



Determinant Factors of Early Menarche among Primary School Girls

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<p>Track Record Article</p> <p>Revised: 28 December 2025 Accepted: 6 February 2026 Published: 31 March 2026</p> <p>How to cite : Firdawati, Rahmatias, F., Abdiana, & Fitria, H. (2026). Determinant Factors of Early Menarche among Primary School Girls. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i>, 8(1), 226–237.</p>	<p style="text-align: center;">Abstract</p> <p><i>Early menarche, defined as the onset of menstruation before the age of twelve, has been linked to adverse physical and mental health outcomes and is a key predictor of rapid pubertal growth. Although data at the elementary school level in Indonesia remain limited, recent findings suggest a rising prevalence of early menarche in urban areas. This study provides local evidence from an urban school in Padang City, where early menarche appears to be increasing. This research examined associations between early menarche among elementary school girls in Public Elementary School (SDN) 03 Alai Timur, Padang City, and factors including nutritional status, maternal age at menarche, and exposure to mass media information technology. Statistical analyses were conducted using the Chi-square test and the Fisher Exact Test, with a significance level of $p < 0.05$. Results showed that three-quarters of the participants experienced early menarche. Overweight-obese nutritional status was significantly associated with higher rates of early menarche (95.2%; $p=0.011$), as was high exposure to mass media information technology (88.9%; $p=0.020$). Although not statistically significant ($p=0.071$), girls whose mothers had experienced early menarche also showed higher rates (90.0%). Overall, early menarche was strongly associated with nutritional status and media exposure, while maternal age at menarche demonstrated a non-significant intergenerational effect. The findings highlight the need for schools to implement programs that educate young girls on proper nutrition, responsible media consumption, and reproductive health from an early age.</i></p> <p>Keywords: <i>Early Menarche, Elementary School Students, Nutritional Status, Maternal Menarche History, Mass Media Exposure.</i></p>
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INTRODUCTION

Menstruation is a natural physiological process that marks the onset of puberty in females. Menarche, the first menstrual period, signifies the full maturation of the reproductive organs and typically occurs between the ages of 12 and 15, as noted by UNICEF (2017). However, research indicates that the prevalence of menarche before age 12 has increased over the past three decades (Malitha et al. 2020; Njoku et al. 2025). Early menarche requires attention, as it is influenced by a combination of biological, nutritional, environmental, and psychosocial factors that can affect women's reproductive health throughout their lives. According to the Indonesian Health Survey (2023), 4.6% of girls experienced menarche between ages 9 and 10, 34.1% between ages 11 and 12; 27.2% reached between ages 13 and 14, and only 0.3% between ages 17 and 18. Data from the Ministry of Health of the Republic of Indonesia (2020) further show that in West Sumatra Province, 2.8% of girls had early

menarche, predominantly among urban populations. Supporting this trend, Trisnadewi et al. (2022) reported that 58.8% of adolescent girls at 15 State Junior High Schools in Padang experienced early menarche (50 respondents), while 41.2% (35 respondents) did not. These findings suggest that the girls in urban areas of West Sumatra tend to experience puberty earlier than their rural counterparts. The determinants of early menarche are multifaceted. Kholifah (2024) identified maternal age at menarche as a genetic factor, noting that daughters of mothers who experienced early menarche are 2.16 times more likely to undergo the same condition compared to those whose mothers had menarche at a normal age. Genetic inheritance, particularly of estrogen receptor genes, influences the development of the hypothalamic-hipophysis-gonad (HPG) axis, which regulates the onset of puberty. Beyond genetics, behavioral and nutritional factors also play a significant role. The growing preference among children for fast foods contributes to obesity, which in turn elevates leptin and estrogen levels. Excessive hormone production accelerates reproductive organ maturation, leading to earlier menarche. Research further shows that overweight girls are at a substantially higher risk of experiencing early menarche compared to those with normal nutritional status, with odds ratios of 4.52 (Li Utari & Tridiyawati, 2023; Wang et al., 2025).

Another important determinant of early menarche is exposure to information technology and the mass media. Modern technology provides children with access to diverse content, including materials that are not age-appropriate. Audiovisual media, particularly sexual content, have the potential to influence the central nervous system, stimulating the production of gonadotropin hormones and accelerating the development of reproductive organs (Agustin et al., 2021). Agustin further noted that media consumption can be linked to earlier onset of menarche in girls, suggesting that excessive or inappropriate exposure may contribute to premature pubertal development.

Early menarche is associated with a range of adverse health consequences. Girls who experience menarche before the age of 12 are at a greater risk of developing metabolic disorders, obesity, cardiovascular disease, and breast cancer later in life. They are also more vulnerable to anxiety, depression, and risky behaviors such as premarital sex, which may lead to a teenage pregnancy. Many children struggle to cope with the physical changes of puberty because they are mentally unprepared and lack adequate education on reproductive health (Putri et al., 2022). Indonesian researchers have examined nutritional, genetic, and psychosocial factors influencing menarche, but most studies have focused on adolescents at junior and senior high school levels, leaving gaps in understanding the full spectrum of biological, nutritional, and environmental impacts. Evidence concerning primary school

students in West Sumatra, particularly in Padang City, remains limited. Given the rising prevalence of early menarche and its detrimental consequences, further research is needed to identify contributing factors among younger children in specific local contexts. This study aimed to examine the association between nutritional status, maternal age at menarche, and exposure to mass media information technology with the occurrence of early menarche among elementary school girls at Public Elementary School (SDN) 03 Alai Timur, Padang City.

METHODS

The study employed a quantitative cross-sectional design and was conducted at Public Elementary School (SDN) 03 Alai Timur, Padang City, between May and June 2025. The initial sample consisted of 161 female students from grades IV, V, and VI. A convenience sampling strategy was used, followed by the application of inclusion and exclusion criteria. Eligible participants were schoolgirls aged 9–12 years who had already experienced menarche, with informed consent provided by parents or guardians. Students who had not yet attained menarche, those with chronic health conditions, those undergoing hormonal therapy, and those who did not complete the questionnaires were excluded. After applying these criteria, 42 respondents were included in the final analysis. The dependent variable was early menarche, defined as the onset of menstruation before age 12. Independent variables included nutritional status, maternal age at menarche, and exposure to mass media information technology. Data collection involved anthropometric measurements and structured questionnaires. Body weight and height were measured to calculate Body Mass Index (BMI), which was then converted to BMI-for-age indicators. Nutritional status was classified according to the WHO 2007 Growth Reference for children aged 5–18 years, as adopted by the Ministry of Health of Indonesia in Permenkes No. 2 Tahun 2020. Categories included underweight, normal weight, and overweight/obese.

The questionnaire consisted of four sections: respondent details, age at menarche, maternal history of menarche, exposure to mass media information technology, and supporting demographic information. Media exposure was assessed using a 10-item Likert-scale instrument that measured daily media use patterns, content accessed, and the types of devices utilized. The total media exposure score was categorized into low and high levels based on the median threshold. Before data collection, the questionnaire was tested for validity and reliability. Content validity was established through expert judgment, while internal consistency reliability was confirmed with a Cronbach's alpha coefficient of 0.82, indicating good reliability. Data processing included editing, coding, entry, and cleaning, followed by

computerized statistical analysis. Univariate analysis was conducted to describe variable distributions, while bivariate relationships were examined using the Chi-square test. When Chi-square assumptions were not met, Fisher's Exact Test was applied. Statistical significance was set at $p < 0.05$. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Andalas University. The study was conducted in accordance with ethical principles, ensuring informed consent, anonymity, and confidentiality of all participants.

RESULTS

Table 1. Characteristic Respondent Distribution

Variable	Statistic
Age at menarche (years)	Mean \pm SD: 10.8 ± 0.9 ; Median 11
Grade level	f (%)
Grade IV	9 (21.5%)
Grade V	19 (45.2%)
Grade VI	14 (33.3%)

Table 2. Univariate Distribution of Variable

No	Variable	Category	F (n = 42)	%
1.	Menarche	Early menarche	32	76.2
		Normal menarche	10	23.8
2.	Nutritional status	Underweight	11	26.2
		Normal	10	23.8
		Overweight	17	40.5
		Obesity	4	9.5
3.	History of Menarche Mother	Early menarche	20	47.6
		Normal menarche	22	52.4
4.	Exposure to mass media information technology	Low	15	35.7
		High	27	64.3

Table 3. Bivariate Analysis of Factors Related to Early Menarche

Variable	Category	Normal menarche		Early menarche		OR (95% CI)	p-value
		f	(%)	f	(%)		
Nutritional status	Underweight	4	36.4	7	63.6	1.75 (0.31-9.95)	0.011
	Normal	5	50.0	5	50.0		
	Overweight-obese	1	4.8	20	95.2		
Maternal menarche history	Normal	8	36.4	14	63.6	1.00	0.071
	Early	2	10.0	18	90.0	5.14 (0.94-28.4)	
Media exposure	Low	7	46.7	8	53.3	1.00	0.020
	High	3	11.1	24	88.9	7.00 (1.45-33.9)	

This section presents the results of the study conducted with 42 eligible students. Table 1 shows the distribution of respondents by age at menarche and grade level. Table 2 presents univariate data on nutritional status, maternal menarche history, and exposure to mass media

information technology. Table 3 displays the results of bivariate analyses examining the relationships between nutritional status, maternal menarche history, and media exposure with the occurrence of early menarche among elementary school girls.

DISCUSSION

Characteristic Respondent Distribution

As shown in Table 1, the average age of participants was 10.8 years ($SD = 0.9$), indicating that most respondents were in late childhood to early adolescence. The median age at menarche was 11.0 years, with a range of 9–11 years, confirming that the majority experienced an early onset of menstruation. Grade distribution revealed that the largest proportion of respondents were in grade V (45.2%), followed by grade VI (33.3%) and grade IV (21.5%). These findings suggest that early menarche was most prevalent among students in the upper elementary grades. This descriptive information provides essential background characteristics of the study population before conducting bivariate analyses

Factors Related to Early Menarche

Table 2 shows that the majority of students in the study experienced early menarche, with 32 respondents (76.2%) reporting onset before age 12, while 10 respondents (23.8%) reached menarche at the standard age. This proportion is considerably higher than national data from the Indonesian Health Survey, which reported 4.6% of girls reaching menarche between ages 9–10 and 34.1% between ages 11–12. Provincial-level SKI data also indicate lower rates of early menarche in West Sumatra compared to the findings of this study. These results provide important epidemiological insights for Padang City, where prior research has been limited. Nutritional status analysis revealed that overweight was the most common condition, affecting 40.5% of respondents, followed by underweight, normal weight, and obesity. Nearly half of the participants (47.6%) reported that their mothers had experienced early menarche, suggesting an even distribution of maternal menarche ages. In addition, the majority of students (64.3%) demonstrated high levels of mass media information technology usage.

The results indicate that the study site reported higher rates of early menarche compared to both national and provincial averages. The urban environment appears to contribute to this trend through dietary changes and reduced physical activity, reflecting contemporary lifestyle patterns. Trisnadewi et al. (2022) similarly found that urban settings are associated with increased rates of early puberty, as children in these environments tend to experience faster physical development. According to BMI-for-age classifications, 40.5% of respondents were overweight, 26.2% underweight, 23.8% of normal weight, and 9.5% obese. This distribution

highlights the double burden of malnutrition among school-aged children, with both undernutrition and overnutrition present, a pattern consistent with findings from previous Indonesian studies.

The results revealed a notable pattern of maternal history of early menarche, with 47.6% of respondents reporting that their mothers had experienced the condition. In addition, the majority of participants (64.3%) demonstrated high levels of exposure to mass media information technology. These findings align with social learning theory, which suggests that children acquire puberty-related beliefs and behaviors through repeated exposure to media content.

Relationship between Nutritional Status and The Early Menarche

The findings indicate that nutritional status is a key determinant of the timing of menarche among elementary school girls. Early menarche was most prevalent among students with overweight-obese nutritional status, with a rate of 95.2%, whereas menarche at a normal age was more common among underweight students (36.4%). The Chi-square test ($p = 0.011$) confirmed a statistically significant relationship between nutritional status and early menarche. Furthermore, the odds ratio of 20.0 (95% CI: 1.90–209.5) demonstrates that excess body weight is a strong risk factor for the premature onset of menstruation. Consistent with previous studies (Brix et al., 2021; Tang et al., 2022), overweight and obese girls were found to be at substantially greater risk of early menarche compared to those with normal nutritional status. This study supports the evidence that excessive body fat increases leptin and estrogen secretion, which stimulates the hypothalamic–pituitary–gonadal axis and accelerates the development of secondary sexual characteristics during puberty.

The high odds ratio observed in this study underscores nutritional status as a primary factor influencing the onset of puberty among school-aged girls. These findings are consistent with the results of Song et al. (2023) and Zhou et al. (2022) who reported that early menarche is most prevalent among girls with an overweight or obese nutritional status, while underweight girls tend to experience menarche at more typical ages. Interestingly, the current study revealed that the underweight group also faced an elevated risk of early menarche compared to the reference group (OR = 1.75; 95% CI: 0.31–9.95). This contrasts with prior studies, such as Brix et al. (2021) which found that underweight individuals were less likely to experience early menarche. Such variations may be attributed to differences in study populations, definitions of early menarche, and uncontrolled social or environmental factors. Early menarche can arise through multiple pathways, including dietary and physical activity patterns in underweight children, as well as psychological stress, which may act as a key determinant of pubertal timing.

The findings of this study reinforce global evidence that excess body weight during childhood is strongly associated with earlier pubertal development (Zhou et al., 2022; Duan et al., 2021). Large-scale cohort and longitudinal studies have consistently demonstrated that higher childhood body mass index (BMI) is linked to younger ages at menarche, establishing a clear dose–response relationship (Brix et al., 2021; Tang et al., 2022). Maintaining appropriate nutritional levels from childhood onward is therefore a critical strategy for protecting against reproductive health problems and metabolic disorders associated with early menarche. Current research also suggests that excess body fat in undernourished populations contributes to earlier menarche compared to past findings, when undernutrition was more strongly associated with delayed pubertal development. The present study confirms that overweight–obese nutritional status has a stronger association with early menarche than underweight status. Importantly, the relationship between nutritional status and menarche timing varies across regions and socioeconomic contexts, influenced by cultural practices, physical activity patterns, and environmental factors. Given its multifactorial nature, the phenomenon of early menarche requires comprehensive investigation to address the complex interplay of biological, nutritional, and psychosocial determinants.

Relationship between the Menarche History in the Mother and the Early Menarche

The bivariate analysis (Table 3) showed that the proportion of early menarche was higher among girls whose mothers had a history of early menarche (90.0%) compared to those whose mothers experienced menarche at a normal age (63.6%). Statistical testing using Fisher’s Exact Test indicated that this association did not reach conventional levels of significance ($p = 0.071$). However, the odds ratio of 5.14 (95% CI: 0.94–28.40) suggests a strong likelihood that girls are more prone to early menarche when their mothers also experienced it. This pattern highlights potential intergenerational effects on pubertal timing, warranting further investigation given the limited sample sizes in existing studies. Previous research has similarly demonstrated that daughters of mothers with early menarche are more likely to experience the condition themselves, supporting the possibility of a genetic link in the regulation of puberty onset (Wang et al., 2019).

The finding that 63.6% of girls whose mothers had normal-age menarche still experienced early menarche indicates that maternal history alone does not account for all factors influencing pubertal timing. While this study supports previous evidence that maternal age at menarche can predict daughters’ pubertal onset, it also emphasizes the role of non-genetic influences. Environmental and lifestyle factors, including high-fat dietary patterns, low physical activity, digital media exposure, and psychosocial stress, have been shown to

accelerate puberty even in the absence of strong genetic predisposition (Ellis, 2004; Shaul et al., 2024; Glass et al., 2022). These results suggest that the impact of maternal menarche history on menstrual cycle development today is more closely intertwined with current environmental conditions than in the past.

The findings of this study did not reach statistical significance, consistent with Ellis & Garber (2000), who noted that small sample sizes often limit the ability to detect meaningful associations between maternal menarche history and daughters' pubertal timing. Nevertheless, previous research has reported biologically significant links, with odds ratio coefficients suggesting that maternal pubertal timing influences daughters' age at menarche (Kholifah, 2024). Family-based and genomic studies further support this relationship, demonstrating genetic and epigenetic regulation of the hypothalamic–pituitary–gonadal axis (Ellis et al., 2022). However, factors such as body mass index and environmental exposures have been shown to weaken this association in longitudinal studies (Shaul et al., 2024). The high proportion of girls experiencing early menarche despite mothers having normal-age menarche underscores the growing importance of non-genetic influences (Duan et al., 2021). Recent evidence highlights nutritional transitions, sedentary lifestyles, increased screen time, and psychosocial stress as key drivers of pubertal development in individuals without strong genetic predisposition (Deardorff et al., 2022; Niiranen et al., 2024). While maternal history remains an important predictor of pubertal timing, its impact is increasingly moderated by daughters' nutritional intake and physical activity patterns (Kholifah, 2024).

The results of this study suggest that maternal menarche history influences daughters' pubertal timing, but it should not be regarded as the sole determinant of their development. Two primary limitations must be acknowledged: the relatively small sample size and the cross-sectional design, which restrict the ability to establish direct cause-and-effect relationships. Nonetheless, the consistently high odds ratio observed, together with findings from national and international research, underscores the importance of considering intergenerational factors alongside environmental influences when examining menarche timing among school-aged girls.

Relationship of Exposure to Mass Media Information Technology with Early Menarche

The bivariate analysis (Table 3) revealed that respondents with high levels of mass media information technology exposure experienced early menarche at substantially higher rates than those with low exposure. Among the high-exposure group, 24 students (88.9%) reported early menarche, compared to only 8 students (53.3%) in the low-exposure group. Conversely, normal-age menarche was more common among students with low media

exposure (46.7%) than those with high exposure (11.1%). Statistical testing confirmed a significant association, with risk analysis showing that students with high media exposure were seven times more likely to experience early menarche than those with low exposure (OR = 7.00; 95% CI: 1.45–33.9). These findings suggest that mass media exposure functions as a critical behavioral factor accelerating pubertal development in primary school girls. Heavy media use has been linked to negative impacts on both mental health and the biological mechanisms regulating puberty. The relationship can be explained through biological and psychosocial pathways: emotionally charged or sexualized media content may activate the hypothalamic–pituitary–gonadal (HPG) axis, stimulating gonadotropin-releasing hormone (GnRH) and subsequently increasing follicle-stimulating hormone (FSH), luteinizing hormone (LH), and estrogen production. This neurohormonal activation process, as noted by Duan et al. (2021), contributes to faster sexual maturation and earlier menarche. However, findings across studies vary, particularly when nutritional status, physical activity, and family environment are taken into account, highlighting the complex interplay of factors influencing pubertal timing.

The results of this study are consistent with earlier research showing that children in urban areas tend to experience menarche earlier when they have greater access to digital and traditional media. Specifically, girls who spend more time on screens and digital platforms were found to reach puberty at younger ages (Santhi et al., 2025). These findings highlight how modern behavioral patterns and technological advancements contribute to shifts in pubertal timing. However, this study also revealed that 53.3% of respondents with low media exposure experienced early menarche, indicating that media exposure alone cannot fully determine pubertal onset. This aligns with previous research emphasizing that media content quality, psychosocial stress, family dynamics, and levels of parental or school supervision are equally important factors influencing pubertal development (Ibitoye et al., 2017; Bigambo et al., 2023). Although prior studies often relied on self-reported measures of media exposure, which may introduce information bias regarding time spent and content consumed, the odds ratio findings in this study remain consistent with earlier evidence that mass media exposure is a significant risk factor contributing to earlier menarche.

These findings reveal that primary school girls who experience early menarche are more likely to have high levels of exposure to mass media content. The results emphasize the importance of promoting digital literacy and regulating media access across age groups. Strengthening parental and school supervision is also essential to support healthy pubertal development and help girls navigate this stage of growth in a balanced and informed manner.

CONCLUSION

The findings of this study indicate that primary school girls in the research setting are experiencing menarche at ages earlier than the national and provincial averages. This trend reflects shifts in nutritional habits, behavioral patterns, and environmental conditions within the urban community under investigation. Early adolescence is therefore a critical stage at which health professionals must monitor and promote reproductive health development. The study concludes that nutritional status is the most influential factor determining the age of menarche. Girls with excess body weight were found to experience menarche at significantly higher rates than those with normal or underweight status, supporting evidence that increased body fat accelerates puberty through heightened leptin and estrogen secretion, which stimulate the hypothalamic pituitary gonadal axis.

These results confirm that contemporary populations are more likely to experience earlier menarche due to overnutrition, contrasting with the long established association between undernutrition and delayed puberty. Although maternal age at menarche showed a tendency to be linked with daughters' pubertal timing, this association was not statistically significant, likely due to the small sample size. Nonetheless, the elevated odds ratio suggests a biologically meaningful trend. The study also found that high levels of mass media exposure were associated with earlier menarche, underscoring the influence of modern behavioral patterns. Overall, early menarche appears to result from a combination of nutritional, behavioral, and intergenerational factors. These findings provide valuable local data that support the need for integrated interventions promoting healthy diets, responsible media consumption, and early reproductive health education to foster optimal pubertal development among schoolgirls.

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