parameters with serum asprosin levels in non-DM adults
- Observational analytic, cross-sectional study involving 80 obese and non-obese adults
- No significant correlation found between anthropometric parameters and serum asprosin levels
- Serum asprosin levels may not be directly linked to anthropometric indicators in non-DM adults
- Cross-sectional design limit generalizability and causal inference

Ceylon Journal of Science 55 (4) 2026: 1744-1751
DOI: https://doi.org/10.4038/cjs.v55i4.8964

RESEARCH ARTICLE

Relationship Between Anthropometric Parameters and Serum Asprosine Levels in Non-Diabetes Mellitus Adult Subjects with A Cross Sectional Study Design

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Received: 17.06.2025 *Accepted: 07.10.2026*

Abstract

Anthropometry involves quantitative measurements of body dimensions and composition, including muscle, bone, and adipose tissue, and is used to assess body shape, health, and nutritional status. Anthropometric parameters can also help identify risk factors for diseases such as obesity. Obesity and overweight are associated with excessive body fat accumulation. Hormones involved in glucose metabolism and homeostasis may contribute to the development of obesity. Asprosin is a protein hormone secreted by white adipose tissue that promotes hepatic glucose release. This study aimed to determine the relationship between anthropometric parameters (height, weight, body mass index, waist circumference, pelvic circumference, mid-upper arm circumference, and skinfold thickness) and serum asprosin levels. An analytical observational study with a cross-sectional design was conducted involving 80 adults: 21 obese women, 20 non-obese women, 18 obese men, and 21 non-obese men. The results showed no significant correlations between serum asprosin levels and any of the anthropometric parameters examined in the adult participants ($p > 0.05$). The study concluded that anthropometric parameters were not significantly associated with serum asprosin levels in adults without diabetes mellitus.

Keywords: Anthropometry; Cross-Sectional Study; Non-Diabetes Mellitus (DM); Obesity; Serum Asprosine

INTRODUCTION

Nutritional status is an important determinant of a person's health and well-being. It influences the quality of human resources by affecting intelligence, productivity, and creativity. Therefore, nutritional status remains an important issue requiring particular attention (Limboto et al., 2024). Overweight and obesity are associated with excessive accumulation of body fat. The prevalence of obesity has increased worldwide in both developing and developed countries (Molintao et al., 2019). In Makassar City, the prevalence of general obesity differs by sex, with reported values of 15.7% in males and 18.4% in females (Suaib et al., 2006).

Malnutrition is an important concern, particularly among adults, because it can increase the risk of certain diseases and affect work productivity. Therefore, nutritional status should be monitored regularly (Noviardi et al., 2023). Assessing nutritional status provides valuable information about general health, nutritional adequacy, body development, and physical performance during sports. Anthropometry involves the quantitative measurement of body dimensions using non-invasive methods and tools. Anthropometric measurements help assess health and nutritional status and identify potential risk factors for conditions such as obesity in adults. Common anthropometric parameters include height, weight, body mass index (BMI), and waist circumference, which are used to assess body size and estimate body composition. Accurate and regular anthropometric measurements can help identify potential medical, nutritional, and social problems in children and adults (Kobel et al., 2022).

In recent years, several hormones involved in metabolism and body fat distribution have been investigated to better understand the pathophysiology of obesity. Hormones that regulate glucose metabolism and homeostasis may be

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associated with the development of obesity. Asprosin is a protein hormone derived from adipose tissue that circulates in the blood at nanomolar concentrations (Ugur & Aydin, 2019). It is secreted by white adipose tissue and promotes hepatic glucose release. Asprosin levels have been positively associated with insulin resistance in individuals with diabetes mellitus (DM), suggesting its potential as a biomarker for predicting the onset of DM and monitoring treatment responses. Asprosin may also interfere with insulin signalling and contribute to inflammation, endoplasmic reticulum dysfunction, and insulin resistance (Cui et al., 2024).

Asprosin has been investigated as a potential biomarker of insulin resistance and an indicator for the early diagnosis of type 2 DM. It stimulates rapid hepatic glucose release and activates hypothalamic neurons involved in appetite regulation. Several clinical studies have examined the relationships between asprosin levels and obesity, type 1 and type 2 DM, insulin resistance, metabolic syndrome, and physical activity (Morcos et al., 2022).

Elevated asprosin levels have been reported in insulin-resistant individuals. Positive associations have also been reported between plasma asprosin levels and waist circumference, fasting plasma glucose, triglyceride concentrations, and insulin resistance. Ugur and Aydin (2019) reported elevated asprosin levels in individuals with obesity and lower levels in underweight individuals.

However, much of the existing research on asprosin has focused on individuals with type 2 DM or metabolic syndrome, or on populations with heterogeneous clinical characteristics. Therefore, further investigation is warranted into the relationship between serum asprosin levels and specific anthropometric parameters in adults without DM. This study aimed to determine the associations between serum asprosin levels and anthropometric parameters in adults without DM.

MATERIALS AND METHODS

Study design and population

This study employed an analytical observational design with a cross-sectional approach. Obesity status was assessed using anthropometric measurements, including body mass index (BMI), hip circumference, and mid-upper arm circumference. The stated BMI threshold was 18–25 kg/m²; however, the criteria used to classify participants as obese and non-obese require clarification. Participants were selected using purposive non-probability sampling. A total of 80 adults were included in the study, comprising 41 women and 39 men, classified as obese or non-obese. The inclusion criteria were adults aged 18–40 years, of either sex, who were classified as obese or non-obese and agreed to participate in the study. The exclusion criteria were a history of diabetes mellitus, pregnancy, an inflammatory or infectious disease diagnosed by a physician, and serum samples that were haemolysed, icteric, or lipaemic.

The study was conducted after obtaining ethical approval from the Health Research Ethics Commission (KEPK) of Hasanuddin University State College Hospital (RSPTN UH), under approval number 1080/UN4.6.4.5.31/PP36/2024.

Laboratory procedures

Participants' demographic details were recorded, and all participants were students enrolled at Hasanuddin University who volunteered to participate in the study. Written informed consent was obtained from all participants after a thorough explanation of the study objectives. Participants did not receive financial compensation but were provided with the results of their medical examinations.

Anthropometric measurements included height, weight, BMI, waist circumference, hip circumference, mid-upper arm circumference, and skinfold thickness. Fasting plasma glucose (FPG) and oral glucose tolerance test (OGTT) measurements were also performed using an ABX Pentra 400 analyser.

Blood samples were collected in the morning after 8–12 h of fasting. Samples collected in tubes without anticoagulants were centrifuged at 3,000 rpm for 10–15 min to separate serum from blood cells. The separated serum was stored at −20 °C until analysis. Serum asprosin concentrations were determined using the sandwich enzyme-linked immunosorbent assay (ELISA) method with a kit from MyBioSource, USA, and an ELISA reader.

Data analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS), version 22. Descriptive statistics, including the range, median, mean, standard deviation, and data distribution, were calculated. The distributions of serum asprosin levels and anthropometric measurements were assessed using the Kolmogorov–Smirnov normality test. Pearson's correlation test was used to assess the relationships between anthropometric parameters and serum asprosin levels when the data met the assumptions for parametric analysis, whereas Spearman's rank correlation test was used for non-normally distributed data. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 80 participants were included in the study, comprising 41 women and 39 men aged 18–40 years, with a mean age of 26.2 years. The participants had a mean body mass index (BMI) of 25.5 kg/m², height of 160.0 cm, weight of 65.1 kg, waist circumference of 81.3 cm, hip circumference of 92.2 cm, mid-upper arm circumference (MUAC) of 29.3 cm, and skinfold thickness of 20.2 mm. The mean fasting plasma glucose (FPG) level was 90.9 mg/dL, and the mean oral glucose tolerance test (OGTT) glucose level was 102.3 mg/dL. The mean systolic and diastolic blood pressures were 112.4 and 76.3 mmHg,

respectively. The mean serum asprosin concentration was 1.30 ng/mL. These results are summarized in Table 1.

Normality Test

Test the normality of the research results between anthropometric parameters and serum Asprosin levels in non-DM adult subjects as a whole and based on whether the data distribution is normal or not. The normality test used is the Kolmogorov Sminrov test to assess the significance of the $p>0.05$ value shown in Table 2.

Based on the Kolmogorov Smirnov test in Table 3. for the variables of body weight, height, BMI, waist circumference, and Asprosin, the p-value is> 0.05 so that shows normally distributed data, while for the pelvic circumference, MUAC, and skinfold thickness variables, the p-value is <0.05 so that it shows that the data is not normally distributed.

Correlation test

Through the Pearson correlation test, the results of this study show that there is no correlation between Asprosin with height, weight, BMI and waist circumference. The results of the Pearson correlation test between anthropometric parameters and Asprosin levels are shown in Table 3.

Previously, the normality test was carried out on the Asprosin value data with pelvic circumference, MUAC, and skinfold thickness, concluding that the data were not normally distributed. To determine the relationship or correlation between the variables of pelvic circumference, MUAC, and skinfold thickness with Asprosin levels, the Spearman correlation test was performed. From the results of the Spearman correlation test, the results of this study show that there is no correlation between Asprosin with pelvic circumference, MUAC, skinfold thickness. The results of the Spearman correlation test between anthropometric parameters and Asprosin levels are shown in Table 3.

Table 1: General characteristics of adult participants without diabetes mellitus

Variables	n (%)	Mean ± SD	Median	Min - Max
Age (years)	59 (73.8)	26.2 ± 5.9	26.0	18 - 40
18 - 30	21 (26.2)			
31 – 40				
Gender	41 (51.2)			
Female	39 (48.8)			
Male				
BMI (kg/m^2)	3 (3.8)			
< 18.0	36 (45.0)	25.5 ± 4.6	24.8	16.8 – 35.8
18.0 – 24.9	26 (32.5)			
25.0 – 29.9	15 (18.8)			
> 30				
Height (cm)	80 (100)	160.0 ± 8.3	160.4	143.5 – 177.0
Body Weight (kg)	80 (100)	65.1 ± 12.9	64.6	42.1 – 100.5
Waist Circumference (cm)	80 (100)	81.3 ± 9.9	82.0	61.0 – 105.0
Pelvic Circumference (cm)	80 (100)	92.2 ± 14.1	93.5	10.0 – 122.0
MUAC (cm)	80 (100)	29.3 ± 3.9	30.0	21.0 – 37.0
Skinfold Thickness (mm)	80 (100)	20.2 ± 9.2	20.9	4.0 – 40.0
FPG (mg/dL)	80 (100)	90.9 ± 8.6	89.7	72.9 – 123.5
OGTT (mg/dL)	80 (100)	102.3 ± 29.9	98.8	41.7 – 190.1
Systolic (mmHg)	80 (100)	112.4 ± 11.7	112.5	82.0 – 138.0
Diastolic (mmHg)	80 (100)	76.3 ± 8.4	75.0	54.0 – 100.0
Asprosine (ng/mL)	80 (100)	1.30 ± 0.31	1.28	0.68 – 1.92

Source: Primary data

Description*:* Mean = Average, SD = Standard Deviation, Median = Middle Value, Min = Minimum, Max = Maximum

Table 2: Normality tests of anthropometric parameters and serum asprosin levels in adults without diabetes mellitus

Variables	p	Description
Height (cm)	0.200	Normal
Body Weight (kg)	0.200	Normal
BMI (kg/m^2)	0.077	Normal
Waist Circumference (cm)	0.200	Normal
Pelvic Circumference (cm)	0.043	Not normal
MUAC (cm)	0.028	Not normal
Skinfold Thickness (mm)	0.012	Not normal
Asprosine (ng/mL)	0.198	Normal

Source: Kolmogorov Smirnov test

Table 3: Correlations between serum asprosin levels and anthropometric parameters in adults without diabetes mellitus

Variables	Asprosin	
	R	p
Height (cm)	-0.100	0.380*
Body weight (kg)	0.127	0.260*
BMI (kg/m^2)	0.154	0.174*
Waist circumference (cm)	0.113	0.317*
Pelvic circumference (cm)	-0.056	0.621$^{\#}$
MUAC (cm)	0.034	0.765$^{\#}$
Skinfold thickness (mm)	-0.102	0.366$^{\#}$

Source: Primary Data. **Description:** r = Correlation coefficient, $^{*}p$ = Significance in the *Pearson* correlation test, $^{\#}p$ = Significance in the *Spearman* correlation test

DISCUSSION

This study investigated the relationships between anthropometric parameters (height, weight, body mass index [BMI], waist circumference, hip circumference, mid-upper arm circumference [MUAC], and skinfold thickness) and serum asprosin levels in adults without diabetes mellitus (DM). The study was conducted from December 2024 to February 2025.

Asprosin is a protein hormone secreted by white adipose tissue. Adipose tissue, traditionally regarded as an energy-storage tissue, is now recognised as a metabolically active endocrine organ that secretes biologically active molecules known as adipokines. These molecules are involved in regulating energy metabolism, inflammation, and fibrosis (Lv et al., 2024). Following secretion, asprosin enters the circulation and stimulates hepatic glucose release. It also activates agouti-related peptide (AgRP)-expressing orexigenic neurons in the hypothalamus through the G protein–cyclic adenosine monophosphate (cAMP)–protein kinase A (PKA) signalling pathway, thereby stimulating appetite (Atta et al., 2023). Furthermore, asprosin has been implicated in inflammatory responses, pancreatic β-cell dysfunction, apoptosis, and impaired insulin sensitivity through pathways involving Toll-like receptor 4 (TLR4), protein kinase C delta, and endoplasmic reticulum stress (Farrag et al., 2023).

Although asprosin is associated with adipose tissue metabolism, its relationship with individual anthropometric parameters remains unclear. Height and weight are used to calculate BMI, which provides an indirect measure of body size and is commonly used to screen for overweight and obesity. However, BMI does not directly measure body fat distribution. Therefore, this study also examined anthropometric indicators of central and peripheral adiposity, including waist circumference, hip circumference, MUAC, and skinfold thickness.

BMI is a widely used screening measure for overweight and obesity because it is associated with body fat mass and can help identify individuals at risk of obesity-related complications (Hasibuan & Palmizal, 2021). However, the

relationship between BMI and serum asprosin levels may vary among populations. In the present study, Pearson's correlation analysis showed no statistically significant associations between serum asprosin levels and height ($r = 0.100$, $p = 0.380$), weight ($r = 0.127$, $p = 0.260$), BMI ($r = 0.154$, $p = 0.174$), or waist circumference ($r = 0.113$, $p = 0.317$).

These findings differ from those of Hong et al. (2021), who reported a positive association between BMI and asprosin levels. Increased BMI may reflect greater adipose tissue mass, which could contribute to increased asprosin secretion (Taha & Sulaiman, 2022). Nevertheless, asprosin concentrations may vary according to body composition, sex, and metabolic responses to physical activity. Although adipose tissue is a major source of asprosin, a consistent association between asprosin concentrations and body composition indices has not been established (Suder et al., 2024). These findings suggest that BMI alone may not adequately explain variations in circulating asprosin levels.

BMI can also be influenced by factors such as dietary intake, physical activity, and stress. Stress-related hormonal responses, including the release of corticotropin-releasing hormone (CRH), may affect appetite and eating behaviour, potentially influencing body weight and BMI (Rodiana, 2022). However, these factors were not evaluated in the present study and therefore cannot be identified as explanations for the observed findings.

Waist circumference is commonly used to assess abdominal fat distribution and is associated with cardiometabolic risk. Thresholds of greater than 80 cm in women and 90 cm in men have been used to identify increased metabolic risk in certain populations (Manungkalit et al., 2015). Although waist circumference may reflect central adiposity more directly than BMI, the present study found no statistically significant association between waist circumference and serum asprosin levels. The relationship between asprosin and obesity-related metabolic disturbances remains incompletely understood, although asprosin has been implicated in dysglycaemia and obesity-associated disorders (Delfan et al., 2024).

Spearman's rank correlation analysis also revealed no statistically significant associations between serum asprosin levels and hip circumference ($r = -0.056$, $p = 0.621$), MUAC ($r = 0.034$, $p = 0.765$), or skinfold thickness ($r = -0.102$, $p = 0.366$). Hip circumference reflects the dimensions of the lower body, including the underlying muscle and adipose tissue. MUAC provides an indirect indication of the combined contributions of muscle, bone, and subcutaneous fat and is used in nutritional assessment (Amila et al., 2020). MUAC may also vary according to nutritional intake and nutritional status (Dewi et al., 2023). Skinfold thickness is used to estimate subcutaneous fat and, when measurements from appropriate anatomical sites are combined with validated equations, can be used to estimate body fat percentage (Muharramah et al., 2024). Its measurements may be influenced by factors such as hydration status and changes in skin tissue characteristics (Gonz et al., 2023). However, the present findings did not demonstrate significant relationships between these anthropometric indicators and serum asprosin levels.

Physical activity may influence circulating asprosin concentrations, potentially contributing to differences between study populations. High-intensity interval training has been reported to reduce asprosin levels in adults with obesity. Aerobic exercise has also been associated with reductions in asprosin concentrations, with the magnitude of change potentially varying according to body weight and exercise conditions (Ceylan et al., 2023). In addition, Zhang et al. (2024) reported no significant association between asprosin levels and obesity severity assessed using BMI. Such findings suggest that the relationship between anthropometric indicators and asprosin may not be consistent across populations or study conditions.

Several factors may contribute to the absence of statistically significant associations in the present study. These may include individual variation in asprosin secretion, differences in body composition and physical activity, and variation in metabolic status. Differences in assay methods, pre-analytical conditions, and participant characteristics, including age, sex, and ethnicity, may also contribute to variation in reported asprosin concentrations. However, these potential explanations were not directly investigated in this study. Further research involving larger and more diverse populations, detailed assessment of body composition, and standardised asprosin measurement procedures is needed to clarify the relationships between circulating asprosin levels and anthropometric parameters.

This study had several limitations. First, the relatively small sample size may have limited the statistical power to detect associations and restricts the generalisability of the findings to the wider adult population. The limited period available for sample collection also constrained participant recruitment. Second, the cross-sectional design allowed the assessment of associations at a single point in time but did not permit causal relationships to be established. Further studies involving larger sample sizes and longitudinal designs are warranted to investigate the relationships between serum asprosin levels and anthropometric parameters.

CONCLUSIONS

No statistically significant associations were observed between serum asprosin levels and the anthropometric parameters examined in adults without diabetes mellitus. These findings suggest that the selected anthropometric measurements were not significantly associated with circulating asprosin concentrations in the study population. Further studies with larger samples and more comprehensive assessments of body composition and metabolic factors are required to clarify these relationships.

ACKNOWLEDGMENTS

The authors acknowledge the Clinical Pathology Laboratory, Research Unit of Hasanuddin University Hospital (RSUH), and Hasanuddin University Medical Research Center (HUM RC), Makassar, Indonesia, for their support.

FUNDING INFORMATION

This research received no external funding.

DECLERATION OF CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHORS CONTRIBUTIONS

Conceptualization, data analysis: **A.N.S.;** Methodology, writing - original draft: **L.B.K.;** Methodology, writing - original draft: **N.;** Methodology, writing - original draft: **A.A.Z. & S.T.;** All authors contributed to the Original Research, data extraction from various databases, conceptualization, development of the economic models on Microsoft Excel Software, formal analysis, findings interpretation, and manuscript writing. All authors approved the final version of the paper.

DATA AVIALABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author, Liong Boy Kurniawan upon reasonable request. The data are not publicly available due to privacy and ethical restrictions.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE MANUSCRIPT PREPARATION PROCESS

During the preparation of this article, the authors used chatGPT in order to assist with language editing and toning. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article. Gemini AI was used to assist in the creation of the graphical abstract.

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