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Healthy fitness zone: identifikasi *body fat percentage*, *body mass index* dan *aerobic capacity* pada mahasiswa

Healthy fitness zone: identification of body fat percentage, body mass index, and aerobic capacity for students

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Abstrak

Tujuan penelitian ini adalah untuk melihat gambaran kebugaran mahasiswa yang dilihat dari *Healthy Fitness Zone* dengan aspek yang diukur adalah *Body Fat Percentage*, *Body Mass Index* dan *Aerobic Capacity*. Metode penelitian ini deskriptif korelasional, subjek penelitian ini adahal 68 mahasiswa pendidikan jasmani. Norma yang digunakan dalam penelitian ini adalah *Fitnessgram* untuk melihat *Healthy Fitness Zone* (HFZ) pada mahasiswa. Hasil penelitian menunjukan bahwa kebugaran mahasiswa sudah baik dengan persentase BFP yang berada pada kriteria HFZ sebesar 91,2%, BMI yang berada pada kriteria HFZ sebesar 72,1% dan *Aerobic Capacity* yang berada pada kriteria HFZ sebesar 80,9%. Sedangkan untuk korelasi menunjukan nilai *Correlation* (R) = 0,570 dan sig. = 0,000 < 0,05 maka terdapat hubungan yang signifikan, dapat disimpulkan terdapat hubungan yang signifikan *Body Mass Index* dan *Body Fat Percentage* dengan *Aerobic Capacity* mahasiswa pendidikan jasmani.

Kata kunci: *healthy fitness zone, body fat percentage, body mass index, aerobic capacity,* mahasiswa.

Abstract

This study aimed to overview student fitness as detected from the Healthy Fitness Zone with the aspects measured were Body Fat Percentage, Body Mass Index, and Aerobic Capacity. This research method is descriptive correlational. The subjects of this study were 68 physical education students. The norm used in this study is the Fitnessgram to observe the Healthy Fitness Zone (HFZ) in students. The results showed that the students' fitness was high-grade with the percentage of BFP who were in the HFZ criteria of 91.2%, BMI in the HFZ criteria of 72.1%, and Aerobic Capacity in the HFZ criteria of 80.9%. Meanwhile, the correlation shows a significant relationship, with the value of Correlation (R) = 0.570 and sig. = 0.000 <0.05. It can be concluded that there is a significant relationship between Body Mass Index and Body Fat Percentage with the Aerobic Capacity of physical education students.

Keywords: healthy fitness zone, body fat percentage, body mass index, aerobic capacity, students.

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INTRODUCTION

Fitness is one crucial aspect to support human life because if the individual has good fitness, it will produce healthiness to carry out daily activities and still have extra energy to do additional activities (Budi, 2015; Irianto, 2004; Suhartoyo et al., 2019). Among students, especially students in sports majors or study programs, healthy body fitness is supported in the studies process. Moreover, the lecture characteristics are not limited to theory in the classroom, but sports practice courses require fitness in their implementation.

The existence of practical courses requires students to have an adequate level of fitness to undergo practical lectures. As an impact, students have better fitness. The material presented during practical studies can be appropriately absorbed, especially in the whole day the students often should attend an extra practical course. This result follows research that sports students must have good fitness in undergoing lectures (Kusnandar et al., 2019; Listiandi, Budi, et al., 2020; Reeves et al., 2018).

An aspect that can be an illustration for student fitness is VO2Max or aerobic capacity. Individuals who have adequate aerobic capacity will have high-grade fitness. Several studies have found that aerobic capacity is an indicator that can represent fitness for students (Oluwadare & Olufemi, 2018; Safaringga & Herpandika, 2018; Sunadi & Permana, 2017). From this research, students can be concluded in practical lectures must have an adequate aerobic capacity. In addition to supporting fitness practice lectures, it is essential to reduce disease risk (Calestine et al., 2017; Listiandi, Kusuma, et al., 2020), especially during the COVID-19 pandemic. Fitness is related to the body's immune system to better guard against the risk of getting the virus (Chen et al., 2020).

The importance of aerobic capacity is one reason this research was conducted. This study tries to get a representation of fitness among the Physical Education Department students. The fundamental difference between this study and previous research is using the Fitnessgram

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Classification System to measure body fitness, instead of VO2Max, which is commonly used in previous studies (Blasingame, 2012; The Cooper Institute, 2011). In the fitness program, body fitness is assessed by Aerobic Capacity and the Body Composition aspect, consisting of Body Fat Percentage (BFP) and Body Mass Index (BMI). In this study, the relationship between BFP and BMI and Aerobic Capacity will be seen. Research using the Fitnessgram Classification is mostly conducted at the school level (Bai et al., 2017; Chen et al., 2018; Saint-Maurice et al., 2017). The Fitnessgram norm has a measurement classification for ages 17+, so it is more suitable for measuring fitness at university students with an average age of more than 17.

The fitness criteria in the Fitnessgram norm consist of four types for BFP and BMI and three criteria for aerobics. High-grade criteria, namely the Healthy Fitness Zone (HFZ) to indicate a healthy/fit condition, middle-grade criteria if Needs Improvement (NI), and Low-grade if there is a potential risk of health problems (NI-Health Risk) and the Very Lean category or too skinny. In Aerobic Capacity, Very Lean is not used in the norm (The Cooper Institute, 2011).

The best criteria for these norms are HFZ, so it is expected that the results of this study can show that most Physical Education students have high-grade fitness. Measuring the Healthy Fitness Zone can be a guideline to create a recommendation for students with results below the HFZ.

METHOD

The research was conducted using a descriptive correlational research method (Fraenkel et al., 2012). The research design used in this study is correlational. The following is a picture of the correlational design used:

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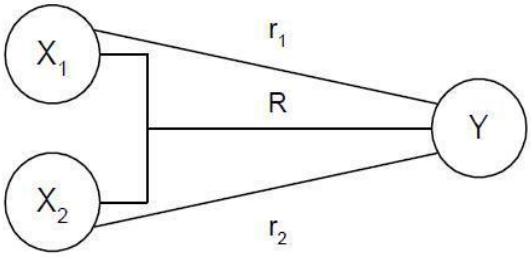

Figure 1. Correlational Design

Keterangan:

X_1 : *Body fat percentage*

X_2 : *Body mass index*

Y : *Aerobic capacity*

r1 : Correlation Coefficient of Body fat percentage with Aerobic capacity

r2 : Correlation coefficient of Body mass index with aerobic capacity

R : Correlation Coefficient of Body fat Percentage and Body mass index with Aerobic Capacity

This study's population was 68 students of physical education at Jenderal Soedirman University in the Banyumas area and following this study's inclusion criteria. The data collection process was carried out in the multipurpose field of the Physical Education Department of Jenderal Soedirman University in September 2020. This research has received a letter of ethical approval from the Health Research Ethics Commission of the Faculty of Health Sciences, Jenderal Soedirman University, with 174 / EC / KEPK / IX2020. Due to the pandemic condition, it was impossible to measure all students because they stayed in their respective homes, so this study used a purposive sampling method with inclusion criteria: 1. They were located in the Banyumas area, especially Purwokerto and Purbalingga, 2. In a healthy condition (body temperature average), 3. Willing to fill in Informed Consent. While the exclusion criteria are being outside the Banyumas, Purwokerto, and Purbalingga areas.

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To measure BFP and BMI using a Bioelectrical Impedance Analysis (BIA) scale Omron Karada Scan Body Composition Monitor HBF-375 (Sandeep et al., 2016).

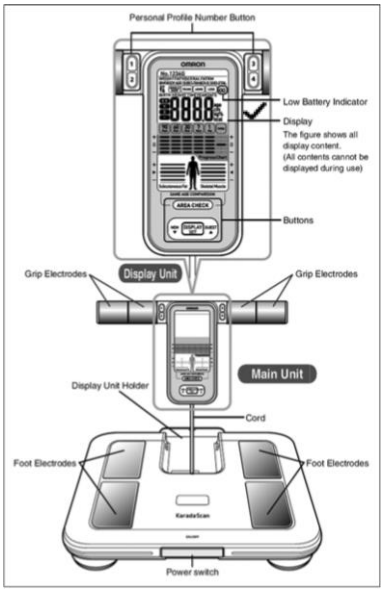

Figure 2. Omron *Body Composition Monitor* HBF-375

To measure aerobic capacity is using the PACER 20m test, a test is almost similar to the Multi-Stage Fitness Test but with different output calculations (The Cooper Institute, 2011).

The measurement results will be described using the following Fitnessgram HFZ norms:

Table 1. Norm of *Healthy Fitness Zone* from *Fitnessgram*

	Age	Sex	NI– Health Risk	NI	HFZ	Very Lean
BFP	17+	Female	≥ 38.6	≥ 31.4	31.3 – 16.5	≤ 16.4
	17+	Male	≥ 35.1	≥ 22.3	22.2 – 7.0	≤ 6.9
BMI	17+	Female	≥ 30.0	≥ 25.0	24.9 – 17.8	≤ 17.4
	17+	Male	≥ 29.3	≥ 25.0	24.9 – 18.6	≤ 18.5
Aerobic Capacity	17+	Female	≤ 35.3	35.4 – 38.5	≥ 38.6	
	17+	Male	≤ 41.2	41.3 – 44.2	≥ 44.3	

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This study's data were analyzed using SPSS to test the data's normality and determine the use of parametric or non-parametric statistics. The following steps are to test the data linearity and the Pearson product-moment correlation.

RESULTS

Research on the measurement of the Healthy Fitness Zone using the fitnessgram measure for university students shows the following results:

Table 2. Data Description

	N	Min	Max	Mean	SD
Age	68	19	21	20.03	0.69
Weight		45	87	61.51	9.51
Height		153	188	168.07	6.37
BFP		5.3	29.9	15.76	5.44
BMI		16.8	28.7	21.74	2.80
Aerobic Capacity		25	97	60.07	16.86

The frequency distribution of the Body Fat Percentage data is as follows.

Table 3. Distribution of Body Fat Percentage Data

Status	Frequency	%
NI- Health Risk	0	0.0
NI	5	7.4
HFZ	62	91.2
Very Lean	1	1.5
N	68	100%

From the number of subjects, 68 students whose BFP was included in the Needs Improvement - Health Risk status as much as 0 or 0%, Needs Improvement 5 students (7.4%), Healthy Fitness Zone or the High-grade was 62 students (91.2%), Very lean as much as one student (1.5%). The number of percentages can be presented in the following graph:

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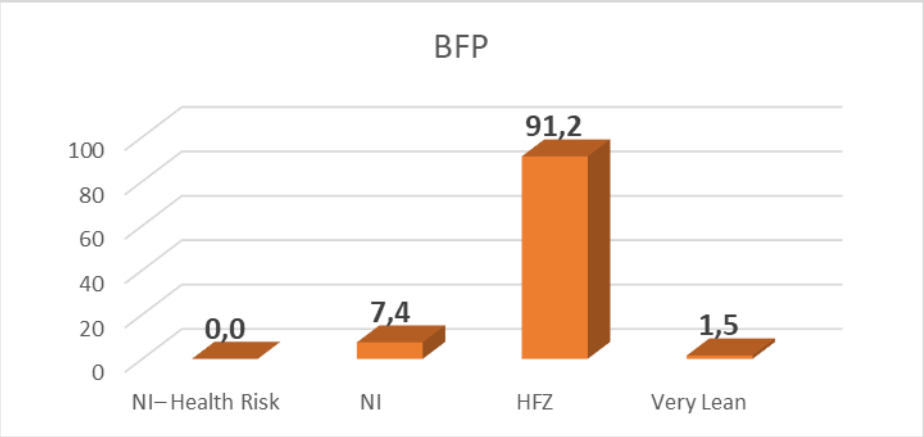

Figure 3. Body Fat Percentage Graph

The frequency distribution of the Body Mass Index data is as follows.

Table 4. Distribution of Body Mass Index Data

Status	Frequency	%
NI- Health Risk	0	0.0
NI	11	15.2
HFZ	49	72.1
Very Lean	8	11.7
N	68	100%

The result shows that 68 students whose BMI was included in the Needs Improvement - Health Risk status was 0 or 0%, Needs Improvement was 11 students (16.2%), Healthy Fitness Zone or the best High-grade was 49 students (72.1%), Very lean as many as eight students (11.7%). The number of percentages presented in the following graph:

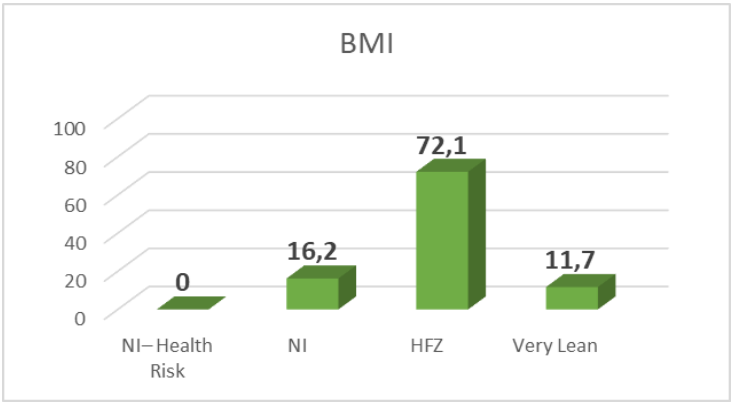

Figure 4. Body Mass Index Percentage Graph

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The aerobic capacity data frequency distribution is as follows.

Table 5. Aerobic Capacity Data Distribution

Status	Frequency	%
NI- Health Risk	6	8.8
NI	7	10.3
HFZ	55	80.9
N	68	100%

The data shows that 68 students whose Aerobic Capacity was included in the Needs Improvement - Health Risk status was 6 or 8.8%, Needs Improvement was seven students (10.3%), Healthy Fitness Zone or the best was 55 students (80.9 %). The number of percentages presented in the following graph:

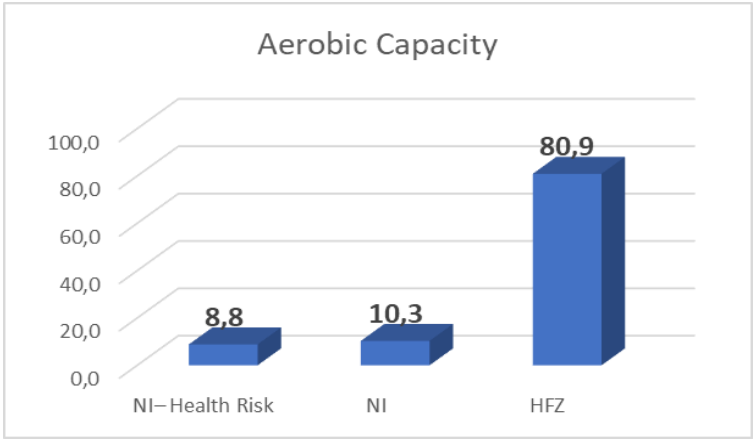

Figure 5. Aerobic Capacity Graph

Normality Test

Table 6. Normality Test Results

Data	*Shapiro-Wilk*	Sig.	Criteria
Body Fat Percentage	0,964	0,053	Normal
Body Mass Index	0,965	0,055	Normal
Aerobic Capacity	0,982	0,425	Normal

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The results of the data normality test in table 6. show that the Body Fat Percentage (BFP) data obtained the Shapiro-Wilk value = 0.964 and significance (Sig.) = 0.053> 0.05, which means that the data is normally distributed. In the Body Mass Index (BMI) data, the Shapiro-Wilk value = 0.965 and the significance (Sig.) = 0.055> 0.05, it is stated that the data is normally distributed.

Aerobic Capacity (AC) data shows the Shapiro-Wilk value = 0.982 and significance (Sig.) = 0.425> 0.05. It is stated that the data is normally distributed.

Linearity Test

Linearity testing is provided to ensure the linearity of the data distribution. This test is needed, especially in the correlation and regression test (Maksum, 2018).

Table 7. Hasil Uji Linearity Test Results

Variable	F (*Deviation from linearity*)	Sig.	Criteria
Body Fat Percentage with *Aerobic Capacity*	1.294	0.231	Linear
Body Mass Index with *Aerobic Capacity*	0.679	0.865	Linear

The linearity test results in table 7 show that the data on the variable Body Fat Percentage and Aerobic Capacity obtained the value of F (Deviation from linearity) = 1.294 and significance (Sig.) = 0.231> 0.05. It can be stated that the relationship between Body Fat variables Percentage with Aerobic Capacity is stated as linear. In the Body Mass Index and Aerobic Capacity variable data, the value of F (Deviation from linearity) = 0.679 and the significance (Sig.) = 0.865> 0.05 can be stated that the relationship between the two variables (Body Mass Index and Aerobic Capacity) is expressed as a linear.

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Correlation and Regression Test (*Body Fat Percentage* with *Aerobic Capacity*)

Table 8. Correlation and Regression Test Results
(Body Fat Percentages with Aerobic Capacity)

Pearson Correlation (r)	Sig.	R Square	Criteria
-0,570	0,000	0,315	Significant

In table 8, the Pearson Correlation (r) = -0.570 and sig. = 0.000 <0.05, show a significant relationship, or it can be stated that there is a significant relationship between Body Fat Percentage and Aerobic Capacity of physical education students. Similar to the previous results, the correlation test results between Body Fat Percentage and Aerobic Capacity also have an inversely proportional direction (because the Pearson Correlation value has a negative sign). This result indicates that if the Body Fat Percentage score is low, the Aerobic Capacity score will be high, and vice versa. The regression test result shows that the value of R square = 0.315, which means that the correlation between Body Fat Percentage and Aerobic Capacity is 31.5%, while other factors influence the remaining 68.5%.

Correlation and Regression Test (*Body Mass Index* with *Aerobic Capacity*)

Table 9. Correlation and Regression Test Results
(Body Mass Index with Aerobic Capacity)

Pearson Correlation (r)	Sig.	R Square	Criteria
-0,413	0,000	0,158	Significant

Table 9 show that Pearson Correlation (r) = -0.413 and sig. = 0.000 <0.05 has a significant relationship, or it can be stated that there is a significant relationship between the Body Mass Index and the Aerobic Capacity of physical education students. The Pearson Correlation (r) value has a negative sign, meaning that the relationship's direction is inversely proportional. It can be interpreted that if the Body Mass Index score is low, the Aerobic Capacity score will be high. The regression test results show

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that the value of R square = 0.158, which means that the relationship between Body Mass Index and Aerobic Capacity is 15.8%, while other factors influence the remaining 84.2%.

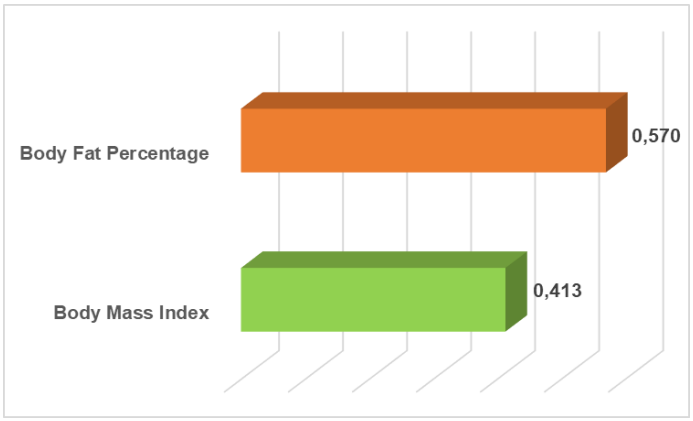

Figure 5. Graph of Correlation of Body Fat Percentage with Aerobic Capacity

Data correlation shows that the data's relationship is that the body fat percentage with aerobic capacity is higher (0.570) than the relationship between body mass index and aerobic capacity (0.413).

Correlation and Regression Test (*Body Mass Index* and *Body Fat Percentage* with *Aerobic Capacity*)

Table 10. Correlation and Regression Test Result
(Body Mass Index and Body Fat Percentage with Aerobic Capacity)

Correlation (R)	Sig.	R Square	Criteria
0,570	0,000	0,305	Significant

Table 10 shows the significant relationship with value (R) = 0.570 and sig. = 0.000 <0.05, or it can be stated that there is a significant relationship between Body Mass Index and Body Fat Percentage with the Aerobic Capacity of physical education students. The regression test results show that the value of R square = 0.305, which means that the relationship between Body Mass Index and Body Fat Percentage and Aerobic Capacity is 30.5%. In comparison, other factors influence the remaining 69.5%.

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DISCUSSION

The study results represent that Body Fat Percentage and Body Mass Index variables have a significant relationship with the dependent variable Aerobic Capacity. This study's results are in line with what was researched by Bonney et al., (2018), which showed that body mass index has a significant relationship with fitness. Increased body mass is associated with decreased physical fitness. This study confirms that someone who has a high body mass index (overweight and obese peers) shows less fitness than those who have a normal body mass index. Low fitness is associated with a higher body mass index. Even in some studies, it can be stated that BMI can affect performance in performance sports, especially sports that require speed and agility (Budi et al., 2020; Cosmin et al., 2016; Kusnandar et al., 2020; Milić et al., 2017; Moncef et al., 2012)

The study Kharbanda et al., (2015) and Widanita et al., (2019) regarding the body mass index, which was also conducted on students, showed a positive correlation between fitness and normal body mass index negative correlation with a higher BMI. The study also showed that students who had a normal body mass index showed a more significant physical capacity increase than students who had a high or low body mass index.

A high Body Mass Index, especially for those with Overweight and Obesity status, is a determinant of injury causes because a high BMI can be an obstacle for the body to move or function properly (Kusuma et al., 2019; Syafei et al., 2020). Children, especially adolescents who are overweight and obese, tend to have a higher risk of injury than children and adolescents with a healthy BMI (Ezzat et al., 2016; Richmond et al., 2013).

The research results Demirkan et al., (2016) regarding body fat percentage show that VO2max and body fat percentage show a strong negative correlation. This result further indicates that lower body fat percentage contributes to better VO2max. Besides, research (Minasian et al., 2014) also shows a more significant association of Body Fat

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Percentage compared to Body Mass Index on aerobic fitness. From these results, it can be concluded that Body Fat Percentage can be a better predictor of aerobic capacity than Body Mass Index.

Simultaneously, the analysis shows that body fat percentage and body mass index with aerobic capacity has a significant relationship. It can also be interpreted that the more body fat percentage and body mass index are in the criteria for a healthy fitness zone, the better the aerobic capacity will be and, of course, the requirements for the Healthy Fitness Zone as well. From the results of this study, Physical Education students' aspects of Body Fat Percentage, Body Mass Index, and Aerobic Capacity are mostly at Healthy Fitness/High-grade. This zone is indicated by the percentage of BFP in the HFZ criteria of 91.2%. BMI in the HFZ criteria was 72.1%, and Aerobic Capacity in the HFZ criteria was 80.9%. From this percentage, it can be concluded that most Physical Education students have fitness criteria at the Healthy Fitness Zone level/High-grade. This positive result must be maintained so that students who have not reached the HFZ criteria, especially those still in the NI-Health Risk criteria, must adjudicate to get back in shape.

Further research is needed, such as dividing the sample group by gender (male and female), division based on body classification that refers to the body mass index (normal, overweight, and obese). Apart from that, the results of this research can also be one of the foundations for designing an exercise program that leads to the criteria of a healthy fitness zone, whether it is a conventional training program or even leads to software-based innovations that provide information, guidance, and monitoring of development status, exercise and body composition overview.

CONCLUSION

From the discussion results, it can be concluded that most Physical Education students have good fitness with a dominant percentage of Healthy Fitness Zone criteria (High-grade) in every aspect, be it Body Fat Percentage, Body Mass Index, and Aerobic Capacity. Maintaining the

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student with a low-grade Healthy Fitness Zone; reaching the HFZ criteria must improve their fitness. In this study, it was also found that there was a significant relationship between Body Fat Percentage and Body Mass Index with Aerobic Capacity. Besides, the results of this study indicate that the correlation between Body Fat Percentage and Aerobic Capacity is higher than that of Body Mass Index and Aerobic Capacity.

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