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# The Infulence of Various Food Intake on Body Fat Distribution among Young Healthy Population

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## ABSTRACT

Food intake is the amount of food obtained by the body via daily food consumption that consists of energy, carbs, fat, and protein. The distribution of fat will be affected by an imbalance in food consumption. The distribution of body fat is classified as either android or gynoid obesity. Someone who has abdominal obesity is more likely to develop metabolic syndrome. This study aims to determine the influence of food intake on fat distribution in dental student of Faculty of Dentistry, University of Jember. Analytic observational research methods were applied in this study. The population comprised of 109 students from the Faculty of Dentistry at the University of Jember. The research procedures comprised instructing, measuring height, weight, the waist-hip circumference ratio, completing the food intake measurement sheet based on 24 hours food recall, data conversion, and data entry. The influence of food intake on fat distribution was determined using logistic regression data analysis. The results revealed that food intake had an effect on fat distribution. The male group's effect was energy, while the female group's influence was carbohydrates and fat, according to the study's findings. Food consumption has a substantial impact on the distribution of body fat among dental students at the Faculty of Dentistry

**Keywords**: food intake; fat distribution; abdominal obesity; waist-hip ratio

## INTRODUCTION

The late teenage phase is a time of peak development, weight, and bone mass, which might influence change on body composition. Adolescents' accelerated growth and development necessitates more energy and nutrients, thus they must consume food that is appropriate for their needs in order to support the body's metabolic processes.

Food intake is made up various component such as energy, carbs, fats, and proteins that the body obtains from daily food consumption. Obesity occurs when energy intake excessive than its needed. Obesity is caused by an imbalance between the number of calories consumed and the number of calories expended. Obesity increase the risk of cardiovascular disease and other degenerative diseases, particularly if fat storage is concentrated in the visceral area[(1)].

Abdominal obesity is a condition in which excess fat is concentrated in the abdominal area/intra-abdominal fat. Abdominal obesity connects with the distribution of adipose tissue instead of total body fatness and poses a greater health risk because fat cells in the abdomen are more ready to release fat into blood vessels than fat cells elsewhere [(2)].

Anthropometric measurement that can be used as an indicator to determine abdominal obesity is the waist-hip circumference ratio (WHR). Waist-hip ratio is the difference between waist circumference measured horizontally in a tiny section of the abdomen and hip circumference measured via the most maximum area of the hip[3].

## METHODS

The research method was using an analytic observational. The population consisted of 109 dental students from the Faculty of Dentistry, Universitas Jember. The sample for this research were healthy young student aged around 19-20 years. The research technique included instructing, measuring height, measuring weight, measuring waist hip ratio, and completing a food intake measurement based on 24-hour food recall. This research was conducted in a hospital at the Faculty of Dentistry, Universitas Jember. Data analysis contain of data selection, data conversion, data categorization, and data entry. The data was analysed using logistic regression to examine the effect of food intake on fat distribution.

## RESULTS

The findings of the research can be described descriptively in terms of the characteristics of the sample, which included 109 students from the Faculty of Dentistry at the Universitas Jember.

Table 1. Characteristics of male and female student samples

| Characteristics | Male ($\bar{x}$) | Female ($\bar{x}$) |
|---|---|---|
| Height (cm) | 169.5 | 157.1 |
| Weight (kg) | 66.7 | 53.25 |
| Age (year) | 19.5 | 19.5 |
| Waist and hip ratio | 0.88 | 0.78 |

Table 1 displays the characteristics of the male student sample, which has an average height of 169.5 cm, a weight of 66.7 kg, an age of 19.5 years, and WHR of 0.88. Female students had average heights of 157.1 cm, weights of 53.25 kg, ages of 19.5 years, and WHR of 0.78.

Table 2. Simultaneous test results male and female

| Gender | p |
|---|---|
| Male | 0.001* |
| Female | 0.000* |

Note: *significant (p<0.05)

According to table 2 displays that p-value 0.001 smaller than the value α equal to 0.05 implying that food intake had a large concurrent effect on the fat distribution of male students from the Faculty of Dentistry, Universitas Jember. The women's simultaneous test results suggest that p-value 0.000 less than the value of α equal to 0.05. It signifies that food intake has a large concurrent effect on the fat distribution of female students at the Faculty of Dentistry, Universitas Jember.

With the formulation of the hypothesis, the partial test was employed to examine each independent variable to see if it had an effect on fat distribution as evaluated by WHR on male students of the Faculty of Dentistry, Universitas Jember (Table 3).

Table 3. Male and female partial test results

| Variable | p-value | | CI (95%) | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Energy | 0.038* | 0.771 | 1.000-1.016* | 0.997-1.002 |
| Protein | 0.317 | 0.834 | 0.965-1.118 | 0.977-1.029 |
| Carbohydrate | 0.526 | 0.032* | 0.985-1.030 | 1.002-1.043* |
| Fat | 0.156 | 0.042* | 0.977-1.158 | 1.001-1.055* |

Note: *significant (p<0,05)

Table 3 reveals that the p-value for energy was less than 0.05. Its indicating that energy has a substantial effect on male waist-hip ratio. The women's partial test analysis revealed that carbs and fats have a p-value less than 0.05, so it's indicating that carbohydrates and fats have a significant effect on women's waist-hip ratio.

Table 4. Odds Ratio Results for Male and Female

| Variable | $\beta$ | $e^{\beta}$ |
|---|---|---|
| Energy (Male) | 0.008 | 1.008 |
| Carbohydrate (Female) | 0.022 | 1.022 |
| Fat (Female) | 0.027 | 1.027 |

The odds ratio results in Table 4 demonstrate that male students who consume more energy have a 1.008 higher probability of having waist-hip ratio in the high-risk category than students who consume less energy. This demonstrates that the higher the energy usage, the greater the likelihood of having waist-hip ratio in the high-risk category.

Female students who have a higher carbohydrate intake, tend to be at risk for having a high-risk waist-hip ratio 1,022 times higher than students who have lower carbohydrates. If a student has a higher fat intake, he tends to be at risk for having a high-risk waist-hip ratio1,027 times higher than a student who has a lower fat intake. This shows that the higher carbohydrate and fat consumption is the same as the risk to have high-risk waist-hip ratio category. The consumption of fat is high enough to have a higher risk for obesity than carbohydrates.

## DISCUSSION

The findings of the simultaneous test research (Table 2) indicate that food intake influences fat distribution in both male and female students. The findings of this study are consistent with the findings of Ernitasari's [(4)] study, which found that food had an effect on the ratio of waist and hip circumference and blood pressure. This is due to the fact that food consumption is linked to changes in body weight that occur in the body, increasing the risk of metabolic syndrome.

Table 3 illustrates that energy intake has an effect on the waist-to-hip circumference ratio in men. This lends credence to the hypothesis that abdominal and visceral fat have the highest metabolic activity. When you need physical activity, the body requires a lot of energy, thus fat stored in the abdomen is mobilised more than fat stored in other parts of the body [(5)]. The findings of this study are also consistent with Pauline's[(6)] research, which discovered that increasing energy expenditure through physical exercise can reduce abdominal obesity by burning more fat in the abdomen area.

The results of the women's partial test revealed that carbohydrate and fat intake had an effect on the ratio of waist to hip circumference in women. This supports the hypothesis that carbohydrate intake is directly proportional to energy intake, and thus directly proportional to WHR. Excess carbohydrate consumption is transformed from pyruvic acid to acetyl CoA, which is ultimately turned to malonyl CoA. Malonyl CoA is converted into free fatty acids, which are then deposited in adipose tissue as triglycerides[(7)]. The findings of this study are consistent with the findings of Ivanovich's[(8)] study, which found a strong link between carbohydrate intake and waist-hip ratio.

Fat consumption also has a considerable impact on the waist-to-hip circumference ratio in women. This supports the hypothesis that waist circumference is one of the measures that may be used to forecast the distribution of body fat in the abdominal cavity and identify persons at risk for metabolic illnesses. Abdominal fat accumulation will result in lipid metabolism problems. The main lipid diseases are an increase in LDL cholesterol, an increase in triglyceride levels, and a decrease in HDL cholesterol levels [(9)]. The findings of this study are consistent with the findings of Dwiningsih's[(10)] study, which found that eating fatty foods increases the ratio of waist to hip circumference and body weight.

The findings of the partial test on men and women (Table 3) reveal that protein intake has no significant influence on the waist-to-circumference ratio for men and women. The findings of this investigation support the hypothesis that protein is a protective agent that also serves as a building block. If the body's supply of glucose or fatty acids is depleted, cells are forced to consume protein to generate glucose and energy, which prevents protein from being stored[(11)]. The findings of this study are also consistent with the findings of Arceiro's 2013[(12)] study, which claimed that eating a lot of protein can help you lose belly fat.

The metabolic control of lipid deposition and mobilization can influence total body fat and fat distribution. Energy-rich free fatty acids are esterified and stored in adipose tissue as triglycerides. It will be released from adipose tissues via triglyceride hydrolysis. Long-term changes in free fatty acid levels in adipocytes can result in significant accretion or redistribution of body fat mass. Triglyceride deposition and mobilization factors in adipocytes have been identified as important candidates for regulating adipose mass accretion and regional fat distribution profiles[(13)].

During the formation and development of adipose tissue, changes in the size and quantity of adipocytes can occur. Lipogenesis in adipocytes is critical for adipose tissue expansion. Plasma is the primary source of fatty acids for triacylglycerol deposition in adipocytes, as fatty acids circulate attached to albumin or as components of lipoproteins, and are given at the concentrations and turnovers found in systemic arterial circulation. The activity of lipoprotein lipase corresponds closely with the size of adipocyte cells[14].

The hydrolysis of circulating triglycerides by LPL can produce free fatty acids in adipose tissue directly from plasma. Adipocytes produce and secrete this lipase, which is rapidly raised by feeding and lowered by energy restriction[15]. Insulin and glucocorticoids are the major mediators of these alterations. The addition of insulin on glucocorticoids significantly boosted LPL activity. Variations in LPL activity correspond to variances in adipocyte size, implying that LPL plays a role in local fat accumulation management. Because lipoprotein lipase (LPL) is a crucial factor in the deposition of triacylglycerol into adipocytes, variations in LPL activity between sites could have an impact on body fat distribution[16].

Hormonal variables also appear to be important in the regulation of lipogenesis. Sexual orientation differences in LPL activity could be linked to sex steroids. LPL activity is inhibited by testosterone, and this impact appears to be amplified by growth hormone[17]. However, many of the effects of sex steroids on LPL activity could be indirect, possibly mediated by corticosteroids[18]. Excess glucocorticoids, on the other hand, can contribute to truncal fat deposition. In human fat cells, cortisol binds to the glucocorticoid receptor, and visceral fat cells have more glucocorticoid receptors. LPL activity is increased when the cortisol-receptor complex is activated[19]. Cortisol and thyroid hormones are also thought to have adipocyte conditioning effects. Women who receive therapeutic doses of exogenous corticosteroids had smaller gluteal adipocyies than untreated age-related controls[20]. Changes in cortisol, insulin, and sex steroids groups could affect LPL activity and lipogenesis. The role of GH in lipogenesis control has also been established[21].

Age, gender, and the sex steroids can all have an impact on abdominal fat. Up until roughly 60 to 70 years old, an increase in total body fat and body fat relative to lean body mass is found with increasing age. This increase occurs in both men and women of normal weight and obesity. With increasing age, an increase in abdominal visceral fat appears to be a key contribution to an increase in total body fatness. Men, on the other hand, have more abdominal visceral fat than women, and the increase with age is more pronounced in men[22].

Gender is one of the most powerful predictors of body fat distribution type. Obesity characterized by the accumulation of subcutaneous fat on the upper body is known as "android" obesity, while gluteo-femoral obesity is known as "gynoid" obesity. The mechanisms underlying the disparities in body fat distribution between men and women are most likely related to sex steroid variances and other hormonal changes. Greater levels of estrogens and progesterone are linked to lower body obesity in young women, while higher levels of estrogens and progesterone are linked to lower body obesity in women. Androgen levels have been linked to upper body obesity in women[23].

In boys, the prevalence of android obesity is associated with an increase in androgen production, whereas in men, decreased androgen levels are frequently linked to upper body fat. Testosterone stimulates lipolysis in abdominal adipocytes but not femoral adipocytes, resulting in a reduction in visceral fat in males. The link between testosterone and body fat distribution appears to be the polar opposite in women. As a result, the effects of various sex steroids on body fat distribution are likely to differ between sexual orientations and may not be linear within one gender[24].

## CONCLUSION

This study found a significant effect between various food intake and body fat distribution in students from the Faculty of Dentistry, University of Jember. Energy intake has an effect on the waist-to-hip circumference ratio in men. Consumption of carbohydrate and fats has an effect on the ratio of waist to hip circumference in women. Fat consumption is high enough that it puts people at a higher risk of developing abdominal obesity than carbohydrate.

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