THE RELATIONSHIP BETWEEN MACRONUTRIENT INTAKE IN WORKERS WITH CENTRAL OBESITY IN THE TENGGARONG SUB-DISTRICT OFFICE

[1] *Rinten Anjang Sari*, [2]*Lika Saqowati*, [3]*Rieska Indah Mulyani*

[1]*Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur, Samarinda, Indonesia,* *rintenanjangsari@gmail.com*

[2]*Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur, Samarinda, Indonesia,* *likas200602@gmail.com*

[3]*Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur, Samarinda, Indonesia,* *rieskaindahmulyani@gmail.com*

ABSTRACT

Central obesity is a condition characterized by excess fat accumulation in the abdominal area, which increases the risk of degenerative diseases such as type 2 diabetes mellitus, cardiovascular disease, and cancer. This study aims to analyse the relationship between macronutrient intake, level of nutrition knowledge, and physical activity with the incidence of central obesity in workers at the Tenggarong District Office.

This research used a cross-sectional design with a quantitative approach. The sample consisted of 35 workers selected through total sampling. Data on macronutrient intake were collected using a 24-hour food recall form for two non-consecutive days and analysed with Nutrisurvey 2007 software. Central obesity was assessed by measuring abdominal circumference using a metline according to the Indonesian Ministry of Health standards. The Spearman rank test was used for bivariate analysis.

The results showed that the prevalence of central obesity among the workers was 85.7%. There was a significant relationship between energy intake (p=0.002), fat (p=0.001), carbohydrate (p=0.005), and physical activity (p=0.002) with central obesity. However, there was no association between protein intake (p=0.096) or level of nutrition knowledge (p=1.000) with central obesity.

These findings indicate that dietary intake and physical activity play important roles in the incidence of central obesity among workers. Therefore, this study recommends implementing dietary changes and increasing physical activity as preventive measures to reduce or prevent central obesity in this population.

INTRODUCTION

Central obesity, characterized by excessive fat accumulation in the abdominal region, remains a growing public health concern in Indonesia, particularly among adults. This condition, also known as abdominal obesity or "apple-type" obesity, is closely linked to increased risks of various degenerative diseases, including type 2 diabetes mellitus, cardiovascular diseases, and certain cancers. The prevalence of central obesity is escalating worldwide, with the World Health Organization (WHO) estimating that over 1 billion people are obese globally, including 650 million adults, and projecting that by 2025, approximately 167 million adults and children will face health problems related to overweight or obesity (FAO/WHO/UNU 2001). In Indonesia, the prevalence of central obesity among individuals aged 15 years and above reached 31% in 2018, marking a 4.4% increase from 2013, with East Kalimantan Province reporting even higher rates, particularly in Bontang (42.49%) and Samarinda (42.16%) (Kemenkes RI 2018).

Among the adult population, workers—especially those in government institutions—are identified as a high-risk group, exhibiting a higher prevalence of central obesity compared to other occupational categories. The development of central obesity is multifactorial, influenced by excessive intake of macronutrients (energy, protein, fat, and carbohydrates), inadequate physical activity, and, to a lesser extent, nutritional knowledge. While overconsumption of macronutrients leads to increased adipose tissue, particularly visceral fat, insufficient energy expenditure due to sedentary lifestyles further exacerbates fat accumulation in the abdominal region. Moreover, although nutritional knowledge can influence dietary choices, its direct impact on central obesity remains inconsistent across studies (Bandur 2022; Purbowati and Afiatna 2018).

A recent preliminary study at the Tenggarong Sub-district Office showed that 30 people out of 35 research samples of most employees were centrally obese, which is often associated with a diet high in fried foods and sedentary work activities. Given the lack of studies specifically addressing the interaction between macronutrient intake in this setting, this study aimed to investigate the relationship between these factors and central obesity among workers at the Tenggarong Sub-district Office. The findings are expected to provide evidence-based recommendations for targeted interventions to prevent and manage central obesity in similar occupational groups.

METHODS

The type of research used is quantitative research with a cross-sectional design which aims to analyse the relationship between macronutrient intake, level of nutritional knowledge, and physical activity with the incidence of central obesity in workers at the Tenggarong District Office. The population of this study were all workers at the Tenggarong District Office who were included in the central obesity category. The study sample totalled 35 people, who were taken by the total sampling method, in which all members of the population who met the inclusion criteria were included in the study without additional selection. Sampling was conducted from August to September 2024 at the research location.

Inclusion criteria in this study include: willing to be a respondent, having central obesity, and in good physical and mental health. The research instruments used were questionnaires to measure macronutrient intake (e.g. 24-hour recall) and anthropometric tools such as waist circumference measuring tape to assess central obesity.

This research was conducted from August to September 2024 at the Tenggarong District Office, which is located at Jalan Udang RT. 66, Timbau, Tenggarong, Kutai Kartanegara Regency, East Kalimantan, Indonesia.

The validity and reliability of the instrument were tested using statistical tests, such as Cronbach's Alpha to

measure internal consistency and the item-total correlation test. The ethical aspects of the study were met based on ethical approval with number DP.04.03/F.XLII.25/0606/2024, as well as through the provision of informed consent to all respondents. Standard procedures, such as maintaining data confidentiality and giving respondents the right to withdraw from the study, were applied in this study.

RESULTS

1. Overview of the Research Site

Tenggarong Sub-district has an area of 398.10 km2. Administratively, Tenggarong Sub-district is bordered by Sebulu Sub-district to the north and west, South Tenggarong Sub-district to the east, and Loa Kulu Sub-district to the south. The Tenggarong Sub-district Office has a total of 68 state civil servants and 23 casual/honorary staff. Based on gender, employees consist of 39 men and 52 women.

The Tenggarong Sub-district Office in its structure has 7 fields, namely the general, management and staffing section, the finance and programme section, the public service section, the government section, the social welfare section, the peace and public order section, and the village community empowerment section.

The research activities were carried out on 13 - 23 August 2024. The implementation of the study began with anthropometric measurements related to body weight, height, and abdominal circumference. Then followed by an interview with the 24-hour food recall method, filling out a physical activity questionnaire with the Physical Activity Level (PAL) questionnaire, and filling out a questionnaire regarding the level of nutritional knowledge containing 12 items.

2. Univariate Analysis
a. Respondent Characteristics

The distribution of research results regarding the characteristics of respondents at the Tenggarong District Office can be seen in table 1 as follows:

Table 1 Frequency Distribution of Respondents' Characteristics

Respondent Characteristics	n	%
Gender		
Male	11	31.4
Women	24	68.6
Total	**35**	**100.0**
Age		
19 – 29 years	2	5.7
30 – 49 years	21	60.0
50 – 64 years	12	34.3
Total	**35**	**100.0**
Nutritional Status (BMI)		
Normal	10	28.6
Overweight	11	31.4
Obesity	14	40.0
Total	**35**	**100.0**
Marital Status		
Yes	0	00.0
No	35	100.0
Total	**35**	**100.0**
Smoking Status		
Yes	11	31.4
No	24	68.6
Total	**35**	**100.0**
Education Level		
SMA/SMK	17	48.6
Diploma/Bachelor's degree	18	51.4
Total	**35**	**100.0**

Based on table 1 shows that workers at the Tenggarong District Office are mostly female as many as 24 people (68.6%). Respondents in this study were mostly aged 30-49 years as many as 21 people (60%). The frequency distribution of nutritional status can be seen that most of the respondents who were obese were 14 people (40%) and most of the respondents had married status. The frequency of smoking status shows high results in the non-smoking category as many as 24 people (68.6%) and the smoking category as many as 11 people (31.4%). Respondents who have studied diploma / bachelor's degree as many as 18 (51.4%) and high school / vocational school education as many as 17 people (48.6%).

b. Central Obesity

The distribution of research results regarding central obesity in workers at the Tenggarong District Office can be seen in table 2 as follows:

Table 2 Frequency Distribution of Central ObesityTable 1 Completeness of Important Reports

Central Obesity	n	%
Normal	5	14.3
At Risk/Central Obesity	30	85.7
Total	**35**	**100.0**

Based on table 2 shows that workers at the Tenggarong District Office there are 30 (85.7%) respondents who are at risk / central obesity and 5 (14.3%) respondents who are not centrally obese.

c. Macronutrient Intake

The distribution of research results regarding macronutrient intake (energy, protein, fat, and carbohydrates) in workers at the Tenggarong District Office can be seen in table 3 as follows:

Tabel 3 Distribusi Frekuensi Asupan Zat Gizi Makro

Macronutrient Intake	n	%
Intake Energy		
Less	3	8.6
Good	13	37.1
More	19	54.3
Total	**35**	**100.0**
Protein Intake		
Less	8	22.9
Good	15	42.9
More	12	34.3
Total	**35**	**100.0**
Fat Intake		
Less	0	00.0
Good	5	14.3
More	30	85.7
Total	**35**	**100.0**
Carbohydrate Intake		
Less	2	5.7
Good	10	28.6
More	23	65.7
Total	**35**	**100.0**

Based on table 3 shows that workers in the Tenggarong District Office have the highest level of energy intake with more categories as many as 19 (54.3%), the highest level of protein intake with good categories as many as 15 (42.9%), the highest level of fat intake with more categories 30 (85.7%), and the highest level of carbohydrate intake with more categories 23 (85.7%).

3. Analisis Bivariat
a. Relationship between Macronutrient Intake and Central Obesity

Bivariate analysis conducted using Spearman rank statistical test between macronutrient intake variables (energy, protein, fat, and carbohydrate) with central obesity is presented in table 4.6 as follows:

Table 4 Relationship between Macronutrient Intake and Central Obesity in Workers at the Tenggarong District Office

Macronutrient Intake	Central Obesity		Total	p Value
	Normal	At Risk/Obesity Central		
Intake Energy				
Less	2	1	3	
Good	3	10	13	0.002
More	0	19	19	
Total	**5**	**30**	**35**	
Protein Intake				
Less	2	6	8	
Good	3	12	15	0.096
More	0	12	12	
Total	**5**	**30**	**35**	
Fat Intake				
Less	0	0	0	
Good	3	2	5	0.001
More	2	28	30	
Total	**5**	**30**	**35**	
Carbohydrate Intake				
Less	2	0	2	
Good	2	8	10	0.005
More	1	22	23	
Total	**5**	**30**	**35**	

a) Energy Intake

Based on table 4 shows the results of the statistical analysis test obtained a p-value of 0.002 (<0.05) which means that there is a significant relationship between energy intake and central obesity in workers at the Tenggarong District Office. The coefficient value obtained is 0.533 which means that the level of strength of the relationship between variables is strong.

b) Protein intake

Based on table 5 shows the results of the statistical analysis test obtained a p-value of 0.096 (<0.05) which means that there is no significant relationship between protein intake and central obesity in workers at the Tenggarong District Office.

c) Fat Intake

Based on 4 shows the results of the statistical analysis test obtained a p-value of 0.001 (<0.05) which means that there is a significant relationship between fat intake and central obesity in workers at the Tenggarong District Office. The coefficient value obtained is 0.533 which means that the level of strength of the relationship between variables is strong.

d) Carbohydrate Intake

Based on table 4 shows the results of the statistical analysis test obtained a p-value of 0.005 (<0.05) which means that there is a significant relationship between carbohydrate intake and central obesity in workers at the Tenggarong District Office. The coefficient value obtained is 0.466 which means that the level of strength of the relationship between variables is quite strong.

DISCUSSION

1. Relationship between Energy Intake and Central Obesity

Based on the results of data collection regarding energy intake that of the 35 respondents who had been interviewed using the 24-hour food recall method, 19 respondents had more energy intake, 13 respondents had good energy intake, and 3 respondents had less energy intake according to the 2019 RDA. The results of statistical tests with Spearman rank obtained a p-value of 0.002 (<0.05) then H0 is rejected, meaning that there is a significant relationship between energy intake and central obesity in workers at the Tenggarong District Office.

This is in accordance with the results of research conducted by (Rosa dan Riamawati 2019) who found

high energy intake to be a significant contributing factor to central obesity. These results are also in line with research by Puspitasari (2018), where subjects with high energy intake have a 1.7 times greater chance of developing central obesity compared to subjects who have lower energy intake. High energy intake is caused by the consumption of foods that have more energy sources and consumption of fatty foods.

When the energy intake consumed exceeds the daily needs, the body will convert it into fat and will be stored which is divided into 3 parts, namely 50% in the tissue under the skin (subcutaneous), 45% around the organs and abdominal cavity, and 5% in the intramuscular tissue. Therefore, a person who consumes more energy will have a higher probability of being obese compared to a person whose energy intake is sufficient. A study showed that those with high energy consumption were 1.86 times more likely to be obese compared to those who maintained adequate energy intake (Puspitasari 2018) (Puspitasari, 2018).

Other studies that support the relationship conducted by Rahmandita dan Adriani (2017) found a positive relationship related to energy intake with adult women who experience central and non-central obesity. The imbalance of energy that comes out with the energy that enters the body can make central obesity occur. Increased food intake and decreased energy expenditure can be the main factors causing central obesity. The onset of central obesity can occur if there is excess energy but not balanced with heavy physical activity.

From the description above, the researcher assumes that more energy intake is caused by less controlled food intake, namely the daily energy intake produced on average 2400 kcal, while the average daily requirement is 2150 kcal. In addition, it is added by consuming snacks before or after meals such as chocolate bread, donuts, fried foods, and sweets which result in the amount of

intake that does not match the needs. If this is done continuously, it will result in central obesity.

2. Relationship between Protein Intake and Central Obesity

Based on the results of data collection regarding protein intake, of the 35 respondents who had been interviewed using the 24-hour food recall method, 15 respondents had a good level of protein intake, 12 respondents had a higher level of protein intake, and 8 respondents had a lower level of protein intake according to the AKG in 2019. The results of statistical tests with Spearman rank obtained a p-value of 0.096 (<0.05), so H0 is accepted, meaning that there is no significant relationship between protein intake and central obesity in workers at the Tenggarong District Office.

The results of this study showed that most respondents had good protein intake, while one of the factors for central obesity is excessive protein intake. This is in line with research by Faridi and Hidayat (2016) that there is no significant relationship between protein intake and central obesity. The research is also supported by Andriyana, Hidayat, dan Kurniasari (2019) that there is no relationship between protein intake and central obesity because respondents with more protein intake have a 0.9 times greater risk than respondents who have good protein intake to experience central obesity.

Protein is a substance that the body needs for cell growth, and it also acts as a calorie contributor. In theory, the amount of protein that the body replaces is equal to the protein obtained from food, so in calculating calories provided, the protein counted is equal to the calories provided. Therefore, the body will initially exceed its calorific needs, thus protein is not used in the formation of body cells but will be burned to produce calories.

In this study, these results are not in line with Azizah (2020) research which says that there is a relationship between protein intake and the incidence of central obesity. If the body consumes more protein than it needs, the excess protein will be converted into fat and stored in the body. This will make the accumulation of fat in the body high, leading to overweight or obesity.

From the description above, the researcher assumes that there is no relationship between protein intake and the incidence of central obesity because the average protein intake consumed is 60 g / day, while the average daily protein requirement is 60-65 g / day according to the 2019 AKG. The average portion of protein consumed by respondents at each meal is 1-2 servings (1 serving is equivalent to 50-60 g) of animal protein such as chicken, fish, and eggs and consume 1-2 servings (1 serving is equivalent to 50-60 g) for vegetable protein such as tofu and tempeh. Therefore, the daily protein intake consumed by respondents can be fulfilled.

3. Relationship between Fat Intake and Central Obesity

Based on the results of data collection regarding fat intake, of the 35 respondents who had been interviewed using the 24-hour food recall method, 30 respondents had more fat intake and 5 respondents had a good level of fat intake according to the 2019 RDA. The results of statistical tests with Spearman rank obtained a p-value of 0.001 (<0.05) then H0 is rejected, meaning that there is a significant relationship between fat intake and central obesity in workers at the Tenggarong District Office.

The results of this study are related to research conducted by (Purbowati dan Afiatna 2018)Purbowati and Afiatna (2018) that there is a relationship between fat intake and central obesity in workers at CV. Karoseri Laksana with a p-value of 0.005 (<0.05). Energy reserves in the body are largely influenced by fat, and are usually stored in the subcutaneous tissue under the skin, around the organs in the abdominal cavity, and in the intramuscular tissue. Thus, when fat intake requirements are exceeded over a long period of time, this can lead to overweight and then central obesity, which is related to the causative factor of excess fat reserves over a long period of time.

In Yanto, Verawati, and Akmalia (2019) showed that there was a significant relationship between fat consumption and the prevalence of central obesity in housewives in Sidomulyo Barat Village in 2019. The conclusion of the study was further strengthened by research conducted by Faridi dan Hidayat (2016) which revealed that respondents who had a high level of fat intake would experience a greater incidence of central obesity.

According to the researcher's assumption, the relationship between fat intake and the incidence of central obesity is due to the average fat intake consumed of 75 g / day, while the average daily fat requirement is 60 g / day. This is due to intake patterns that often consume foods that are processed by frying and often consume fried foods with more than one portion and 1 tablespoon of oil is equivalent to 100 calories. Therefore, one serving of fried food contributes more than 1 tablespoon of oil and this can increase the accumulation of fat in the body.

4. Relationship between Carbohydrate Intake and Central Obesity

Based on the results of data collection regarding fat intake, of the 35 respondents who had been interviewed using the 24-hour food recall method, 23 respondents had more carbohydrate intake, 10 respondents had good carbohydrate intake, and 2 respondents had less carbohydrate intake according to the 2019 RDA. The results of statistical tests with Spearman rank obtained a p-value of 0.005 (<0.05) then H0 is rejected, meaning that there is a significant relationship between carbohydrate intake and central obesity in workers at the Tenggarong District Office.

The results of this study are in line with research conducted by (Nurali, Tasnim, and Sunarsih 2018) that there is a relationship between carbohydrate intake and central obesity in agency employees in Kendari City, this is because respondents who consume carbohydrate intake exceeding the standard nutritional adequacy rate can trigger central obesity and respondents who consume less carbohydrate intake tend not to experience central obesity. The research of Purbowati and Afiatna (2018) is in line, with the results of a p value of 0.004 (<0.05) which means that there is a relationship between carbohydrate intake and the incidence of central obesity in the CV. Karoseri Laksana workforce.

There is an association between carbohydrate intake and central obesity. The main role of carbohydrates is to provide energy for the body (Mardalena dan Suryani 2016). When a person consumes excessive amounts of carbohydrates, the metabolic mechanism changes. Excess glucose is converted into glycogen, which can be stored in the liver and muscles to a certain extent. Excess glucose will be converted into pyruvate and glycerol. Since glycerol is only needed in minimal amounts, pyruvate is quickly converted into acetyl coenzyme A (acetyl Co-A) which will not pass through the Krebs cycle but is converted into fat in the body stored in adipose tissue (Fridawati 2016).

However, the results of this study differ from the research of Purwaningtyas, Tanjung, and Dhanny (2023) which states that there is no relationship between carbohydrate intake and the incidence of central obesity in adult women. The study is believed to occur due to other factors that have a stronger influence on central obesity or due to the presence of confounding variables in the study. This could be due to factors such as physical activity level, sleep quality, and parity. Parity, or the number of children a woman has borne, is also one of the factors associated with obesity. In premenopausal adult women who have had at least one pregnancy and plan to give birth within five years, visceral adipose tissue increases by about 40% leading to an increase in waist circumference.

The cause of the relationship between carbohydrate intake and the incidence of central obesity is due to the average carbohydrate intake consumed of 320 g / day, while the average daily carbohydrate requirement is 280 g / day.

The average portion of rice consumed if each meal is 200 g accounts for 57.2 g of carbohydrates. In addition, the intake pattern often consumes instant noodles consumed in the afternoon or evening which assumes that instant noodles to hold hunger while then continued with the main meal. It should be noted that in one packet of instant noodles contributes 54 g of carbohydrates and the nature of instant noodles is more likely to cause hunger faster than rice.

Instant noodles are high in calories but low in other essential nutrients that are detrimental to health such as vitamins, minerals and fibre. Some of the main ingredients are carbohydrates, starchy proteins, and fats (either from the noodles themselves or the vegetable oil in the sachets). If instant noodles are consumed every day, the impact will inhibit the absorption of nutrients, cause cancer, disrupt the body's metabolism, interfere with digestion, and lead to obesity or overweight (Audina 2019).

CONCLUSION

Based on the results of the study, it was found that there was a significant relationship between energy, fat, and carbohydrate intake with the incidence of central obesity in workers at the Tenggarong District Office, as indicated by p-values of 0.002 for energy, 0.001 for fat, and 0.005 for carbohydrates, respectively. In contrast, protein intake showed no significant association with central obesity in the same group, with a p-value of 0.096.

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