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Research Article

Interaction of Physical Activity and Body Mass Index with Age at Menarche

Interaksi Aktivitas Fisik dan Indeks Massa Tubuh dengan Usia Menarche

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Abstract

Objective: To investigate the interaction of physical activity and body mass index with age at menarche in Babun Najah Junior High School.

Methods: This was a cross sectional study. The sampling technique in this study is non-probability sampling by a total sampling.

Result: The results of the study were processed using the Chi-Square statistical test on 142 samples, obtained p-value = 0.748 (p>0.05) for the relationship between physical activity and age at menarche, p-value = 0.048 (p<0.05) for relationship between body mass index with age at menarche, and p-value > 0.05 for the interaction of physical activity and body mass index with age at menarche.

Conclusions: There is no interaction of physical activity and body mass index with age at menarche in Babun Najah Junior High School.

Keywords: body mass index, interaction, menarche age, physical activity.

Abstrak

Tujuan: *Mengetahui interaksi aktivitas fisik dan indeks massa tubuh dengan usia menarche di Madrasah Tsanawiyah Swasta Babun Najah.*

Metode: *Jenis penelitian ini adalah observasional analitik dengan desain penelitian potong lintang. Teknik pengambilan sampel dalam penelitian ini adalah pengambilan sampel non probabilitas dengan metode total sampling.*

Hasil: *Terdapat hubungan antara indeks massa tubuh dengan usia menarche (p-value = 0,048) , tidak terdapat hubungan antara aktivitas fisik dengan usia menarche (p-value = 0,784) serta tidak terdapat interaksi antara aktivitas fisik dan indeks massa tubuh dengan usia menarche (p-value > 0,05).*

Kesimpulan: *Tidak terdapat interaksi aktivitas fisik dan indeks massa tubuh dengan usia menarche si Madrasah Tsanawiyah Swasta Babun Najah.*

Kata kunci: *aktivitas fisik, indeks massa tubuh, , interaksi, usia menarche.*

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INTRODUCTION

According to the World Health Organization, adolescence is a period of human growth and development that occurs after childhood and before adult with an age range of 10 to 19 years[1] The United Nations International Children's Emergency Fund (UNICEF) defines adolescents as those who have an age range of 10 to 14 years (young adolescents) who are experiencing a transition period from childhood to adulthood and need attention and protection[2] Based on The Ministry of Health of Republic Indonesian in 2009, adolescents classification becomes early adolescence (12- 16 years) and late adolescence (17-25 years).[1] Physical activity of teenagers majority decreases every year along with the times, from playing outside the home a lot has shifted to being indoors such as playing games on smartphones, watching television, using computers instead of cycling, walking or exercising.[3]

Mild physical activity makes low energy expenditure resulting in an imbalance between incoming and outgoing energy. As a result, the remaining energy will be stored as fat and influence body mass index (BMI).[3,4] Assessment of adolescent nutritional status is BMI according

to age, but before entering adolescence, a person experiences a puberty period first.[2,5] Puberty is the growth and development that occurs gradually from secondary sex characteristics and the ability to reproduce.[6] This puberty period will be an acceleration of growth and physical development from childhood to adulthood.5 This is characterized by the maturity of the reproductive organs such as psychological changes, rapid physical growth and secondary sex characteristics.[5] In a girl, a sign of reproductive organ maturity is menarche.

Menarche is menstruation that occurs for the first time in a woman and is a sign of a young woman growing up and ready to become a complete woman, meaning that all of the woman's intimate organs are ready to reproduce.[7,8] The age of menarche in each individual varies, where the age range of 11-15 years is the normal range.[5]

In the mid-19 century, the age of menarche was 16-17 years and decreased by 4-5 years in the middle of the 20th century in the age range < 13 years.[9,10] The average age of menarche in Portugal, Italy, Spain, Venezuela, and England for women born in 1880-1890 was 15 years, but adolescents born in 1970-1980 are 12,03 years.[7] Studies in this decade have suggested a remarkable decrease in age at menarche.[11] Studies in Europe reported a significant decrease from the mean age of menarche, from 13,66 years to 13,05 over 50 years[11] In the United States, early menarche (< 11 years) increased from 4% to 11,8% in 50 years, while in Indonesia in 2010, the average age of menarche among girl was 12,96 years.[9,11]

Age of menarche describes several health aspects of a population, and can also represent a potential health risk if it deviates from the normal value of menarche it self.[7] Recent studies reported that the age of menarche can affect the risk of some diseases as adults, such as an increased risk of cardiovascular disease, gestational, cancer, and psychological disorder.[11-13]

Many factors influence the age of menarche, such as genetics, geography, eating habits, physical activity, socio-economic status, environmental conditions, body mass index (BMI), and even climate.[8,11] BMI was statistically inversely related to age at menarche.[11] The results of a study found that there was a very significant relationship between BMI and age of menarche, the girl with overweight menstruated earlier than women who had normal and underweight BMI.[14,15]

Physical activity also affects the onset of puberty and the age delay of menarche in women who are exposed to intense physical exercise during childhood and adolescence.[11] A study stated that there was a significant relationship between physical activity and age of menarche, namely a meta-analysis of 12 athletes / non-athletes showing that female athletes experienced menarche 1.13 years later than non-athletes.[16] Although physical activity and BMI are separately associated with menarche age, the interaction between physical activity and BMI with menarche age is still less to be discussed. Reported that there was an interaction between physical activity and BMI with the age of menarche.[11] It is against this background that researchers are interested in researching the Interaction of Physical Activity and Body Mass Index with Menarche Age in Babun Najah Private Madrasah (MTsS), where junior high school students have an age range of 12 to 15 years.

METHODS

This study used an observational analytic research method with a cross-sectional approach to determine the interaction between physical activity and body mass index with the age of menarche at Madrasah Tsanawiyah Swasta Babun Najah. This research was conducted from October to November 2020. Data were collected from 26 October to 10 November 2020. The sampling of this study used non-probability sampling with a total sampling method in which the research sample was obtained based on inclusion and exclusion criteria, which was 142 students. The instrument used in this study was the International Physical Activity Questionnaire short form (IPAQ) questionnaire specifically for adolescents and measuring body weight and height to assess body mass index.

Data analysis was using univariate and bivariate methods. The characteristics of respondents based on age, class, socioeconomic, physical activity, body mass index, and age of menarche were using the univariate test. The chi-square used bivariate test to determine the relationship between physical activity and age at menarche, the relationship between body mass index and age at menarche, and the interaction between physical activity and body mass index and age at menarche at MTsS Babun Najah.

RESULTS

Table 1. Characteristics of the sample among Babun Najah Junior High School

Respondence Characteristics	Total	%
Age (years)		
11	3	2.1
12	36	25.4
13	54	38.0
14	47	33.1
15	2	1.4
Grade		
7	40	28.2
8	51	35.9
9	51	35.9
Socio-economics		
Low	26	18.3
Moderate	88	62.0
High	28	19.7
Physical Activity		
IPA	20	14.1
SMPA	37	26.1
SVPA	85	59.9
Body Mass Index		
Very thin	1	0.7
Thin	3	2.1
Normal	90	63.4
Overweight	33	23.2
Obese	15	10.6
Age at menarche		
Have not	22	15.5
Early	18	12.7
Normal	102	71.8

SVPA = sufficient vigorous physical activity; SMPA = Sufficient moderate physical activity; IPA= insufficient physical activity.

Table 2. Relationship between Physical Activity and Age of Menarche

IPAQ*	Age at Menarche						
	< 11 years		≥ 11 years		Total		*P-value*
	n	%	n	%	n	%	
IPA	3	17.6	14	82.4	17	100	0.784
SMPA	6	17.6	28	82.4	34	100	
SVPA	9	13	60	87	69	100	

SVPA = sufficient vigorous physical activity; SMPA = Sufficient moderate physical activity; IPA= insufficient physical activity.

Table 3. Interaction of Physical Activity and Body Mass Index with Age at Menarche

BMI	Physical Activity	Age at Menarche				Total		Total
		< 11 years		≥ 11 years				
Normal	IPA	**n**	**%**	**n**	**%**	**n**	**%**	0.320
	SMPA	0	0	10	100	10	100	
	SVPA	4	15.4	22	84.6	26	100	
Over-weight	IPA	3	7.7	36	92.3	39	100	0.448
	SMPA	3	42.9	4	57.1	7	100	
	SVPA	2	25	6	75	8	100	
		6	20	24	80	30	100	

SVPA = sufficient vigorous physical activity; SMPA = Sufficient moderate physical activity; IPA= insufficient physical activity.

DISCUSSION

Bivariate analysis using Chi-square test showed p = 0.784 (p> 0.05). The results explain that physical activity does not affect the age of menarche in young women. The results are not in line with several previous studies, a cross-sectional and multistage sampling study conducted in 2013 on 660 adolescents found that low menarche age was independently associated with high calorie and protein consumption and low daily physical activity.[17] As well as research on overweight and physical activity on menarche age in 2014 on 62 young women, it was reported that there was a significant relationship between physical activity and age of menarche, in which young women with high physical activity experienced menarche longer than girls with low physical activity.[18] This study was supported by research conducted in 2018 on 124 female students who stated that there was no significant relationship between physical activity and age of menarche.[19]

Research in Iran in 2017 also reported that there was no relationship between physical activity and menarche.[20]

Physical activity does not directly affect the age of menarche, but physical activity has a secondary effect on the hypothalamus-pituitary axis through its effect on changes in body mass index.[21] Heavy physical activity, intense and makes mental stress can slow down the age of menarche, but daily physical activity does not affect the age of menarche.[22] Research on 65 female students in Jambi City had a significant relationship between physical activity and age of menarche, this is presumably because the majority of physical activities carried out by respondents were daily physical activities, not physical activities such as sports, but rather activities, extracurricular activities, where the effect of regular and intense exercise is more significantly related to slowing the age of menarche than daily physical activities.[23]

Bivariate analysis using Chi-square test showed p = 0.048 (p ≤ 0.05). The Odds ratio value obtained is 2.619 (1.094 - 6.268), then the OR> 1 is obtained. The Odds Ratio is 2.619 means that students with a BMI of overweight and obesity tend to experience early menarche by 2.619 or 2 times greater than students who have a normal, underweight BMI. These results are in line with a 2014 study of 15,005 adolescent girls with an age range of 12-18 years, that BMI had a significant relationship with the age of menarche where someone who had an overweight BMI tended to early menarche.[21] A 2020 study of 5,863 young women reported that the age of early menarche was related to the BMI value of adolescents who were classified as overweight BMI.[24] The majority of studies regarding the association of BMI with menarche age have a significant correlation, this related study in 2017 on 2000 adolescents with an age range of 9 to 18 years had significant results between BMI and age of menarche.[25] Research in 2018 on adiposity markers and their relationship with age at menarche with 400 respondents found that women with a high BMI, high waist-to-hip ratio, and high waist ratio are at risk of experiencing early menarche.[26] A study in 2018 on the mediation analysis and randomization of Mendel regarding birth weight, time-varying adiposity, and early menstruation in women found that levels of the protein hormone derived from adipocyte leptin were higher in individuals with high BMI. [27]

Interaction of physical activity and body mass index with age at menarche in female students of MTsS Babun Najah, using the Chi-Square statistics obtained p value> 0.05. So it can be concluded that there is no interaction between physical activity and body mass index with the age of menarche to students at MTsS Babun Najah. The result of this study is not in line with the research which was carried out in 2017 which is the first study examining the combined effects of physical activity and BMI with the age of menarche in China, it is reported that there is significant results regarding the interactions of physical activity and BMI with the age of menarche, this is because BMI has a negative correlation with age at menarche which can be modified with the physical activity done by teenagers, it means when the adolescents' physical activity is classified as insufficient, it will affect the value of the BMI tend to be overweight so it gives impact on adolescent menarche age.[11]

However, daily physical activity is not has a great influence in modifying BMI values, based on research conducted in 2018 for respondents aged 13-15 years who noted overweight on BMI have vigorous physical activity seen from their extracurricular activities in their school. Meanwhile, students who are having a thin BMI tend to have insufficient physical activity, seen from one who noted overweight on BMI has insufficient physical activity. On the other hand, not everyone with a thin BMI has vigorous physical activity. So that the term insufficient physical activity is not always associated with the value of an overweight BMI or obese.[28]

Research found that vigorous physical activity, continuously, and mentally stressful activity can slow down the age of menarche, however, daily physical activity is not affecting the age of menarche.[22] Thus, when there is an interaction between vigorous physical activity, continuously, and mentally stressful activity with the adolescents' body mass index, it affects the age of menarche. This is because BMI has a negative correlation to the age of menarche, while vigorous physical activity, continuously, and mentally stressful activity have a correlation which is directly proportional to the age of menarche.[22,24]

CONCLUSSION

Based on the results of this study, it can be concluded that the average menarche age of students at MTsS Babun Najah is 11.5 years old (which is classified as normal) with majority of students' physical activity is classified as vigorous physical activity and there is no relationship between physical activity and the age of menarche in MTsS Babun Najah. Most of students' Body Mass Index were at normal BMI (63.4%) and there is a relationship between body mass index with the age of menarche to students at MTsS Babun Najah. There is no interaction between physical activities and body mass index with the age of menarche to students at MTsS Babun Najah.

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