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Comparative Analysis of Random Blood Glucose Levels Based on Waist Circumference Among Personnel at Pakupatan Terminal

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ABSTRACT

Central obesity, measured by waist circumference, is a key anthropometric indicator and a major risk factor for Type 2 Diabetes Mellitus (T2DM). The prevalence of central obesity and metabolic disorders continues to increase globally and locally, including in Serang City. Certain occupational groups, such as terminal personnel, may be at higher risk due to sedentary work patterns and occupational stress. This study aimed to examine differences in Random Blood Glucose (RBG) levels based on central obesity status among personnel at Pakupatan Terminal, Serang City. A cross-sectional design was employed, involving 23 management and operational personnel selected through convenience sampling in November 2025. Data were collected through waist circumference measurements and RBG testing, and analyzed using descriptive statistics and the Independent Samples t-test. The results showed a p-value greater than 0.05, indicating no significant difference in RBG levels between central obesity and normal groups. This finding may be influenced by the small sample size or early metabolic changes not yet reflected in glucose levels. Despite the non-significant results, central obesity remains an important indicator of long-term metabolic risk. Therefore, preventive interventions such as workplace health screening, nutrition education, and regular physical activity are recommended to reduce the risk of metabolic syndrome and other non-communicable diseases among high-risk occupational groups.

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INTRODUCTION

Non-communicable diseases (NCDs), including obesity and diabetes mellitus (DM), are a growing global public health concern, with Indonesia experiencing a similar trend (Azis et al., 2020; Kohir et al., 2024). Type 2 diabetes mellitus (T2DM), characterized by elevated blood glucose levels resulting from impaired insulin production or function, and obesity, has been identified as a substantial risk factor in the development and progression of T2DM across all age groups. Consequently, interventions targeting obesity are imperative for the prevention and management of T2DM on a global scale (Chandrasekaran & Weiskirchen, 2024; Ojo et al., 2023).

The global prevalence of adult diabetes has escalated significantly, rising from 4.7% in 1980 to 8.5% by 2014. Given that type 2 diabetes constitutes over 90% of all diagnoses, the International Diabetes Federation (IDF) reports a current burden of 589 million cases among adults—a figure projected to reach 853 million by 2050. This upward trajectory is primarily attributed to the rising incidence of obesity and deleterious lifestyle factors (IDF, 2025; WHO, 2016).

Indonesia is witnessing a significant escalation in the prevalence of central obesity and diabetes mellitus. National data indicates that central obesity has reached 23.4% among adults and 36.8% in individuals aged 15 and older, while diabetes prevalence increased from 10.9% in 2018 to 11.7% in 2023 (Darmawanti, 2024; Kemenkes RI, 2018, 2023). The concurrent rise of these comorbid conditions poses a substantial public health challenge, necessitating urgent intervention strategies.

At the sub-national level, epidemiological data from Serang City, Banten Province, reflect a burgeoning burden of obesity and diabetes. Between 2018 and 2023, the prevalence of central obesity among individuals aged 15 and above rose significantly from 30.57% to 36.4%. Similarly, local data for Serang City recorded an upward trend in these indicators, reaching 31.3% in 2018, which underscores the intensifying regional public health challenge (Kemenkes RI, 2013, 2018, 2023).

Furthermore, epidemiological reports indicate that the physician-diagnosed prevalence of diabetes mellitus (DM) in Banten Province (1.6%) surpasses the national average (1.5%). Notably, Serang City exhibits a higher prevalence of 1.82%, ranking third among the eight regencies and cities within the province (Kemenkes RI, 2018).

The age group demonstrating a high risk of central obesity and elevated blood sugar levels is the working population, particularly those employed in the public sector, such as administrative and operational personnel at land transport terminals (Hussein et al., 2025). One of the land transport terminals in Banten Province is the Type A Bus Terminal Pakupatan, which functions as the primary terminal in Serang City. The terminal is overseen by the Ministry of Transport and serves both inter-city and inter-provincial transport (AKAP) as well as intra-provincial urban transport (AKDP).

The terminal work environment is typified by elevated workloads, erratic schedules, considerable stress exposure, and the provision of foodstuffs characterized by high fat and sugar content, coupled with limited physical activity (i.e., sedentary behavior) over protracted periods, a circumstance that has the potential to expedite adipose tissue accumulation in the abdominal region. These conditions render terminal personnel susceptible to metabolic disorders (Madya Nurhuda et al., 2024; Suha & Rosyada, 2025).

According to data from the Indonesia Central Bureau of Statistics, which spans the period up to 2021, individuals aged 18 and older who are employed in office roles exhibit the highest prevalence of obesity when compared to those engaged in other occupations (Annurullah et al., 2021). Furthermore, data from the 2018 *Riset Kesehatan Dasar* (RISKESDAS) in Banten Province also indicates that the adult working population (aged over 18) exhibits a higher prevalence of obesity among employees in government institutions (civil servants/TNI/Polri/BUMN/BUMD) (36.61%) compared to other workers such as private-sector employees (21.87%), the self-employed (27.2%), fishermen (4.72%), farmers/agricultural laborers (7.16%), manual laborers/drivers/domestic helpers (13.29%), and others (22.27%) (Kemenkes RI, 2018).

Waist circumference is a measure of central obesity and an important indicator of increased visceral fat, which is closely associated with insulin resistance and metabolic dysfunction—factors that constitute risk factors for type 2 diabetes (DM) (Adnyana et al., 2021; S. K. Yadav et al., 2018). It has been established that waist circumference offers a superior reflection of visceral obesity and serves as a more accurate predictor of the development of type 2 diabetes mellitus (T2DM) in comparison to the Body Mass Index (BMI) (Li et al., 2023). A substantial body of research has demonstrated a robust correlation between central obesity and type 2 diabetes mellitus (T2DM) (Pradono et al., 2015; Trisnadewi et al., 2019). Consequently, a concentration on waist circumference is imperative for elucidating the association between diabetes risk and the adult population.

Despite the documented rise in metabolic disorders across Indonesia, there is a notable lack of empirical evidence focusing on the specific metabolic profiles of transportation hub personnel. Current literature often generalizes the working population without accounting for the unique environmental stressors inherent in terminal operations. Furthermore, while the link between central obesity and glycemia is established, comparative studies specifically evaluating the disparities in Random Blood Glucose (RBG) levels between individuals with central obesity and those with normal waist circumferences in this sector are virtually non-existent. This study addresses this gap by utilizing waist circumference as a more precise indicator of metabolic risk than BMI in a localized, high-stress occupational context. Consequently, it is imperative to investigate the disparities in RBG levels between individuals with central obesity and those with a normal waist circumference among the personnel at Pakupatan Terminal, Serang City, to better elucidate the metabolic implications within this specific population.

METHOD

The present study employed an analytical cross-sectional research design. The research location was Pakupatan Terminal, Serang City, in November 2025. The present study employed the convenience sampling technique, surveying a total of 23 respondents comprising administrative and operational personnel. The independent variable in this study was waist circumference, defined as an anthropometric measurement method to determine an individual's nutritional status by measuring the circumference around the abdomen, typically taken at navel level, with cut-off values of: men >90 cm and women >80 cm (Kemenkes RI, 2023; S. K. Yadav et al., 2018). Waist circumference was measured using a tape measure. The dependent variable is random blood glucose (RBG), defined as the blood glucose level of an individual measured at any time without fasting, with a normal threshold of 200 mg/dl, measured using a capillary blood sample (fingertip) (Keputusan Menteri Kesehatan RI No. HK.01.07/MENKES/603/2020 Tentang Pedoman Nasional Pelayanan Kedokteran Tata Laksana Diabetes Melitus Tipe 2 Dewasa, 2020). RBG measurement employs the Easy Touch device.

Descriptive statistics were used to determine the frequency distribution of respondent characteristics based on nutritional status and RBG levels according to age and gender. Prior to conducting correlation tests, a Shapiro-Wilk normality test was performed on the sample, which had a sample size of less than 50. The data were normally distributed if the p-value was greater than 0.05. An independent t-test was employed to analyze the differences in Random Blood Glucose (RBG) levels between individuals with

central obesity and those with a normal waist circumference, with a p-value <0.05 being considered statistically significant.

RESULTS

Characteristics of the Respondent Based on Waist Circumference and Random Blood Glucose

The subjects of this study were 23 administrative and operational personnel at Pakupatan Terminal in Serang City, and the study was conducted in November 2025. In regard to the characteristics of the respondents based on waist circumference measurements, it was determined that the majority of respondents were female (60.9%), with the measurement results indicating central obesity in 10 individuals, comprising 5 men (50%) and 5 women (50%). The majority of respondents were in the 25–44 age group (65.2%), with the highest number of cases of central obesity, namely 7 individuals (70%) (Table 1).

Table 1. Frequency Distribution of Respondent Characteristics Based on Waist Circumference

Variable	Waist Circumference					
	Central Obesity		Normal		Total	
	n=10	%	n=13	%	N=23	%
Sex						
Male	5	50.0	4	30.8	9	39.1
Women	5	50.0	9	69.2	14	60.9
Age Group (years)						
22–44	1	10.0	4	30.8	5	21.7
25–44	7	70.0	8	61.5	15	65.2
45–56	2	20.0	1	7.7	3	13.0

Source: Primary Data (2025)

The results of random blood glucose (RBG) measurements revealed that all respondents exhibited normal blood glucose levels (<200 mg/dl), irrespective of sex and across all age groups (Table 2).

Table 2. Frequency Distribution of Respondent Characteristics Based on Random Blood Glucose (RBG) Levels

Variable	Random Blood Glucose Level					
	Abnormal		Normal		Total	
	n=0	%	n=23	%	N=23	%
Sex						
Male	0	0	9	39.1	9	39.1
Women	0	0	14	60.9	14	60.9
Age Group (years)						
22–44	0	0	5	21.7	5	21.7
25–44	0	0	15	65.2	15	65.2
45–56	0	0	3	13.0	3	13.0

Source: Primary Data (2025)

Descriptive Statistic and Bivariate Analysis

Descriptive statistics for waist circumference and RBG levels in the 23 respondents indicated that the mean waist circumference was 84.43 ± 15.37 cm, with a minimum of 66.5 cm and a maximum of 135 cm. This finding suggests that a proportion of respondents may be at risk of central obesity, particularly when compared with the established adult waist circumference thresholds (women: >80 cm; men: >90 cm) (Table 3).

Table 3. Results of Descriptive Analysis and Independent Samples t-tests for Waist Circumference (WC) and Random Blood Glucose (RBG)

Variable	n	Min.	Max.	Median	Mean	SD	*p-value*
WC (cm)	23	66.5	135	82.5	84.43	15.367	0.441
RBG (mg/dl)	23	83	138	103	106.09	16.376	

The mean RBG level among respondents was 106.09 ± 16.38 mg/dl, with a range from a minimum of 83 mg/dl to a maximum of 138 mg/dl. In general, these values remain within the normal range; however, some respondents exhibited RBG levels approaching the upper limit of normal, thereby potentially increasing the risk of glycemic disorders. The substantial variation in waist circumference and RBG values among respondents suggests the presence of differences in individual metabolic status. However, the Independent Sample T-test analysis yielded a p-value of 0.441 (p>0.05), indicating no statistically significant difference in RBG levels between the centrally obese and normal waist circumference groups. This finding suggests that while central adiposity is a recognized metabolic risk factor, it has not yet manifested as significant glycemic dysregulation within this specific cohort.

DISCUSSION

The results of the Independent Sample T-test showed no significant difference in Random Blood Glucose (RBG) levels between individuals with central obesity and those with normal waist circumferences (p=0.441). This result differs from the general scientific view that links abdominal fat to high blood sugar. Several reasons may explain this outcome.

The main limitation of this study is the small sample size (n=23), which reduced the study's ability (statistical power) to detect real differences between the two groups. In statistics, a small group makes it harder to find a significant relationship even if one exists. Additionally, Random Blood Glucose (RBG) can change quickly depending on what a person recently ate or their time of testing. This variability might have hidden the long-term impact of obesity on blood sugar levels in this specific group.

The findings of this study diverge from several established investigations that identify a significant link between central adiposity and glucose dysregulation in working populations. For instance, Putri and Anita (2019) demonstrated a significant relationship between central obesity and postprandial glucose (PPG) levels among adult workers. Similarly, Tanusi et al. (2026) identified significant disparities in fasting blood glucose (FBG) levels between centrally obese individuals and those

with normal waist circumferences within a similar occupational cohort. Furthermore, a large-scale study by Li et al. (2023) confirmed that an increasing waist circumference serves as a potent predictor for the elevated risk of Type 2 Diabetes Mellitus (T2DM) in adults (Li et al., 2023; Putri & Anita, 2019; Tanusi et al., 2026).

However, the lack of significant difference observed in this research aligns with the findings of Yadav et al., who also reported no significant disparity in Random Blood Glucose (RBG) levels between centrally obese and normal waist circumference groups (S. Yadav et al., 2024). These conflicting outcomes are likely attributable to the specific physiological nature of the blood glucose indicators employed across the various studies. Fasting Blood Glucose (FBG), as utilized by Tanusi et al. (2026), measures glucose levels after twelve hours of caloric restriction, providing a stable baseline of endogenous glucose production. Meanwhile, Postprandial Glucose (PPG), investigated by Putri and Anita (2019), measures the metabolic response two hours after a meal and is often more sensitive in detecting early-stage insulin resistance specifically linked to visceral fat accumulation.

In contrast, the RBG measurement used in this study is highly susceptible to acute external variables, such as the timing of the last meal, carbohydrate composition, and immediate physical activity levels of the terminal personnel. In the context of the Pakupatan Terminal personnel, the high variability of RBG may have obscured the underlying metabolic impact of central obesity. These non-significant results suggest that while these individuals manifest central adiposity, they may still be in a compensatory physiological phase where their glucose levels remain within a normal range under random conditions, despite the potential presence of chronic visceral inflammation (Rabhi et al., 2014; Regazzi et al., 2014). Ultimately, this study underscores the limitations of using RBG as a sole indicator and highlights the necessity for more sensitive diagnostic tools, such as FBG or PPG, in future occupational health screenings.

Even without a significant statistical link in this sample, central obesity remains a major health risk (Chaithanya et al., 2020). Central obesity, defined by the accumulation of visceral fat, is a significant contributing factor to insulin resistance and type 2 diabetes mellitus (T2DM) through the production of inflammatory mediators, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), and free fatty acids. These factors disrupt insulin signaling, particularly by interfering with GLUT-4 translocation, thereby rendering cells unresponsive to insulin. Dysfunctional adipose tissue, particularly in the abdominal region, has been demonstrated to increase chronic and systemic inflammation, which exacerbates metabolic complications (Hardy et al., 2012; Rohm et al., 2022).

Central obesity is prevalent among public sector workers, including administrative and operational personnel in land transport terminals, who engage in sedentary lifestyles marked by low physical activity and unhealthy dietary patterns (Hussein et al., 2025). Consequently, preventive measures remain imperative, as central obesity constitutes a significant risk factor for the development of metabolic disorders.

The Ministry of Health of the Republic of Indonesia has issued a series of recommendations for the promotion and prevention of health. These recommendations include the implementation of *Perilaku Hidup Bersih dan Sehat* (PHBS), *Gerakan Masyarakat Hidup Sehat* (GERMAS), the promotion of at least 30 minutes of physical activity per day, the promotion of a balanced diet, the limitation of sugar to 4 tablespoons per day, salt to 1 teaspoon per day, and fat to 5 tablespoons per day, the cessation of smoking, and the early detection of risk factors for non-communicable diseases (NCDs) through waist circumference measurement and regular blood sugar checks (Kemenkes RI, 2021). For instance, in the context of terminal personnel, workplace-based interventions emerge as a pivotal aspect of addressing these concerns, encompassing initiatives such as nutrition education, the creation of a work environment conducive to physical activity, and the implementation of routine health checks aimed at averting the onset of metabolic disorders in the future.

CONCLUSION

In conclusion, while waist circumference is a critical anthropometric indicator for central obesity and a documented precursor to Type 2 Diabetes Mellitus, this study found no statistically significant difference in Random Blood Glucose (RBG) levels between centrally obese and normal waist circumference personnel. This lack of significance is likely attributable to the limited sample size and the potential compensatory metabolic state of the participants. Nevertheless, these findings underscore the clinical importance of early detection. Targeted promotive and preventive interventions remain imperative within occupational settings, such as terminal hubs, to mitigate the long-term progression of metabolic syndrome among high-risk workers.

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AUTHOR CONTRIBUTION AND COMPETING INTEREST

The first author served as the principal investigator and was responsible for the conceptualization of the study, research design, data collection, data analysis, and drafting of the manuscript. The second author contributed to the research design, assisted in data analysis and interpretation, and critically reviewed and revised the manuscript for important intellectual content.

Both authors read and approved the final version of the manuscript.

The authors declare that there are no competing interests associated with this study.

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