

Correlation of Anthropometric Index with Serum Pentraxin 3 Levels in Adult Subjects Non-Diabetes Mellitus

Muh Ali Baharuddin¹, Liong Boy Kurniawan², Ulung Bahrin², Burhanuddin Bahar³, Aminuddin⁴

¹Master Program of Biomedical Science, Graduate School, Universitas Hasanuddin, Makassar, Indonesia;

²Department of Clinical Pathology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia; ³Department of Public Health and Preventive Medicine, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia;

⁴Department of Nutrition, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

Correspondence to: Muh Ali Baharuddin, muhalhy676@gmail.com

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ABSTRACT

Background: Serum pentraxin 3 is an inflammatory biomarker involved in the innate immune system and plays a role in vascular and metabolic inflammation, while anthropometric parameters are used to assess nutritional status and the risk of metabolic disorders. However, the relationship between these variables in individuals without diabetes mellitus remains inconsistent. **Objective:** This study aimed to analyze the correlation between anthropometric parameters and serum pentraxin 3 levels in non-diabetic adult subjects. **Methods:** This study used a cross-sectional study design involving 70 subjects. Measurements included body mass index (BMI), mid upper arm circumference (MUAC), waist circumference (WC), and waist-to-hip ratio (WHR), while serum pentraxin 3 levels were measured using the enzyme-linked immunosorbent assay (ELISA) method. Data analysis was performed using the Spearman correlation test. **Results:** BMI ($r = -0.148$; $p = 0.222$), MUAC ($r = -0.227$; $p = 0.059$), waist circumference ($r = -0.182$; $p = 0.133$), and WHR ($r = -0.169$; $p = 0.163$) showed no significant correlations. Overall, all parameters demonstrated weak negative correlations. **Conclusion:** The results showed that body mass index (BMI), mid upper arm circumference (MUAC), waist circumference (WC), and waist-to-hip ratio (WHR) had no statistically significant correlation with serum pentraxin 3 levels ($p > 0.05$). Overall, these findings indicate that anthropometric parameters are not significantly associated with serum pentraxin 3 levels, suggesting that body size is not a major factor influencing serum pentraxin 3 levels in non-diabetic adult subjects.

1. INTRODUCTION

Adulthood is a stage of human development ranging from 18 - 65 years of age, divided into young adulthood (18 - 40 years) and older adulthood (40 - 65 years) [1]. Obesity in Indonesia continues to increase annually. In 2013, the prevalence of obesity among individuals aged >15 years was 26.6% and increased to 31.0% in 2018 [2].

Anthropometry is a method used to assess human body size, proportions, and composition. Anthropometric indicators of nutritional status include measurements of body weight, height, mid upper arm circumference, waist circumference, hip circumference, and subcutaneous fat thickness [3]. Anthropometric values can also be used as diagnostic criteria for obesity, which is one of the major risk factors for cardiovascular disease, diabetes mellitus, and various other diseases. In addition to diagnosis, anthropometry also plays an important role in monitoring and therapeutic intervention planning [4].

Anthropometric measurements such as mid upper arm circumference (MUAC), height, body weight, and waist-to-hip ratio can provide an overview of body fat distribution and potential inflammatory risk. For example, increased visceral fat detected through anthropometric measurements may be associated with elevated serum pentraxin 3 levels, although evidence in healthy populations remains limited [5].

Serum pentraxin 3, which functions as an inflammatory biomarker, is known to be associated with various pathological conditions such as cardiovascular disease and metabolic syndrome [6]. Several studies have shown that elevated serum pentraxin 3 levels are associated with an increased risk of cardiovascular disease [7].

Serum pentraxin 3 plays a role in regulating immune responses and may function as a mediator in inflammatory processes. In the context of obesity, studies have shown that obese individuals have lower serum pentraxin 3 levels compared with normal individuals. One study found that serum pentraxin 3 levels in obese subjects were approximately 40% lower than those in normal subjects, while pro-inflammatory cytokines such as IL-6 increased significantly. Previous studies have also shown that exercise can increase serum pentraxin 3 levels in healthy individuals, although this response may be reduced in obese individuals [8].

Studies have demonstrated that serum pentraxin 3 levels increase in patients with chronic kidney disease and have a negative correlation with estimated glomerular filtration rate values. This finding indicates that serum pentraxin 3 may play a role in inflammatory processes associated with impaired renal function [9].

A study by Małgorzata Waluś-Miarka found that serum pentraxin 3, an inflammatory cardiovascular risk marker, was strongly associated with lipid and apolipoprotein risk factors in patients with type 2 diabetes mellitus [10]. In Malaysia, research findings showed a correlation between serum pentraxin 3 levels and body mass index (BMI) in male subjects with normal glucose tolerance, but not in females [11].

Based on these findings, the researchers were interested in conducting a study on the correlation between serum pentraxin 3 and anthropometric indices.

2. METHODS

This study was an observational analytic study with a cross-sectional study design. The study was conducted on 70 respondents in Makassar City from July 2025 to April 2026. The samples included individuals aged 18 - 45 years who met the inclusion criteria, were willing to provide blood samples, and signed informed consent forms. Exclusion criteria included icteric, lipemic, or hemolyzed serum samples, diabetes mellitus, and cardiovascular disease.

The study subjects were recruited from July 2025 to April 2026 at Hasanuddin University Hospital (RSUH), Makassar. All research procedures were conducted at the Hasanuddin University Medical Research Center (HUM-RC) Laboratory, which is part of the Hasanuddin University State Teaching Hospital.

The study was conducted by recording participant identities. Anthropometric examinations were performed, including measurements of body mass index, waist circumference, hip circumference, mid upper

arm circumference, and waist-to-hip ratio. Blood samples were collected in the morning after 8 - 12 hours of fasting using tubes without anticoagulants. Blood samples in non-anticoagulant tubes were centrifuged at 3000 rpm for 10 - 15 minutes to separate serum from blood cell components. The obtained serum was stored at -20°C . Serum pentraxin 3 examination was performed using the Enzyme Linked Immunosorbent Assay (ELISA) method with the MyBiosource kit insert.

Data analysis was performed using SPSS version 25. Statistical methods included descriptive statistics (data distribution, median, mean, and standard deviation). Data normality was assessed using the Kolmogorov-Smirnov test. The correlation between anthropometric parameters (BMI, WC, MUAC, WHR) and Pentraxin-3 was evaluated using the Spearman test. Statistical significance was set at $p \leq 0.05$.

All procedures in this study were conducted after providing information and obtaining participant consent through informed consent forms. This study was conducted after being declared ethically eligible by the Health Research Ethics Committee of the Faculty of Medicine, Hasanuddin University - UNHAS-RS Wahidin Sudirohusodo Makassar (KEPK FKUH-RSUH-RSWS) with ethical approval number 410/UN4.6.4.5.31/PP36/2026.

3. RESULTS

The total number of research subjects who met the inclusion criteria was 70 individuals, consisting of 31 males and 39 females. The characteristics of the study subjects are presented in [Table 1](#).

Table 1. Characteristics of study subjects.

Characteristics	Category	n	%	Mean $\pm$ SD	Median
Sex	Male	31	44.3	–	–
	Female	39	55.7	–	–
Age (years)	18 - 25	30	42.9	–	–
	26 - 40	40	57.1	–	–
Serum Pentraxin-3 (ng/mL)	–	70	100.0	1.63 $\pm$ 0.68	1.40
Body Mass Index (kg/m^2)	–	70	100.0	27.12 $\pm$ 5.58	26.35
Waist Circumference (cm)	–	70	100.0	88.24 $\pm$ 13.66	85.00
Mid-Upper Arm Circumference (cm)	–	70	100.0	30.26 $\pm$ 4.54	30.00
Waist-to-Hip Ratio	–	70	100.0	0.88 $\pm$ 0.08	0.87

The normality test of anthropometric parameters and serum Pentraxin 3 levels in study subjects using the Kolmogorov-Smirnov test is presented in [Table 2](#).

Table 2. Normality test of anthropometric parameters and serum pentraxin 3 levels.

Variable	n	p	Description
Pentraxin 3	70	<0.001	Not normal
Body Mass Index	70	0.012	Not normal
Mid Upper Arm Circumference	70	0.200	Normal
Waist Circumference	70	0.042	Not normal
Waist to Hip Ratio	70	0.013	Not normal

The correlation test between anthropometric parameters and serum Pentraxin 3 levels in study subjects using the Spearman test is presented in [Table 3](#).

Table 3. Correlation test between serum pentraxin 3 and anthropometric parameters.

Variable	r	*p
MUAC	-0.227	0.059
WC	-0.182	0.133
BMI	-0.148	0.222
WHR	-0.169	0.163

Description: *Spearman test.

A total of 70 non-diabetic adult subjects were included in the study, and all participants completed anthropometric measurements and laboratory examinations. No missing data were identified; therefore, all observations were included in the final statistical analysis. Female participants accounted for 55.7% (n = 39) of the study population, whereas males represented 44.3% (n = 31). Most participants were aged 26 - 40 years (57.1%), while 42.9% were between 18 and 25 years of age, indicating that the study population predominantly consisted of adults in the productive age group.

Prior to correlation analysis, data normality was assessed using the Kolmogorov-Smirnov test. Serum PTX3, BMI, waist circumference, and waist-to-hip ratio showed non-normal distributions ($p < 0.05$), whereas MUAC was normally distributed ($p = 0.200$). Because the majority of variables violated the normality assumption, Spearman's rank correlation test was selected to evaluate the association between anthropometric indices and serum PTX3 concentrations.

Spearman correlation analysis demonstrated that none of the anthropometric parameters were significantly associated with serum PTX3 levels. BMI exhibited a weak negative correlation with PTX3 ($r = -0.148$, $p = 0.222$), while MUAC also demonstrated a weak inverse relationship ($r = -0.227$, $p = 0.059$). Similarly, waist circumference ($r = -0.182$, $p = 0.133$) and waist-to-hip ratio ($r = -0.169$, $p = 0.163$) showed weak negative correlations that did not reach statistical significance. Overall, these findings indicate that larger anthropometric measurements tended to be accompanied by lower serum PTX3 concentrations; however, the observed associations were weak and statistically insignificant.

4. DISCUSSION

This study aimed to analyze the correlation between anthropometric parameters consisting of body mass index (BMI), mid upper arm circumference (MUAC), waist circumference (WC), and waist-to-hip ratio (WHR) with serum pentraxin 3 (PTX3) levels in non-diabetic adult subjects.

Adulthood describes individuals who have reached a mature biological stage. Adults are no longer children but men and women who have completed earlier developmental stages. Adults often experience life-style-related health problems that may lead to disease. Obesity in Indonesia continues to increase annually. In 2013, the prevalence of obesity among individuals aged > 15 years was 26.6% and increased to 31.0% in 2018.

Anthropometric measurements are widely used in clinical settings and large-scale epidemiological studies. Anthropometric values can be used as diagnostic criteria for obesity, which is one of the main risk factors for cardiovascular disease, diabetes mellitus, and various other diseases [12].

Serum pentraxin 3 is an acute and chronic phase protein belonging to the pentraxin subfamily and is expressed by various cells such as monocytes, endothelial cells, dendritic cells, and neutrophils during inflammatory processes. Pentraxin 3 production is induced by cytokines such as interleukin-1, TNF- α , and TLR agonists, but not by IL-6 or interferon. In the context of obesity, adipose tissue acts as an endocrine

organ that produces inflammatory mediators and triggers chronic low-grade inflammation [13].

Based on Table 2, the total number of study subjects was 70 individuals. The sex distribution showed that most subjects were female, totaling 39 individuals (55.7%), while males accounted for 31 individuals (44.3%). Based on age group, most subjects were in the 26 - 40 years age range, totaling 40 individuals (57.1%), while the 18 - 25 years age group consisted of 30 individuals (42.9%). This finding indicates that most respondents were adults of productive age. All study variables, including Pentraxin 3 levels, body mass index, mid upper arm circumference, waist circumference, and waist-to-hip ratio, were obtained from 70 samples (100%).

The normality test is an important initial step in statistical analysis to determine whether research data are normally distributed. In this study, normality testing was performed using the Kolmogorov-Smirnov method with a significance threshold of 0.05. In this study, the main interpretation referred to the Kolmogorov-Smirnov test because the sample size was >50 . Variables showing significance values < 0.05 included serum Pentraxin 3 (≤ 0.001), body mass index (0.012), waist circumference (0.042), and waist-to-hip ratio (0.013). These results indicate that these variables were not normally distributed.

The results of the Spearman correlation analysis showed that body mass index (BMI) had no significant correlation with serum pentraxin 3 levels, with a significance value of 0.222 ($p > 0.05$). This value indicates that statistically there was no correlation between variations in BMI and pentraxin 3 levels in adult subjects. Thus, BMI cannot be considered a factor influencing pentraxin 3 levels in this study.

The results of the Spearman correlation test between mid upper arm circumference (MUAC) and serum pentraxin 3 levels presented in Table 3 showed a significance value (p-value) of 0.059, which was greater than the significance threshold of 0.05 ($p > 0.05$). This result indicates that there was no statistically significant correlation between MUAC values and serum pentraxin 3 levels in adult subjects. Therefore, variations in pentraxin 3 levels were not directly associated with differences in MUAC values among the study subjects.

The results of the Spearman correlation analysis showed that waist circumference (WC) had no significant correlation with serum pentraxin 3 levels, with a significance value of 0.133 ($p > 0.05$), indicating that statistically there was no correlation between variations in waist circumference and pentraxin 3 levels in adult subjects.

The results of the Spearman correlation analysis showed that waist-to-hip ratio (WHR) had no significant correlation with serum pentraxin 3 levels, with a significance value of 0.163 ($p > 0.05$), indicating that statistically there was no correlation between variations in WHR and pentraxin 3 levels in adult subjects.

These findings confirm that serum pentraxin 3 is not a biomarker that directly reflects anthropometric status. Meanwhile, BMI, MUAC, WC, and WHR showed no significant correlations, indicating that changes in body composition are not directly proportional to changes in serum pentraxin 3 levels in this population.

The results of this study are consistent with the study by Abu Seman, which demonstrated a negative correlation between serum pentraxin 3 levels and body mass index (BMI) in subjects with normal glucose tolerance, although not across all groups. Other studies have also shown that individuals with higher BMI tend to have lower serum pentraxin 3 levels, and increased serum pentraxin 3 levels occur following weight loss [14].

However, these findings differ from studies that found significant correlations, such as studies showing increased serum pentraxin 3 expression in obese adipose tissue. This study did not identify a significant correlation. These differences may be due to the use of healthy subjects without diabetes and chronic disease in this study, resulting in lower inflammatory levels. Serum pentraxin 3 also reflects local and acute inflammation more than mild chronic inflammation [15].

Serum pentraxin 3, which functions as an inflammatory biomarker, is known to be associated with various pathological conditions such as cardiovascular disease and metabolic syndrome. This finding is in line with a study from Japan that demonstrated a significant inverse correlation between serum pentraxin 3 levels and BMI, with lower pentraxin 3 levels observed in patients with higher BMI [16].

The correlation between anthropometric parameters and serum pentraxin 3 levels can be explained through the role of body fat distribution in metabolic and inflammatory activity. Recent studies have

reported that serum pentraxin 3 levels increase significantly in individuals with metabolic disorders such as diabetes and are associated with metabolic parameters including body mass index and glycemic control [17].

Research by Liong Boy Kurniawan demonstrated that body composition indicators, particularly visceral fat, have better predictive ability for insulin resistance than conventional anthropometric parameters such as body mass index and waist circumference. In this context, increased visceral fat promotes higher metabolic activity, including increased production of inflammatory mediators such as serum pentraxin 3. Therefore, serum pentraxin 3 levels more accurately reflect inflammatory activity triggered by adipose tissue dysfunction, particularly in visceral locations, rather than general anthropometric measurements alone. This finding indicates that fat distribution plays a more important role than total fat amount in determining an individual's metabolic condition. In this study, serum pentraxin 3 levels may be understood as an inflammatory indicator that is more sensitive to metabolic changes than conventional anthropometric parameters [18].

Overall, the findings of this study indicate that conventional anthropometric parameters, including body mass index (BMI), mid-upper arm circumference (MUAC), waist circumference (WC), and waist-to-hip ratio (WHR), were not sufficient to explain variations in serum pentraxin 3 (PTX3) levels among non-diabetic adults. Although all anthropometric parameters showed a negative direction of correlation with serum PTX3 levels, the weak strength of these associations suggests that the relationship between anthropometric characteristics and PTX3 is complex and may not be linear. These findings indicate that changes in anthropometric measures do not necessarily correspond to changes in inflammatory activity as reflected by serum PTX3 levels.

PTX3 has distinct biological characteristics compared with conventional systemic inflammatory biomarkers. Unlike C-reactive protein (CRP), which primarily reflects systemic inflammation induced by interleukin-6 (IL-6) stimulation, PTX3 is produced locally by endothelial cells, macrophages, neutrophils, fibroblasts, and adipocytes in response to activation of the innate immune system. Therefore, PTX3 levels may more directly reflect tissue-level inflammatory processes, endothelial activation, and innate immune responses than simply an increase in total body fat. PTX3 production is particularly associated with local tissue inflammation and vascular responses, supporting its potential role as a biomarker of vascular and innate immune activation rather than as a direct marker of obesity.

In non-diabetic adults, as represented by the population in this study, chronic inflammatory activity may remain at a relatively low level. Consequently, variations in anthropometric parameters may not be sufficient to induce a substantial increase in PTX3 production. This may help explain why BMI, MUAC, WC, and WHR demonstrated weak associations with serum PTX3 levels despite showing a consistent negative direction of correlation. The absence of strong associations also suggests that anthropometric measurements alone may have limited capacity to reflect specific inflammatory processes, particularly those involving vascular inflammation and endothelial dysfunction.

Thus, BMI, MUAC, WC, and WHR should not be considered independent or stand-alone indicators of serum PTX3 levels in non-diabetic adults. Rather, anthropometric measurements may provide complementary information when interpreted alongside biomarkers that capture specific biological processes. A more comprehensive assessment of metabolic and cardiovascular risk may therefore be achieved by integrating conventional anthropometric parameters with inflammatory biomarkers such as PTX3, particularly among populations at increased risk of cardiovascular and metabolic disorders.

From a scientific perspective, the findings of this study contribute to the growing evidence that the relationship between anthropometric characteristics and PTX3 is not straightforward. This study further extends previous evidence by simultaneously examining multiple anthropometric indices in non-diabetic Indonesian adults, a population that remains relatively underrepresented in PTX3 research. The findings emphasize the importance of considering the biological specificity of PTX3 when interpreting its relationship with body composition and anthropometric characteristics. Further studies incorporating additional measures of body composition, metabolic status, endothelial function, and inflammatory activity are warranted to better clarify the mechanisms underlying the relationship between anthropometric characteristics

and circulating PTX3 levels.

5. CONCLUSION

Based on the results of this study, it can be concluded that there was no correlation between anthropometric parameters (BMI, MUAC, WC, WHR) and serum Pentraxin 3 levels in non-diabetic adult subjects.

AUTHOR CONTRIBUTIONS

Conceptualization, Muh Ali Baharuddin, Liong Boy Kurniawan, and Ulung Bahrn; methodology, Muh Ali Baharuddin, Liong Boy Kurniawan, and Ulung Bahrn; validation, Muh Ali Baharuddin, Liong Boy Kurniawan, and Ulung Bahrn; formal analysis, Muh Ali Baharuddin; investigation, Muh Ali Baharuddin; resources, Muh Ali Baharuddin, Liong Boy Kurniawan, and Ulung Bahrn; data curation, Muh Ali Baharuddin; writing—original draft preparation, Muh Ali Baharuddin; writing—review and editing, Muh Ali Baharuddin, Liong Boy Kurniawan, Ulung Bahrn, Burhanuddin Bahar, and Aminuddin; visualization, Muh Ali Baharuddin; supervision, Liong Boy Kurniawan and Ulung Bahrn; project administration, Muh Ali Baharuddin; funding acquisition, Muh Ali Baharuddin. All authors have read and agreed to the published version of the manuscript.

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