Analyze of body mass index (BMI) and macronutrition needs for student age 11-13

Muhammad Fikri Pratama[1abcde], Hendra Mashuri[2cde]*, I Komang Sukarata Adnyana[3de]

[123]Departement of Physical Education, Health and Recreation, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Indonesia

ABSTRACT

Calculation of students' nutritional status can be done using measurement tools, namely anthropometry, assisted by body mass index (BMI) classification. The components of the body mass index consist of height and weight. This study aims to analyze the BMI and macronutrient needs of seventh grade students of MTs Kalifa Nusantara Denpasar. This study is a quantitative descriptive study using a survey method. The sample in this study were 66 seventh grade students of MTs Kalifa Nusantara Denpasar, with 24 (36%) males and 42 (64%) females. Based on the results of the study, it was found that 10 (15%) students were classified as severely underweight, 17 (26%) students were classified as mildly underweight, 24 (36%) students had an ideal BMI, 9 (14%) students were classified as mildly obese, and 6 (9%) students were categorized as severely obese. The average daily energy requirement for male is 2959,82 cal and for female 2529,38 cal. The average seventh grade students of MTs Kalifa Nusantara Denpasar have a non-ideal body mass index, because the calculation results of all categories except ideal (light thin, heavy and mild obesity, heavy) are 64%, while the ideal category is only 36%. This condition needs to be a concern, both for students personally, PE teachers, and parents, so that students are able to obtain balanced nutrition so that the ideal category is achieved.

Keywords: analyxe; BMI; Macronutrition; Needs for Student; age 11-13

Corresponding Author: Hendra Mashuri, Department of Physical Education, Health and Recreation, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Bali, Indonesia

email: hendra.mashuri@undiksha.ac.id

INTRODUCTION

Education is an important aspect in the development of human resources (HR) in a country (Pradesa et al., 2024). One of the subjects that educates through physical activity that aims to maximize the potential of motor skills, emotional intelligence, build a sense of sportsmanship and provide knowledge about healthy living is physical education, sports and health (PESH)(Wijaya et al., 2025). Students in adolescence are in a growth phase, because this phase is a crucial momentum to instill a physical, mental, knowledge, social, and spiritual foundation (Spyanawati et al., 2024). Therefore, PESH as a subject with physical activity, must be able to control students' body mass index and control diet, lifestyle, and be able to collaborate with parents/guardians in optimizing student growth and development. Therefore, PESH teachers must be able to measure students' body mass index as a reference and report on nutritional status or student growth and development (Mashuri, 2022). In Physical Education (PE) subjects, students' nutritional status greatly influences their ability to carry out the movement activities that will be given later. Students with good nutritional status tend to have the necessary abilities to carry out the given movement activities and do not experience obstacles like students with poor nutritional status, such as students who have the criteria of being thin or overweight (obese)(Hanif et al., 2024). For example, if students with thin nutritional status will experience fatigue more quickly, due to lack of nutritional intake, then for students with overweight (obese) nutritional status will experience obstacles in the form of reduced mobility in movement, and less than optimal movement activities carried out, this certainly has an impact on declining learning outcomes in PESH subjects. PESH teachers should be able to monitor children's growth and development during school, because most of the children's time is spent at school, and only PE teachers have the authority to provide education about health in schools, one of which is about their nutritional needs and control student growth (Mustafa, 2023). Therefore, it is important for PE teachers to be able to carry out simple analysis and measurements of students' nutritional status, so that they can provide activities that suit the needs based on the students' nutritional status.

Calculation of students' nutritional status can be done using measurement tools, namely anthropometry, assisted by body mass index (BMI) classification. The components of the body mass index consist of height and weight (Yuniarti et al., 2025). As for the interpretation of the BMI range, namely BMI <17.0 is included as severely underweight, BMI 17.0 - 18.4 is included as mild underweight, BMI 18.5 - 25.0 is included as ideal, BMI 25.1 - 27.0 is included as mild obesity, BMI > 27.0 is included as severely obese (Kemenkes.go.id, 2024). Nutritional intake is a factor directly related to nutritional status. Nutrition is food that is taken into our body, which will then be absorbed as fuel so that our body can be active and carry out its physiological functions properly (Saidi et al., 2022). From these nutrients will be processed into calories through energy metabolism. The energy obtained comes from the nutrients contained in macronutrients, these macronutrients are carbohydrates, fats, and proteins (Jahfal, 2024). The relationship between nutritional intake and nutritional status depends on the individual's daily nutritional intake. If the individual's intake is balanced, then the individual's nutritional status will reach the ideal interpretation. Conversely, if the individual's intake is unbalanced, such as a nutritional deficiency, then the individual's nutritional status can be interpreted as thin, while excess nutrition will be interpreted as fat (Irianti & Yolandha, 2022).

Based on the results of initial observations, it was found that students in class VII MTs Kalifa Nusantara Denpasar numbered 66 students, with a total of 42 female students and 24 male students, in this initial observation the author focused on a visual assessment to see how the PESH learning took place at the school, then found an incident where students with a body posture that tends to be thin, quickly experienced fatigue during the learning process, while students who tend to be fat had

difficulty in moving and fulfilling the given movement tasks. Then based on interviews with PE teachers at MTs Kalifa Nusantara Denpasar, the author learned that the calculation of nutritional status had never been carried out independently and regularly by the school, and likewise analysis related to macro nutrient intake had never been carried out. With these findings, it is known that students do not know about their individual nutritional needs, and do not have knowledge about arranging eating patterns that suit their daily nutritional needs. Therefore, the implementation of routine nutritional status calculations is necessary to provide students with an understanding of their own body condition, and macro nutrient needs analysis is needed to provide an understanding and reference regarding their appropriate daily needs. In addition, the benefits of implementing routine nutritional status calculations and macro nutrient needs analysis are to provide information as a reference to PE teachers, especially in providing appropriate movement tasks based on the physical condition of each student, so that sports subjects can be more effective and efficient in supporting optimal health and physical development. Thus, the urgency of this research lies in the students' ignorance of their own body condition, and what intake is appropriate for them daily and there has never been a BMI measurement on each student, and there has never been education about the daily macro nutrient needs required by them. The results of the calculation of students' nutritional status and daily macro nutrient needs, which are expected to be able to be used by PE teachers in designing movement activity programs and education about nutrition based on the conditions and needs of students.

Previous research has mostly focused on high school students or athletes, and available data on integrated analysis of BMI and macronutrient needs among early adolescents (11-13 years old) in the context of MTs, especially in Denpasar, is still limited. Therefore, the author wants to conduct a scientific study entitled "Analyze of body mass index (BMI) and macro nutrition needs for students aged 11-13". This study aims to: (1) determine the distribution of BMI, (2) calculate total energy needs, and (3) estimate the macronutrient needs of seventh grade students at MTs Khalifa Nusantara Denpasar. It is hoped that in the future this study can also be used as a reference for daily nutritional needs that will be provided by the government in the free nutritious meal (MBG) program, so that the food provided can provide more effective benefits because it is tailored to the needs of each student based on their daily nutritional needs.

METHOD

This type of research is a quantitative descriptive study using a survey method. Quantitative descriptive research that displays data in the form of numbers which are then clearly described related to symptoms, phenomena or events that actually occur (M. Sari et al., 2023). Namely about the body mass index and macro nutritional needs of students at Mts Kalifa Nusantara Denpasar using a survey method. Quantitative methods emphasize hypotheses, specific, in the form of numbers, statistical analysis, focus on results and deductive (Charismana et al., 2022). This research began by asking for permission from the school to conduct research, then conducting initial observations when PESH learning was taking place, then conducting interviews with PE teachers regarding whether BMI measurements and analysis of students' macro nutritional needs, the last is to provide a questionnaire in the form of what activities they do daily, both non-sports physical activities and sports physical activities that have been divided based on their time, namely morning to noon, and afternoon to evening for non-sports physical activities, while for sports activities a column is provided to fill in what activities they do, then their duration, and intensity for one week.

The subjects in this study were 66 seventh-grade students at MTs Kalifa Nusantara Denpasar, consisting of 42 female students and 24 male students. The characteristics of the seventh-grade students at MTs Kalifa Nusantara Denpasar are as follows.

Table 1. Demographics of Research Subject

No	Research Subject Category	Sum	Average Age	Average Weight	Average Height	Precentage
1	Woman	42	12,57	48,12	155,07	64 %
2	Man	24	12,58	53,46	157,00	36 %
	N	66				

The data collection technique for body mass index (BMI) is using anthropometric tools, such as digital scales for weight measurement (BB) and a staturemeter for height measurement (TB). To determine BMI before being included in the categories determined by the Ministry of Health, Nurhasan & Narlan (2011) in (Mashuri, 2022) suggest the following formula.

After determining the BMR and SDA, the students' daily non-exercise physical activity was calculated. This was categorized as light, moderate, and vigorous, with each classification having a factor value calculated using basic energy. The physical activity requirement was then calculated by considering the type of exercise performed, the duration of each exercise per day, and the frequency of exercise per week. The type of exercise will influence the activity factor, which will then be adjusted based on the student's weight. The calculation was made by multiplying the activity factor value by the number of minutes of exercise performed per day, and then by the number of times the exercise was performed per week. The WHO (2017) in (Mashuri, 2022) provides a table classifying non-exercise physical activity and a table of physical activity factor values that can be used. It should be noted that because students are in the growth phase, additional nutrition is needed so that they can grow well (Mashuri, 2022).

Table 2. Classification of Physical Activity Non-Sport

| Classification	Description of Act	Gender	Value of Factors
Light	75% of time spent sitting or standing. 25% of time spent standing or moving.	Male	1,56
		Female	1,55
Moderate	25% of time spent sitting or standing. 75% of time spent on specific work activities.	Male	1,76
		Female	1,7
Heavy	40% of time spent sitting or standing. 60% of time spent on specific work activities.	Male	2,1
		Female	2

Table 3. Additional Calories Needs in Growth Age

| Age	Value
10-14	2 cal / kg W
15	1 cal / kg W
16-18	0,5 cal / kg W
>19	0 cal / kg W

RESULTS

This study began by measuring the body mass index (BMI) of students by measuring height, weight and age (Mashuri et al., 2024). In male students, there were 4 (17%) students who were in the category of severe underweight, 6 (25%) students were in the category of mild underweight, while there were 6 (25%) students in the ideal category, and 5 (21%) students were in the category of mild

obesity, and followed by 3 (12%) students in the category of severe obesity. Meanwhile, for female students, there were 6 (14%) in the category of severe underweight, 11 (26%) students in the category of mild underweight, then 18 (43%) students in the ideal category, while 4 (10%) students were in the category of mild obesity, and finally there were 3 (7%) female students in the category of severe obesity. Based on the results of body mass index measurements, grade VII students of MTs Kalifa Nusantara Denpasar were in the non-ideal category.
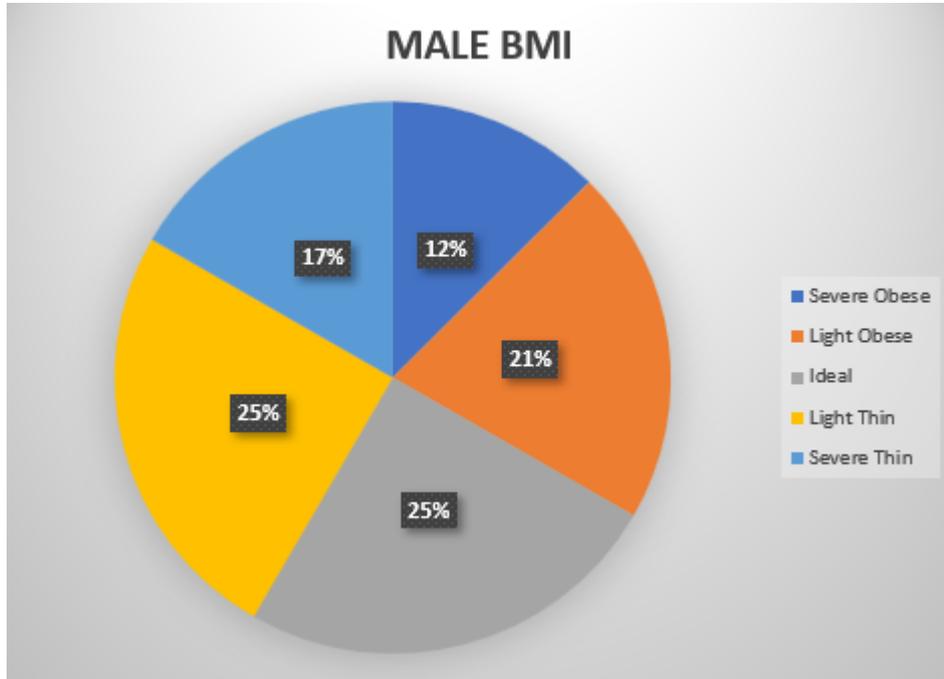
Picture 1. Male Body Mass Index Distribution
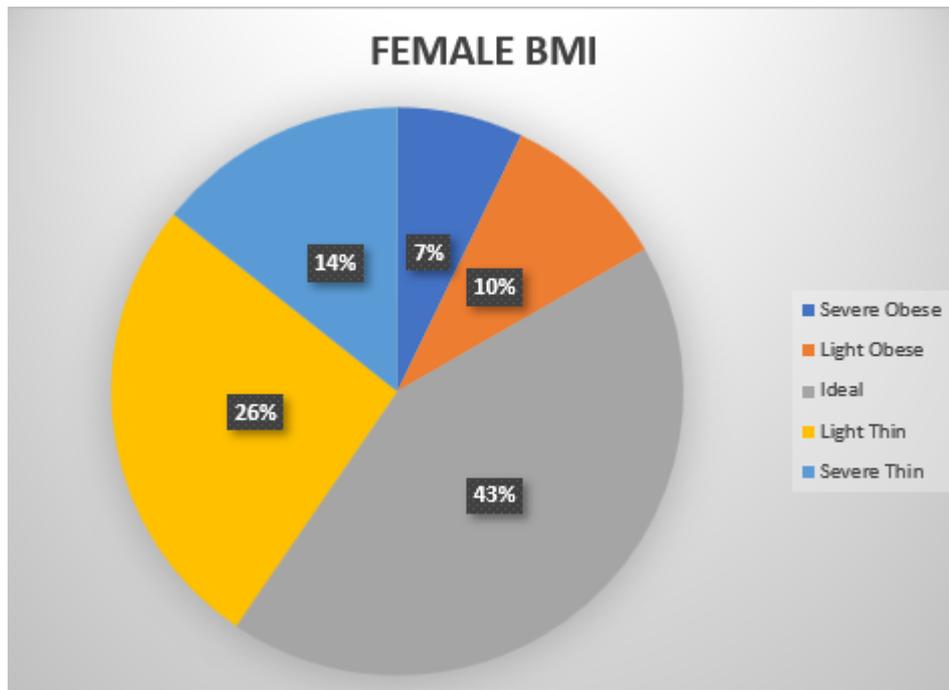
Picture 2. Female Body Mass Index Distribution

After calculating and distributing the body mass index of students according to their respective categories, the next step is to calculate the basic energy needs, which are the results of the calculation of BMR + SDA of each student. BMR itself is the energy needed by the body to simply survive every day, while SDA is the energy needed to process food consumed by the body in energy metabolism. The average BMR for male students in grade VII MTs Kalifa Nusantara Denpasar is 1498.31 cal, while the average SDA is 149.83 cal. So the average basic energy needs for male students in grade VII MTs Kalifa Nusantara Denpasar is 1648.14 cal. While the average BMR for female students in grade VII MTs Kalifa Nusantara Denpasar is 1336.99 cal, while the average SDA is 133.69 cal. So the average basic energy requirement of female students in class VII of MTs Kalifa Nusantara Denpasar is 1470.68 cal.

Tabel 4. Calculation of BMR,SDA and Basic Energy needs

No			BMR	SDA	Basic Energy Needs
1.		Mean	1498,31	149,83	1648,14
2.	Male	SD	229,35	22,93	252,28
3.		Min	1045,90	104,59	1150,49
4.		Max	1852,40	185,24	2037,64
5.		Mean	1336,99	133,70	1470,68
6.	Female	SD	92,48	9,25	101,73
7.		Min	1171,00	117,10	1694,00
8.		Max	1540,00	154,00	1288,10

The next step is for students to fill out the survey questionnaire that has been given to find out what daily non-sports physical activities they do and sports physical activities as well of course. Energy calculations for class VII students of MTs Kalifa Nusantara Denpasar are derived from daily activities without sports, which are categorized into light, moderate, or heavy categories, each of which contains values calculated with basic energy needs. Based on the calculation results, it shows that on average, male students in class VII MTs Kalifa Nusantara Denpasar need 2762.26 cal of energy for non-sports physical activities. For female students, on average, they need 2364.68 cal of energy for non-sports physical activities. Meanwhile, sports energy needs come from sports activities carried out by class VII MTs Kalifa Nusantara Denpasar students based on (table 4). The average sports energy needs of male students in class VII MTs Kalifa Nusantara Denpasar are 634.50 cal. Meanwhile, for women, the average energy requirement for exercise is 479.24 cal. The results of the calculations and analysis of non-exercise and exercise physical activity are as follows.

Tabel 5. Distribution of Non-Sport Physical Activity

No	Gender	Category	Score	Frequency
1.		Light	1,55	26
2.	Woman	Medium	1,7	14
3.		Heavy	2	2
4.		Light	1,56	16
5.	Man	Medium	1,76	4
6.		Heavy	2,1	4
		Total		66

After knowing the needs of students based on basic needs, non-sports physical activities and sports activities, the next step is to add nutritional needs for the development of class VII students at MTs Kalifa Nusantara Denpasar, because these students are still in the growth phase, namely aged 10-14 years, then the additional nutritional needs for them are 2 cal/kg.

Tabel 6. Energy Calculation of Non-Sport and Sport Physical Activity

No			Non-Sport Energy	Sport Energy	Activity Energy needs
1.		Average	2762,26	634,50	2852,90
2.	Male	SD	479,45	244,87	290,92
3.		Average	2364,68	479,24	2433,14
4.	Female	SD	229,57	251,34	235,14

Tabel 7. Calculation of Additional Energy for growth age

No			Age	Activity Energy needs	Additional Energy	Total Energy
1		Average	12,58	2852,90	106,92	2959,82
2	Male	SD	0,57	490,92	28,85	513,06
3		Average	12,57	2433,14	96,24	2529,38
4	Female	SD	0,54	235,14	18,71	249,65

The total energy needs of grade VII students of MTs Kalifa Nusantara Denpasar which have been explained above are formulated with the theory of meal portions, and calorie content in macronutrients, then analyzed so that later it can be recommended on the daily macronutrient needs in units per gram. Macronutrient needs themselves are divided into three, namely the needs of carbohydrates, fats and proteins. The average needs for male students are carbohydrates of 1775.89 cal or 443.97 grams, for fat is 739.95 cal or 82.22 grams, while for protein is 443.97 cal or 110.99 grams. While the average needs for female students are carbohydrates of 1517.63 cal or 379.41 grams, for fat is 632.34 grams or 70.26 cal, while for protein is 379.41 cal or 94.85 grams.

Tabel 8. Macronutrients Needs of student 7th grade in MTs Kalifa Nusantara Denpasar

No			Macronutrients Needs					
			Carbohydrate		Fat		Protein	
			Calories	Gram	Calories	Gram	Calories	Gram
1		Average	1775,89	443,97	739,95	82,22	443,97	110,99
2	Male	SD	307,84	79,96	128,27	14,25	76,96	19,24
3		Average	1517,63	379,41	632,34	70,26	379,41	94,85
4	Female	SD	149,79	37,45	62,41	6,93	37,45	9,36

DISCUSSION

This study began by calculating the body mass index of seventh-grade students at MTs Kalifa Nusantara Denpasar. Based on the results of the study, the overall results were that seventh-grade students at MTs Kalifa Nusantara Denpasar were in the non-ideal category. This needs to be a concern for students, PE teachers, and parents at home, because the cause must be investigated and immediately addressed and begin to implement a healthy lifestyle. One of the factors causing this non-ideal in schools is the category of obesity, both mild and severe, the causes of obesity can be due

to environmental and genetic factors, one of the causes is following the trend of consuming junk food or fast food which tends to be unhealthy (Fatmasari et al., 2024). This is a figure that needs to be considered because obesity is associated with various serious health problems, such as heart disease, diabetes, and stroke (Yuniarti et al., 2025). Meanwhile, another factor that causes non-ideal is underweight, the cause of this underweight is the result of not fulfilling macro and micro nutrient intake and manifests in four forms: wasting, underweight, stunting, and malnutrition. Malnutrition among adolescents can be caused by infectious and non-infectious diseases, economic growth, inadequate childcare, and food intake including consumption of snacks which is one of the means of socialization of students with their friends (Fatmasari et al., 2024). Meanwhile, the impact of malnutrition in school-age children can cause a child to become weak, easily tired, and susceptible to disease so that the child experiences difficulties in going through the learning process (Riska et al., 2024).

Then the research continued by calculating the basic energy needs of students, which is a calculation of BMR + SDA, after that classifying their non-sports physical activities into 3 different categories based on their gender as well, namely light, moderate and heavy categories. Students of grade VII MTs Kalifa Nusantara Denpasar are classified into the category of light non-sports physical activities, because as many as 42 students, with 26 girls and 16 boys in the light category, this number is the majority of the total number of students, namely 66. One of the causes of this lack of non-sports physical activity is that students tend to spend their daily time playing gadgets, sleeping and watching TV. The exchange of lifestyles in the past with the present which was previously busy with traditional games had more diverse movements, now this is not and is rarely seen anymore (Afandi & Avandi, 2022). If this lifestyle continues, the ideal category will be difficult to achieve and many diseases will attack in the future.

Furthermore, the calculation of physical sports activities, which is adjusted to the weight of the students, the duration of the exercise, and the number of times the exercise is done in one week, then adding additional energy because students are still in the growth phase, namely under 19 years old, precisely between the range of 10 - 14 years, and require additional energy of 2 cal / per kg. Adding sports activities is one way to increase the level of possibility of achieving the ideal category, because for students who are overweight, burning extra energy is very necessary, while for underweight students, sports activities can increase their appetite after doing these activities (Warahma et al., 2025).

Finally, recommendations are provided regarding the macronutrient needs of seventh-grade students at MTs Kalifa Nusantara Denpasar, which are divided into three components: carbohydrates, fat, and protein. A balanced nutritional intake is certainly a crucial component for achieving the ideal category. This aligns with (A. K. Sari & Dora, 2024), which states that providing healthy and nutritious food is not only the responsibility of parents but also a potential determining factor in supporting children's learning and development.

CONCLUSION

In the future, it is hoped that students will be able to understand their own needs, so they can manage the nutritional intake that enters their bodies, daily, by watching the snacks they eat at school, eating nutritious food, and exercising regularly at least twice a week. For PE teachers, it is hoped that after knowing information about the body mass index of students who vary, they will be able to provide specific movement tasks according to their needs, and for parents, it is hoped that after understanding the needs of their respective children, they will be able to develop a diet that suits the needs of their students. For the school institution MTs Kalifa Nusantara Denpasar, it is hoped that

after this, they will routinely carry out measurements and weigh-ins that can be done periodically to monitor the growth and development of their students. Finally, with this research, it is hoped that recommendations can be given to the government, so that the MBG program can be adjusted to the needs of students in the future.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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