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Original Research Article

Analysis of Waist-to-Hip Ratio with Total Cholesterol Levels in Obese and Non-Obese Employees at El Tari Airport Kupang

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Abstract: Increased cholesterol levels are one of the causes of obesity. One type of obesity is central obesity, characterized by the amount of accumulation of fat in the abdominal area. Waist-to-Hip Ratio (WHR) measurement is more potent than Body Mass Index (BMI) in predicting cardiovascular disease risk. WHR is also used to identity the occurrence of central obesity, which is a risk factor for elevated cholesterol levels. This study aimed to analyze the difference in total cholesterol levels in the group of normal and above normal WHR employees at El Tari Airport, Kupang. This study was an observational analytic type with the cross-sectional method and used venous blood samples to measure total cholesterol levels and WHR. Data analysis using independent sample t-test. The results of the independent sample t-test showed a significant difference in total cholesterol levels between obese employees (above normal WHR) and non-obese employees (normal WHR). The significance result is 0.027 ($p < 0.05$) in the independent sample t-test. This indicates that WHR can be used to identify central obesity in a person and also person with above normal WHR tend to have high total cholesterol levels.

Keywords: WHR, Waist-to-Hip Ratio, Cholesterol, Employee.

INTRODUCTION

Non-communicable diseases are still a significant cause of death in the world. According to data from the World Health Organization (WHO) in 2021, cardiovascular disease is the leading cause of non-communicable diseases in many deadly cases worldwide (WHO, 2021). Cardiovascular disease can be caused by high total cholesterol in the blood or what is called hypercholesterolemia (PERKENI, 2021). According to the 2018 Basic Health Research (RISKESDAS) shows that in total there are 28.8% of Indonesian people aged ≥15 years with total cholesterol level above normal, which is categorized as borderline (200-239 mg/dL) as much as 21.2% and the high category (≥240 mg/dL) as much as 7.6% (Balitbangkes RI, 2018).

An increase in total cholesterol is triggered by various aspects, including obesity or excess fat in the body's adipose tissue. Obesity consists of peripheral obesity and central obesity. Peripheral obesity is defined as an excessive amount of fat accumulated in the body, especially in the peripheral parts of the body, while in central obesity, the amount of fat accumulated is more in the waist and hip. The measurement of obesity often uses the Body Mass Index (BMI) measurement. Body Mass Index is still often used to estimate the incidence of obesity in a population. BMI is a cheap, easy, and quick measurement to determine general body size but it cannot assess body fat distribution and body shape (Larasati & Alvina, 2018). Waist-to-hip ratio (WHR) can be used as an alternative in measuring abdominal fat, especially visceral fat, which is a marker of central obesity. Individuals are said to be centrally obese if the WHR result is ≥0.90 cm for men and ≥0.85 cm for women. Waist-to-hip ratio measurement is more potent than BMI in predicting cardiovascular disease risk (Myint *et al.*, 2014).

Various risk factors, incuding diet, physical activity level, and genetics, can cause obesity. Diet and physical activity levels contribute significantly to obesity, especially central obesity in adulthood. Reduced levels of physical activity due to work conditions that require sitting for long hours and a diet that tends to

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consume fast food and high fat have resulted in the prevalence of adult obesity in Indonesia increasing every year. Based on the results of pre-research conducted by the author and team, it was found that in the environment of El-Tari Kupang Airport, employees have busy working hours which generally start from 3 am to 6 pm for shift 1 followed by 6 pm to 4 am for shift 2, this has not been calculated with certain activities or holidays that make work even more dense so that rest, exercise and diet become irregular. Based on pre-research data from simple grouping results in the form of body mass index data, 54.4% of employees were found to be overweight or have a BMI above normal.

The existence of differences in total cholesterol between obese and non-obese subjects was stated in previous research by Hapsari (2019) (Hapsari, 2019) Dinutanayo's research (2021) on comparing lipid profiles and inflammatory markers in obese and non-obese men who had 28 male respondents aged 18-35 years also stated that there were significant differences in total cholesterol levels between groups of individuals with normal nutritional status and obesity with BMI measurements (Dinutanayo & Akhriyani, 2021) It differs from Hastuty's (2018) and Rumampuk's (2017) research, which states there is no difference in average cholesterol between obesity and non-obesity (Hastuty, 2018), (Rumampuk *et al.*, 2017).

From several previous studies, it is still rare to find studies using WHR measurements to measure obesity. This study aims to analyze the differences in total cholesterol levels in the normal and above normal WHR employees at El Tari Airport in Kupang City.

METHODS

This research has ethical clearance approval number 69/UN15.16/KEPK/2023 by the Health Research Ethics Commission of the Faculty of Medicine and Veterinary Medicine Universitas Nusa Cendana Kupang. This study was an observational analytic type with a cross-sectional method conducted form September 1, 2023 to September 23, 2023. Prior to data collection, researchers conducted screening through direct interviews and filling out screening sheets on El Tari Kupang Airport employees. This research was conducted with a total sample size of 88 subjects of El Tari Kupang Airport employees aged 18-59 years according to the inclusion and exclusion criteria. The sampling technique used was consecutive sampling.

After screening, the researcher explained the procedure and general description of the study and asked respondents to fast for 12 hours the day before blood collection. The researcher also asked consent to become a respondent with an informed consent sheet. After obtaining approval from the employees of El-Tari Kupang Airport to become respondents, the researchers asked the employees who were willing to become research respondents to be present on the day of the examination and blood sampling.

A 3cc median cubital vein blood draw was done on the morning of the day after screening with the help of a laboratory assistant. Blood samples were stored in vacuum tubes without anticoagulants that had been centrifuged to separate blood cells and serum. Blood serum was then delivered to the RSUD S.K Lerik Kupang laboratory for total cholesterol examination. The total cholesterol examination used Biosystem BA-200 Biochemistry Analyzer, a spectrophotometric method with the principle of light being absorbed in a specific wavelength by the material being examined. After taking blood, respondents were directed to take waist and hip circumference measurements. Waist circumference was measured at the center between the last palpable rib's margin and the iliac crest's upper margin. In contrast, hip circumference was measured around the top of the gluteus region. The waist circumference measurement was then divided by the result of the hip circumference measurement to obtain the waist-to-hip ratio.

RESULTS

Characteristics of Respondents

Table 1: Characteristics of Respondents by Gender and Age among El-Tari Kupang Airport Employees

Characteristics	Frequency	Percentage (%)
Gender		
Men	62	70,45
Women	26	29,55
Age		
18-19	4	4,545
20-24	20	22,727
25-29	15	17,045
30-34	21	23,864
35-39	10	11,364
40-44	8	9,091
45-49	6	6,818
50-54	4	4,545
Total	88	100

Based on the data in Table 1, it is known that the distribution of gender is primarily male gender (70.45%) and the least female (29.55%), as well as the distribution of age is mainly 30-34 years old (23.86%) and the least at the age of 18-19 (4.54%) and 50-54 (4.54%).

Univariate Analysis

Table 2: Frequency Distribution Table of Gender on Waist-to-Hip Ratio among Employees at El-Tari Airport Kupang

Waist-to-Hip Ratio	Frequency	Percentage (%)
Normal		
Men	47	76
Women	15	24
Above normal		
Men	15	58
Women	11	42
Total	88	100

Based on Table 2, the number of respondents with normal WHR was 47 male and 15 female respondents, while WHR above normal was found to be 15 male and 11 female respondents.

Table 3: Mean Total Cholesterol by WHR in Men

Variable	Frequency	Mean Total Cholesterol
Waist-to-Hip Ratio		
Normal	47	182,82
Above normal	15	206,86

Based on Table 3, it was found that the average total cholesterol in men for respondents with normal WHR was 182.82 and for respondents with WHR above normal was 206,86.

Table 4: Mean Total Cholesterol by WHR in Women

Variable	Frequency	Mean Total Cholesterol
Waist-to-Hip Ratio		
Normal	15	173,46
Above normal	11	197,00

Based on table 4, the average total cholesterol in women for respondents with normal WHR is 173.46 and for respondents with WHR above normal is 197,00.

Bivariate Analysis

Table 5: Bivariate Test Results of Waist-to-Hip Ratio with Total Cholesterol Levels

Variable	Mean Total Cholesterol	*p*-value
Waist-to-Hip Ratio	180,56	0,027*
Normal		
Above normal	202,69	

*Independent t-test significant when p-value <0.05

Bivariate analysis determined the difference in total cholesterol content in El Tari Airport employees with normal and above normal WHR. This data analysis was preceded by conducting a normality test using the Kolmogorov-Smirnov test and obtaining a significance value >0.05 so that it could be concluded that the data was normally distributed and an independent t-test could be used.

The independent t-test results are declared significant if the p-value is <0.05 and are said to be insignificant if the p-value is >0.05. In Table 5, significant results were obtained between the differences in total cholesterol levels in Kupang El Tari Airport employees with normal and above normal WHR. The significant result is indicated by the analysis of the variable significance level, which is 0.027 ($p < 0.05$).

DISCUSSION

Obesity is an excess body weight of about 20% above normal (Salim *et al.,* 2021). Obesity is characterized by excessive fat accumulation caused by an imbalance in energy intake and energy use over a long period. In other words, energy intake through food is very much compared to daily energy needs and energy

expended to support body activities (Sulistyowati *et al.*, 2015). One type of obesity is central obesity.

Central obesity is a type of obesity characterized by fat accumulation in the abdomen caused by high levels of visceral fat. One of the measurements to determine central obesity is the Waist-to-Hip Ratio (WHR) (Larasati & Alvina, 2018). Waist-to-Hip Ratio (WHR) results from anthropometric measurements obtained from the division of waist circumference by hip circumference. According to the WHO STEPS protocol, waist circumference is measured at the center between the last palpable rib's margin and the iliac crest's upper margin, while the hip circumference is measured around the gluteus region's peak. An above-normal WHR of ≥0.90 in men and ≥0.85 in women indicates central obesity (World Health Organization, 2013).

In this study, 88 respondents were obtained, divided into 62 respondents in the non-obese group and 26 respondents in the obese group. The obesity group (above normal WHR) has a total cholesterol level of 202.69, and the non-obesity group (normal WHR) has a total cholesterol level of 180.56. Based on the independent t-test, a significant value was obtained ($p<0.05$), so it was concluded that there was a difference between the average total cholesterol levels in the obese respondent group (above normal WHR) and the non-obese respondent group (normal WHR).

The existence of this significant difference is in line with the results of Hapsari's research (2019) on the difference in total cholesterol levels between centrally obese individuals and normal and consumptive forms of vegetables and fruit in Gianyar Regency, Bali, which has 63 female and male respondents in the age range 21-60 with the results there is a difference in the average total cholesterol content of central obesity (Hapsari, 2019).

Similar results were also stated in Dinutanayo's (2021) study, which had 28 male respondents aged 18-35. This research states a significant difference in total cholesterol between groups of individuals with normal nutrition and obesity based on BMI (Dinutanayo & Akhriyani, 2021).

Different research results were obtained in the studies of Hastuty (2018) and Rumampuk (2017), which stated that there were no differences in cholesterol between obese and non-obese individuals. This is because many things influence cholesterol synthesis. Various influencing factors are genetics, age, gender, a diet high in saturated fat, and physical activity (Hastuty, 2018), (Rumampuk *et al.*, 2017).

Central obesity is triggered by rapid urbanization. Dietary changes that tend to consume fried foods with lots of oil, fat, and high sugar content, as well as a decrease in physical activity, can trigger visceral fat accumulation in the abdominal area, which is the beginning of central obesity. Visceral fat has the characteristic of being located upstream of the liver through the portal vein. Visceral fat has high lipogenic activity and lipolysis. The high visceral fat in central obesity leads to impaired fatty acid regulation. Visceral fat will release large amounts of free fatty acids that are transported to the liver (Dinutanayo & Akhriyani, 2021).

Furthermore, in the liver, acyl CoA synthetase (ACS) activates free fatty acids into acyl CoA, which is then used for triglyceride synthesis. Due to the high levels of free fatty acids, this means that the levels of triglycerides synthesized will also be high. The synthesized triglycerides will then combine with Microsomal Triglyceride Transfer Protein (MTP). MTP helps assemble triglycerides and apolipoprotein B (apo B) and then facilitates the secretion of VLDL (very low-density lipoprotein) (Dinutanayo & Akhriyani, 2021).

The mechanism of increased fatty acid synthesis in the liver can also be triggered by a state of insulin resistance in obese people. Insulin stimulates the SREBP-1c factor, which causes an increase in hormone-sensitive lipase activity, resulting in fatty acid synthesis. Increased fatty acid synthesis from this process also leads to increased synthesis of triglycerides and apolipoprotein B, facilitating increased VLDL secretion (Dinutanayo & Akhriyani, 2021).

Another theory related to visceral fat was presented by Yuniari's research (2023). The study said visceral fat has a significant relationship with total cholesterol. Fat accumulation in obesity causes macrophage infiltration and becomes a source of proinflammatory cytokine production, such as Tumor Necrosis Factor (TNF). Proinflammatory cytokines have been shown to trigger insulin resistance and inhibit adiponectin synthesis and secretion. Decreased adiponectin secretion is associated with decreased HDL levels. Increased secretion of VLDL and LDL and decreased HDL levels will increase total cholesterol levels (Yuniari *et al.*, 2023).

This study found a wide range of total cholesterol levels in various ages. Not limited to respondents aged >40, but respondents aged <40 and even those in their 20s can have borderline or high total cholesterol levels. In theory, age and gender have an impact on blood cholesterol levels. In children and young adults (less than 20 years old), plasma total cholesterol concentrations tend to decrease between 10 and 20 years old. After the age of 20, plasma total cholesterol concentrations increase progressively, and in men, they peak between the ages of 50 and 60, while in women, they peak between the ages of 60 and 70. Cholesterol levels in women are higher in childhood than in men. In contrast, during adolescence, men show a regular decrease in cholesterol due to the impact of the rising testosterone hormone. In general, adult men over the age of 20 have very high cholesterol levels compared to

women. Women tend to have elevated cholesterol levels after menopause due to the lack of estrogen activity (Wajchenberg *et al.,* 2015), (Ujiani, 2015).

Nowadays, it is undeniable that all ages have the same risk of increasing cholesterol levels. This is reinforced by consuming high-cholesterol foods that are popular among the public. These foods usually tend to be consumed by people of younger age. It can be concluded that hypercholesterolemia is a modifiable risk due to dietary and lifestyle choices that can increase or decrease cholesterol levels and are not limited to one's age.

Men more often have significantly higher WHR. Men accumulate excess fat in the abdominal cavity (android obesity). In contrast to women, fat distribution in women tends to be in the gluteofemoral area and is of the subcutaneous fat type rather than visceral fat. This fat distribution is maintained in young women until around 60 years old. In general, above the age of 60, there is a change to the android type of fat distribution, which can be attributed to increased androgenic activity in postmenopausal subjects. On the other hand, men at any age tend to accumulate fat in visceral depots, increasing with age (Wajchenberg *et al.*, 2015).

Another theory is that subcutaneous and visceral abdominal fat increases with weight gain in both sexes. Visceral fat is more sensitive to weight loss than subcutaneous adipose tissue because omental and mesenteric adipocytes, the main components of visceral abdominal fat, are more metabolically active and sensitive to lipolysis. It can be concluded that all forms of weight loss affect the percentage of visceral fat rather than subcutaneous fat (Wajchenberg *et al.,* 2015).

Metabolic healthy obesity (MHO) is the criteria for someone with obesity but no lipid profile abnormalities and no degenerative diseases. This is the basis for the results of this study, where the total cholesterol levels of 11 respondents in the obese group (WHR above normal) were at the normal threshold. MHO can be triggered by several risk factors, including age, level, physical activity, and proportion of visceral fat. The average age of obese respondents in this study is 35 years old and falls into the young adult category. MHO is more common in obese people of younger age and have better living habits such as not consuming alcohol, not smoking, and regular physical activity (Dinutanayo & Akhriyani, 2021).

The results of this study indicate that there is a differences in total cholesterol levels of normal and above normal waist-to-hip ratio (WHR) employees at El Tari Airport in Kupang City.

CONCLUSION

There is a significant difference between normal and above normal waist-to-hip ratio (WHR) on total cholesterol levels in employees at El tari Airport Kupang.

REFERENCES

- Balitbangkes RI. (2018). Laporan Riskesdas 2018 Nasional.pdf. In *Lembaga Penerbit Balitbangkes*.
- Dinutanayo, W. W., & Akhriyani, M. (2021). Perbandingan Profil Lipid dan Penanda Inflamasi pada Pria Obesitas dan Non-Obesitas. *Jurnal Kesehatan*, *12*(3), 472. https://doi.org/10.26630/jk.v12i3.2923
- Hapsari, N. L. M. T. P. (2019). Perbedaan Kadar Kolesterol Total Berdasarkan Kejadian Obesitas Sentral dan Pola Konsumsi Sayur Buah di Kabupaten Gianyar. *Journal of Nutrition Science*, *8*(2), 29–34.
- Hastuty, Y. D. (2018). Perbedaan Kadar Kolesterol Orang Yang Obesitas Dengan Orang Yang Non Obesitas. *AVERROUS: Jurnal Kedokteran Dan Kesehatan Malikussaleh*, *1*(2), 47. https://doi.org/10.29103/averrous.v1i2.407
- Larasati, S., & Alvina, A. (2018). Rasio Lingkar Pinggang Panggul Berhubungan dengan Kadar Kolesterol Total pada Dewasa. *Jurnal Biomedika Dan Kesehatan*, *1*(2), 126–132. https://doi.org/10.18051/jbiomedkes.2018.v1.126-132
- Myint, P. K., Kwok, C. S., Luben, R. N., Wareham, N. J., & Khaw, K. (2014). Body Fat Percentage, Body Mass Index and Waist-to-Hip Ratio as Predictors of Mortality and Cardiovascular Disease. *Heart BMJ*, 1–7. https://doi.org/10.1136/heartjnl-2014-305816
- PERKENI. (2021). Pengelolaan Dislipidemia Di Indonesia. *PERKENI*, 1–2.
- Rumampuk, H., Doda, D. V.D., & Polii, H. (2017). Perbandingan Kadar Kolesterol pada Guru Obes dan Non-Obes di SMP Negeri I dan II Kauditan Minahasa Utara. *Jurnal E-Biomedik*, *5*(2). https://doi.org/10.35790/ebm.5.2.2017.18518
- Salim, B. R. K., Wihandani, D. M., & Dewi, N. N. A. (2021). Obesitas sebagai Faktor Risiko terjadinya Peningkatan Kadar Trigliserida dalam Darah: Tinjauan Pustaka. *Intisari Sains Medis*, *12*(2), 519–523. https://doi.org/10.15562/ism.v12i2.1031
- Sulistyowati, L. S., Andinisari, S., & Ramayulis, R. (2015). Pedoman Umum Pengendalian Obesitas. In *Kemenkes RI*.
- Ujiani, S. (2015). Hubungan Antara Usia Dan Jenis Kelamin Dengan Kadar Kolesterol Penderita Obesitas RSUD Abdul Moeloek Provinsi Lampung. *Jurnal Kesehatan*, *6*(1), 43–48. https://ejurnal.poltekkes-tjk.ac.id/index.php/JK/article/view/24
- Wajchenberg, B. L., Lé, B., & Wajchenberg, O. (2015). Subcutaneous and Visceral Adipose Tissue : Their Relation to the Metabolic Syndrome. *Endocrine Reviews*, *21*(6), 697–738. https://academic.oup.com/edrv/article-

abstract/21/6/697/2424212

- WHO. (2021). *Cardiovascular Diseases (CVDs)*. WHO. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
- World Health Organization. (2013). *Waist Circumference and Waist–Hip Ratio: Report of A WHO Expert Consultation: Geneva, 8-11, 2013*. *1*, 8–11. www.who.int
- Yuniari, D., Puruhita, N., Probosari, E., Subagyo, H. W., & Nugrohowati, A. K. (2023). Correlation Between Visceral Fat And Lipid Profile in Myocardial Infarction Patients. *Medica Hospitalia : Journal of Clinical Medicine*, *10*(2), 168–176. https://doi.org/10.36408/mhjcm.v10i2.797

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