



Factor associated with central obesity among patients with non-communicable disease in urban area of Gorontalo

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Fitri Yani Arbie^{1*}, Nuryani², Fatmayanti Nawai³, Ayu Bulan Febry⁴,
Vera Tasintimbang Harikedua⁵, Nonce Nova Legi⁶

¹ DIII Nutrition Study Program,
Department of Nutrition, Poltekkes
Kemenkes Gorontalo, Indonesia.

E-mail: fitri.y.arbie@gmail.com

² Applied Nutrition and Dietetics
Undergraduate Program, Poltekkes
Kemenkes Gorontalo, Indonesia.

E-mail: nuryanigz@gmail.com

³ Poltekkes Kemenkes Gorontalo,
Indonesia.

E-mail:

fatmayantinawai@poltekkesgorontalo.ac.id

⁴ DIII Nutrition Study Program,
Department of Nutrition, Poltekkes
Kemenkes Gorontalo, Indonesia.

E-mail: ayubulanfebry@gmail.com

⁵ Applied Nutrition and Dietetics
Undergraduate Program, Poltekkes
Kemenkes Manado, Indonesia.

E-mail: veraharikedua65@gmail.com

⁶ Applied Nutrition and Dietetics
Undergraduate Program, Poltekkes
Kemenkes Manado, Indonesia.

E-mail: noncenovalegi@gmail.com

*Correspondence Author:

DIII Nutrition Study Program,
Department of Nutrition, Poltekkes
Kemenkes Gorontalo, Indonesia.

E-mail: fitri.y.arbie@gmail.com

Article History:

Received: November 13, 2024; Revised:
January 31, 2025; Accepted: July 22, 2025;
Published: September 8, 2025.

Publisher:



Politeknik Kesehatan Aceh
Kementerian Kesehatan RI

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Abstract

Non-communicable disease (NCD) is a chronic health condition caused by various factors, such as age, physical activity, obesity, and economic status, which can increase the risk of unhealthy living conditions. This study aimed to identify factors associated with the occurrence of central obesity in patients with NCDs using a quantitative approach with a cross-sectional study design calculated using the Slovin formula, involving 207 people who filled out the questionnaire instrument. Sample collection using stratified sampling with inclusion criteria for patients with NCD at five community health centers in Gorontalo City from June to October 2024. After normality testing, the independent sample t-test and Mann-Whitney U test were used to analyze the data. The research results showed the characteristics of the respondents with diabetes mellitus (52,7%) and hypertension (25,2%). The overall incidence of central obesity was 75,8%. Bivariate analysis indicated a relationship between physical activity ($p=0,008$), sex ($p=0,000$), smoking habits ($p=0,000$), long illness of NCDs ($p=0,049$), and the incidence of central obesity, while there was no association between family history of NCDs ($p=0,935$), income ($p=0,941$), and central obesity. The factors related to the incidence of central obesity in NCDs patients are physical activity, sex, smoking habits, and prolonged illness.

Keywords: Physical activity, Risk factors , central obesity

Abstrak

Penyakit tidak menular (PTM) adalah kondisi kesehatan kronis yang disebabkan oleh berbagai faktor seperti usia, aktivitas fisik, obesitas, dan status ekonomi, yang dapat meningkatkan risiko kondisi kehidupan yang tidak sehat. Penelitian ini bertujuan untuk mengidentifikasi faktor-faktor yang berhubungan dengan terjadinya obesitas sentral pada pasien dengan PTM. Studi ini menggunakan pendekatan kuantitatif dengan desain studi potong lintang yang dihitung menggunakan rumus Slovin, melibatkan 207 orang yang mengisi instrumen kuesioner. Pengambilan sampel menggunakan stratifikasi sampling dengan kriteria inklusi untuk pasien dengan PTM di 5 pusat kesehatan masyarakat di kota Gorontalo dari Juni hingga Oktober 2024. Setelah uji normalitas, uji t sampel independen dan uji Mann-Whitney digunakan untuk menganalisis data. Hasil penelitian menunjukkan karakteristik responden yang mengalami diabetes melitus (52,7%) dan hipertensi (25,2%). Kejadian obesitas sentral secara keseluruhan (75,8%). Analisis bivariat menunjukkan terdapat hubungan antara aktivitas fisik ($p=0,008$), jenis kelamin ($p=0,000$), kebiasaan merokok ($p=0,000$) dan lama waktu mengalami PTM ($p=0,049$) dengan kejadian obesitas sentral, sementara tidak ada hubungan antara riwayat keluarga PTM ($p=0,935$) dan pendapatan ($p=0,941$) dengan obesitas sentral. Kesimpulan faktor yang berhubungan dengan kejadian obesitas sentral pada penderita PTM yaitu Aktivitas fisik, jenis kelamin dan kebiasaan merokok dan lama mengalami PTM.

Kata Kunci: Aktivitas fisik, faktor resiko, obesitas sentral

Introduction

Non-communicable diseases (NCD) are long-term diseases with a significant global prevalence, morbidity, and mortality. NCDs usually include diabetes, cancer, respiratory conditions, and cardiovascular disorders (Cerf 2021; Ling et al. 2023). Obesity contributes to metabolic changes that lead to NCDs which are also associated with high blood pressure (Cerf, 2021). Research has shown that weight loss can stabilize neurohormonal activity and lead to clinically significant reductions in blood pressure (El Meouchy et al., 2022).

Waist circumference is significantly correlated with body mass index, blood pressure, and triglyceride and cholesterol levels (Chumpathat et al. 2018). Obesity has more than doubled, making it a pandemic (Koceva et al. 2024). More than 890 million adults live with obesity, and 2,5 billion adults are overweight (WHO, 2024). NCDs can cause a 14-year reduction in life expectancy (Putra et al. 2024).

Lack of physical activity is associated with weight gain and increased risk of health problems, such as cardiovascular disease, diabetes mellitus, depressive symptoms, and other negative impacts on quality of life (Hamzah et al., 2018; Mohamed et al., 2020). Low physical activity is caused by high inactivity owing to the number of steps, high screen, and cell phone time (Miranda et al., 2020). Raiman et al., (2023) Factors causing insufficient physical activity include female sex, older age, marital status, and high income (Ching et al., 2020). Sedentary and inactive lifestyle classes, together with high levels of weight and percentage of body fat (Miranda et al., 2020). Physical inactivity increases the risk of obesity (Arundhana et al., 2018; Niemiro et al., 2019).

Sex also influenced differences in nutritional status. Women are more likely to develop obesity than men are. Depots and sex affect adipose tissue expansion. The male primary fat storage region, the abdominal depot, is characterized by adipocyte hypertrophy, whereas the female primary fat storage location, the gluteofemoral depot, is characterized by adipocyte hyperplasia (Koceva et al., 2024). Female are more physically inactive and sedentary than males lead to an increase in body fat (Miranda et al., 2020; Edwards & Sackett, 2016; Karastergiou & Fried, 2017).

Several factors can contribute to the development of NCDs. Therefore, NCDs and

poverty are closely related. It is anticipated that the sharp increase in NCDs will hinder efforts to reduce poverty in low-income nations, especially by increasing household healthcare expenses. Low socioeconomic status makes people more vulnerable and socially disadvantaged because they are more likely to be exposed to dangerous items, such as tobacco or poor eating habits, and have less access to health care (WHO, 2023). Obesity is more prevalent among people living in deprived areas, and poverty and deprivation increase inequalities in health (Akhter et al., 2021; Nagarkar & Kulkarni, 2018).

Genetic factors are risk factors for NCDs (Ling et al. 2023). A family history of type 2 diabetes and hypertension may increase the risk of poor health behaviors that lead to obesity (Downing et al., 2020; Al Rahmad et al., 2020). Strong inter-individual differences in body weight dictate how an individual reacts to an obesogenic environment and is a genetic component. According to research on twin families, the heritability of obesity ranges from 40% to 70%. Genetic methods can be used to describe physiological and molecular processes that govern body weight (Loos & Yeo, 2022).

Non-Communicable Diseases (NCD) account for 74% of all deaths worldwide; each year, 17 million people die from NCDs, with 86% coming from low- and middle-income countries (WHO, 2023). In Gorontalo Province, the prevalence of diabetes mellitus (DM) in 2023 is 2,3%, hypertension is 26,6%, heart disease based on doctor diagnosis is 0,60%, stroke is 8,0%, and chronic kidney disease is 0,29% (Kemenkes, 2023).

However, there is still a lack of specific data regarding the relationship between physical activity, diet, and central obesity in Gorontalo. Therefore, the purpose of this study was to analyze the factors associated with central obesity among patients with NCD.

Methods

This was a quantitative, the study was conducted in Gorontalo City, which was determined purposively based on a large number of diabetic patients according to the Primary Health Center (PHC), namely Kota Timur, Kota Selatan, Kota Tengah, Kota Utara, and Kota Barat. Data were collected from June to October 2024. This study included patients with diabetes residing in the city of Gorontalo. As

many as 207 people were selected based on the population with non-communicable diseases in each PHC in Gorontalo, calculated using the Slovin formula. Stratified random sampling was carried out based on population non-communicable diseases in each location of the Health Center in Gorontalo city.

Data were collected through questionnaires, interviews, and direct measurements. The interviews were conducted by four enumerators who were previously trained to complete the questionnaire and measure their nutritional status. A structured questionnaire was used to measure respondents' characteristics, including domicile, age, marital status, smoking habits, sex, education level, income per month, history of noncommunicable diseases, and physical activity. The validity and reliability of the questionnaire have been tested by previous researchers.

Non-communicable diseases were determined based on a doctor's diagnosis. Physical activity was measured using physical activity level (PAL), which was calculated using the total metabolic equivalent (MET) for each activity reported 24 h over two days. PAL was categorized as sedentary (PAL=1,0-1,39), low active (PAL=1,4-1,59), active (PAL=1,6-1,89), and very active (PAL=1,9-4,8) (Matthews et al., 2023). Waist circumference was measured using the Onemed waist ruller OD 235, which classifies nutritional status as either central obesity (≥ 80 cm for females and ≥ 90 cm for males) or normal (< 80 cm for females and < 90 cm for males) (Mardotillah et al., 2024).

Data processing and analyses were performed using Microsoft Excel and SPSS software, respectively. Data processing and analyses were conducted using Microsoft Excel and SPSS. After the normality test, the independent sample t-test was used if the data distribution was normal, and the Mann-Whitney test was used if the data distribution was not normal to analyze the data. This study was approved by the Health Research Ethics Commission (HREC) of the Gorontalo Ministry of Health (Polytechnic number: DP.04.03/KEPK/127/2024). All participants provided informed consent and data confidentiality protection. Patients who did not provide consent were not included in this study. After completing the questionnaire, the sample received a gift as a token of appreciation.

Result and Discussion

Table 1 provides a summary of respondents' characteristics. According to the Gorontalo City Health Centre's working area, a significant proportion of responders (34,8%) were from the Kota Barat PHC. Ages 41–50 had the highest incidence of noncommunicable diseases (31,9%), whereas ages 31–40 had the lowest prevalence (8,7%). Regarding marital status, the majority of respondents (74,9%) were married, whereas 22,7% were separated or divorced. 11.1 Of the participants surveyed, 11,1% smoked regularly. According to the gender characteristics, 72,5% of the participants were women. According to their educational background, a large percentage of the respondents (34,2%) had completed senior high school. The monthly income is as high as 72,9%, with revenue below the Regional Minimum Wage (RMW) of Gorontalo Province.

The prevalence of central obesity was as high as 75,8% among the respondents. This amount is almost the same as that in a previous study on healthy adults, which indicated that 61,3% of the respondents had central obesity (Bohari et al., 2021). Waist circumference was a measure of central obesity, a condition of excessive visceral fat accumulation in the abdominal area (Chumpathat et al., 2018). Diabetes mellitus was the most common disease (52,7%). The high prevalence of NCDs is supported by the results of a national health survey that indicated that the highest prevalence of diabetes mellitus was found in adults aged ≥ 35 years (Ministry of Health, 2018).

The factors related to the abdominal circumference measurements are presented in Table 2. The majority of the respondents had low physical activity levels (46,9%), similar to a previous study that indicated that respondents had very low physical activity levels (91,1%) (Nuryani et al., 2021). Physical activity was associated with central obesity ($p = 0,008$). Respondents with normal nutritional status having quite a lot of physical activity in the active and very active categories compared to physical activity in the sedentary and low physical activity categories. Meanwhile, respondents with central obesity had a fairly high percentage of sedentary and low physical activity compared with physical activity in the active and very active categories. Low physical activity is associated with weight gain, which leads to obesity and increases the risk of health

problems and death due to NCDs (Arundhana et al., 2018; Mohamed et al., 2020; WHO, 2023). A study on Bangladeshi migrants indicated that respondents who did not walk for at least 20 min a day were more likely to develop NCDs (Akhter et al., 2021).

Table 1. Characteristics of the respondents

Variable	n	%
Domicile		
Kota Timur	62	30,0
Kota Utara	23	11,1
Kota Selatan	20	9,7
Kota Tengah	30	14,5
Kota Barat	72	34,8
Age (years)		
31-40 years old	18	8,7
41-50 years old	66	31,9
51-60 years old	58	28,0
61-70 years old	42	20,3
≥ 71 years old	23	11,1
Marital status		
Marry	155	74,9
Unmarried	5	2,4
Other	47	22,7
Smoking habits		
Yes	23	11,1
Not	184	88,9
Sex		
Men	57	27,5
Woman	150	72,5
Education		
Elementary school	62	30,0
Junior high school	43	20,8
Senior high school	71	34,2
University level	31	15,0
Income per month		
< RMW	151	72,9
≥ RMW	56	27,1
Waist circumference		
Normal	50	24,2
Central obesity	157	75,8
Noncommunicable diseases (NCDs)		
Diabetes mellitus	109	52,7
Hypertension	52	25,2
Hypercholesterolemia	34	16,4
Hyperurecemia	8	3,9
Stroke	2	0,9
Heart disease	2	0,9

Male respondents had a more normal nutritional status (59,6%) than central obesity (40,4%), in contrast to female respondents

who had more central obesity (88,7%) than those with normal nutritional status (11,3%). Bivariate analysis showed a significant relationship between sex and central obesity ($p = 0,000$). Female are more physically inactive and have a sedentary lifestyle than males leads to an increase in body fat (Miranda et al., 2020). Female sex is associated with the development of NCDs (Akhter et al., 2021). Being a woman, having a high socioeconomic status, being 55 years or older, being physically inactive, being overweight or obese, and having hypertension are factors associated with central obesity (Tegegne et al., 2022). In addition to socioeconomic factors, educational level is another factor that affects the development of obesity (Motswagole et al., 2020);Cohen et al., 2013; Witkam et al., 2021). Consequently, it is essential for governments and health organizations to design and implement preventive strategies such as early detection, close surveillance, and positive reversal of central obesity in all patients and the general population. A high-quality study on the prevalence of central obesity in the city of Gorontalo (Tegegne et al., 2022).

As many as 11,1% of the respondents had smoking habits, and bivariate analysis showed that there was a significant relationship between smoking habits and central obesity ($p = 0,000$). Tobacco use increases the risk of death from NCDs (WHO 2023).

The proportion of family members who experienced NCDs was 30,9%. The percentages of normal nutritional status and central obesity were almost the same between respondents who had family members with NCDs and those who did not have a history of NCDs. Thus, the results of the bivariate test showed no significant relationship between a history of diabetes mellitus in family members and the incidence of central obesity ($p = 0,935$).

Genetic status is a risk factor for NCDs (Nagarkar & Kulkarni, 2018; Ling et al., 2023). However, this study found no association between a family history of NCDs and central obesity because the number of respondents with a family history of NCDs with central obesity (75,0%) was almost the same as that of respondents who did not have a family history of NCDs (75,5%). However, the distribution of normal data and central obesity data was uneven. A study by Puspitasari (2018) showed a strong

correlation between central obesity and family history (p-value = 0,003). times more likely to be classified as obese than those without a family

history of central obesity, and those with such a history were 1,5 times more likely to be classified as obese (Puspitasari 2018).

Table 2. Analysis of factors that associated with waist circumference

Variable	Normal		Central obesity		Total		p-value
	n	%	n	%	n	%	
Physical activity level							
Sedentary	9	19,6	37	80,4	46	22,2	0,008*
Low physical activity	19	19,6	78	80,4	97	46,9	
Active	17	30,9	38	69,1	55	26,6	
Very active	6	66,7	3	33,3	9	4,3	
Sex							
Male	34	59,6	23	40,4	57	27,5	0,000*
Female	17	11,3	133	88,7	150	72,5	
Smoking habits							
Yes	17	73,9	6	26,1	23	11,1	0,000**
No	34	18,5	150	81,5	184	88,9	
Family history of NCDs							
Yes	16	25,0	48	75,0	64	30,9	0,935*
No	35	24,5	108	75,5	143	69,1	
Duration illness of NDCs							
≥ 10 years	12	38,7	19	61,3	31	15,0	0,049*
< 10 years	39	22,2	137	78,8	176	85,0	
Income per month							
< RMW	37	24,5	114	75,5	151	72,9	0,941**
≥ RMW	14	25,0	42	75,0	56	27,1	

*Independent Sample T test ** Mann whitney test

Most respondents had an NCD duration of < 10 years (85,0%). A significant relationship was observed between the duration of NCDs and the incidence of central obesity (p = 0,049). Patients with NCD suffering from the disease for more than ten years indicated better nutritional status, which may be due to the awareness of the patient to control disease more highly and better lifestyle (Chen et al., 2024; Putra et al., 2025).

The majority of the respondents had an income below the regional minimum wage (72,9%). However, bivariate analysis indicated no association between monthly income and central obesity (p = 0,941). Low socioeconomic vulnerability has NCDs risk factors such as unhealthy dietary practices and limited access to health services (WHO, 2023). This may be because of low physical activity (Ching et al., 2020). Lifestyle by doing physical activity for at least 150 minutes a week and maintaining a healthy diet to be able to control risk factors for prediabetes (Rezavitawanti & Helda, 2024). Obesity is more prevalent in metropolitan locations among wealthier populations,

particularly women in low-income countries. In high-income nations, these effects are felt equally by both men and women. Groups with a lower socioeconomic status are more affected (Koceva et al., 2024; Al Rahmad, 2021). Lower self-assessed financial status is more likely to lead to the development of NCDs (Akhter et al., 2021). However, this study found no association between income per month and central obesity because the majority of respondents had income less than the regional minimum wage and the percentage of respondents with central obesity had low income (75,5%), almost the same as the respondents with high income (75,0%).

This study identified factors associated with central obesity among patients with NCD in the urban area of Gorontalo that provide current information about the progression of NCDs in a large City in Gorontalo. However, the study variables were not comprehensive enough to analyze the risk factors of central obesity, such as not measuring the trend consumption of fruit and vegetables, fat and fast food, and type of physical activity that the majority practice by

respondents. Thus, this study has another limitation: the short duration of data collection. There are no in-depth measurements of diet types and physical activity, and the sample size is limited for generalization. As we age, the liver, heart, and pancreas cells are harmed by insulin resistance, a type of obesity (Nawai et al., 2024a). One solution for the treatment of diabetes mellitus and obesity is to reduce energy intake and mitigate metabolic effects. An anti-inflammatory diet, Mediterranean diet, and vegan diet consisting of many fruits and vegetables, whole grains, cocoa, coffee, tea, red wine, and extra virgin olive oil can be combined with a resistant starch diet (Nawai et al., 2024b). Porang tuber flour, banana flour, and mangrove flour are some fruits high in resistant starch. These flours contain dietary fiber, resistant starch, bioactive compounds, phenolic antioxidants, flavonoids, and inulin, which are beneficial for people who are obese and have diabetes (Nawai et al., 2023).

Conclusion

Factors associated with central obesity in patients with non-communicable diseases in Gorontalo Province are low physical activity, female sex, smoking, and the duration of suffering from non-communicable diseases.

Therefore, the government can take specific actions, such as enhancing health education, regularizing community sports programs, or building easily accessible and affordable sports facilities for the surrounding community, such as cycling sports.

Acknowledgments

We thank the Directorate General of Health Personnel of the Ministry of Health and the Gorontalo Ministry of Health Polytechnic for funding this research in the Higher Education Cooperation Research Scheme (PKPT).

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