



Normal anthropometric profiles but high prevalence of hypertension among the elderly in Semarang City: A descriptive cross-sectional study

Profil antropometri normal tetapi prevalensi hipertensi tinggi pada lansia di Kota Semarang: Studi deskriptif cross-sectional

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Abstract

The increase in the elderly population poses a challenge in the field of health because it is associated with physiological changes that can affect nutritional status and increase the risk of noncommunicable diseases. Anthropometric measurements, such as body mass index (BMI) and waist circumference (WC), are important indicators for assessing nutritional status and the risk of cardiometabolic diseases. This study aimed to describe the anthropometric profile and blood pressure of older adults in Semarang City. This study used a descriptive quantitative design with a cross-sectional approach. Data were collected in the working areas of the Pegandan and Bulu Lor Community Health Centers in Semarang City in February 2024. A sample size of 80 elderly respondents was selected using purposive sampling. The results showed that most respondents were aged 60–69 years (61.25%) and were female (72.5%). Based on anthropometric profiles, 51.2% of respondents had a normal waist circumference, and 55% were not classified as obese based on BMI. However, the prevalence of hypertension among the respondents was quite high at 68.8%. In conclusion, this study shows that most older adults in Semarang City have waist circumferences within the normal range and are not obese based on their body mass index. However, the prevalence of hypertension among respondents was relatively high.

Keywords: Anthropometry, blood pressure, body mass index, waist circumference.

Abstrak

Peningkatan populasi lanjut usia menjadi tantangan di bidang kesehatan karena berkaitan dengan perubahan fisiologis yang dapat mempengaruhi status gizi dan meningkatkan risiko penyakit tidak menular. Pengukuran antropometri seperti indeks massa tubuh dan lingkar pinggang merupakan indikator penting dalam menilai status gizi dan risiko penyakit kardiometabolik. Studi ini bertujuan untuk menggambarkan profil antropometri dan tekanan darah pada lanjut usia di Kota Semarang. Penelitian ini menggunakan desain kuantitatif deskriptif dengan metode *cross-sectional*. Pengumpulan data dilakukan di wilayah kerja Puskesmas Pegandan dan Bulu Lor di Kota Semarang, Februari 2024. Sampel sebanyak 80 responden lansia yang dipilih menggunakan *purposive sampling*. Hasil menunjukkan bahwa sebagian besar responden berusia 60–69 tahun (61,25%) dan berjenis kelamin perempuan (72,5%). Berdasarkan profil antropometri, 51,2% responden memiliki lingkar pinggang normal dan 55% responden memiliki IMT normal. Namun, prevalensi hipertensi di kalangan responden cukup tinggi, yaitu 68,8%. Kesimpulannya, temuan ini menunjukkan bahwa sebagian besar lansia di Kota Semarang memiliki lingkar pinggang yang normal dan tidak mengalami obesitas berdasarkan indeks massa tubuh. Namun, prevalensi hipertensi pada lansia relatif tinggi.

Kata Kunci: Antropometri, indeks massa tubuh, lingkar pinggang, tekanan darah.

Introduction

The elderly population continues to increase globally and nationally, in line with rising life expectancy. In Indonesia, the elderly population has grown rapidly, from approximately 18 million people (7.56%) in 2010 to 25.9 million people (9.7%) in 2019, and is expected to continue to increase to 48.2 million people (15.77%) in 2035 (Kementrian Kesehatan RI, 2019). Population aging poses a significant challenge in the field of health, as the increase in the number of elderly people is associated with physiological changes that can affect nutritional status and increase the risk of non-communicable diseases (Gianfredi et al., 2025). Hypertension is one of the main health problems among older adults. (Riyada et al., 2024). Currently, no data are available from the Pegandan and Bulu Lor Community Health Centers regarding blood pressure and anthropometric measurements of the elderly.

The World Health Organization (WHO) reports that hypertension is a major risk factor for cardiovascular disease, and its prevalence increases with age (Sadeghi et al., 2025). It is estimated that approximately 1.4 billion adults worldwide have hypertension, and this condition often goes undetected because it does not cause any specific symptoms (WHO, 2025). Based on the results of the 2018 Basic Health Research (Riskesdas), the prevalence of hypertension in Indonesia was 34.1%. Among the elderly (aged 60 years and above), 22.9% were diagnosed with hypertension, but only 11.9% took their medication regularly, and only 11.0% made follow-up visits to health care facilities. This highlights the importance of regular blood pressure monitoring (Kementrian Kesehatan RI, 2023). Unlike the secondary data from Riskesdas, our study used standardized direct measurements and included waist circumference.

In addition to blood pressure, anthropometric measurements, such as weight, height, and waist circumference, are important parameters for assessing the nutritional status and health risks of older adults (Emmanuel, 2022). Measuring body mass index (BMI) and waist circumference is a simple way to assess body fat accumulation and central obesity, which are closely related to the risk of cardiometabolic diseases (Zeng, 2025). Anthropometric measurements can complement

nutritional status assessments and help identify health risks in adult and elderly populations (Reber et al. 2019).

Changes in body composition due to the aging process, such as decreased muscle mass and increased visceral fat, can affect the anthropometric profiles and blood pressure of older adults. In addition, it can be influenced by lifestyle factors such as excessive sugar consumption, low physical activity, and short sleep duration (Jannah et al., 2025). Therefore, collecting anthropometric and blood pressure data on the older adult population is important as a basis for mapping health conditions in primary healthcare. Based on this description, this study aimed to describe the anthropometric profile and blood pressure of the elderly population in Semarang City through direct measurement using primary data. The results of this study are expected to provide preliminary information regarding the condition of the elderly in Semarang City and serve as a basis for the development of promotive, preventive, and curative programs for older adults.

Methods

This quantitative descriptive study used a cross-sectional approach to describe the anthropometric profile and blood pressure of older adults in Semarang City. The study was conducted in the working areas of the Pegandan and Bulu Lor Community Health Centers in Semarang City from February to March 2024. Primary data were obtained through direct measurements of the respondents. The research subjects were elderly individuals who visited health centers during the data collection period. The sample size in this study was 80 respondents selected using purposive sampling, which is the selection of samples based on certain criteria, in accordance with the research objectives.

The inclusion criteria for this study were elderly individuals aged ≥ 60 years, who were in good health at the time of data collection, visited the Pegandan or Bulu Lor Community Health Centers during the study period, and were able to communicate actively. The exclusion criteria included respondents who were unable to complete anthropometric or blood pressure measurements, had incomplete data, or declined to participate fully in the study procedures. The main variables measured in this study were

weight, height, waist circumference, and blood pressure. In addition, supplementary data collected included the age, gender, and occupation of respondents.

Data were collected through direct measurements by researchers or trained enumerators using standardized measuring instruments. Body weight was measured using digital scales, height was measured using a microtoise, waist circumference was measured using a measuring tape (Metlin), and blood pressure was measured using a digital sphygmomanometer. Blood pressure measurements were performed after the respondents had rested for at least 5 min in a seated position, with the arm supported at heart level. Two measurements were taken, and the average value was used for the analysis. The entire measurement process was performed following standard operating procedures to minimize measurement errors and improve data validity.

The data obtained were descriptively analyzed using univariate analysis. Variables were presented as frequency distributions and percentages. This study was conducted in accordance with research ethics principles, whereby all respondents were given an explanation of the purpose and procedures of the study and provided their informed consent to participate voluntarily before data collection. This study was approved by the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Diponegoro University (number 057/EC/KEPK/FK-UNDIP/II/2024)

Result and Discussion

The respondents in this study were 80 older adults. The characteristics of the respondents in this study included age, gender, and education level. An overview of the respondents' characteristics is presented in Table 1.

Table 1. Characteristics of respondents

Characteristics	n	%
Age (years old)		
60-69	49	61.25
70-79	23	28.75
80-84	8	10
Gender		
Male	22	27.5
Female	58	72.5
Level of Education		
High (bachelor – master	6	7.5

degree)		
Medium (senior high school)	25	31.3
Low (not in school – junior high school)	49	61.3

Based on Table 1, the majority of respondents were in the 60–69 age group, numbering 49 (61.25%), followed by the 70–79 age group, numbering 23 (28.75%), and the 80–84 age group, numbering 8 (10%). Most respondents were classified as early elderly individuals. In this age group, the aging process begins to cause various physiological changes, such as a decrease in basal metabolism, changes in body composition, and an increased risk of degenerative diseases (JafariNasabian et al., 2017a). Based on gender, most respondents were female (58 people, 72.5%), while 22 people (27.5%) were male. The dominance of female respondents in studies involving older adults is a common phenomenon because women have a higher life expectancy than men (Lemaître et al., 2020). In addition, women tend to be more active in public health activities, such as elderly health posts, thereby becoming more involved in health research (JafariNasabian et al., 2017b).

In terms of educational attainment, most respondents had a low level of education (49 people, 61.3%), followed by a medium level of education (25 people, 31.3 %) and a high level of education (6 people, 7.5 %). Educational attainment is one of the factors that can influence a person's health knowledge and behaviors. Older adults with lower levels of education tend to have limited access to health information, which can affect their understanding of healthy eating, physical activity, and management of chronic diseases that are common in old age (Kwon & Kwon, 2025).

Based on Table 2, the distribution of waist circumference shows that the majority of respondents had a waist circumference in the normal category, namely 41 respondents (51.2%), while 39 respondents (48.8%) fell into the abnormal category. Waist circumference is an important indicator for assessing central obesity and fat accumulation in the abdominal area. An abnormal waist circumference indicates an increased risk of visceral fat accumulation associated with various metabolic diseases, such as hypertension, diabetes mellitus, and cardiovascular disease. Although the majority of respondents had normal waist circumference

based on the criteria used (men ≤ 90 cm and women ≤ 80 cm), the proportion of respondents with abnormal waist circumference remains

quite high, necessitating attention in efforts to prevent non-communicable diseases among the elderly.

Table 2. Frequency distribution of variables

Variables	n	%	Mean $\pm$ SD
Waist Circumference (cm)			89,5 $\pm$ 10,8
Normal	41	51.2	
Abnormal	39	48.8	
Body Mass Index (BMI)			24,9 $\pm$ 4,8
Not obese	44	55	
Obese	36	45	
Blood Pressure Systolic / Diastolic (mmHg)			142.6 $\pm$ 18.4 / 87.3 $\pm$ 10.2
Not hypertension	25	31.2	
Hypertension	55	68.8	

Normal range. Waist Circumference, male: ≤ 90 cm, female: ≤ 80 cm. BMI, 18,5-22,9. Blood Pressure : $\leq 120/80$ mmHg.

Table 3. Overview of hypertension based on anthropometric profiles

Profil Anthropometric	Hypertension, (n = 55)		Not Hypertension (n = 25)		Total
	n	%	n	%	
Waist Circumference					
Normal	29	52,7	12	48,0	41
Abnormal	26	47,3	13	52,0	39
Body Mass Index (BMI)					
Not obese	28	50,9	16	64,0	44
Obese	27	49,1	9	36,0	36

Based on body mass index (BMI), the majority of respondents fell into the non-obese category, totaling 44 individuals (55%), while 36 individuals (45%) were classified as obese. These results indicate that more than half of the respondents had a relatively normal nutritional status, as indicated by their BMI. However, the proportion of obesity among older adults remains high. Obesity in older adults can increase the risk of various degenerative diseases, such as hypertension, heart disease, and other metabolic disorders. Additionally, changes in body composition due to the aging process, such as increased fat mass and decreased muscle mass, can affect the nutritional status of the elderly.

The distribution of blood pressure showed that the majority of respondents had hypertension (55 people, 68.8%), while 25 people (31.2%) did not have hypertension. The high prevalence of hypertension among older adults is a common condition resulting from the aging process, which causes a decrease in vascular elasticity and an increase in peripheral resistance. Although most respondents had a normal waist circumference and were not obese

based on their BMI, the prevalence of hypertension remained high in this population. These findings indicate that hypertension in the elderly is not only influenced by anthropometric status but is also associated with age-related factors and physiological changes resulting from the aging process. Therefore, routine blood pressure checks and monitoring of nutritional status through anthropometric measurements remain essential for the early detection and prevention of complications from noncommunicable diseases in the elderly.

Based on Table 3, the distribution of hypertension according to anthropometric profiles shows that among the elderly group with hypertension, the majority of respondents had a normal waist circumference, namely, 29 people (52.7%), while 26 people (47.3%) had an abnormal waist circumference. Meanwhile, in the group without hypertension, the majority of respondents had an abnormal waist circumference, namely 13 people (52%), while 12 people (48%) had a normal waist circumference. These results indicate that hypertension among the elderly in this study was not only found in respondents with central

obesity but also in elderly individuals with a normal waist circumference. This finding suggests that other factors, such as age, changes in vascular elasticity, family history, salt intake patterns, physical activity, and lifestyle, may also contribute to the development of hypertension in the elderly.

Based on the body mass index (BMI) distribution, in the hypertension group, 28 respondents (50.9%) fell into the non-obese category, and 27 respondents (49.1%) were classified as obese. Meanwhile, in the non-hypertensive group, the majority of respondents were in the non-obese category, with 16 (64 %) and 9 (36 %) people being non-obese and obese, respectively. These results indicate that the proportion of obesity was higher in the hypertensive group than in the non-hypertensive group. Nevertheless, the number of hypertensive older adults who are not obese is also significant. This suggests that hypertension in the elderly is not only influenced by obesity status but is also associated with the aging process and other risk factors.

The results of this study indicate that hypertension remains prevalent among the elderly, even though some respondents had anthropometric measurements within the normal range.

Based on the results of the study in Table 2, 48.8% of the respondents had abnormal waist circumference. Waist circumference is an important indicator for assessing abdominal obesity or fat accumulation in the abdominal area (Chait & Den Hartigh, 2020). Abdominal fat is known to be strongly associated with various metabolic diseases, such as diabetes mellitus, hypertension, and cardiovascular disease (Chen et al., 2024). Normal waist circumference values in most respondents indicate that, in general, body fat distribution in older adults in the study area is still within relatively acceptable limits. However, according to the literature, the presence of respondents with abnormal waist circumference indicates a risk of central obesity, which can increase the risk of non-communicable diseases (Chen et al., 2024)(Bramhankar et al., 2021).

Based on the results of the study in Table 3, most respondents were classified as non-obese (55%), while the rest were classified as obese (45%). The proportion of obesity in the elderly shows a tendency toward weight gain in this group. According to the literature, this

condition can be caused by a decrease in physical activity, changes in metabolism, and an unbalanced diet (Poniasih, 2025). A decrease in physical activity that is not balanced with adjustments to energy intake can lead to body fat accumulation and an increased risk of obesity (Sciarrillo et al., 2023). Obesity in older adults is a significant risk factor for various degenerative diseases, such as diabetes mellitus, heart disease, and hypertension (Sugiharta et al., 2024).

Based on the results of the study in Table 4, the majority of respondents were classified as hypertensive, accounting for 68.8% of the total respondents. The high rate of hypertension in the elderly is consistent with various studies showing that hypertension is one of the most common chronic diseases among the elderly (Camara et al., 2024). Hypertension is one of the most common chronic diseases in the elderly and is a major risk factor for coronary heart disease, stroke, and kidney failure (Burnier & Damianaki, 2023; Fuchs & Whelton, 2020). Physiologically, increased blood pressure in the elderly is associated with various changes in the cardiovascular system that occur as a result of aging (Boutouyrie et al., 2021). As we age, the elasticity of our arteries decreases due to atherosclerosis and thickening of the arterial walls. This condition causes an increase in peripheral vascular resistance, leading to an increase in blood pressure (Herzog et al., 2025). In addition to age, hypertension can be influenced by nutritional status, high-salt diets, lack of physical activity, and obesity.

Although this study is purely descriptive, when considered in relation to anthropometric profiles, obesity based on BMI and increased waist circumference may be important risk factors for hypertension in older adults (Gui et al., 2024; Zhang et al., 2021). The accumulation of body fat, especially abdominal fat, can increase insulin resistance, chronic inflammation, and the workload on the heart, which ultimately contributes to increased blood pressure (Conte et al., 2022). Therefore, waist circumference and BMI measurements are important indicators for monitoring cardiovascular disease risk in older adults (Tylutka et al., 2023).

From a nutritional intervention perspective, managing the nutritional status of older adults should focus on balancing their energy intake and physical activity. Older adults are advised to consume nutritionally balanced

meals that include complex carbohydrates, high-quality proteins, healthy fats, and fiber from vegetables and fruits. Sodium intake should also be limited to help control the blood pressure (Cicero et al., 2021; Hu, 2024a). Although snacks, which are consumed in addition to main meals, are very high in sodium, this can still be managed by limiting the consumption of high-sodium snacks. One alternative is to replace high sodium snacks with healthy ones. Some people think that healthy snacks are unappetizing and bland, but in reality, healthy snacks are low in calories, contain essential nutrients, and are low in fat (Vivian & Aripadono, 2025). In addition, physical activities such as walking, senior gymnastics, or light strength training are important for maintaining muscle mass, reducing visceral fat accumulation, and improving cardiovascular health (Tsai et al., 2025).

Regular health monitoring is an important part of disease prevention efforts in the elderly. Anthropometric examinations, such as waist circumference and BMI measurements, as well as routine blood pressure checks, can help detect risk factors for noncommunicable diseases early on. Public health programs, such as elderly health posts, can be used for health monitoring, nutrition education, and promotion of healthy lifestyles for the elderly (Hu, 2024b; Izquierdo et al., 2025).

Overall, the results of this study show that although most elderly people have waist circumferences that are still within the normal range and most are not obese based on their BMI, the prevalence of hypertension remains high. This shows that age and physiological changes due to the aging process play a major role in increasing blood pressure in the elderly. Therefore, promotional and preventive efforts are needed through nutrition education, dietary management, increased physical activity, and regular health monitoring in the elderly to prevent complications from non-communicable diseases.

Conclusion

study shows that most older adults in Semarang City have waist circumferences within the normal range and are not obese, based on their body mass index. However, the prevalence of hypertension among respondents was relatively high.

Therefore, regular health monitoring through anthropometric measurements and blood pressure checks should be conducted periodically in this population. Additionally, promotive and preventive interventions, such as nutrition education, management of a balanced diet, and increased physical activity, are crucial for maintaining nutritional status and preventing complications from noncommunicable diseases in the elderly population.

The limitations of this study are that it did not include a bivariate analysis and that the sample size was small.

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