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Student sports achievement: Can it control body mass index (BMI) and cholesterol?

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ABSTRACT

The aim of this study was to assess the BMI and cholesterol levels of athletes selected for preparation for the National Sports Week in Indonesia. The study used a quantitative approach through a survey with researchers giving a test and measurement. The subjects used as research samples were all athletes in the sports of Weightlifting, Fencing, Aero Modeling, Bicycle Racing, Billiard, Handball, Badminton, Parachuting, Judo, Karate, Kempo, Muay Thai, Archery, Wall Climbing, Pencak Silat, Petangque, Swimming, Sepak Takraw, Taekwondo, Tarung Derajat, Table Tennis, Boxing, Volly Beach, Wushu. Additionally, following the selection test, a total of 328 athletes were included in the study. Instruments utilized in this study included the Omron Karada Scan HBF-328 scales for weight measurement, and the OneTouch device for cholesterol testing. The data were analyzed using Microsoft Excel and IBM SPSS Statistics version 26. The results revealed that the mean BMI and cholesterol levels were 22.85 and 171.38, respectively. Among the athletes, 11% were categorized as underweight, 63.11% as normal weight, 21.65% as overweight, 2.74% as obese I, 0.91% as obese II, and 0.61% as obese III. In terms of cholesterol levels, 80% were within the normal range, 10% were low, and 10% were high. Non-parametric correlation analysis demonstrated no significant relationship between BMI and cholesterol levels among the athletes, with a significance value of 0.815. This study concluded that the athlete's BMI was normal, as well as the average athlete's cholesterol condition in normal conditions.

KEYWORDS

Sports Achievement; BMI; Cholesterol; Athlete

1. INTRODUCTION

Habits of lack of movement and eating foods that do not have fiber are the basic capital for weight gain (Fonseca et al., 2021). Body fat will increase as a result of high fat intake, among others. (Rizal et al., 2020), as well as malnutrition (Wulansari & Kasyani, 2021). In addition to high-fat foods high-carb foods (Macuh et al., 2023; Riagustin et al., 2019), and saturated fats such as fast food will more quickly increase the fat composition in the body (Concha et al., 2019). Strictly speaking, the increase in body fat composition has a very close relationship with the incidence of prehypertensive symptoms (Aliza, 2020). The review has illustrated that unhealthy food patterns such as high-fat foods have a negative impact on the body.

A study revealed that the negative effect of fatty foods is an increase in Body Mass Index (BMI) (Nurfadhilah et al., 2018), and a reduced quality of muscle performance (Setyaningrum & Sugiharto, 2015). Possibly even worse with the risk of developing type II diabetes (Gumilar, 2022), and high blood pressure (Zuraida et al., 2021). If this goes on for a long time then some negative things will increase the percentage of fat (Salamah et al., 2019). That way it can reduce fitness (Baek et al., 2020). One important thing that is not desirable is that there will be some diabetes or high blood pressure (Faridah, 2015). Various exercise activities have been proven to control and maintain fitness and body fat such as yoga performing resistance training (Park et al., 2019), and actively exercising (Samodra et al., 2023; Suryadi et al., 2023).

High-intensity exercise also has a significant effect (Samodra, 2020), or by increasing the amount of oxygen that enters the body (Sugiharto et al., 2019). Reliable research evidence proves that there is a positive relationship between BMI and sloth percentage (Hooper et al., 2020). Furthermore, if people have a high percentage of fat, this is closely related to an increase in the waist and abdominal circumference and results in decreased strength (Fukuoka et al., 2019). And has an influence on low back pain, commonly referred to as low back pain (Widiastuti et al., 2018). Therefore, the evidence of this research cannot be overlooked.

A series of research evaluations undertaken present an analogy that those who acquire weight will have an increase in BMI. Based on this BMI status, overweight to obesity is suspected. Furthermore, there will be an increase in the percentage of fat, increasing the percentage of fat will

increase cholesterol levels (Serrano et al., 2019). Increasing cholesterol will be a combination of deadly degenerative diseases (Nugroho & Fahrurodzi, 2019; Zuraida et al., 2021). This research review provides scientific evidence on how BMI and cholesterol fat levels in sportsmen are still very minimal. The urgency in this study is whether if people do active sports (athletes) the relationship between BMI and cholesterol is interrelated.

A population fact West Kalimantan Province is divided into 14 districts, with a total population of 5,440,444 people as of 2019, with 2,800,189 males and 2,639,841 females (Diskominfo, 2023). Of these, each city district fosters various sports. In an effort to face the Indonesian National Sports Week in 2021, each sport sends the best athletes for selection. The competition consists of 37 sports which are held at the National Sports Week in Papua. Based on these problems, this study aims to determine the BMI and cholesterol status of athletes selected to prepare for National Sports Week. Furthermore, this study also wants to prove whether participating in sports can maintain BMI and cholesterol in athletes.

2. METHODS

2.1. Participants

The subjects in this study were 376 athletes from 25 sports who were the best representatives of athletes to take part in the national sports week in Papua. Of the 376 athletes who underwent a complete BMI and cholesterol test amounted to 328 athletes. The athletes are selected and selected based on previous achievements, namely on the results of the acquisition of provincial sports week achievements and national championships attended by regional athletes. Athletes who are tested are chosen from their respective sports' parent organizations based on criteria such as first, second, and third place finishes in porprov or national championship achievements in the sports in which they compete.

All athletes range in age from 16-45 years with an average age of 21 years. The sports are track and field, weightlifting, fencing, aero modeling, bicycle racing, billiards, handball, badminton, skydiving, judo, karate, kempo, muay thai, archery, wall climbing, pencak silat, petangque, swimming, sepak takraw, taekwondo, degree combat, table tennis, boxing, volly beach, wushu (Table 1).

Table 1. Description of study sample

No	Sport Branch	Total
1	Track And Field	16
2	Weightlifting	18
3	Fencing	15

4	Aero Modeling	7
5	Bicycle Racing	7
6	Billiards	9
7	Hand Ball	14
8	Badminton	17
9	Parachuting	2
10	Judo	10
11	Karate	16
12	Kempo	8
13	Muay Thai	10
14	Archery	28
15	Rock Climbing	17
16	Pencak Silat	27
17	Petanque	9
18	Swimming	8
19	Sepak Takrau	6
20	Taekwondo	9
21	Tarung Derajat	24
22	Table Tennis	5
23	Boxing	27
24	Beach Volleyball	4
25	Wushu	15

2.2. Research instruments

The method in this study used a quantitative approach through a survey with researchers giving a test and measurement. Height, weight, and cholesterol data were measured by assigned medical personnel. The medical personnel was recruited from Pontianak city hospital. The athlete must first fill out their biodata before the medical staff collects their height and weight measurements. Weight measuring scales Omron Karada Scan HBF-375 were used in this study. During the cholesterol test, use one touch.

2.3. Statistical analysis

This study's data analysis is descriptive, with the goal of determining BMI and cholesterol data on athletes from various branches in West Kalimantan Province. The results of calculating BMI and cholesterol are then evaluated using the Microsoft Excel 2019 tool. Then, using the SPSS Version 26 tool, examine the relationship using the normality prerequisite test step and the correlation test.

3. RESULTS

The research was conducted by measuring 376 athletes from 25 sports who were the best representatives of each sport. Of the 376 athletes who underwent a complete BMI and cholesterol test amounted to 328 athletes. The measurement results are presented in the following table.

Table 2. Summary of BMI and cholesterol test results

Result		Cholesterol	BMI
N	Valid	328	328
	Missing	0	0
Mean		171.38	22.85
Median		161.00	22.10
Mode		123.00[a]	20.60[a]
Std. Deviation		46.79	3.97
Minimum		100.00	16.60
Maximum		357.00	41.70

Based on Table 2, it turns out that the overall average cholesterol is 171.38, while BMI is at 22.85. Furthermore, based on the sport in detail is presented in Table 3.

Table 3. Description of BMI and cholesterol results

Sport Branch		N	Mean	Std. Deviation	Minimum	Maximum
Cholesterol	Track And Field	16	164,81	42,02	119	292
	Weightlifting	18	193,89	58,21	133	338
	Fencing	15	183,07	53,35	121	307
	Aero Modeling	7	177	30,35	141	216
	Bicycle Racing	7	164,57	40,72	119	229
	Billiards	9	177	53,95	136	313
	Handball	14	158,07	29,89	102	211
	Badminton	17	182,94	68,49	109	357
	Sky Diving	2	188	8,49	182	194
	Judo	10	136,7	29,03	103	186
	Karate	16	181,19	52,11	119	300
	Kempo	8	158,13	36,25	108	203
	Muay Thai	10	164,4	27,98	123	200
	Archery	28	162,89	44,8	103	294
	Wall	17	157,24	40,9	100	292

	Climbing					
	Pencak Silat	27	183,67	42,54	124	283
	Petanque	9	170,89	55,68	120	271
	Swimming	8	201,63	68,7	140	344
	Sepak Takraw	6	141,83	9,26	126	151
	Taekwondo	9	176,67	57,89	110	305
	Tarung Drajat	24	162,83	45,56	103	266
	Table Tennis	5	172,4	40,18	123	207
	Boxing	27	157,89	23,97	121	207
	Beach Volleyball	4	167,25	38,45	143	224
	Whusu	15	199,8	54,08	131	325
	Total	328	171,39	46,8	100	357
BMI	Track And Field	16	22,51	5,98	18,4	40,1
	Weightlifting	18	29,07	5,21	19,56	41,7
	Fencing	15	22	2,32	17,6	26,5
	Aero Modeling	7	20,77	3,71	16,9	26,1
	Bicycle Racing	7	20,74	2,67	17,9	26
	Billiards	9	24,57	1,77	20,5	26,9
	Handball	14	23,52	2,39	20,3	27,6
	Badminton	17	22,79	3,03	18	28,2
	Sky Diving	2	26,9	2,4	25,2	28,6
	Judo	10	23,87	2,59	20,7	28,1
	Karate	16	23,14	4,13	17,2	33,8
	Kempo	8	20,98	2,24	17,2	23,8
	Muay Thai	10	21,12	1,18	19,7	23,3
	Acher	28	23,55	4,4	17,3	34
	Wall Climbing	17	19,88	2,96	16,7	28,9
	Pencak Silat	27	23,68	4,58	17,6	31,7
	Petanque	9	20,73	2,11	16,6	22,6
	Swimming	8	21,39	2,56	17,5	25,5
	Sepak Takraw	6	21,5	2,99	18,3	26
	Taekwondo	9	24,01	5,16	17,7	35,6
	Tarung Drajat	24	22,58	3,23	17,3	33,5
	Table Tennis	5	22,06	1,43	19,8	23,5
	Boxing	27	22,44	3,15	18,2	32,2
	Beach Volleyball	4	21,68	3,71	18,3	26,6
	Whusu	15	21,9	2,21	17,3	26,7

	Total	328	22,86	3,98	16,6	41,7

Based on Table 3, the total BMI of 22.86 cholesterol was 171.39. Swimming had the highest average cholesterol level (201.63), while judo had the lowest (136.7). Weightlifting athletes have the greatest average BMI of 29.07, while wall-climbing athletes have the lowest average BMI of 19.88.

Table 4. Body Mass Index (BMI) Criteria (Di Angelantonio et al., 2016)

Classification	**Status**	**F**	**Percentage**
Underweight	<18,5	36	10,98%
Normal	18,5-25	207	63,11%
Overweight	25-30	71	21,65%
Obesitas I	30-35	9	2,74%
Obesitas II	35-40	3	0,91%
Obesitas III	40-60	2	0,61%

Table 4 BMI criteria for athletes shows 11% of athletes fall into the underweight category, 63.11% normal, 21.65% overweight, 2.74% obese I, 0.91%m Obesity II, and 0.61%, Obesity III.

Table 5. Cholesterol Criteria (Grundy., 2001)

Total Cholesterol	**Status**	**Frequency**	**Percentage**
<200	Normal	261	80%
200-239	High lower limit	35	10%
≥240	hight	33	10%

The results of Table 5 show that athletes have blood cholesterol levels of 80% in normal conditions 10% are at the lower threshold of high and 10% high. Based on the results in Table 6, the normality test shows a significance value of 0.000 <0.05, so the data is declared abnormal for BMI or cholesterol. Furthermore, in the homogeneity test it turns out that cholesterol and BMI are not homogeneous with sig. 0.009 and 0.006. The results can be seen in Table 7.

Table 6. Normality Test of Kolmogorov-Smirnov[a]

Result	**Statistic**	**df**	**Sig.**
Cholesterol	,113	328	0,000
BMI	,114	328	0,000

Table 7. Homogeneity Test of cholesterol and BMI

Homogeneity of Cholesterol and BMI		Levene Statistic	df1	df2	Sig.
Cholesterol	Based on Mean	1,992	24	303	,004
	Based on Median	1,405	24	303	,102
	Based on the Median and with adjusted df	1,405	24	231,384	,105
	Based on trimmed mean	1,870	24	303	,009
BMI	Based on Mean	2,161	24	303	,002
	Based on Median	1,559	24	303	,049
	Based on the Median and with adjusted df	1,559	24	153,489	,057
	Based on trimmed mean	1,942	24	303	,006

Table 8. Results of Non-Parametric Correlation of cholesterol and BMI

Spearman's rho			Cholesterol	BMI
	Cholesterol	Correlation Coefficient	1,000	-,013
		Sig, (2-tailed)	,	,815
		N	328	328
	BMI	Correlation Coefficient	-,013	1,000
		Sig, (2-tailed)	,815	,
		N	328	328

Furthermore, the data were analyzed with Spearman's rho non-parametric correlation with the analysis results in Table 8 obtained sig. 0.815 with a correlation number of -0.013. The results show that BMI and cholesterol are not related to sportsmen.

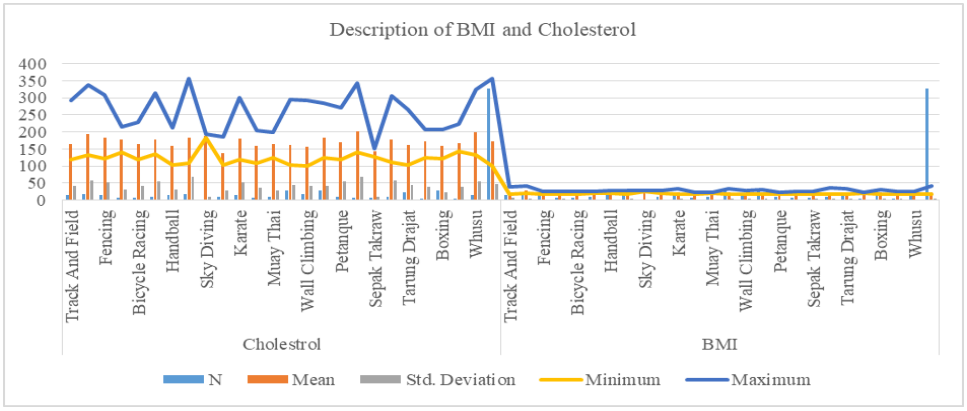

Figure 1. Cholesterol and BMI Chart

4. DICUSSION

This study tried to prove whether BMI and cholesterol correlate with people who are active in sports performance. The initial assumption is that if people have a high BMI, it will affect the percentage of fat. Where the percentage of fat there is a tendency to increase cholesterol. The results showed 11% of athletes fell into the underweight category, 63.11% normal, 21.65% overweight, 2.74% obese I, 0.91%, Obesity II, and 0.61% Obesity III. The interesting data in this study is that it turns out that 100% of weightlifters are included in the overweight BMI. It should be understood together that weightlifters are anthropometrically supposed to be in the endomorph mesomorph body type (Hasan et al., 2021). Evidence of the results of cholesterol levels in the blood 80% in normal conditions 10% are at the lower threshold of high and 10% are high. The results also show that there is a negative correlation between BMI and cholesterol in athletes. There are several branches of athletes who have high BMI such as weightlifters and martial artists.

In relation to BMI, especially in martial arts sports, it is necessary to have a high BMI, which will automatically affect the classes that are followed. So that gaining and losing weight often occurs (Reale et al., 2020), considering that anthropometric factors, body type, BMI, and body composition are very important in the sport of karate (Gloc et al., 2012). Some martial arts sports have different BMI requirements, in Aikido athletes' body composition is less important (Reguli et al., 2016). Another opinion states that specifically for martial arts athletes it is recommended that the percentage of fat and body type be 12.20% (3.07%); endomorphic component, 2.9 (1.30); mesomorphic component, 4.25 (1.30); and ectomorphic component, 3.10 (1.30) (Catikkas et al., 2013). While in the sport of degree combat, the mesomorph endomorph type is more dominant (Samodra et al., 2023; Suryadi et al., 2022).

These results also signaled that participation in sports has a positive influence in maintaining overall cholesterol. The results of this study show that by becoming an athlete, the overall average total cholesterol of athletes in normal conditions is 80%. These results provide a message that for athletes who are actively training even though there is a high BMI, cholesterol levels can still be said to be safe. This statement is supported by looking at the significance number 0.815 with a correlation of -0.013, based on this data BMI and cholesterol are negatively correlated. Relevant research studies have also shown the same thing where participation in sports is proven to reduce total LDL cholesterol (Herlina et al., 2015). Healthy living with physical activity and sports (Anakonda et al., 2019b, 2019a; Lestari et al., 2020; Ta et al., 2017), poco-poco exercise (Saputra et al., 2015), can lower cholesterol.

Avoiding alcohol and cigarettes and a good nutritional diet (Rampengan, 2015) is a smart way to lower LDL and prevent it from rising. It is further stated that actively exercising such as Taichi (Maryati, 2018; Utami et al., 2021), aerobics (Tungka et al., 2017), Zumba (Ikayani et al., 2019; Tendean et al., 2018), then it will have a good effect on good cholesterol (TA et al., 2017). The good cholesterol in question is HDL, this exercise activity will positively affect weight loss which will automatically reduce LDL as well (Yani, 2015).

Various other research results prove that exercise has a positive effect on reducing body fat by doing exercises (Bakri, 2020; Sitepu et al., 2020), super set weight training (Nasrulloh & Shodiq, 2020), pilates workout (Devi et al., 2022; Fatmawati & Syurrahmi, 2018), walking (Febriyanti & Rusmariana, 2021) can lower cholesterol. Likewise, the study of cholesterol-lowering with exercise (Anakonda et al., 2019b; Anakonda et al., 2019a). The results of relevant research and studies prove that by doing physical activity. Whether it's recreational sports, fitness, or performance sports shown in this study. It gives the message that moving will have a positive effect on increasing high-density lipoprotein (HDL) and decreasing low-density lipoprotein (LDL).

LDL blood cholesterol is harmful to health, so various studies have been conducted to try to reduce LDL and increase HDL. A study says high cholesterol in the blood is caused by students' ignorance of dietary knowledge (Tungka et al., 2017). While aerobic exercise performed for 1 x per week for 4 weeks succeeded in reducing the circumference of the thighs, abdomen, arms, and thighs (Tungka et al., 2017). Other studies in addition to participating in sports activities to reduce LDL can be done by improving diet (Supardi, 2018). This includes the consumption of olive oil (Fadhilah & Sutysna, 2020), and consuming lime 1.5 cc/kg bb for 7 days can reduce cholesterol levels (Elon & Polancos, 2016). Furthermore, guava juice at a dose of 400mg per day for one month can reduce cholesterol (Asmarani et al., 2019). It turns out that soy intake can also lower LDL (Carolyn dkk, 2019), and dragon fruit (Zahra et al., 2019).

The results of this study illustrate that by participating in sports, BMI and cholesterol will be maintained in conditions that tend to be normal, secondly for active athletes between BMI and cholesterol are not positively correlated. Various efforts to maintain BMI and cholesterol levels in the blood have been proven. Previous studies agree that physical activity and nutritional regulation are good solutions to maintain the balance of BMI and cholesterol.

5. CONCLUSIONS

Based on the findings and discussions, there is a solid foundation for BMI and cholesterol. This has been mentioned in the conversation. The findings revealed that there was no overall relationship between BMI and cholesterol. The average BMI status in the condition tends to be normal and normal cholesterol, with only 10% on the verge of high and only 10% on high status. So it cannot be confirmed that people who have high BMI will have high cholesterol if they are active in sports, especially achievement sports. The results of this study have provided additional references in sports performance coaching. That way, these results can also be a consideration for coaches in providing training programs and regulating athletes' diets. Further research recommendations to consider body fat percentage.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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