



The Relationship Between Body Mass Index, Percent Body Fat, And Belly Fat With U20 Futsal Athlete Fitness

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Abstract

This study aims to determine the relationship between body mass index, body fat, and physical fitness of U20 futsal players at the Futsal Student Activity Unit (UKM) University of Indonesia and Pivot FC Club. The data collection technique was carried out by measuring the futsal team of the University of Indonesia and Pivot FC with Purposive Sampling totaling 32 people. Aerobic capacity values are taken through a bleep test. The values of body mass index, body fat, and visceral fat are taken through the BIA (Bioelectric Impedance Analysis) method. The data obtained is then processed and analyzed using SPSS. The results of the analysis using SPSS obtained an average VO₂Max value of 36.64 / kg/minute while the average body mass index, body fat, and visceral fat respectively were 21.2, 14.2%, and 4.81. The results of the Spearman Rank correlation test (1) there is a correlation between body mass index and physical fitness of $r = -0.471$ and the significance of P-Value = 0.007 (2) there is a correlation between body fat and physical fitness of $r = -0.391$ and the significance of P-Value = 0.027 (3) there is a correlation between visceral fat and physical fitness of $r = -0.409$ and the significance of P-Value 0.020. The results of the analysis through UI showed that there was an inverse relationship with the value of body mass

Keywords: *Futsal, Body Mass Index, Body Fat, Visceral Fat, Physical Fitness, Aerobic Capacity, Correlation*

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INTRODUCTION

Optimal achievement becomes the goals and expectations that every coach and athlete wants. To be able to improve the achievements and achievements of an athlete in addition to good technique and tactics, excellent body condition and physical condition are needed. Balanced nutrition and excellent physical condition are important factors. Futsal is a sport derived from the Spanish language, Futbol Sala, which means indoor football. Futsal originated in 1930 when Juan Carlos Ceriani as a teacher made indoor football. Futsal continued to grow until finally in 1989 the Futsal World Cup was held in the Netherlands. Since then Futsal has continued to grow rapidly and massively throughout the world.

Futsal is a complex sport because it requires technique, tactics, and physical condition (Lhaksana, 2011) Futsal demands excellent physical condition for each player. A prim a physical condition is very supportive of a player's appearance. Poor physical appearance will adversely affect his technique and tactics. With these conditions, the lack of physical fitness becomes one of the important factors for the performance of futsal players. The higher the athlete's aerobic endurance, the athlete's fatigue level will decrease. Aerobic endurance can be measured by looking at the maximum oxygen consumption that can directly enter the body (VO2 Max). Athletes who do not have a good VO2 Max will be seen with their performance on the field. Traditionally, VO2 max is used to prescribe aerobic exercise intensity and assess cardiovascular adaptations to an exercise program(Esco et al., 2011). It is also the most useful predictor of endurance performance across the general populationThe player will experience a decrease in stamina and do a lot of basic changes that can be detrimental (Rismayanthi, 2016)

Body Mass Index is an objective instrument used to measure the relationship between an individual's height and weight to determine the risk of health and excessive weight. Body Mass Index measurement is one of the anthropometric measurements to know a person's body composition. Achieve good aerobic endurance is influenced by various factors. Based on previous studies that studied the relationship between Body Mass Index (BMI), physical activity with VO2 max in adolescents showed results that adolescents with normal BMI generally have better VO2 Max levels than adolescents who are deficient and overweight or obese(Borga et al., 2018)

Fat is a source of nutrients that contribute 60% of the total energy needed at rest and is also needed in greater quantities when exercising. Apart from being an energy source, the function of fat in the energy system is as an energy reserve. The more calories consumed, the more energy obtained by the body, but too much calorie intake compared to the energy expended (for blessings) will cause excessive calories to be stored in energy reserves in the body in the form of fat. In previous studies, aerobic endurance by athletes can be significantly influenced by percent body fat, muscle mass, and somatotype(Latifah et al., 2019)

Reserve fat can be distributed in the tissues under the skin as subcutaneous fat and around the visceral apparatus contained in the chest cavity and abdominal cavity as visceral fat (Sudiby, 2013). One of the areas of fat accumulation that causes central obesity is the abdomen which is

often called visceral fat (Intraabdominal fat) (Munawaroh & Fatimah, 2021) The amount of visceral fat in the athlete's body will threaten the performance of futsal athletes with dynamic movements according to the game situation. Several studies conducted on football and handball athletes concluded that the higher the percent of athletes' body fat, the lower the max vo2 levels (Esco et al., 2011; Gligoroska et al., 2015 ; (Marangoz & Var, 2018). The purpose of this study was to look for the relationship between body mass index, body fat, and abdominal fat (visceral fat) on the physical fitness of futsal athletes in the Student Activity Unit (UKM) of the University of Indonesia and the futsal school Pivot Futsal Club.

Making a table that contains research results or data obtained during the introduction, research methods or research results using only horizontal lines without borders like the following table:

METHOD

The type of research used in this study according to the type of data and analysis is a quantitative method, namely research that collects, compiles, processes, and analyzes data in the form of numbers, which in practice are given certain treatments studied in it. According to Sugiyono (Sugiyono, 2015) quantitative research can be interpreted as a method based on the philosophy of positivism, used to examine certain populations or samples, sampling techniques are generally carried out randomly, data collection using research instruments, quantitative/statistical data analysis to test hypotheses that have been set. According to (Supriadi, 2021), this research according to explanation or explanation is classified into three, namely;

a. Descriptive Research

Descriptive research is research conducted to determine the value of independent variables, either one variable or more (Independent) without making comparisons or linking with other variables.

b. Comparative Research

Comparative research is a comparative study. Here the variable is still the same as the independent variable but for more than one sample in different periods

c. Associative Research.

Associative research is research that aims to determine the influence or relationship between two or more variables. This research will be conducted in April 2023 with total sampling.

Total sampling was conducted against the Futsal Student Activity Unit (UKM) of the University of Indonesia and the Futsal School Pivot Futsal Club. Total sampling is carried out as preparation for the two teams in general preparation for a competition. The total sample was 32 players.

The dependent variable is physical fitness measured through a Multistage fitness test commonly called a bleep test. The bleep test is done by running a distance of 20 meters back and forth, which begins with a gradual slow run that gets faster and faster until the athlete is unable to keep up with the rhythm of the run. If two consecutive times the athlete is unable to follow the rhythm of the running time, it means that his maximum ability is only at that level and reverse. (Wiriawan, 2017) Here's a schematic image of the bleep test

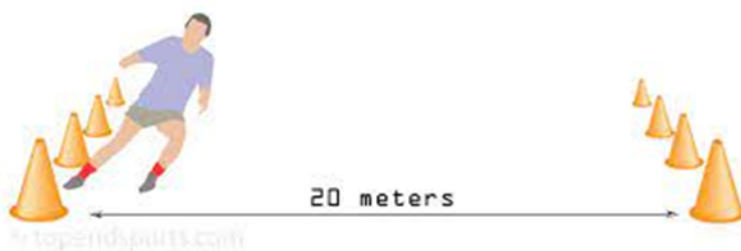


Figure 1. Tes Bleep (www.topendsport.com)

The independent variables are body mass index (BMI), Body Fat, and Visceral Fat (Belly Fat). Measurements of independent variables are carried out with BIA (Bioelectrical Impedance Analysis). Measurements of body mass index, body fat, and visceral fat are carried out using the Bioelectrical Impedance Analysis (BIA) tool where respondents climb to the top of the scale where after a few seconds the results of body composition data will come out which can be seen from the application connection in a mobile or laptop application. Here's a picture of the tool.

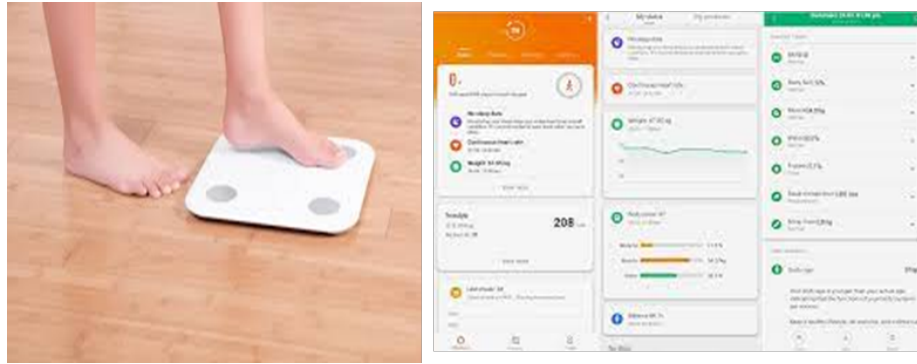


Figure 2. Bioelectrical Impedance Analysis (BIA) (www.dignited.com)

After that, independent (physical fitness) and dependent variables (BMI, body fat, and visceral fat) will be analyzed through SPSS software by going through the normality test stage and correlation test which are analyzed through descriptive, comparative, and associative approaches. For more details, here is a diagram of the steps of the activities to be carried out by researchers.

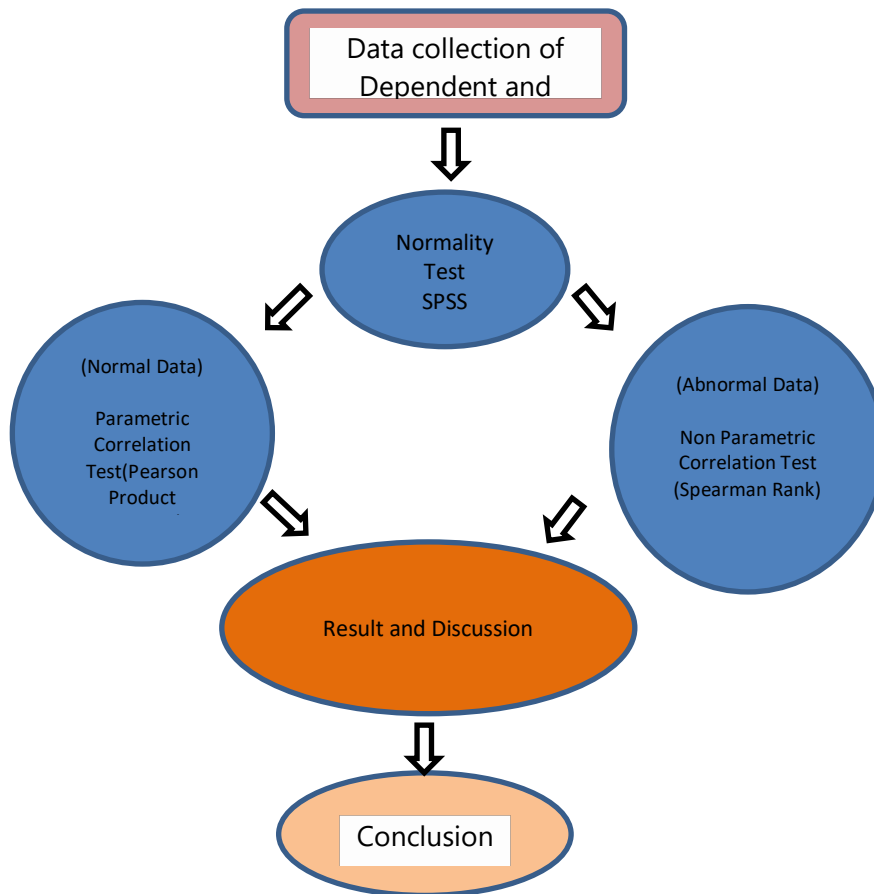


Figure 3. Flow Chart Research

In Figure 3, a correlation test can be seen, so it will be concluded that whether the hypothesis is acceptable or not. Then the author will conduct a multiple correlation test to determine the simultaneous relationship of independent variables (BMI, Body Fat, and Visceral Fat) to independent variables (Vo2 max)

RESULTS AND DISCUSSION

The results of this study showed 32 samples had BMI values, Body Fat, and Visceral Fat. Table 1 shows the distribution values of BMI, Body Fat, and Visceral Fat.

Table 1. Distribution of BMI, , Body Fat, and Visceral Fat

		Statistics			
		Endurance	BMI	Fat	Visceral
N	Valid	32	32	32	32
	Missing	6	6	6	6
Mean		36.6438	21.2969	14.2781	4.8125
Std. Deviation		5.54006	3.86627	6.58937	3.52354
Range		21.90	20.00	32.60	14.00
Minimum		23.60	16.80	4.50	1.00
Maximum		45.50	36.80	37.10	15.00

Observations of Table 1. It can be seen that the average value of body mass index is 21.2 with a minimum/maximum value (16.80-36.80). Body fat showed an average value of 14.27 with a minimum/maximum value (4.50% -37.10%). Abdominal fat (visceral) showed an average of 4.81% with a minimum/maximum value (1.00% -14%). For dependent variables, namely, physical fitness or aerobic capacity can be seen as an average value of 36.64 ml/kg/minute with a minimum / maximum value (of 23.60-45.50) ml/kg/minute. Figure 4 shows a description of the variable body mass index as follows.

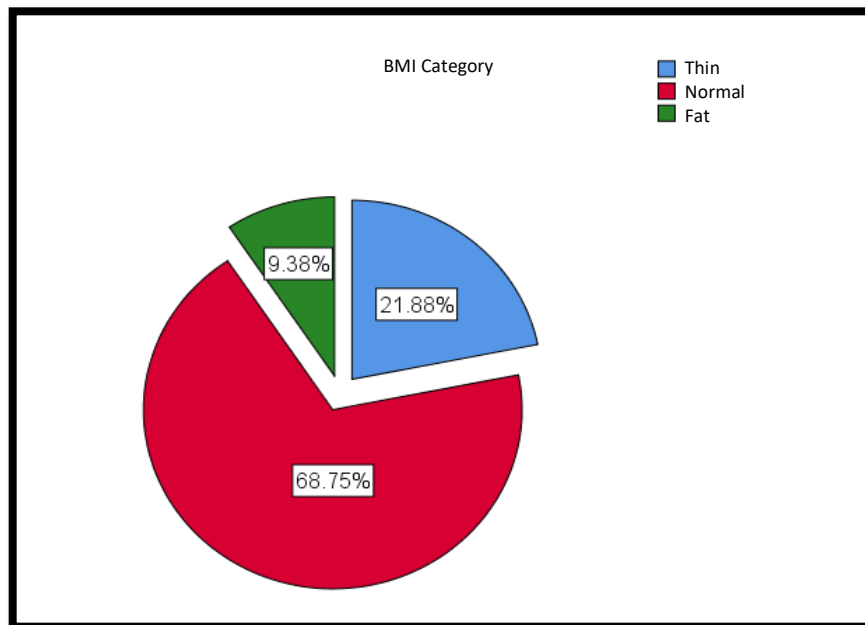


Figure 4 Pie Chart Body Mass Index Chart

From the observation of Figure 4, it can be seen that 21.88% are in the thin category with a range of BMI scores ($0 < x \leq 18.4$). Then 68.75% of incoming samples can be in the normal category with a range of BMI score values ($18.4 < x \leq 25$) and a total of 9.38% of samples are included in the fat category with a range of $x > 25$. Most of the samples that took the body composition test turned out to be categorized as normal body mass index. Some players who are categorized as fat through the data collected usually occur because there is a futsal sports position which is usually dominated by players who are large enough such as goalkeepers or pivots.

Figure 5 shows a description of the body fat variable as follows.

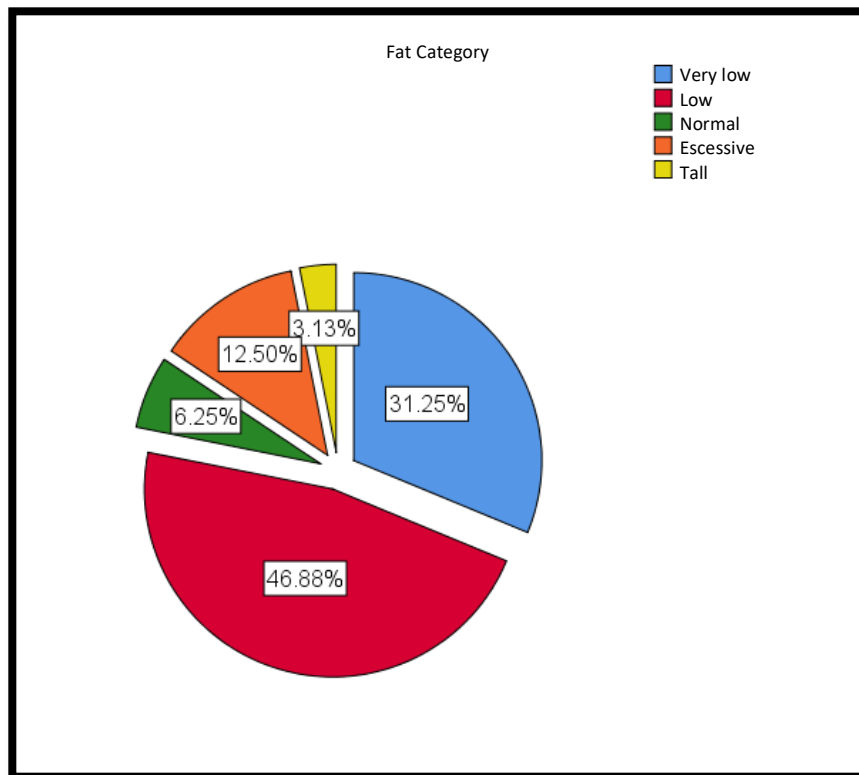


Figure 5. Pie Chart Body Fat Chart

The very low-fat category was present in 31.25% of the sample with body fat values ($0% < x \leq 11%$). Body fat in the low category was in 46.88% of the sample with body fat values ($11% < x \leq 17%$). Body fat with normal category is shown by 6.25% of the number of samples with body fat value ($17 < x \leq 22$). Body fat with excess category was in 12.50% of the number of samples with body fat values ($22 < x \leq 27$). High-category body fat is aimed at 3.13%. With a body fat value ($x > 27$).

The sample above shows that the largest frequency of the body fat category group is at a low number of 46.86% of the total number of samples. Almost half of the samples had normal body fat.

Figure 4 shows the description of the variable description of abdominal fat or visceral fat as follows.

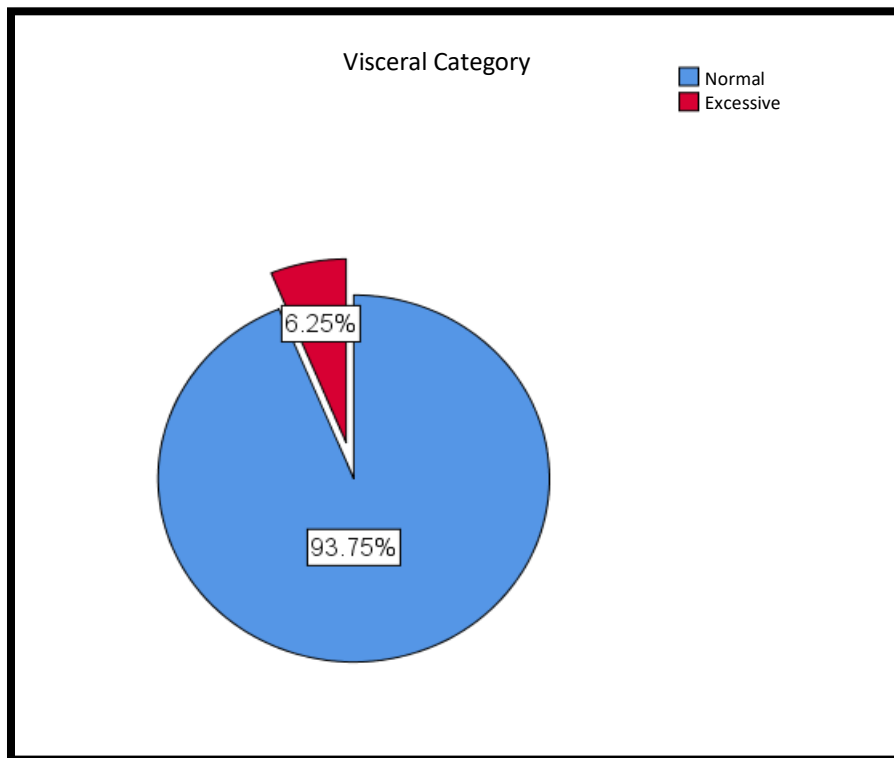


Figure 6 Pie Chat Chart Visceral Fat

The results of the observation of Figure 6 can be seen that there are 93.75% of the total samples included in the normal category with a score value ($0 < x \leq 10$). For the excess category, there are 6.25%. From the total sample with a score value ($x > 10$). Positions with high visceral fat are found in futsal sports positions, namely, goalkeepers and pivots.

Figure 7 shows the physical fitness value graph as follows.

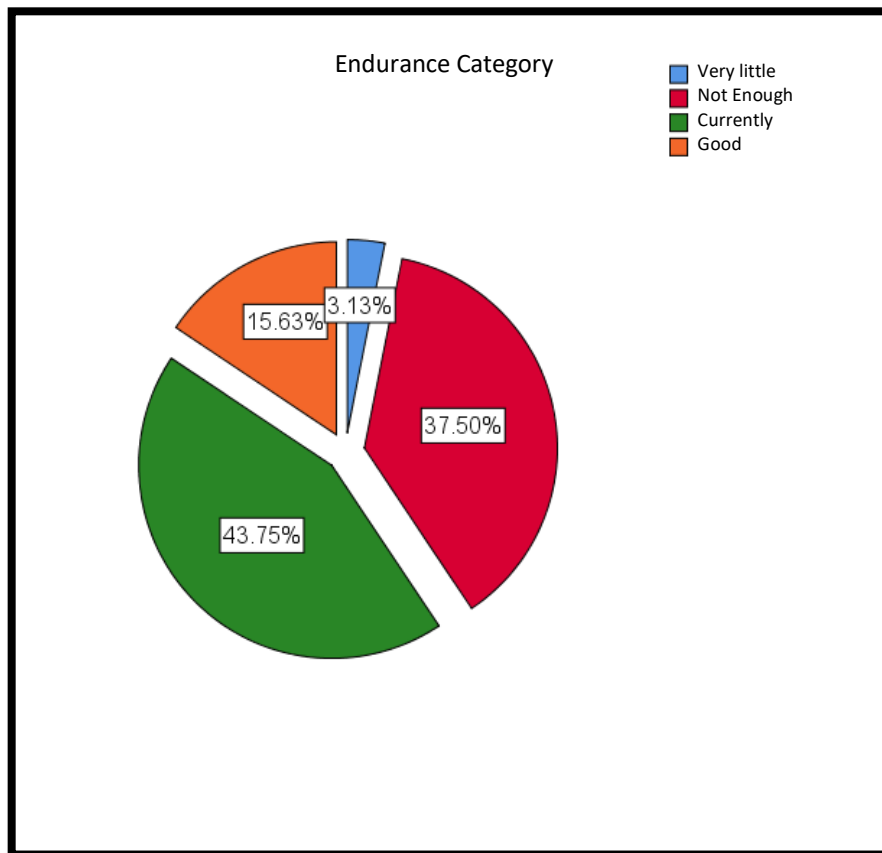


Figure 7. Pie Chart Physical Fitness (Aerobic Capacity) Vo2 max

The results of the observation of Figure 7 can be seen that 3.13% of the total sample is categorized as less than once. The low category represents 37.50% of the total sample. The medium category represents 43.75% of the total sample. The good category showed 15.63% of the total sample. According to Cooper's aerobic capacity norms, it can be seen that 3.13% of the number of samples is categorized as very low with a max Vo2 value of ($x < 28$) ml/kg/min. Category less than 37.5% of the number of samples with a VO2 value max of ($28 < x \leq 34$) ml/kg/min. Medium category 43.75% of the number of samples with a VO2 value max of ($34 < x \leq 42$) ml/kg/min. Good category 15.63 % of the total sample with score value ($42 < x \leq 52$) ml.kg/minute. For the very good category (Athlete) with a score value ($x > 52$), no player or sample can reach it (0%).

Table 2 shows the normality test of the independent (Vo2 max) and independent variables consisting of body mass index, body fat, and visceral abdominal fat and as follows

Table 2. One Sample Normality Test Kolmogorov- Smirnov

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Endurance	.159	32	.038	.924	32	.027
BMI	.168	32	.022	.808	32	.000
Fat	.157	32	.043	.887	32	.003
Visceral	.185	32	.007	.896	32	.005

a. Lilliefors Significance Correction

The results of the normality test observation with the Kolmogorov-Smirnov method showed that the significance value for physical fitness (vo2 max) $\alpha = 0.38$. The variable body mass index shows $\alpha = 0.022$. The variable body fat showed $\alpha = 0.043$. Variable visceral fat $\alpha = 0.007$. From Kolmogorov Smirnov's normality test data, it can be concluded that endurance, body mass index, body fat, and visceral fat do not pass the normality test where the requirement for passing the normality test is $\alpha > 0.05$.

The results of observations with the Shapiro-Wilk test showed that physical fitness $\alpha = 0.027$. The variable shows body mass index $\alpha = 0.000$. For the variables body fat and visceral fat respectively showed values $\alpha = 0.003$ and 0.005 . From Shapiro Wilk's normality test data, it can be concluded that the data of vo2 max (physical fitness), body mass index, body fat, and visceral fat do not meet the normality requirements of $\alpha > 0.05$.

From the normality test above, it can be seen that these data are not normal and have been inputted by IBM 25 SPSS software. With the abnormality of the data above, we cannot test the correlation test with the Pearson Moment Product method. With data that is not normally distributed, the data must be processed with a ranking system by changing the involvement of interval/ratio data first to ordinal data (ranking) to be tested for correlation with the Spearman Rank Correlation correlation method (Parametric Test).

Table 3. shows the Spearman Rank Correlation test

			Correlations			
			RVo2mkas	RBMI	RFAT	RVisceral
Spearman's rho	RVo2mkas	Correlation Coefficient	1.000	-.471**	-.391*	-.409*
		Sig. (2-tailed)	.	.007	.027	.020
		N	32	32	32	32
	RBMI	Correlation Coefficient	-.471**	1.000	.837**	.825**
		Sig. (2-tailed)	.007	.	.000	.000
		N	32	32	32	32
	RFAT	Correlation Coefficient	-.391*	.837**	1.000	.949**
		Sig. (2-tailed)	.027	.000	.	.000
		N	32	32	32	32
	RVisceral	Correlation Coefficient	-.409*	.825**	.949**	1.000
		Sig. (2-tailed)	.020	.000	.000	.
		N	32	32	32	32

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

The results of table 3 observations show the correlation value between body mass index, body fat, belly fat to physical fitness. The correlation value between body mass index and physical fitness showed ($r = -0.471$) with significance ($P\text{-value} = 0.007$). This value indicates that there is a significant relationship ($P\text{-value} < 0.05$). The correlation value showing ($r = -0.471$) shows that the correlation is inversely proportional to the degree of moderate correlation. It can be said that if the greater the value of body mass index, the value of physical fitness or aerobic capacity (vo2max) is lower and vice versa. This data shows similarities with previous studies which showed a negative correlation between body mass index values and maximum Vo2 levels (Kumar & Laroija, 2017) The correlation between body fat and physical fitness showed a correlation ($r = -0.391$ with significance ($P\text{-value} = 0.005$). This value indicates that there is a significant relationship ($P\text{-value} < 0.05$).

The correlation value that shows ($r = -0.391$) shows that the relationship has an inverse correlation with the degree of moderate correlation (Sarwono, 2006). These results are in accordance with research (Sari, 2019) which conducted research on athletes aged 10-30 years. It can be said that if the greater the value of body fat, the value of physical fitness or aerobic capacity (Vo2 max) is lower and vice versa.

The correlation between abdominal fat (visceral) and physical fitness showed a correlation

($r = -0.409$) with significance (P-value = 0.020. This value indicates that there is a significant relationship (P-value<0.05). The correlation value that shows ($r = -0.409$) shows that the relationship has an inverse correlation with the degree of moderate correlation. It can be said that if the greater the value of visceral fat, the value of physical fitness or aerobic capacity (Vo2 max) is lower and vice versa. This is also in accordance with previous research conducted by (Parikh et al., 2018) which conducted a study on adolescents aged 18-19 years where the value of visceral fat was inversely proportional to the value of vo2 max.

CONCLUSION

The results of this study showed an inversely proportional relationship between the value of body mass index, body fat, visceral fat with physical fitness (aerobic capacity) of the U-20 futsal players of the University of Indonesia futsal team and Pivot FC with moderate degrees. We recommend that players continue to control their diet, rest, and run the right training program (as needed) to be able to maintain body mass index, fat levels, abdominal fat (visceral).

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