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# The Relationship Between Body Mass Index, Percent Body Fat, And Belly Fat with U23 Futsal Athlete Fitness

**Dzulfiqar Diyananda[1], Andri Irawan[2], Muchtar Hendra Hasibuan[3], Alfonsius Billy Joe Haslim[4]**

[1] Ilmu Keolahragaan, Universitas Negeri Jakarta, Jl Pemuda 10 Rawamangun, DKI Jakarta, 13220, Indonesia

[2] Kepelatihan Kecabangan Olahraga, Universitas Negeri Jakarta, Jl Pemuda 10 Rawamangun, DKI Jakarta, 13220, Indonesia

[3]Pendidikan Jasmani, Universitas Negeri Jakarta, Jl Pemuda 10 Rawamangun, DKI Jakarta, 13220, Indonesia

[4]Magister Administrasi Bisnis, Universitas Katolik Indonesia Atma Jaya, Jl Jenderal Sudirman No 51, DKI Jakarta, 12930, Indonesia

**Abstract**

The purpose of this study was to determine the relationship between BMI, body fat, and physical fitness in U23 futsal players. The data collection method was carried out through a survey using purposive sampling on the University of Indonesia futsal team and Pivot FC totaling 44 participants. The value of aerobic capacity is measured by a bleep test. BMI, body fat, and visceral fat values were measured using the BIA (bioelectrical impedance analysis) method. Spearman rank correlation test results (1) There is a correlation between BMI and physical fitness r = -0.422, significance P value = 0.002 (2) There is a correlation r = -416 between body fat and physical fitness, Significance P value = 0.003 (3) There is a relationship between visceral fat and physical fitness of r = -400, with a significant P value of 0.004. The results of the analysis using multiple correlation UI with linear regression showed that BMI, body fat, and visceral fat had a simultaneous influence of R = 0.521(3) which is a moderate influence.

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

Correspondence author: Dzulfiqar Diyananda, Universitas Negeri Jakarta, Indonesia.
Email: dzulfiqardiyananda39@gmail.com



## INTRODUCTION

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. 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.

The player will experience a decrease in stamina and do a lot of basic changes that can be detrimental (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. 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 also needed in greater quantities when exercising. The more calories consumed, the more energy obtained by the body, but too much calorie intake compared to energy expended (for blessings) will cause excessive calories to be stored into 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(Sudibyo, 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). 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.

## 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, Discriptive 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. 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. 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 consisted of 44 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

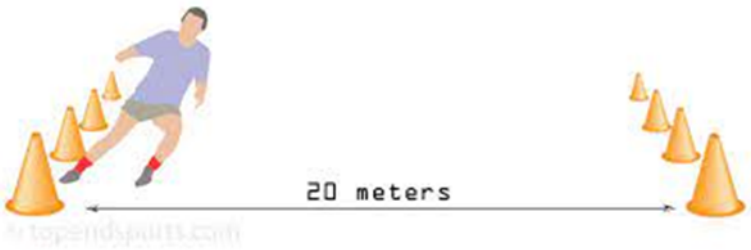


**Figure 1. Tes Bleep (www.topendsport.com)**

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 Impandences 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.

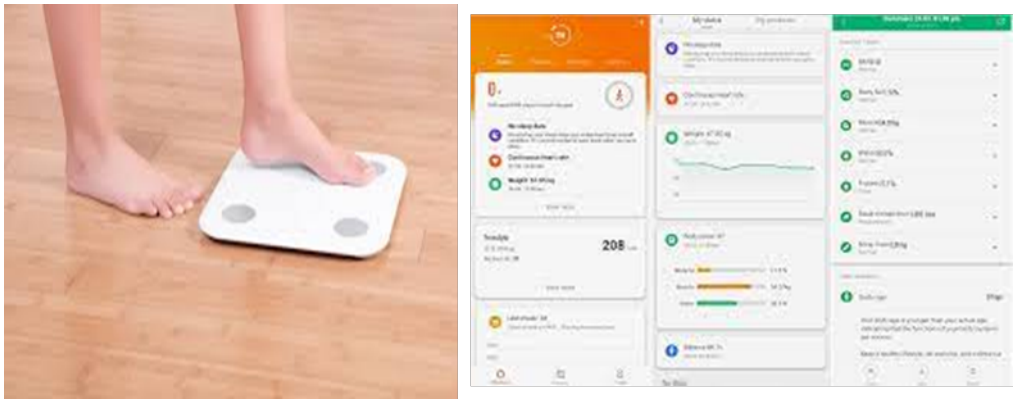

**Figure 2.Bioelectrical Impedance Analysis (BIA) (www.dignited.com)**

After that, independent (physical fitness) and dependent variables (BMI, body fat, and visceral fat will be analyzed through SPSS software through the normality test stage, and correlation test 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.

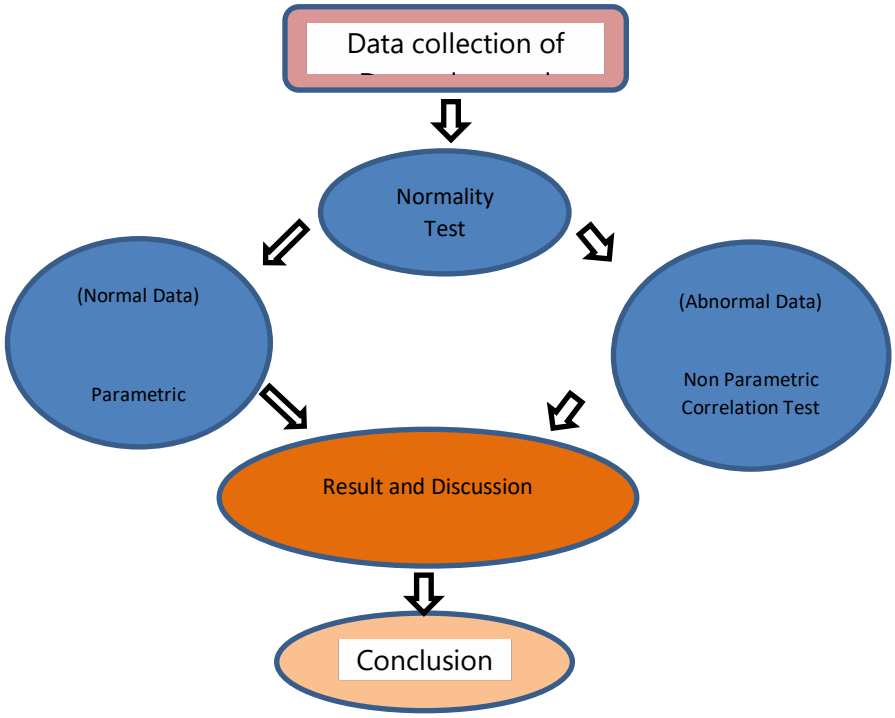


**Figure 3.** Flow Chart Research

In Figure 3, a correlation test can be seen, so it will be concluded 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 that 44 samples had BMI, Body Fat, and Visceral Fat. Table 1.1 shows the distribution values of BMI, Body Fat, and Visceral Fat.

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

| | | Body mass index | Body fat | Belly Fat | Physical fitness |
|---|---|---|---|---|---|
| N | Valid | 44 | 44 | 44 | 44 |
| Mean | | 21.5207 | 15.1000 | 5.0909 | 37.2045 |
| Std. Error of Mean | | .57988 | 1.04866 | .56857 | .79777 |
| Std. Deviation | | 3.84647 | 6.95604 | 3.77149 | 5.29181 |
| Variance | | 14.795 | 48.387 | 14.224 | 28.003 |
| Range | | 20.00 | 32.60 | 14.00 | 23.50 |
| Minimum | | 16.80 | 4.50 | 1.00 | 23.60 |
| Maximum | | 36.80 | 37.10 | 15.00 | 47.10 |

The results of table 1 observations show that the average value of body mass index is 21.5 with a minimum/maximum value (16.80-36.80). Body fat showed an average value of 15.1 with a minimum/maximum value (4.50% -37.10%). Abdominal fat (visceral) shows an average of 5.09% with a minimum/maximum value (1.00% -15%). For dependent variables, namely, physical fitness or aerobic capacity can be seen an average value of 37.20 ml/kg/minute with a minimum / maximum value (23.60-47.10) ml/kg / minute.

Table 2 shows the normality test of the dependent variable consisting of body mass index, body fat, and visceral abdominal fat as follows

Table 2 One Sample Normality Test Kolmogorov- Smirnov

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Vo2 Maks | .127 | 44 | .074 | .961 | 44 | .144 |
| Indeks Massa Tubuh | .122 | 44 | .099 | .874 | 44 | .000 |
| Lemak Tubuh | .165 | 44 | .004 | .913 | 44 | .003 |
| Lemak Visceral | .182 | 44 | .001 | .898 | 44 | .001 |

a. Lilliefors Significance Correction

The results of the observation of the normality test with the Kolmogrov-Smirnov method showed that the significance value for physical fitness α = 0.74. The variable body

mass index shows α= 0.99. The variable body fat showed α= 0.004. Variable visceral fat α= 0.001. From Kolmogorov Smirnov's normality test data, it can be concluded that body fat and visceral fat do not pass the normality test where the condition for passing the normality test is α>0.05.

The results of observations with the Shapiro-Wilk test showed that physical fitness α= 0.144. The variable shows body mass index α=0.000. The variables body fat and visceral fat respectively showed values α=0.003 and 0.001. From Shapiro Wilk's normality test data, it can be concluded that only vo2 max (Physical Fitness) data is the normality test with conditions α>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) with the Spearman Rank Correlation correlation test (Parametric Test).

Table 3 Spearman Rank Correlation Test

**Correlations**

| | | | Ranking Vo2maks | Ranking BMI | Ranking FAT | Ranking Visceral |
|---|---|---|---|---|---|---|
| Spearman's rho | Ranking Vo2maks | Correlation Coefficient | 1.000 | -.422** | -.416** | -.400** |
| | | Sig. (2-tailed) | . | .004 | .005 | .007 |
| | | N | 44 | 44 | 44 | 44 |
| | Ranking BMI | Correlation Coefficient | -.422** | 1.000 | .853** | .880** |
| | | Sig. (2-tailed) | .004 | . | .000 | .000 |
| | | N | 44 | 44 | 44 | 44 |
| | Ranking FAT | Correlation Coefficient | -.416** | .853** | 1.000 | .927** |
| | | Sig. (2-tailed) | .005 | .000 | . | .000 |
| | | N | 44 | 44 | 44 | 44 |
| | Ranking Visceral | Correlation Coefficient | -.400** | .880** | .927** | 1.000 |
| | | Sig. (2-tailed) | .007 | .000 | .000 | . |
| | | N | 44 | 44 | 44 | 44 |

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

The results of Table 3 observations show the correlation value between body mass index, body fat, and belly fat to physical fitness. The correlation value between body mass index and physical fitness showed (r = - 0.422) with significance (P-value = 0.004). This value indicates that there is a significant relationship (P-value < 0.05). The correlation value that shows (r = -0.422) shows that the correlation is inversely proportional to the degree of moderate correlation. It can be said that if the greater 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 & Laroiya, 2017)

The correlation between body fat and physical fitness showed a correlation (r = -416 with significance (P-value = 0.005). This value indicates that there is a significant relationship (P-value <0.05). The correlation value that shows (r = -,0.416) shows that the relationship has an inverse correlation with a moderate degree of correlation(Sarwono, 2006). These results are by research (Sari, 2019) which researched athletes aged 10-30 years and . It can be said that if greater value of body fat lower, 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 = -0.400) with significance (P-value = 0.007). This value indicates that there is a significant relationship (P-value<0.05). The correlation value that shows (r = -0.400) shows that the relationship has an inverse correlation with the degree of moderate correlation. It can be said that if the value of visceral fat is greater, the value of physical fitness or aerobic capacity (Vo2 max) is lower and vice versa. This is also by previous research conducted by (Parikh et al., 2018) (Diyananda et al., 2023) which conducted a study on adolescents aged 18-19 years and under 20 years where the value of visceral fat was inversely proportional to the value of vo2 max.

Before carrying out a multicorrelation test, it must go through the conditions: Normal distributed data through a non-parametric normality test (one sample ks). The relationship between the independent variable and the dependent variable must have a linear relationship

**Table 1.** One Sample Kolmogrov-Smirnov test

**One-Sample Kolmogorov-Smirnov Test**

| | | Unstandardized Residual |
|---|---|---|
| N | | 44 |
| Normal Parameters[a,b] | Mean | .0000000 |
| | Std. Deviation | 4.51842766 |
| Most Extreme Differences | Absolute | .098 |
| | Positive | .093 |
| | Negative | -.098 |
| Test Statistic | | .098 |
| Asymp. Sig. (2-tailed) | | .200[c,d] |

In a non-parametric test one sample Kolmogorov Smirnov. The results of α=0.200 where α>0.05 prove that the above data can pass the test for multicorrelation tests with the linear regression method.

**Table 2.** Linearity Test between dependent (Vo2 Max) and independent variables (Body Mass Index, Body Fat, and Visceral Fat)

| | | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| Vo2 Maks * Indeks Massa Tubuh | Between Groups | (Combined) | 1175.504 | 38 | 30.934 | 5.401 | 0.034 |
| | | Linearity | 323.381 | 1 | 323.381 | 56.466 | 0.001 |
| | | Deviation from Linearity | 852.123 | 37 | 23.030 | 4.021 | 0.062 |
| Vo2 Maks * Lemak Tubuh | Between Groups | (Combined) | 1083.537 | 37 | 29.285 | 1.457 | 0.338 |
| | | Linearity | 252.782 | 1 | 252.782 | 12.576 | 0.012 |
| | | Deviation from Linearity | 830.755 | 36 | 23.077 | 1.148 | 0.474 |
| Vo2 Maks * Lemak Visceral | Between Groups | (Combined) | 632.609 | 11 | 57.510 | 3.220 | 0.005 |
| | | Linearity | 253.957 | 1 | 253.957 | 14.219 | 0.001 |
| | | Deviation from Linearity | 378.652 | 10 | 37.865 | 2.120 | 0.052 |

The results of Table 5 observations can be explained that the value between the deviation of linearity between Vo2 max and body mass index shows α= 0.062. The linearity between Vo2max and body fat shows α=0.474. The linearity between Vo2 max and visceral fat is 0.052. From the data above it can be seen that for all values α >0.05, it can be said that the relationship between the dependent variable and the independent liner relationship

After the results are obtained that the normality test with Kolmogorov Smirnov's One Sample and linearity test has passed, the variable data can be processed into multiple correlation tests with the linear regression method.

**Tabel 3.** Multicorrelation Test of Independent Variables and Dependent Variables

**Model Summary**

| | | | | | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df 1 | df 2 | Sig. F Change |
| 1 | .521[a] | .271 | .216 | 4.68481 | .271 | 4.955 | 3 | 40 | .005 |

a. Predictors: (Constant), Lemak Perut, Indeks Massa Tubuh , Lemak Tubuh

The summary model table shows information about the closeness of the relationship between the independent variable and the dependent variable. R shows a quantity that expresses the degree of closeness of the linear relationship between dependent and independent variables together.

The R-value is always positive and ranges from 0 to 1. Based on the output above, an R-value of 0.521 is obtained which means that the relationship between the dependent variable (Physical Fitness) and the independent variable (body mass index, body fat, and belly fat) is quite strong. R square (R2), also called the coefficient of determination, is a quantity that expresses the proportion or percentage of total variation of the dependent variable that can be described by the independent variable. The value of R square indicates 0.271. This shows that 27.1% of the dependent variables can be explained by independent variables (body mass index, body fat, and visceral fat). While the remaining 72.9% can be determined or explained by other variables that are not included in this model

## CONCLUSION

The results of this study showed an inversely proportional relationship between the value of body mass index, body fat, and visceral fat with physical fitness (aerobic capacity) of U-23 futsal players of the University of Indonesia futsal team and Pivot FC. Then there is a simultaneous relationship of independent variables (body mass index, body fat, and visceral fat with independent variables (physical fitness). We recommend that players continue to control their diet, rest, and run the right exercise program to be able to maintain body mass index, fat levels, and abdominal fat (visceral) more regularly. We recommend that players continue to control their diet, rest, and run the right exercise program to be able to maintain body mass index, fat levels, abdominal fat (visceral) more regularly.

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