


## **Central Obesity Incidence in Students of Public Health Department, Universitas Negeri Gorontalo Based on Fiber Intake**

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Article Info	ABSTRACT
<p><b>Article history:</b></p> <p>Received July 22, 2023 Revised July 27, 2023 Accepted August 22, 2023</p> <hr/> <p><b>Corresponding Author:</b></p> <p>Tri Septian Maksum Public Health Department, Faculty of Sports and Health, Universitas Negeri Gorontalo, Gorontalo, Indonesia Email: <a href="mailto:triseptian@ung.ac.id">triseptian@ung.ac.id</a></p>	<p>Central obesity is excess fat accumulation in abdominal area. Prevalence of central obesity in Gorontalo Province has exceeded the national prevalence (36.6%) based on results of Basic Health Research in 2018. Adolescents of reproductive age are one of the risk groups for central obesity due to an imbalance in food consumption intake and energy use. This study aims to analyze central obesity incidence in students of Public Health Department, Universitas Negeri Gorontalo based on fiber intake. This type of research is an analytic survey with a cross-sectional study design. Instruments used include 3x24 hour food recall and nutrisurvey to measure fiber intake and a measuring tape to measure waist circumference. Research sample was 120 people obtained using simple random sampling technique. Data analysis technique uses a simple logical regression test. The results showed that all respondents had less fiber intake (100.0%), and at most did not have central obesity (85.0%). There is an effect of fiber intake on the incidence of central obesity (<math>p=0.003</math>; <math>OR=0.854</math>). It is recommended for students to manage their diet by choosing the right ingredients, increasing consumption of vegetables and fruits by 1 to 3 servings per day and always doing sports and physical activity regularly.</p> <p><b>Keywords:</b></p> <p>Central obesity, fiber intake, students</p> <p>This article is licensed under a <a href="https://creativecommons.org/licenses/by-sa/4.0/">Creative Commons Attribution-ShareAlike 4.0 International License</a>.</p> <div style="text-align: center;"></div>

### **1. INTRODUCTION**

Today there are various health problems in society such as obesity which is one of the most obvious but most neglected problems. Obesity is an emerging problem throughout the world, even the WHO in 2011 declared obesity as a global epidemic and is a health problem that must be addressed immediately. Imbalance between intake (due to excessive food intake in a long time) and energy use will result in obesity. One type of obesity, namely central obesity, occurs due to an increase in the amount of visceral fat in the abdominal area so that there will be an increase in body weight and body fat percentage. Visceral fat is body fat that collects in the central part of the body and covers the internal organs. Increasing body weight without any effort to reduce it can lead to excess body weight and obesity which triggers an increase in non-communicable diseases [1].

Central obesity is obesity that resembles an apple shape in which fat is stored in the waist and abdominal cavity. The accumulation of fat occurs due to excessive fat in the subcutaneous fat tissue and abdominal visceral fat. Fat accumulation in visceral fat is a form of non-functioning subcutaneous fat tissue in the face of excess energy due to excessive fat consumption. Excess energy occurs when a person has less physical activity and high lonesome behavior. In addition, the inability of the subcutaneous fat tissue as a buffer for excess energy will lead to the production of fat which can accumulate in unwanted body parts, such as the liver, heart, kidneys, muscles and pancreas glands [2]. Central obesity can be measured using the waist to hip ratio method. Limits for stating central obesity status for men with a waist circumference > 90 cm and women with a waist circumference > 80 cm [3].

Central obesity is currently an emerging problem throughout the world, and is a health problem that must be addressed immediately [4]. This type of central obesity is more dangerous than general obesity because it risks the emergence of various degenerative diseases and metabolic disorders as well as other health risks, such as hypertension, diabetes, metabolic syndrome, hyperlipidemia, atherosclerosis, gallstones, and even certain types of

cancer, for example colon and rectal cancer [5]. Central obesity is independently associated with cardiovascular disease, myocardial infarction, and total mortality [6], [7].

Epidemiological transitions, demographics, and urbanization factors have resulted in the prevalence of central obesity always increasing from year to year. The traditional diet which was high in carbohydrates, high in fiber and low in fat has changed to a new diet which is low in carbohydrates, low in fiber and high in fat, thus shifting the quality of food in an unbalanced direction, especially in people who live in urban areas [8]. Urban communities generally like fast food, and street food is no exception [9].

One of the factors that has a very large influence on central obesity is the intake of nutrients, one of which is fiber intake. Fiber is part of carbohydrates and belongs to the type of non-starch polysaccharides [10]. Fiber is a part of plants that can be consumed and is composed of carbohydrates that are resistant to digestion and absorption in the human small intestine. Fiber is an integral part of food that is consumed daily with the main sources coming from plants, vegetables, cereals, fruits and nuts [11]. Fiber itself is a type of complex carbohydrate belonging to the polysaccharides that the body cannot digest through enzymatic processes. In another sense, fiber is a term used to describe complex carbohydrates found in plants that the body cannot digest. Fiber is a non-nutritional substance whose adequacy is considered because of its benefits [12].

A research result states that high fiber intake can significantly reduce central obesity. Fiber intake has been shown to have a role in regulating body weight related to waist circumference, namely it is known that fiber intake can affect the distribution of body fat caused by the effect of insulin expression which can be seen clearly in the abdominal viscera rather than in subcutaneous adipocytes [13]. Snacks contain high fat, high sugar and high sodium which can increase the risk of central obesity [14].

Teenagers aged 10-18 years are a period of nutritional vulnerability due to various reasons, namely, first, teenagers require higher levels of nutrition due to increased physical growth. Second, there are changes in lifestyle and eating habits. Third, teenagers have special nutritional needs, for example the needs of athletes. One of the changing eating habits is due to widespread globalization. Teenagers are one of the target groups who are at risk of experiencing excess nutrition. Overnutrition in teenagers is characterized by relatively excessive body weight when compared to the age or height of teenagers of the same age, as a result of excessive accumulation of fat in the body's adipose tissue [15].

Nowadays, the majority of teenagers don't really like vegetables and fruit because they don't like the texture, taste, appearance, and smell. Subjects with central obesity consumed lower fiber intake compared to subjects who were not centrally obese [16]. College students are an early adult age group. At the age of 20-30 years, it is known that there is a decrease in fat-free tissue mass and an increase in fat tissue mass. Central obesity is common in adults. The increasing age, the higher the risk of developing central obesity which is caused by the accumulation of body fat, especially abdominal fat [17].

WHO in 2011 has estimated that in the world there are around 1.6 billion teenagers aged 15 years are overweight and as many as 400 million people are obese (obese) and it is estimated that more than 700 million adults will be obese (obese) in 2015. Almost all over the world, the prevalence of obesity has increased. In the 2015-2019 National Medium-Term Development Plan, several main targets are outlined as an effort to improve the nutritional status of the community, one of which is the prevalence of obesity to 15.4% [18]. Based on the Basic Health Research of the Ministry of Health of the Republic of Indonesia in 2018, the proportion of central obesity in adults  $\geq 15$  years has increased to 31.80%. Gorontalo Province ranks fifth in the incidence of central obesity with a proportion of 36.64% after North Sulawesi, DKI Jakarta, East Kalimantan and Bali [19]. Meanwhile, the prevalence of central obesity in residents  $\geq 15$  years by district/city in Gorontalo Province was 36.64%. Most cases of central obesity were in Gorontalo City, namely 43.96%, then followed by Gorontalo Regency at 37.16%, North Gorontalo Regency at 35.24%, Pohuwato Regency at 33.71%, Bone Bolango Regency at 33.63%, and Boalemo Regency by 32.05% [20].

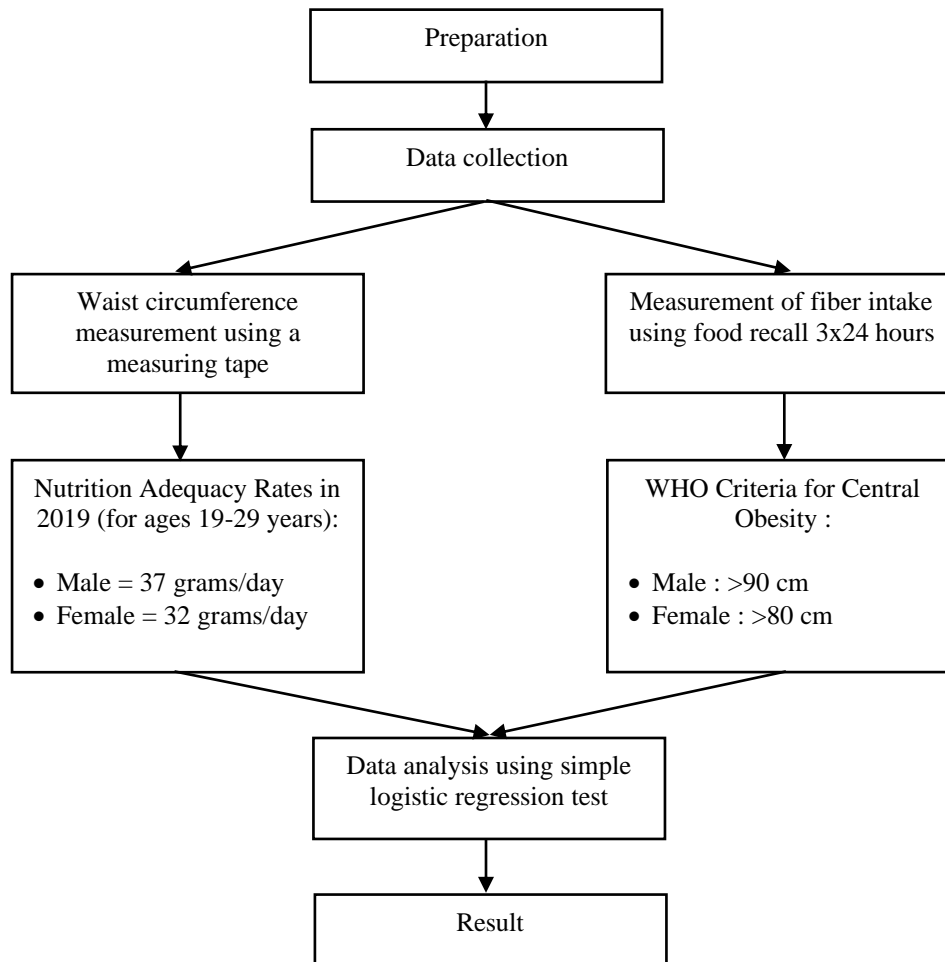
A preliminary study was conducted on 10 students of the Public Health Department, Universitas Negeri Gorontalo, class of 2019, the results obtained were that 8 out of 10 (80%) students had central obesity, where for men exceeding the waist circumference limit in general, namely more than 90 cm, namely 91 cm, 94 cm and 101 cm, and for women over 80 cm, namely 83 cm, 85 cm, 93 cm, 96 cm and 105 cm. Meanwhile, fiber intake was measured using the 1x24 hour food recall method, and it was found that fiber intake consumed by students was very low and not up to standard. Fiber intake for men is 37 grams/day and for women is 32 grams/day. Overall fiber intake in the initial survey group was only around 2 to 5 grams/day (under the Nutrition Adequacy Rate in 2019 for men aged 19 to 29 years = 37 grams/day; women aged 19 to 29 years = 32 grams /day). Therefore, it is necessary to care about the family and the campus to choose and serve a healthy diet high in fiber and low in fat [21].

## 2. METHOD

This research was conducted at the Department of Public Health, State University of Gorontalo from February to March 2023. Type of research is an analytic survey using a cross sectional study design. Research variables include fiber intake (independent variable), and the incidence of central obesity (dependent variable). Fiber intake data was obtained using a 3x24 hours food recall and then processed using nutrisurvey software. The population in this study were all active students of the Public Health Department, Universitas Negeri Gorontalo, class of 2019,

odd semester of the 2022/2023 academic year, with a total of 167 students. By using the Slovin Formula ( $\alpha=5\%$ ), a minimum sample size of 120 students is obtained. Samples were taken using simple random sampling technique, namely by making a list of all members of the population, then doing a lottery 120 times. Fiber intake is categorized as sufficient if it is in accordance with the recommended Nutrition Adequacy Rate in 2019, namely men aged 19 to 29 years = 37 grams/day and women = 32 grams/day. Meanwhile, it is categorized as lacking if it is below the Nutrition Adequacy Rate in 2019.

Meanwhile, for measuring central obesity, a measuring tape is used to determine the respondent's waist circumference. The category of central obesity is if the waist circumference for male is  $>90$  cm and for female is  $>80$  cm, while it is categorized as not having central obesity if the waist circumference for male is  $\leq 90$  cm and female is  $\leq 80$  cm. The data were then analyzed using a simple logistic regression test. For more detailed research procedure is presented in Figure 1 below.



**Figure 1.** Research procedure

### 3. RESULTS AND DISCUSSION

The study was conducted on 120 students of the Department of Public Health, State University of Gorontalo class of 2019 and the results obtained were that most respondents were 22 years old, namely 74 (61.7%) students, 104 female sex (86.7%), had less fiber intake of 120 (100.0%), and 102 (85.0%) students did not experience central obesity (Table 1). Based on the analysis of fiber intake data for all students, it shows that the average fiber intake is lower or does not meet the Adequacy of Nutrition Standards in Indonesia. Most of them get fiber intake in carbohydrates. This is due to the low consumption of vegetables and fruit. Based on the interview results, most of the students stated that they rarely consumed vegetables and fruits. Within a week, consume vegetables and fruits a maximum of 3 times, and there are even some who do not consume vegetables at all. This is because they do not like to consume vegetables. Several students admitted that their parents rarely cooked vegetables because of their busy schedule. In addition, students also admit that they prefer to consume fried foods, various side dishes (chicken, fish, meat), various snacks (batagor, sausages, meatballs, chicken noodles), and sweet foods such as bread and cakes.

**Table 1.** Characteristics of Respondents

No	Variable	Frequency	Percentage
1	Age (years)		
	a) 20	1	0.7
	b) 21	12	10.0
	c) 22	74	61.7
	d) 23	28	23.3
	e) 24	3	2.5
	f) 25	2	1.7
2	Sex		
	a) Male	16	13.3
	b) Female	104	86.7
3	Fiber intake (grams/day)		
	a) Sufficient	0	0.0
	b) Lacking	120	100.0
4	Central obesity incidence		
	a) Yes	18	15.0
	b) No	102	85.0

Source: Primary Data, 2023

Consumption of excessive intake of nutrients will certainly trigger the incidence of central obesity. This is supported by research in the working area of the Jagir Health Center, Wonokromo District, Surabaya in 2018 where it was found that it was not only nutrient intake (energy, protein, fat, carbohydrates and fiber) that was a factor in the high and low incidence of central obesity but there were other variables that could also affect the incidence of central obesity. This happens because not only does a person directly experience or is said to be central obesity, in the process it will begin with being overweight. Excess weight that is not handled properly can rise to the category of obesity level 1. If obesity level 1 is not handled well, then the person can enter into level 2 obesity. Consuming a lot of food is not always the cause of a person experiencing obesity [22]. In some respondents in this study it was found that the food intake that entered their bodies was less than their needs, but the type of food chosen and the wrong eating schedule were often the cause. In addition, unbalanced sleep patterns can also contribute to some cases of obesity. Lack of sleep or rest patterns will affect hormonal imbalances, and this is experienced by many respondents. Not to mention, with the current technological advances it is also enough to encourage someone to experience obesity. Starting from how easy it is to order food through online applications, to carrying out activities without having to meet face to face which also reduces physical activity.

Many factors influence the lack of fiber intake in adolescents, namely diets that tend to be high in energy and fat, lifestyles that tend to enjoy eating fast food, family environmental factors, campus canteens, and the influence of peers [13]. In this study, it was known that most of the subjects during recess tended to buy high-calorie and high-fat snacks such as instant noodles, dumplings, fried foods, cilok, and macaroni snacks, because most of these types of food were sold in canteens and campus environments. When they come home from campus or on weekends, some of them also often eat fast food, such as burgers, pizza, french fries, and fried chicken. The obesity group stated that respondents admitted that they often consumed fast food at least 1x/month and a maximum of 1x/week. This is because every time they do a group assignment, the respondent must go to places that provide various types of fast food such as KFC and Mc Donald. Apart from that, there are also many local fast food vendors around the campus, both in the campus canteen and outside the campus, such as street vendors. The frequency of excessive consumption of fast food is what triggers the risk of obesity. This is because fast food is a type of fast food that contains high energy, contains lots of sugar, is high in fat, and is low in fiber. From this information it can be seen that respondents tend to choose and consume foods that are low in dietary fiber.

Someone with a low level of knowledge will usually often choose food that is full without understanding the balanced nutritional intake needed by the body. So that too many carbohydrates are consumed in one serving of food. Someone who has good knowledge about obesity, still engages in unhealthy behaviors such as a sedentary lifestyle and overeating when experiencing stress. Knowledge is basically part of behavior, but this does not guarantee that people who have good knowledge also have good behavior. Because a person's behavior is also influenced by other factors [3].

Consumption of nutritional intake in the body can determine the degree of nutritional status. The attitude of choosing and consuming food that is not appropriate and excessive and bad eating habits such as consuming snack foods excessively can lead to obesity problems. Environmental factors also affect the incidence of obesity, the perception in society that fat is a symbol of prosperity can affect people who live will experience obesity. In addition, low activity coupled with excess calories can increase the risk of obesity. Busy schedules (school/college, helping parents) cause teens to have little free time, so teens make that excuse for not having regular physical activity. For people who don't work or don't do much physical activity, the energy expended will be less, especially with the habit of consuming food excessively, it can cause accumulation of body fat. People who sit for too long can

increase total cholesterol levels in the blood as a result of decreased insulin sensitivity and enzymes that break down fat. Coupled with the condition of the COVID-19 pandemic which requires limiting going out of the house and physical distancing has an effect on decreasing physical activity [23].

Based on research that has been conducted on students from Batch 2019 of the Department of Public Health, it was found that all respondents (100.0%) did not reach the predetermined Nutrition Adequacy Rate where the average student fiber intake per day is only around 19 grams. Most of them get their fiber intake from the fiber content in carbohydrates. This is in line with data from the Health Research and Development Agency in 2018 that the level of consumption of vegetables and fruit of less than 5 servings recommended for residents aged  $\geq 5$  years in Indonesia in 2013 reached 93.5% which shows that most of Indonesia's population still has a low level of fiber intake. Fiber is one of the main nutrients needed by the body. However, many people experience a lack of fiber. The majority of adolescents who were respondents to this study consumed little fiber intake from vegetables and fruit. More fiber intake is consumed from sources in the cereal and tuber groups [16].

In addition, age and gender are related to the problem of central obesity [24]. The prevalence of central obesity was found to be higher in older samples. At an older age, there is a decrease in muscle mass and changes in several types of hormones that trigger the accumulation of abdominal fat. As you get older, your BMI will decrease so that the incidence of obesity also decreases. If it is not balanced with a healthy lifestyle, such as regulating diet and physical activity, there will be an accumulation of body fat. This is supported by research conducted on the elderly regarding the obesity factor that with increasing age the prevalence of obesity decreases [25]. The results of research in the field showed that the majority (86.7%) who had central obesity were female respondents. The high prevalence of obesity in women indicates that excess central fat is more common in women. Women naturally have more body fat reserves, especially in the abdominal area than men. Women tend to be more at risk of developing central obesity, especially after menopause. Post-menopausal women have high percentages of belly fat, total cholesterol, and triglycerides. Along with increasing age and the effects of menopause, in women there will be an increase in body fat content, especially the distribution of central body fat. In addition, during pregnancy too, due to an increase in adipose tissue as a reserve that will be needed during breastfeeding [3].

**Table 2.** Effect of fiber intake on the incidence of central obesity incidence

Variable	p-value	Odds Ratio
Fiber intake*Central obesity incidence	0.003	0.854

Source: Primary Data, 2023

Based on the results of statistical tests using the simple logistic regression test, an Odds Ratio (OR) value of 0.854 was obtained, meaning that students with less fiber intake had a 0.854 times greater risk than students who had sufficient fiber intake to experience central obesity. Fiber is an integral part of food that is consumed daily with the main sources from plants, vegetables, cereals, fruits, nuts. [9]. Dietary fiber is categorized into soluble fiber and insoluble fiber is a group of carbohydrates and lignin which cannot be digested or absorbed in the human body. Soluble fiber, found in foods such as carrots, broccoli and onions, is more easily fermented by colonic bacteria and has the ability to absorb water, which in turn causes an increase in food transit time, a decrease in nutrient absorption, and slows down digestion. Insoluble fiber found in foods like whole grains, legumes, has the opposite effect of soluble fiber reducing food transit time to help relieve constipation [26].

Dietary fiber plays a role in controlling blood fat levels including blood triglyceride levels by slowing the absorption of sugar and binding to bile acids, fats and cholesterol and excreting them in the feces. The results of this study are not much different from the results of a study in America in 2011 which showed that fiber intake is associated with metabolic syndrome, high fiber intake reduces the risk of developing metabolic syndrome while saturated fat intake is not associated with risk of metabolic syndrome [27].

Dietary fiber has good benefits for the body, namely it can delay hunger by slowing gastric emptying. When fiber is hydrated and forms a viscous gel in the stomach, the release of chyme from the stomach into the duodenum is slowed. Thus, nutrients remain in the stomach longer by consuming fiber. This has the effect of feeling full and slowing down the digestive process because carbohydrates and fats remain in the stomach for a long time and the digestion process in the small intestine is also slowed down [28].

The results of research on Public Health Study Program Students at UIN Syarif Hidayatullah Jakarta in 2015 showed that fiber intake had a relationship with the incidence of central obesity ( $p=0.000$ ). Consuming foods that contain fiber can reduce the risk of central obesity. Fiber may affect abdominal adipose tissue through its impact on insulin sensitivity, particularly water-soluble fiber. This water-soluble fiber can blunt the post-prandial glycemic and insulinemic responses in the small intestine which are associated with decreased levels of hunger returns and subsequent energy intake. In addition, in the digestive tract, water-soluble fiber binds bile acids (the end product of cholesterol) which is then excreted with the feces. The higher the consumption of water-soluble fiber, the more bile acids and fat excreted by the body. The American Cancer Institute recommends consuming 20-30 grams of fiber every day. Consuming fiber 12 grams/day can reduce 0.63 cm of abdominal circumference within 9 years [29].

The results of a similar study also in women aged 15 to 44 years at the Posbindu Working Area of the Pasar Minggu District Health Center, South Jakarta in 2017 showed that the statistical test results obtained  $p = 0.000$ , meaning that there was a significant relationship between fiber intake and the incidence of central obesity. From these results also obtained an OR value of 9,663, which means that respondents with less fiber intake have a 9 times greater risk than respondents who have sufficient fiber intake to experience central obesity [30]. Consuming foods containing sufficient fiber can reduce the risk of central obesity among adolescents [31], [32], including type-II diabetes, and cardiovascular disease [33]. Several studies have shown that the risk of insulin resistance is reduced and/or insulin sensitivity is increased when fiber is consumed in excess [34].

One suggestion made is to replace foods high in fat and sugar with foods high in fiber, such as leafy vegetables, whole grains, and nuts [35]. The addition of high fiber in the low-calorie diet significantly increased weight loss, where the placebo group lost 5.8 kilograms and those given additional fiber lost more, namely 8 kilograms [36]. The results showed that those who had a high intake of dietary fiber from enzyme-treated wheat bran for 12 weeks did not affect insulin sensitivity, body composition in stable weight subjects with central obesity compared to low-fiber diets [37], [38].

On the other hand, research participants in China who rarely consumed fast food, snacks and drinks had a reduced risk of central obesity [39]. Some snacking patterns (i.e. pastries, crackers/salty snacks, candy, and other grains) are associated with a reduced risk of overweight and central obesity. Overall, some snacking patterns compared with no snackers had better quality diets and were more likely to be overweight or obese and less likely to have central obesity. Education is needed to improve snacking patterns in terms of nutrition to the limit in the diet [40].

#### 4. CONCLUSION

Based on the results of this study, it can be concluded that all respondents had less fiber intake (100.0%), and at most did not have central obesity (85.0%). The statistical test results showed that there was an effect of fiber intake on the incidence of central obesity ( $p=0.003 \leq \alpha=0.05$ ), and the OR=0.854 meaning that respondents with less fiber intake had a risk of 0.854 times greater than respondents who had sufficient fiber intake to experience central obesity. It is recommended for students to improve or adjust their diet by choosing the right ingredients, increasing consumption of vegetables and fruits by 1 to 3 servings per day and always doing sports and physical activity regularly. Eating foods with high fiber content can prevent central obesity.

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