Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Sunarto Kadir
Assignment title:	Karya Tulis Ilmiah
Submission title:	The Correlation between Age, Fat Intake, and Visceral Fat an...
File name:	Open_Public_Health_Journal-Blind_Review_revised_persama...
File size:	73.89K
Page count:	10
Word count:	4,955
Character count:	25,742
Submission date:	01-May-2023 10:17PM (UTC-0500)
Submission ID:	2081640217

The Correlation between Age, Fat Intake, and Visceral Fat and Body Mass Index at the Gym

Sunarto Kadir[1*], Yasir Mokodompis[2]

[1]Department of Public Health, Faculty of Sports and Health, State University of Gorontalo, Gorontalo 96128, Indonesia
[2]Department of Public Health, Faculty of Sports and Health, State University of Gorontalo, Gorontalo 96128, Indonesia

(Corresponding Author's information)
Sunarto Kadir, Jl. Jend. Sudirman No.6, Dulalowo Tim., Kec. Kota Tengah, Kota Gorontalo, Gorontalo 96128, +62 812-4419-262, sunartokadir.ung@gmail.com.

Abstract This quantitative research aimed to investigate the correlation between age, fat intake, visceral fat, and the body mass index of gym members. It employed a cross-sectional approach and involved 87 respondents as the sample. Furthermore, Chi Square test was applied to analyze the data. The data used in this study consisted of both primary and secondary data. The primary data was obtained directly from the owners of Zahra Gym (32 individuals), Atlantik Gym (35 individuals), and D'Master Gym (20 individuals), while the secondary data was obtained directly from the gym owners. The research instrument used was a questionnaire, and the data analysis was conducted using the Chi Square test. The results of the study showed that there were 8 respondents (9.2%) who had a fat intake categorized as appropriate, while 79 respondents (90.8%) had a higher fat intake than recommended. As for visceral fat levels, 4 respondents (4.6%) were categorized as having an ideal healthy level, 35 respondents (40.2%) had a fairly high level, and 48 respondents (55.2%) had a high level. In terms of body mass index (BMI), 28 respondents (32.2%) were categorized as having a normal BMI, 20 respondents (23.0%) were classified as overweight, and 39 respondents (44.8%) were classified as obese. The bivariate analysis showed a significant correlation between age and BMI among gym members, with a p-value of $0.001 < \alpha\ 0.05$. There was also a significant correlation between fat intake and BMI among gym members, with a p-value of $0.002 < \alpha\ 0.05$. Additionally, there was a significant correlation between visceral fat and BMI among gym members, with a p-value of $0.029 < \alpha\ 0.05$.

Keywords Age, Body Mass Index, Correlation, Fat Intake, Visceral Fat, Gym Members.

1. Background

Health development is an investment in developing socially and economically productive human resources. Indonesia is currently experiencing a double burden, i.e., unresolved communicable disease-related problems and a significant increase in non-communicable diseases. (Kemenkes RI, 2020).

The WHO data mention that more than one billion people worldwide are overweight, meaning that on average, one in seven people you meet every day deals with this issue. Of such a number, 475 million people are considered obese. (WHO, 2022). The WHO data also suggest that globally, 2.8 million people die each year due to overweight and obesity. It is estimated that 35.8 million disability-adjusted life years (DALY) are also due to overweight and obesity.

According to the data from Basic Health Research in 2013 in Palembang, the prevalence of overweight in young adults experienced an increase from 9.3% in 2010 to 12.7% in 2013, and; the obesity prevalence grew from 9.3% to 16.7% in 2013. A study conducted by Nyangasa (2019) discovered that 26.4% of 195 people aged ≥18 years were obese with a

The Correlation between Age, Fat Intake, and Visceral Fat and Body Mass Index at the Gym

by Sunarto Kadir

Submission date: 01-May-2023 10:17PM (UTC-0500)
Submission ID: 2081640217
File name: Open_Public_Health_Journal-Blind_Review_revised_persamaan.docx (73.89K)
Word count: 4955
Character count: 25742

The Correlation between Age, Fat Intake, and Visceral Fat and Body Mass Index at the Gym

Sunarto Kadir[1*], Yasir Mokodompis[2]

[1]Department of Public Health, Faculty of Sports and Health, State University of Gorontalo, Gorontalo 96128, Indonesia

[2]Department of Public Health, Faculty of Sports and Health, State University of Gorontalo, Gorontalo 96128, Indonesia

(Corresponding Author's information)

Sunarto Kadir, Jl. Jend. Sudirman No 6, Dulalowo Tim., Kec. Kota Tengah, Kota Gorontalo, Gorontalo 96128, +62 812-4419-262, sunartokadir.ung@gmail.com.

Abstract This quantitative research aimed to investigate the correlation between age, fat intake, visceral fat, and the body mass index of gym members. It employed a cross-sectional approach and involved 87 respondents as the sample. Furthermore, Chi Square test was applied to analyze the data. The data used in this study consisted of both primary and secondary data. The primary data was obtained directly from the owners of Zahra Gym (32 individuals), Atlantik Gym (35 individuals), and D'Master Gym (20 individuals), while the secondary data was obtained directly from the gym owners. The research instrument used was a questionnaire, and the data analysis was conducted using the Chi Square test. The results of the study showed that there were 8 respondents (9.2%) who had a fat intake categorized as appropriate, while 79 respondents (90.8%) had a higher fat intake than recommended. As for visceral fat levels, 4 respondents (4.6%) were categorized as having an ideal healthy level, 35 respondents (40.2%) had a fairly high level, and 48 respondents (55.2%) had a high level. In terms of body mass index (BMI), 28 respondents (32.2%) were categorized as having a normal BMI, 20 respondents (23.0%) were classified as overweight, and 39 respondents (44.8%) were classified as obese. The bivariate analysis showed a significant correlation between age and BMI among gym members, with a p-value of $0.001 < \alpha\ 0.05$. There was also a significant correlation between fat intake and BMI among gym members, with a p-value of $0.002 < \alpha\ 0.05$. Additionally, there was a significant correlation between visceral fat and BMI among gym members, with a p-value of $0.029 < \alpha\ 0.05$.

Keywords Age, Body Mass Index, Correlation, Fat Intake, Visceral Fat, Gym Members.

1. Background

Health development is an investment in developing socially and economically productive human resources. Indonesia is currently experiencing a double burden, i.e., unresolved communicable disease-related problems and a significant increase in non-communicable diseases. (Kemenkes RI, 2020).

The WHO data mention that more than one billion people worldwide are overweight, meaning that on average, one in seven people you meet every day deals with this issue. Of such a number, 475 million people are considered obese. (WHO, 2022). The WHO data also suggest that globally, 2.8 million people die each year due to overweight and obesity. It is estimated that 35.8 million disability-adjusted life years (DALY) are also due to overweight and obesity. According to the data from Basic Health Research in 2013 in Palembang, the prevalence of overweight in young adults experienced an increase from 9.3% in 2010 to 12.7% in 2013, and; the obesity prevalence grew from 9.3% to 16.7% in 2013. A study conducted by Nyangasa (2019) discovered that 26.4% of 195 people aged ≥18 years were obese with a

BMI >26 kg/m2, and the prevalence of waist circumference >88 cm was 24.9%. Overweight and obese people will go through physiological adaptation, such as increased blood volume, which leads to high blood pressure (Jin W, Chunhe L, Erkang W. 2010). This indicates that being overweight and obese requires special attention to prevent the risk of metabolic syndrome, including hypertension, often called a "silent killer", because it has no symptoms yet is potentially dangerous (Thomas WB. 2016).

On that ground, it is essential to perform innovative attempts by involving several parties from the central government and local government, community, and entrepreneurs. The attempts are expected to restrain the rate of obesity prevalence in Indonesia by 15.4% until the end of 2019 as in accordance with the indicators in the National Medium-Term Development Plan (RPJMN) of 2015-2019 stipulated in Presidential Regulation Number 2 of 2015.

The prevalence of overweight (BMI ≥ 25 to < 27) and obesity (BMI ≥ 27) among adults has dramatically risen. Besides, obesity has now presented a major challenge to Indonesia. From 2013 to 2018, the prevalence of obesity had increased by 6% and higher than the target of RPJMN of 2015-2019. (Kemenkes RI, 2018).

Gorontalo Province was ranked second among other areas in Indonesia, with the obesity prevalence of 21% higher than the national obesity prevalence of 15.4%. The highest obesity prevalence was in the city of Gorontalo with 24.2%, and the lowest was in Boalemo Regency with 13.6% (Kemenkes RI, 2013). By taking into account the high prevalence of this problem, a test is required to identify the risk of non-communicable diseases. Overweight is widely known as pre-obesity yet considered trivial, making it one of the factors contributing to the high prevalence of obesity. People are inattentive in controlling their weight, especially when being overweight.

National Socio-Economic Survey of Statistics Indonesia (BPS) revealed that the national-scale consumption of oil and fat kept rising from 236.60 kcal in 2016 to 248.90 kcal per person per day in 2020 (BPS, 2020). This has exceeded the limit of oil and fat consumption of 215 kcal per person per day recommended by the National Workshop on Food and Nutrition (Widyakarya Nasional Pangan dan Gizi) of the Ministry of Agriculture.

Fat is a nutrient with the most calories, i.e., nine calories per gram. High-fat or too much energy-sourced food consumption will cause excessive fat stored in the body's cells. Foods with fat provide more energy as they contain two times more calories than proteins (Etisa AM, Lailatul F. 2017).

Measuring body fat is necessary to observe obesity and regulate dietary patterns in healthcare programs. Human's body has two kinds of fat, namely subcutaneous fat (under the skin) and visceral fat (around the abdominal organs) (Dwi NW, Hermina S, Deny YF. 2018). The reduced energy expenditure by the body is due to the slow metabolism, physical activity, and food thermic effect determined based on food compositions. The thermic effect from fat is lower than that from carbohydrates and protein; it is 3% of the total energy produced by fat, 6-7% of the total energy produced by carbohydrates, and 25% of the total energy produced by protein. This signifies that dietary habits and food intake influence obesity (Muhammad AAY, Arief C, Andika CP, Astrid SD, Ayatullah K, Saptawati B, Eva S. 2017).

Numerous studies have proven that visceral fat accumulation usually triggers various health problems, such as cardiovascular disease, type 2 diabetes, stroke, breast cancer, colorectal cancer, and Alzheimer's disease.

A study entitled 'The correlation between body mass index (BMI) and visceral fat value' indicates that both variables are correlated (Adhitya P, 2014). Another research by Sri Andarini, Nia Novita W, Widya Rahmawati, and Annisa Rizky Maulidiana entitled 'The correlation between body mass index, fat intake, micronutrient, and physical

activity and the blood pressure of women of child-bearing age' discovers that there is a correlation between body mass index and fat intake (Sri A, Nia NW, Widya R, Annisa RM. 2019)

Based on the initial data collection on fat intake, there were 12 individuals who did not meet the recommended fat intake of an average of 800 kcal or more than 702 kcal or 67 grams, while 3 individuals met the recommended fat intake of an average of 600 kcal or less than 702 kcal or 67 grams. According to the initial observation using a Bioelectric Impedance Analyzer (BIA) scale, there were 14 individuals with a fairly high visceral fat scale and 1 individual with an ideal healthy visceral fat scale. Additionally, based on the initial observation of measuring the body mass index (BMI), 12 individuals were classified as overweight and 3 individuals were classified as obese (Primary data, 2022).

The present study was conducted in an area where the community has a habit of consuming high-fat foods. One example is some traditional activities that require serving high-fat foods. Further, Gym exercise in Gorontalo is not a favorable and popular sport in the community; this sport is developing along with the Covid-19 pandemic so people tend to choose indoor sports. In view of the foregoing, this case study was conducted to examine the correlation between age, fat intake, and visceral fat and body mass index of gym members in the city of Gorontalo).

2. Methods

Research sites comprised Zahra Gym, Atlantik Gym, and D'Master Gym in Gorontalo, Gorontalo Province. It was conducted from November to December 2022 and employed an analytical survey design with a cross-sectional approach. The population involved 87 male gym members; the sample was taken by a total sampling technique where the entire population is sampled. Research variables consisted of age, fat intake, visceral fat, and body mass index. Further, the data analysis using Spearman Rank Test. The inclusion criteria for this study were individuals who were members of the gym. The exclusion criteria were individuals who were also members of the gym but did not regularly attend the gym. The body mass index (BMI) was calculated using height and weight measurements, age was determined based on the year of birth, fat intake was measured using a questionnaire, and visceral fat was measured using a Bioelectric Impedance Analyzer (BIA). The data analysis was conducted using the Chi Square test.

3. Results

3.1. Respondents' Characteristics

Provided below are the respondents' characteristics based on age group.

Table 1. Distribution of Respondents Based on Age Group

Age Group (Years)	Total	
	n	%
17-25	16	18.4
26-35	48	55.2
36-45	20	23.0
46-55	3	3.4
Sum	87	100.0

Source: Primary Data, 2021

The above table illustrates that out of 87 respondents, most of them (48 respondents) are aged 26-35 years (55.2%), and the least age group is 46-55 years (three respondents or 3.4%).

3.2. Univariate Analysis

3.2.1. Distribution of respondents based on fat intake

Here are respondents' characteristics based on fat intake.

Table 2. Distribution of Respondents Based on Fat Intake

Fat Intake	Total	
	n	%
Meet the recommended intake level	8	9.2
Exceed the recommended intake level	79	90.8
Sum	87	100.0

Source: Primary Data, 2021

The above table shows that eight respondents (9.2%) have met the recommended fat intake level, and 79 respondents (90.8%) have exceeded the intake level.

3.2.2. Distribution of respondents based on visceral fat

Given below are respondents' characteristics based on visceral fat.

Table 3. Distribution of Respondents Based on Visceral Fat

Visceral Fat	Total	
	n	%
Ideal or healthy	4	4.6
Moderate	35	40.2
High	48	55.2
Sum	87	100.0

Source: Primary Data, 2021

Based on Table 3, out of 87 respondents, four respondents (4.6%) have an ideal or healthy level of visceral fat, 33 respondents (37.9%) and 50 respondents (57.5%) have moderate and high levels of visceral far, respectively.

3.2.3. Distribution of respondents based on body mass index

The following table provides respondents' characteristics based on body mass index.

Table 4. Distribution of Respondents Based on Body Mass Index

Body mass index (BMI)	Total	
	n	%
Normal 18.5 - 25.0	28	32.2
Overweight 25.1 - 27.0	20	23.0
Obese > 27.0	39	44.8
Sum	87	100.0

Source: Primary Data, 2021

Table 4 illustrates that 28 respondents (32.2%) have normal BMI, 20 respondents (23.0%) are overweight, and 39 respondents (44.8%) are obese.

3.3. Bivariate Analysis

3.3.1. The analysis result of the correlation between age and body mass index of gym members in Gorontalo.

The analysis result of the correlation between age and body mass index is presented below.

Table 5. Analysis Result of the Correlation between Age and Body Mass Index of Gym Members

Age	Body Mass Index						Total		r value	P value
	Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%		
17-25	6	37.5	6	37.5	4	25	16	100	0.24	0.12
26-35	15	31.5	10	20.8	23	47.9	48	100		
36-45	7	35	2	10	11	55	20	100		
46-55	0	0	2	66.7	1	33.3	3	100		
Sum	**28**	**32.2**	**20**	**23**	**39**	**44.8**	**87**	**100**		

Source: Primary Data, 2021

Following Table 5, it is seen that out of 16 respondents aged 17-25 years old, six respondents (37.5%) have a normal body mass index, six respondents (37.5%) are overweight, and four respondents (25.0%) are obese. Further, of 48 respondents aged 26-35 years old, 15 respondents (31.3%) have a normal body mass index, ten respondents (20.8%) are overweight, and 23 respondents (47.9%) are obese. Next, the body mass index of 20 respondents aged 36-45 years is as follows: seven respondents (35.0%) are normal, two respondents (10.0%) are overweight, and 11 respondents (55.0%) are obese. Last, in the age group of 46-55 years (three respondents), none (0%) has a normal body mass index, two respondents (66.7%) are overweight, and one respondent (33.3%) is obese. The test result also obtains the p-value of 0.12 or α <0.05, implying that age and body mass index do not correlate. The r-value also gets 0.24 which indicates a very weak correlation.

3.3.2. The analysis result of the correlation between fat intake and body mass index of gym members in Gorontalo

The analysis result of the correlation between fat and body mass index is illustrated in the following table.

Table 6. Analysis Result of the Correlation between Fat Intake and Body Mass Index of Gym Members

Fat Intake	Body Mass Index						Total		r value	P value
	Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%		
Meet the recommended intake level	7	87.5	0	0	1	12.5	8	100	0.31	0.03
Exceed the recommended intake level	21	26.6	20	25.3	38	48.1	79	100		
Sum	**28**	**32.2**	**20**	**23**	**39**	**44.8**	**87**	**100**		

Source: Primary Data, 2021

Table 6 illustrates that the majority of respondents (79 respondents) have exceeded the recommended fat intake level, in which 21 respondents (26.6%) have normal body mass index, 20 respondents (25.3%) are overweight, and 38 respondents (48.1%) are obese. Meanwhile, the minority of respondents have fulfilled the recommended fat intake level, in which only one respondent (12.5%) is obese. The test result also obtains the p-value of 0.03 or α <0.05, meaning that fat correlates with body mass index. The r-value also gets 0.31, signifying a moderate correlation.

3.3.3. The analysis result of the correlation between visceral fat and body mass index of gym members in Gorontalo

Provided below is the analysis result of the correlation between visceral fat and body mass index.

Table 7. Analysis Result of the Correlation between Visceral Fat and Body Mass Index of Gym Members

Visceral Fat	Body Mass Index	Total	r value	P value

	Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%		
Ideal/healthy	2	50	2	50	0	0	4	100	0.33	0.02
Moderate	16	45.7	8	22.9	11	31.4	35	100		
High	10	20.8	10	22.8	28	58.3	48	100		
Sum	**28**	**32.2**	**20**	**23**	**39**	**44.8**	**87**	**100**		

Source: Primary Data, 2021

Table 7 indicates that the majority of respondents (48 respondents) have a high level of visceral fat, in which ten respondents (20.8%) had normal body mass index, ten respondents (22.8%) are overweight, and 28 respondents (58.3%) are obese. Only four respondents have ideal or healthy visceral fat; two respondents (50.0%) have normal body mass index, two respondents (50.0%) are overweight, and none (0%) is obese. The test result also obtains the p-value of 0.02 or $\alpha < 0.05$, meaning that visceral fat correlates with body mass index. The r-value also gets 0.33 or indicates a moderate correlation.

4. Discussion

4.1. Fat Intake

The measurement of energy intake relied on a semi-quantitative food frequency questionnaire method, in which eight respondents (9.2%) have met the recommended fat intake level, and 79 respondents (90.8%) have exceeded the limit. Those 79 respondents regularly consume staple foods with a pretty large portion, fritters, noodles, meatballs, and local snacks high in calories. They consume such foods every day, or four to six times a week. On the other hand, respondents with healthy fat intake solely consume staple foods without excessive supplementary foods, making their calorie intake reach 80% of RDA. This is because the respondents get used to eating a small amount of food.

Fat is an energy-forming source in the body that per gram of fat produces more energy than either carbohydrates or protein. One gram of fat will make nine calories; meanwhile, one gram of carbohydrate and protein only has four calories. In addition, fat functions as structural building blocks of the body, offers protection against rapid heat loss, and regulates body temperature. It also produces essential fatty acids and serves as a solvent for vitamin A, D, E, and K (Mami. 2014).

The present study is in line with previous research that out of 148 respondents, eight respondents (5.4%) had less fat intake, six respondents (4.1%) had a moderate fat intake, and 134 respondents (90.5%) had excessive fat intake (Amalia R, Peggy SB. 2019). In this context, excessive fat intake may affect adipose tissue; and this can put fat mass at risk leading to obesity. This research has obtained an Ethical Clearance Recommendation Letter Number: 13/UN47.B7/KE/2023.

4.2. Visceral Fat

This research finds out through the bioelectrical impedance analysis that out of 87 respondents, four respondents (4.6%) have an ideal or healthy level of visceral fat, 33 respondents (37.9%) and 50 respondents (57.5%) have moderate and high levels of visceral far, respectively.

Adipose tissue is distributed within two main compartments with different metabolic characteristics: subcutaneous adipose tissue and visceral adipose tissue or visceral fat (VF). Visceral fat is an accumulation of intra-abdominal fat (central obesity) that is stored beneath the skin deeper than subcutaneous fat (Shuster A, Patlas M, Pinthus JH, Mourtzakis M. 2012). The increase in the secretion of inflammatory mediators in visceral fat of obese people reflects ongoing chronic inflammation within the people's adipose tissue (Xu L, Mitsuhiro K, Takeshi Y, Ke JL. 2012). An excessive amount of fat will be normally stored in the subcutaneous layer, yet it is accumulated in the visceral layer due

to damage. Fat distribution in different areas has implications for morbidity. Abdominal fat and intra-abdominal fat (visceral fat) have greater significance than fat distributed in the lower extremities or whole body (fat mass). A prospective study using anthropometric measurements suggests that visceral obesity is closely related to hypertension, diabetes, and cardiovascular disease (Yulina DH, Yahwardiah S, Ramlan S. 2013).

Some decades of evidence have strongly determined that abdominal fat is associated with cardiometabolic risk factors outside of obesity itself. There is no dispute that abdominal fat is the main target of treatment for strategies designed to prevent or manage health risks associated with stomach obesity. The findings of the systematic review confirm that the negative energy balance caused by exercise or diet is associated with a significant reduction in abdominal fat and related cardiometabolic risk factors.

In the same tune, Purwanti Susantini pointed out that 18.3% of respondents had a high level of visceral fat, and 8.7% of respondents had an extremely high level of such fat (Purwanti S. 2021). Visceral fat is located inside the peritoneal cavity, wrapped around the internal organs. Excessive visceral fat strongly connects with an increased risk for cardiovascular disease, metabolic syndrome (hypertension, dyslipidemia, and type II diabetes), and insulin resistance. A study has investigated that an obese person is more likely to have excessive visceral fat. Visceral fat can also contribute to waist circumference, so the higher the visceral fat percentage, the higher the risk of a person experiencing central obesity (Ira MS. 2018).

4.3. Body Mass Index

This research used a scale and microtoise with the following results: out of 87 respondents, 28 respondents (32.2%) have normal body mass index, 20 respondents (23.0%) are overweight, and 39 respondents (44.8%) are obese. Body mass index is a method to measure one's nutritional status relating to malnutrition and overnutrition. According to Irianto (Irianto DP. 2017), body mass index is used to determine the nutritional status of adults aged 18 years and over. Body mass index calculated from self-reported weight and height is systematically comparable to body mass index calculated from objectively measured data, despite the high correlation between the two. Errors in self-reported weight and height can lead to substantial misclassification into the body mass index category.

Body composition is related to height, weight, and fat thickness. One's height is measured on a flat section of floor and a flat section of wall. They need to stand straight with their feet flat on the floor with their heels against the corner where the wall and floor meet, and their shoulders, buttocks, and hips are touching the wall.

In accordance with the present results, a previous study by Amalia Rahma and Peggy Setyaning Baskari had demonstrated that four respondents (2.70%) had a body mass index of <18.5, 34 respondents (22.97%) had a body mass index of 18.5-22.9, 44 respondents (29.72%) had a body mass index of 23-24.9, 48 respondents (32.43%) had a body mass index of 25-29.9, and 18 respondents (12.16%) had a body mass index of >30 (Amalia R, Peggy SB. 2019).

The increase in body mass index is associated with increased body weight and the accumulation of fat in the body.

4.4. The correlation between age and body mass index of gym members in Gorontalo

Following Table 5, it is seen that out of 16 respondents aged 17-25 years old, six respondents (37.5%) have a normal body mass index, six respondents (37.5%) are overweight, and four respondents (25.0%) are obese. Further, of 48 respondents aged 26-35 years old, 15 respondents (31.3%) have a normal body mass index, ten respondents (20.8%) are overweight, and 23 respondents (47.9%) are obese. Next, the body mass index of 20 respondents aged 36-45 years is as follows: seven respondents (35.0%) are normal, two respondents (10.0%) are overweight, and 11 respondents (55.0%)

are obese. Last, in the age group of 46-55 years (three respondents), none (0%) has a normal body mass index, two respondents (66.7%) are overweight, and one respondent (33.3%) is obese. The test result also obtains the p-value of 0.12 or $\alpha < 0.05$, implying that age and body mass index do not correlate with each other. The r-value also gets 0.24 or indicates a very weak correlation.

Both variables were analyzed using Chi Square test to find the correlation between age and body mass index. Since the p-value gets 0.12 (p or $\alpha < 0.05$), there is no correlation between age and body mass index. The correlation coefficient (r-value) is 0.24, indicating a very weak correlation.

4.5. The correlation between fat intake and body mass index of gym members in Gorontalo

The measurement of fat intake and body mass index in this research shows that of eight respondents meeting recommended intake level, seven respondents (87.5%) have a normal BMI, none (0%) is overweight, and one respondent (12.5%) is obese. Moreover, 79 respondents have exceeded the limit of recommended fat intake, in which 21 respondents (26.6%) have a normal BMI, 20 respondents (25.3%) are overweight, and 38 respondents (48.1%) are obese.

Both variables were analyzed using Chi Square test to determine the correlation between fat intake and body mass index. Since the p-value gets 0.03 (p or $\alpha < 0.05$), there is a correlation between fat intake and body mass index. The correlation coefficient (r-value) is 0.31, signifying a moderate correlation.

Fat is an energy-forming source in the body that per gram of fat produces more energy than either carbohydrates or protein. One gram of fat will produce nine calories; meanwhile, one gram of carbohydrate and protein only has four calories. In addition, fat functions as structural building blocks of the body, offers protection against rapid heat loss, and plays a role in regulating body temperature. It also produces essential fatty acids and serves as a solvent for vitamin A, D, E, and K (Marni. 2014).

Fat is a source of energy that the body needs for physical activities and helps dissolve fat-soluble vitamins. The intake recommendation for fat is 10 to 25% of total energy.

The recommended fat intake is vegetable fat as it contains essential fatty acids, such as oleic, linoleic, linolenic, and arachidonic acids that can prevent blood vessel constriction due to cholesterol build-up. The recommended dietary allowance, or RDA, for fat of 10 to 18-year old adolescent boys and girls ranges between 70 and 89 grams/day and 67 and 71 grams/day, respectively (Hardinsyah H, Supariasa S. 2016).

The present findings are strengthened by Gagah Mukti Widodo that fat intake significantly correlated with body mass index with p-value of 0.04 and correlation coefficient (r) of 0.208, meaning that both variables had a low yet certain correlation (Widodo GM. 2014) Both variables also reached a positive correlation, so that the higher the fat intake, the higher the body mass index. These findings broadly support the work of Sari that the more people consume fat in the long term, the higher the risk of over nutrition and obesity (Ratu ADS. 2008)

One respondent has fulfilled the recommended fat intake level, yet s/he is obese due to the excess body weight. Excess body weight is caused by the muscles and bones the respondent has built. Additionally, there are 21 respondents exceeding the recommended fat intake level, yet having a normal body mass index. It is because they regularly exercise and get their body mass index controlled.

4.6. The correlation between visceral fat and body mass index of gym members in Gorontalo

It is revealed that four respondents have ideal or healthy visceral fat, in which two respondents (50.0%) have a normal

body mass index, two respondents (50.0%) are overweight, and none (0%) is obese. Moreover, 35 respondents have a moderate level of visceral fat, in which 16 respondents (45.7%) have a normal BMI, eight respondents (22.9%) are overweight, and 11 respondents (31.4%) are obese. Moreover, 48 respondents have exceeded the limit of recommended fat intake, in which ten respondents (20.8%) have a normal BMI, ten respondents (22.8%) are overweight, and 28 respondents (58.3%) are obese.

Both variables were analyzed using Chi Square to determine the correlation between visceral fat and body mass index. Since the p-value gets 0.02 (p or $\alpha < 0.05$), it is concluded that visceral fat correlates with body mass index. The correlation coefficient (r-value) is 0.33, indicating a moderate correlation.

Visceral fat is an accumulation of intra-abdominal fat (central obesity) that is stored beneath the skin deeper than subcutaneous fat (Shuster A, Patlas M, Pinthus JH, Mourtzakis M. 2012). The increase in the secretion of inflammatory mediators in visceral fat of obese people reflects ongoing chronic inflammation within the people's adipose tissue (Xu L, Mitsuhiro K, Takeshi Y, Ke JL. 2012).

From Epic Wellness data collection, visceral fat can trigger various health risks as it can increase the release of proteins and hormones that stimulate inflammation. Such inflammation can damage arteries and affect liver function, making it harder for the body to break down sugar and fat. Visceral fat can also increase the production of low-density lipoprotein or often called the "bad" cholesterol, which ultimately leads to inflammation and narrowing of arteries. This condition can increase blood pressure, put a strain on the heart, and increase the risk of blood clotting.

Theories have revealed that visceral fat is among the body's components that can influence body weight. Body mass index is an indicator showing one's nutritional status by calculating the height and weight, so that visceral fat as a body component may also affect body mass index (Arisman D. 2018).

The present work is consistent with a study that body mass index significantly correlated with visceral fat ($p<0.01$) (Jin W, Chunhe L, Erkang W. 2010). Another research also found a positive correlation between body mass index and visceral fat ($r=0.60$) (Ratu ADS. 2008). This study indicated that body mass index correlates with visceral fat (Ian J, Peter TK, Robert R. 2002). Therefore, an increase in body mass index is also accompanied by an increase in visceral fat.

The present findings are also strengthened by Adhitya Pradana's case study in 2014 on the correlation between body mass index and visceral fat of medical students in Universitas Diponegoro (Adhitya P. 2014). The analysis result showed a positive correlation between body mass index and visceral fat with ($p=0.005$) and ($r=0.912$). Kevin Kurniawan Soegeng's study in 2016 regarding the correlation between waist circumference and body mass index with visceral fat of medical students in Surabaya Widya Mandala Catholic University also supported these findings (Kevin KS. 2016). The p-values for all samples in the correlation between waist circumference and visceral fat were ($p=0.000$) and ($r=0.513$), and the p-values for all samples in the correlation between body mass index and visceral fat were ($p=0.000$) and ($r=0.651$) (Kevin KS. 2016).

Two respondents have ideal or healthy visceral fat, yet they are overweight as the visceral fat is only stored in the waist circumference. Although one's waist circumference is ideal yet has an overweight body mass index, fat may be accumulated in other body parts, e.g., upper arm circumference and thigh. Next, 16 respondents have a moderate level of visceral fat with a normal body mass index because they do not control the visceral fat. They only build muscles and bones and still consume more fats, making the fats accumulated in the abdomen.

Conclusion

In connection with the correlation between age, fat intake, and visceral fat and body mass index of gym members in the city of Gorontalo, this research concludes that: (1) There is no correlation between age and body mass index with the significance p-value = 0.12 (>α= 0.05) and r-value = 0.24. (2) Fat intake correlates with body mass index with the significance p-value = 0.03 (<α= 0.05) and r-value = 0.31. (3) Visceral fat correlates with body mass index with the significance p-value = 0.02 (<α= 0.05) and r-value = 0.33.

The Correlation between Age, Fat Intake, and Visceral Fat and Body Mass Index at the Gym

ORIGINALITY REPORT

19%	12%	12%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	"Track 1 – Track 5", International Journal of Obesity, 2008 Publication	2%
2	Nofita Syafaatin, Diah Jerita Eka Sari, Ervi Suminar, Widiharti Widiharti. "The Correlation Between Age and Body Mass Index and The Incidence of Osteoarthritis in The Elderly at Outpatient Unit of PKU Muhammadiyah Sekapuk Hospital", Indonesian Vocational Research Journal, 2022 Publication	2%
3	jddtonline.info Internet Source	1%
4	Robert Ross, Simrat Soni, Sarah A. Houle. "Negative Energy Balance Induced by Exercise or Diet: Effects on Visceral Adipose Tissue and Liver Fat", Nutrients, 2020 Publication	1%
5	gssrr.org Internet Source	1%

6	anzos-aoco-ossanz-2017.p.asnevents.com.au Internet Source	1 %
7	Katherine M. Flegal, John P.A. Ioannidis, Wolfram Doehner. "Flawed methods and inappropriate conclusions for health policy on overweight and obesity: the Global BMI Mortality Collaboration meta - analysis", Journal of Cachexia, Sarcopenia and Muscle, 2019 Publication	1 %
8	repository.poltekkes-kaltim.ac.id Internet Source	1 %
9	knepublishing.com Internet Source	<1 %
10	Submitted to Universitas Sebelas Maret Student Paper	<1 %
11	Submitted to Napier University Student Paper	<1 %
12	Submitted to Çankırı Karatekin University Student Paper	<1 %
13	"Oral Presentations", Obesity Reviews, 9/2006 Publication	<1 %
14	123dok.com Internet Source	<1 %
15	link.springer.com	

	Internet Source	<1%
16	"Obesity and Cancer", Springer Science and Business Media LLC, 2016 Publication	<1%
17	C. Dan Lantsman, A. Herman, J.J. Verlaan, M. Stern, R. Mader, I. Eshed. "Abdominal fat distribution in diffuse idiopathic skeletal hyperostosis and ankylosing spondylitis patients compared to controls", Clinical Radiology, 2018 Publication	<1%
18	ejournal.unibo.ac.id Internet Source	<1%
19	qpc78.co-aol.com Internet Source	<1%
20	www.ncbi.nlm.nih.gov Internet Source	<1%
21	Nyasha Mangava, Saralees Nadarajah. "Mixture modeling of hospital charge in Zimbabwe", Heliyon, 2023 Publication	<1%
22	www.science.gov Internet Source	<1%
23	Ridha Ridha, Andi Zulkifli, Veni Hadju, Aminuddin Syam. "The Effect of Pumpkin	<1%

	Seed Biscuits and Moringa Capsules on (Malondialdehyde) Levels and Birth Outcomes of Pregnant Women", Open Access Macedonian Journal of Medical Sciences, 2022 Publication	
24	nz.news.yahoo.com Internet Source	<1 %
25	journal.uin-alauddin.ac.id Internet Source	<1 %
26	Kathleen L. Keller, Angelo Pietrobelli, Shoshanna Must, Myles S. Faith. "Genetics of eating and its relation to obesity", Current Atherosclerosis Reports, 2002 Publication	<1 %
27	oaji.net Internet Source	<1 %
28	tnp2k.go.id Internet Source	<1 %
29	Submitted to London School of Commerce Student Paper	<1 %
30	etd.aau.edu.et Internet Source	<1 %
31	core.ac.uk Internet Source	<1 %
32	wjbphs.com Internet Source	<1 %

33	www.aihw.gov.au Internet Source	<1 %
34	www.coursehero.com Internet Source	<1 %
35	www.thieme-connect.com Internet Source	<1 %
36	eprints.undip.ac.id Internet Source	<1 %
37	jkb.ub.ac.id Internet Source	<1 %
38	pdfs.semanticscholar.org Internet Source	<1 %
39	R. A Whitmer. "Obesity in middle age and future risk of dementia: a 27 year longitudinal population based study", BMJ, 6/11/2005 Publication	<1 %
40	Ragimun, Imran Rosjadi. "Fiscal incentive policy for coal downstreaming in Indonesia", IOP Conference Series: Materials Science and Engineering, 2020 Publication	<1 %
41	Zul Fikar Ahmad, Siti Surya Indah Nurdin, Ekawaty Prasetya, Yasir Mokodompis. "The impact of virtual meetings in learning on eye fatigue during the Covid-19 pandemic", AIP Publishing, 2022	<1 %

Publication

42	depbangkol.perpusnas.go.id Internet Source	<1%
43	www.researchgate.net Internet Source	<1%
44	Submitted to Aston University Student Paper	<1%
45	Carlos A González, Guillem Pera, José R Quirós, Cristina Lasheras et al. "Types of fat intake and body mass index in a Mediterranean country", Public Health Nutrition, 2007 Publication	<1%
46	Courtney J. Balentine, Jose Enriquez, William Fisher, Sally Hodges et al. "Intra-abdominal Fat Predicts Survival in Pancreatic Cancer", Journal of Gastrointestinal Surgery, 2010 Publication	<1%
47	Moh Arif Dulambuti, Irwan Irwan, Laksmyn Kadir. "ANALYSIS OF FACTORS RELATED TO PRESENTIAL SEX BEHAVIOR IN ADOLESCENTS IN SMP 3 BOTUMOITO", International Journal of Health Science & Medical Research, 2022 Publication	<1%
48	eprints.unm.ac.id Internet Source	<1%

49	www.ijnms.net Internet Source	<1%
50	Abd. Hamid Isa, Muhammad Zubaidi. "The Phenomena of Life Skill Education of a Coastal Community: An Empirical Study of Education from The Aspect of Community's Productivity", Journal of Educational and Social Research, 2022 Publication	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		