

(RESEARCH ARTICLE)



Overweight and Age of Menarche in Early Adolescents

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Abstract

Background: Overweight has become a global epidemic, particularly in Indonesia. The prevalence of overweight in elementary school children continues to rise every year, posing a pressing health concern that requires immediate attention. Epidemiological studies reveal that the age of menarche is decreasing globally. This phenomenon reflects improvements in nutrition and overall health. Additionally, it is a consequence of changes in socio-economic circumstances and human lifestyle. This study aimed to investigate the relationship between overweight and the age of menarche in early adolescent.

Methods: The study was analytical observation with a Cross-Sectional research approach conducted at Islamic Elementary School 1 Malang city, with data collection taking place from February to March 2023. The research population consisted of 42 overweight adolescents, and a total sampling technique was utilized. The variables under investigation are the age at which adolescents first experience menarche and the body weight of adolescents. Data was analyzed using the Spearman Rank correlation test.

Results: The result of Spearman Rank correlation test, yielded a p-value of 0.408 (>0.05) indicating that there was no significant relationship observed between overweight and the age of menarche among early adolescents at Madrasah Ibtidaiyah Negeri 1 in Malang City.

Conclusion: There is no significant relationship between overweight and the age of menarche among early adolescents. It is crucial to monitor balanced food intake to uphold a healthy nutritional status. Insufficient nutrition can impair both body and reproductive functions.

Keywords: Adolescents; Age of menarche; Lifestyle; Nutritional status; Overweight,

1. Introduction

Overweight and obesity have emerged as a global epidemic, particularly in Indonesia. Each year, the prevalence of overweight continues to rise, posing a significant health concern that demands immediate attention. Based on epidemiological studies indicate a global trend of earlier onset of menarche. This reduction in age is attributed to improved nutritional intake and overall health. According to the Indonesian Ministry of Health (2018), the average age of menarche in Indonesia has decreased from 14 years to 12,4 (Hartati, Farapti, and Isaura 2022). This change is attributed to shifts in socioeconomic conditions and alterations in human lifestyle (Nugraha, Relaksana, and Siregar 2021).

According to the survey conducted by the World Health Organization (WHO) in 2018, approximately 155 million children worldwide are overweight, with 30-45 million of them being obese. In Indonesia, among children aged 5-12

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years old, 18.8% are overweight, and 10.8% are obese (Ministry 2018). According to the Ministry of Health (2018), the prevalence of menarche in Indonesia is as follows: 60% experience it at 12.4 years old, 2.6% at 9-10 years old, and 30.3% at 13 years old. The remaining individuals experience menarche after the age of 13 years old (Hafidha 2020).

At the beginning of adolescence there is physical development followed by reproductive development characterized by menstruation or menarche in adolescent girls. In puberty, obesity often occurs. This is because during puberty there is an increase in body composition components, that is total body fat, body muscle mass and mineral content in bones (Tarigan 2023).

Nutritional factors related to age of menarche are nutritional status based on a measurable body mass index (BMI) that can be measured by weight and height. This because an increase in BMI can describe an increase in fat mass that stimulate the formation of leptin so that it can stimulate GnRH (gonadotropin releasing hormone) as a sign of reproductive maturity (Rahmananda and Sari 2020).

The difference of this study with other studies is, in this study the subjects studied at the age of early adolescence in elementary school so that age of menarche and weight are studied more accurately, where some other studies use middle adolescent subjects, so that menarche variables are recall and subject weight can be research deviations due to decrease or increase. Given the high prevalence of overweight and the decreasing age of menarche, this research aimed to investigate whether there is an association between being overweight and the age at which menarche occurs.

2. Material and methods

The type of research employed in this research was analytical observational research with a cross-sectional design. The subjects of this research were early adolescents who experienced overweight in the sixth grade of the 2022–2023 academic year and alumni from the 2021-2022 academic year at Islamic Elementary School 1 Malang city. The materials used include body weight scales, microtoise for height measurement, Z-Score charts, and questionnaire instrument. Obesity measurement was conducted by weighing body weight using a digital scale and measuring height using a microtoise, which were then entered into a Z-Score chart Body Mass Index for Age). Sample collection was carried out using a total sampling technique. The exclusion criteria for the samples included adolescents who were consuming doctor-prescribed steroid medications. Based on the slovin formula, the total number of samples that can represent the population is 45 adolescents. However, of the 45 adolescents, there were 3 adolescents who took steroid drugs, so they were excluded from the sample study. The sample size, adjusted for inclusion and exclusion criteria, consisted of 42 adolescent respondents. The research was conducted at Islamic Elementary School 1 Malang city from February to March 2023. This research utilized a questionnaire instrument that had undergone validity and reliability testing (Hidayat 2021). Measurement criteria were based on the Ministry of Health Regulation No. 2 of 2022. The classification threshold for Body Mass Index for Age (BMIA) for children aged 5-18 years was categorized as follows: very underweight (<-3SD), underweight (-3SD to <-2SD), normal (-2SD to +1SD), overweight (+1SD to +2SD), and obesity (>+2SD). This variable was measured on an interval scale. The menarche categories were as follows: early menarche if the respondent experiences menarche before the age of 11, normal menarche if it occurred between the ages of 11-13, and late menarche if it occurred after the age of 13, Menarche is also expressed in numerical form, 1 for not yet menstruating, 2 for early menarche, 3 for normal menarche and 4 for tarda menarche. This variable was measured on an ordinal scale (Zalni 2023). The statistical test employed in this research was the Spearman Rank correlation test. Data analysis was conducted using univariate and bivariate tests, specifically the Spearman Rank correlation test, with a significance level of 5% ($\alpha=0.05$). The data was presented in the form of frequency distribution tables and percentages. Prior to data collection for this research, respondents had signed informed consent, and the research had obtained ethical approval from the research ethics commission from Health Polytechnic of the Ministry of Health Malang, with approval number 427/V/KEPK POLKESMA/2023.

3. Results

Based on the assessment of research data conducted, the results of overweight adolescents are:

Of the 45 adolescents who were overweight, 20 adolescents had a BMI between 20-21.5, 14 adolescents had a BMI between 21.5-23, 6 adolescents had a BMI between 23-24.5 and 5 adolescents had a BMI between 24.5-26. 3 adolescents were excluded from the study because didn't fit the inclusion criteria.

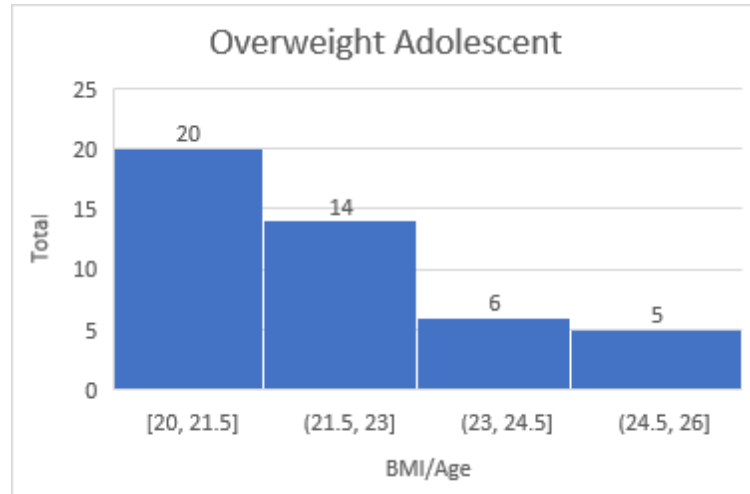


Figure 1 BMI/Age Overweight Adolescents

Based on Table 1 concerning the demographic characteristics of the respondents, the majority of adolescents (54.8%) had an early onset of menarche. Among overweight adolescents, the age at which their mothers experienced menarche was mostly within the normal range (66.7%). Furthermore, a significant proportion of the respondents (61.9%) had parents with a high income. Approximately half (47.6%) of the overweight adolescents engaged in moderate physical activity. Additionally, a substantial majority of adolescents (71.4%) frequently consumed pornographic content.

Table 1 Demographic Characteristics of Respondent

Demographic Characteristics	N	%
IMT Average	22,2	
Adolescent Menarche Age		
Early Menarche	23	54.8
Normal Menarche	16	38.1
Late Menarche	3	7.1
Mother's Menarche Age		
Normal Menarche	28	66.7
Late Menarche	13	33.3
Parent's Income		
Medium	16	38.1
High	26	61.9
Physical Activity		
Lightweight	8	19
Medium	20	47.6
High	14	33.3
Media Exposure		
Lightweight	12	28.6
Weight	36	71.4

Based on the normality test results, a p-value of ≥ 0.05 was obtained for the overweight variable, while a p-value of < 0.05 was obtained for the age of menarche variable. Consequently, it could be concluded that the distribution of the overweight variable was normal, while the distribution of the age of menarche variable was not normal. Therefore,

parametric correlation tests could not be employed in this research analysis. Instead, an alternative statistical test, the Spearman Rank Correlation test, could be utilized for data analysis.

Based on the results of the Spearman Rank Correlation Test, the significance value or Sig (2 tailed) was 0.408, which was greater than 0.05. This indicated that there was no significant relationship between overweight and the age of menarche. The correlation coefficient was 0.131, suggesting that the strength of the relationship (correlation) between overweight and the age of menarche was very weak. Furthermore, the correlation coefficient in these results was positive at 0.131, indicating a unidirectional (one-way) type of relationship between the two variables.

4. Discussion

Excess weight is not solely linked to the age at menarche, as it is influenced by various factors including lifestyle, environment, and genetics. The secretion of the fat-derived hormone leptin in women is one of the factors that stimulate the hypothalamus to increase the secretion of GnRH, which in turn activates the pituitary-ovary axis and initiates puberty. Overweight is not the primary factor determining the onset of menarche; it is also influenced by other factors such as genetics, social and economic environment, physical activity, and exposure to media. Consumption of steroid drugs from doctors has an immunosuppressive effect of steroids that cause infectious complications, on prednisone therapy 20 mg / day for more than 2 weeks at a cumulative dose of 700 mg. Steroid therapy increases the risk of becoming infected with bacteria, fungi and viruses. Systemic administration of steroids can also lead to weight gain, increased appetite, and sleep disorders (Aviana and Birawan 2021). This is the consideration of researchers to make steroid consumption as an exclusion criterion.

Elevated body weight leads to alterations in leptin levels, which in turn influence oocyte maturation, stimulate ovum maturation in the ovaries, and impact Gonadotropin-releasing Hormone (GnRH) production. Changes in Gonadotropin-releasing Hormone (GnRH) secretion result in fluctuations in the levels of Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH), which can subsequently affect the onset of menarche (Tarigan 2023). Increased body fat at birth or during early childhood, along with a rapid increase in body mass index (BMI), is indicative of an earlier onset of puberty (Roswendi and Damayanti 2023).

Secondary sexual development is influenced by hormones produced by the hypothalamus, pituitary and ovarian glands. One of the things that can affect the formation of hormones is nutritional status, where good nutritional status can accelerate the formation of hormones that affect menarche. This is due to the influence of body fat composition on the expenditure of GnRH which will trigger the onset of puberty and menarche.

Sexual maturity that occurs in adolescent girls is influenced by the presence of nutrients in the body so the age of early menarche can occur due to nutritional factors. Adolescents who experience early menarche have a higher body mass index (BMI) than adolescents who have a smaller BMI at the same age. Apart from nutritional factors, genetics is one of the factors that affect the slow or fast onset of menarche in adolescent girls, a mother who experiences early menarche age can pass on to her daughter. Reproductive organs in adolescents develop according to their biological function can be influenced by a diverse food intake, nutritious, balanced and fulfilled according to the nutritional adequacy rate (RDA) of adolescents. The acceleration and deceleration of the age of menarche in adolescent girls due to the role of consumption of macro nutrients in the form of fat, protein (animal and vegetable) and micronutrient intake in the form of calcium and fiber.

According to the research's outcomes, the age at which overweight adolescents' mothers experienced menarche mostly fell within the normal range (66.7%). Rapid onset of menarche in adolescent girls tends to align with the menarche age of their mothers or sisters (Roswendi and Damayanti 2023). The age at which a mother experiences menarche can impact the growth and development of her child because the genetic locus responsible for regulating estrogen hormones may be inherited by her child. Nevertheless, other factors like family environment, lifestyle, and technological advancements can also influence the onset of menarche in children (Aviana and Birawan 2021).

According to the research's outcomes, the majority (61.9%) of the respondents' parents had high incomes. Individuals with middle to upper economic status find it easier to access animal protein and saturated fat. However, a poor economic status can adversely affect nutritional status as it may not adequately meet their nutritional requirements (Lazzeri et al. 2018). High parental income leads to changes in the modern lifestyles, purchasing power, and consumption patterns of children. The rise of fast-food restaurants and the availability of high-calorie, high-fat, high-sugar, and high-sodium snacks for children at school, added with low micronutrient content, have nutritional implications for sexual maturity. Nutrient influences sexual maturity by impacting the secretion of GnRH and the response to LH, which in turn affect

estrogen and progesterone secretion in the ovaries, potentially leading to an earlier onset of puberty (Fathin, Ardiaria, and Fitranti 2017).

Socioeconomics is also a contributing factor to stress. Stress is a psychological response that occurs when facing demands or pressures that do not align with one's expectations, whether those expectations are self-imposed, parental, or external. If these pressures are not effectively managed, they can lead to stress, which can in turn disrupt the reproductive system (Oktaviani and Wisnusakti 2023). Stress leads to the suppression of hormones such as GnRH, FSH, and LH, which can result in ovulation failure (Fauziah Botutihe and Hapsan 2022). The body's response to stress impacts various hormone levels and metabolic processes in the body, including the function of the hypothalamus, which regulates the thyroid gland, adrenal glands, and ovaries working in conjunction to manage hormones. Consequently, ovarian dysfunction can play a pivotal role in issues related to estrogen production, ovulation, and other reproductive processes, including the onset of menarche and alterations in the menstrual cycle (Irshad, Aijaz, and Husain 2022). Respondent stress is an academic stress that arises due to students' perception of some knowledge that must be mastered in a certain period and is also related to their learning activities. The tension that students feel can affect physical, emotional, and behavioral. Academic stress can also be caused by academic stressors in the teaching and learning process or matters related to learning activities. For example, the pressure to move up, the length of study, anxiety about exams, the number of tasks to be completed, getting bad test scores, complicated bureaucracy, decisions to determine majors and careers, and time management (Bahrodin and Widiyati 2021).

Based on the research's outcomes, nearly half (47.6%) of overweight adolescents engage in moderate physical activity. Physical activity involves body movements that increase energy expenditure and calorie burning (Deviliawati and Sayati 2023). Overweight is the consequence of excessive and continuous calorie intake without a balanced level of physical activity, leading to the accumulation of fat reserves (Deviliawati and Sayati 2023).

Physical activity also influences the age at which menarche occurs. Engaging in sufficient and regular physical activity can enhance muscle strength and is closely associated with sexual maturity (Napitululu, Hubaybah, and Halim 2018). Excessive physical activity and insufficient food intake can postpone the onset of menarche due to reduced progesterone production, which delays endometrial maturation. Fatigue and loss of appetite may occur when engaging in strenuous physical activity without a proper diet, leading to weight loss. A significant reduction in body fat can result in a decreased metabolic rate and estrogen production, potentially causing amenorrhea (Fitra hayati 2019). The importance of providing education that individuals with excess body weight may lead to the development of future diseases (Ayumaruti 2022).

According to the research's outcomes, a majority of adolescents (71.4%) frequently consume pornographic content. These behaviors may contribute to the early onset of menarche. Stimuli received through the eyes and ears are transmitted to the hypothalamus, which then triggers the release of GnRH. GnRH stimulates the anterior pituitary gland via the portal system, leading to the secretion of FSH and LH. These hormones, in turn, stimulate the ovaries to produce estrogen and release the ovum. Within the breast glands, there are receptors for estrogen, which can induce breast growth and contribute to secondary sexual characteristics such as increased hair growth, hip and buttock enlargement, vulvar development, and endometrial development in the uterus. Due to ongoing technological advancements, information can be readily accessed through various forms of audio-visual media. This leads to adolescents developing detrimental habits, such as watching shows that are not age-appropriate and accessing pornographic content via their mobile phones on the internet (Karmila and Perbata 2022). The exposure to mass media is indirectly associated with the acceleration of puberty in teenagers, leading to the early onset of menarche in adolescent girls (Pesa 2020). Adolescents who are exposed to pornography represent a significant issue that can lead to an escalation in the number of adolescents engaging in sexually active behavior and displaying deviant sexual conduct (Yazia 2019).

The factors that can influence both *overweight* and *menarche* are comparable. These two factors have a reciprocal interaction. The results of the correlation coefficient test conducted on these variables indicate a positive correlation, implying that as an adolescent's body becomes heavier or experiences *overweight*, the onset of menarche will happen sooner. This demonstrates a positive relationship between overweight and the age of *menarche*, albeit the association is relatively weak.

The limitation of the study are not controlling for other factors that may influence *menarche* age, such as genetic factors, socio-economic environment, physical activity, and media exposure, the questionnaire completion relies on recall, potentially leading to difficulties in recall for respondents, which could introduce bias into the research and the sample size utilized in this research is limited, and a larger sample size could result in differences in research outcomes. The population in this research is restricted to the *Overweight* category, and a more comprehensive categorization based on Body Mass Index could yield different research outcomes.

5. Conclusion

In conclusion, there is no significant correlation between *overweight* adolescents and the age of *menarche*. However, there is a linear relationship between the age of menarche and overweight, contributing to a reduction in the average age at menarche due to excess body weight. Factors influencing overweight and menarche share similarities. Both factors interact with each other. Excess body weight is not the primary factor causing early *menarche*; instead, overweight interacts with genetic, environmental, and daily lifestyle factors.

Compliance with ethical standards

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Disclosure of conflict of interest

No potential conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study. Using written informed consent that contains the risk and benefit of research, data use dan data confidentiality.

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