# REDUCING MENSTRUAL PAIN IN ADOLESCENTS: THE EFFECT OF DARK CHOCOLATE CONSUMPTION

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## Abstract

Primary dysmenorrhea is a common problem among adolescent girls and may negatively affect daily activities, emotional well-being, and academic performance. Various non-pharmacological approaches have been explored to manage menstrual pain with minimal side effects, including the consumption of dark chocolate, which contains magnesium and bioactive compounds associated with pain modulation and neuromuscular relaxation. However, evidence regarding structured dark chocolate consumption in early adolescent populations, particularly within school-based settings in semi-urban areas of Indonesia, remains limited, and optimal dosing schedules and implementation under nursing supervision have not been sufficiently explored. This study aimed to examine the effect of dark chocolate consumption on the reduction of primary dysmenorrhea pain intensity among adolescent girls. Methods: A pre-experimental study with a one-group pretest–posttest design was conducted among 30 seventh-grade female students who experienced primary dysmenorrhea. Participants consumed dark chocolate consumption with ≥70% cocoa content at a total dose of 30 grams per day, divided into three intakes per day, for two consecutive days during the first and second days of menstruation. Pain intensity was measured using a numerical rating scale before the first consumption (pretest) and after completion of the intervention (posttest). Data were analyzed using univariate analysis and the Wilcoxon signed-rank test to assess changes in pain intensity following the intervention. The findings demonstrated a statistically and clinically significant reduction in dysmenorrhea pain intensity within the study sample. The mean pain score decreased markedly from 6.13 prior to the intervention to 3.70 after dark chocolate consumption, reflecting a transition from moderate to mild pain levels among most participants. Wilcoxon signed-rank analysis confirmed that this reduction was significant ($p < 0.05$), indicating that the observed improvement represented a consistent and meaningful change across the sample rather than random variation. Dark chocolate consumption was associated with a significant reduction in primary dysmenorrhea pain among adolescent girls. These findings support the use of dark chocolate as a simple, acceptable, and low-risk non-pharmacological intervention.

**Keywords:** Dark chocolate; primary dysmenorrhea; menstrual pain; adolescents.

## INTRODUCTION

Primary dysmenorrhea is one of the most common reproductive health problems experienced by adolescent girls and frequently emerges during the early years following menarche. Globally, the prevalence of dysmenorrhea among adolescents ranges from 60% to 75%, with varying degrees of pain intensity (Brin, 2023). Data from the World Health Organization indicate that more than half of women of reproductive age experience menstrual pain, with higher prevalence reported among adolescents. In Indonesia, the prevalence of dysmenorrhea reaches 64.5%, and a substantial proportion of adolescents report moderate to severe pain requiring appropriate management (Brin, 2023). This epidemiological pattern highlights primary dysmenorrhea as a persistent and underaddressed adolescent health concern, particularly during the early post-menarche period, as emphasized in the document (Marmi & Riyadi, 2025a).

Among junior high school students, dysmenorrhea does not only cause physical discomfort but also adversely affects learning activities, school attendance, and psychological well-being. Menstrual pain that is inadequately managed may lead to decreased concentration, reduced academic engagement, and emotional disturbances such as irritability and anxiety (Azizah, Anggreini, & Prasetya, 2023). These conditions may ultimately interfere with adolescents' academic performance and participation in school-based activities.

Repeated or prolonged use of common analgesic medications for menstrual pain may be associated with undesirable side effects, including gastrointestinal disturbance, nausea, dizziness, and drowsiness, which can limit treatment tolerability and effectiveness in adolescent populations. Studies of analgesic use report nausea and sedation as predictable adverse effects, particularly with opioid-based pain relievers, and similar systemic symptoms may also accompany non-opioid analgesic use (Barnes & Heppenstall-Harris, G., Dickman, 2025). Consequently, there is a growing need for safe, acceptable, and non-pharmacological alternatives that are suitable for adolescents.

One non-pharmacological approach that has gained increasing attention is the consumption of dark chocolate. Dark chocolate contains magnesium, flavonoids, and various bioactive compounds that may contribute to pain modulation and mood enhancement through the stimulation of endorphin and serotonin release (Asih, Yuviska, & Astriana, 2020; Chaliani, Afrina, & Kamillah, 2024). Previous studies have reported that dark chocolate consumption can significantly reduce the intensity of primary dysmenorrhea without notable adverse effects (Ferina, Hadianti, & Fatimah, 2023; Nuha, Rusmil, Ganiem, Permadi, & Diah Herawati, 2023).

Despite the growing body of evidence highlighting the potential benefits of dark chocolate in alleviating menstrual pain, empirical studies focusing on junior high school adolescents in semi-urban areas of Indonesia remain scarce. Subang Regency represents a context where adolescent reproductive health concerns intersect with limited exposure to non-pharmacological pain management strategies within the school setting. Preliminary observations indicated that the majority of female students experiencing dysmenorrhea had not previously considered dark chocolate as a coping option, and many reported difficulties maintaining concentration and participation in learning activities during menstruation. This contextual gap underscores the relevance of exploring accessible and culturally acceptable interventions within this population.

Therefore, this study aimed to analyze the effect of dark chocolate consumption on reducing the intensity of primary dysmenorrhea among seventh-grade female students.

**METHODS**

This study employed a pre-experimental design using a one-group pretest–posttest approach, which was selected to allow preliminary evaluation of changes in dysmenorrhea pain intensity before and after the intervention within a natural school setting. This design is considered appropriate for exploratory studies aimed at assessing the initial effectiveness of a non-pharmacological intervention when randomization and the inclusion of a control group are not feasible due to ethical and practical constraints (Polit & Beck, 2021). The study was conducted at junior high school during the 2025 academic year. By comparing participants' pain intensity before and after the intervention, this design enables the detection of short-term intervention effects while minimizing disruption to routine school activities.

The study population consisted of all seventh-grade female students at junior high school, totaling 175 students. Based on preliminary screening, 87 students reported experiencing dysmenorrhea. From this population, 30 students were selected as study participants using purposive sampling, in accordance with predefined inclusion and exclusion criteria.

The inclusion criteria were as follows: (1) seventh-grade female students experiencing primary dysmenorrhea, (2) willingness to participate in the study with written informed consent obtained from parents or legal guardians, and (3) not consuming analgesic medications or other pain-relief therapies during the study period. Of the students initially screened, only 30 met all inclusion criteria and agreed to participate, while the remaining

students were excluded primarily due to the use of analgesic medications during menstruation or the presence of exclusion criteria. The exclusion criteria included a history of reproductive system disorders, known allergy to chocolate, or other medical conditions that could influence pain perception. A history of chocolate allergy was positioned as an exclusion rather than an inclusion criterion to ensure participant safety during the intervention, as the absence of allergy was verified during the screening process. Students who reported regular analgesic use were excluded to avoid potential confounding effects on pain intensity outcomes.

The intervention consisted of dark chocolate with a cocoa content of at least 70%, administered at a dose of 30 grams per day. The selection of 70% cocoa and a daily dose of 30 grams was based on previous studies indicating that high-cocoa dark chocolate can effectively reduce menstrual pain due to its flavonoid content and anti-inflammatory properties (Buitrago-Lopez et al., 2011; Nuha et al., 2023). The daily dose was divided into three equal portions and administered three times per day over two consecutive days (the first and second days of menstruation), resulting in six administrations per participant during the intervention period.

The chocolate used was Roman Merk, chosen for its standardized cocoa content, availability in local markets, and palatability among adolescents. The dark chocolate was consumed during the first and second days of menstruation. Participants did not menstruate simultaneously; therefore, the intervention was scheduled individually according to each student's menstrual cycle.

Chocolate consumption was conducted at school under supervision to ensure adherence and accurate dosing. The three daily administrations were scheduled at approximately 08:00 AM, 12:00 PM, and 04:00 PM. These time points were selected to maintain relatively stable exposure to the intervention throughout the day while aligning with school routines and minimizing interference with academic activities. The morning dose was consumed before the first lesson, the midday dose during the lunch break, and the afternoon dose after formal classroom activities had ended.

Participants consumed the chocolate individually in a designated private area within the school to maintain comfort, privacy, and focus during consumption. This arrangement prevented peer influence and ensured that each participant received the full assigned dose without distraction.

The intervention was facilitated by a registered nurse, whose role included participant

education regarding the purpose and safe consumption of the intervention, supervision of chocolate intake, monitoring for potential adverse reactions, and documentation of adherence. The nurse also provided supportive care and reassurance to participants during menstruation, consistent with the principles of school-based nursing and holistic adolescent health care.

Dysmenorrhea pain intensity was measured using the Numeric Rating Scale (NRS) ranging from 0 to 10, where 0 indicates no pain and 10 indicates the most severe pain. The pretest measurement was performed on the first day of menstruation prior to the initial administration of dark chocolate, while the posttest measurement was conducted after completion of the two-day intervention period, following the final chocolate consumption on the second day of menstruation. Because participants experienced menstruation at different times, pain assessments were scheduled individually according to each participant's menstrual cycle rather than conducted simultaneously.

Data analysis included univariate analysis to describe participant characteristics and pain intensity. Individual NRS scores obtained during the pretest and posttest were recorded as numerical values and subsequently summarized using descriptive statistics. Mean and standard deviation were calculated to represent the average pain intensity before and after the intervention, allowing for comparison of overall changes in dysmenorrhea severity at the group level.

Bivariate analysis was conducted using the Wilcoxon signed-rank test to assess differences in pain scores before and after the intervention. This non-parametric test was selected because the NRS produces ordinal data and the sample size was relatively small, making it appropriate for comparing paired measurements that may not meet the assumptions of normal distribution.

All research procedures were conducted in accordance with ethical principles, including voluntary participation, confidentiality, and informed consent from participants and their parents or guardians. Ethical approval for this study was obtained from the Research Ethics Committee of Universitas YPIB Majalengka, Indonesia, with approval number No. 004481/Universitas YPIB Majalengka/2025.

## RESULTS

### Characteristics of Study Participants

The study participants (Table 1) consisted entirely of early adolescent girls aged 12–13 years, representing seventh-grade students in the early post-menarche period, a developmental stage

commonly associated with a higher prevalence of primary dysmenorrhea. More than half of the respondents experienced menarche at the age of 12 years, and nearly one-third at ≤11 years, indicating relatively early menarche among participants. Early menarche has been linked to hormonal immaturity and increased prostaglandin activity, which may intensify uterine contractions and pain perception during menstruation. Most participants reported a menstrual duration of five to six days, reflecting a normal menstrual pattern but with potential for sustained discomfort during the menstrual period.

At baseline, the majority of respondents experienced moderate dysmenorrhea, while almost one-third reported severe pain intensity, highlighting the clinical relevance of menstrual pain in this population and its potential impact on daily functioning and school activities. Importantly, none of the participants reported prior use of analgesic medications during menstruation, minimizing pharmacological confounding and allowing a clearer assessment of the effect of dark chocolate consumption on pain intensity. Overall, these characteristics indicate a relatively homogeneous group of early adolescents with clinically significant primary dysmenorrhea, making them an appropriate population for evaluating a school-based, non-pharmacological intervention.

**Table 1. Characteristics of Study Participants (n = 30)**

| Characteristic | Category | n | % |
|---|---|---|---|
| **Age (years)** | 12 | 14 | 46.7 |
| | 13 | 16 | 53.3 |
| **Age at menarche (years)** | ≤11 | 9 | 30.0 |
| | 12 | 17 | 56.7 |
| | ≥13 | 4 | 13.3 |
| **Duration of menstruation (days)** | 3–4 days | 11 | 36.7 |
| | 5–6 days | 19 | 63.3 |
| **Baseline dysmenorrhea intensity (NRS)** | Moderate (4–6) | 21 | 70.0 |
| | Severe (7–10) | 9 | 30.0 |
| **Previous analgesic use for dysmenorrhea** | Yes | 0 | 0 |
| | No | 30 | 100 |

*Primary research data, 2025.*

**Changes in Dysmenorrhea Pain Intensity Before and After Dark Chocolate Consumption**

Descriptive analysis demonstrated a noticeable reduction in dysmenorrhea pain intensity following dark chocolate consumption among the participants. Prior to the intervention, students reported moderate pain levels. After the intervention, pain intensity decreased to a mild level in most participants (Table 2).

**Table 2. Dysmenorrhea Pain Scores Before and After Dark Chocolate Consumption (n = 30)**

| Pain Assessment Time | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Before intervention | 6.13 | 1.04 | 5.00 | 8.00 |
| After intervention | 3.70 | 0.75 | 2.00 | 5.00 |

Primary research data, 2025.

These findings indicate a consistent reduction in pain scores after the intervention, suggesting an improvement in menstrual pain intensity following dark chocolate consumption.

**Normality Test of Pain Score Data**

The Shapiro–Wilk normality test showed that pain score data were not normally distributed both before and after the intervention ($p < 0.001$). Based on this result, a non-parametric statistical approach was deemed appropriate for further analysis (Table 3).

As presented in Table 3, the Shapiro–Wilk test statistics for pain scores before and after the intervention were below the threshold indicating normal distribution, and the corresponding p-values were less than 0.05. This finding suggests that the distribution of dysmenorrhea pain scores among participants deviated from normality, both prior to and following the intervention. Consequently, the use of a non-parametric test for comparing pretest and posttest pain scores was justified.

**Table 3. Shapiro–Wilk Normality Test Results**

| Variable | Statistic | df | p-value |
|---|---|---|---|
| Pain score before intervention | 0.850 | 30 | < 0.001 |
| Pain score after intervention | 0.849 | 30 | < 0.001 |

Primary research data, 2025.

Effect of Dark Chocolate on Dysmenorrhea Pain Intensity

The Wilcoxon signed-rank test revealed a statistically significant difference in dysmenorrhea pain intensity before and after dark chocolate consumption ($p < 0.05$). All participants experienced a decrease in pain scores following the intervention, with no cases of increased pain or unchanged scores (Table 4).

**Table 4. Wilcoxon Signed-Rank Test Results for Dysmenorrhea Pain Scores**

| Comparison | Negative Ranks (n) | Mean Rank | Sum of Ranks | Positive Ranks (n) | Ties | p-value |
|---|---|---|---|---|---|---|
| Posttest - Pretest | 30 | 15.50 | 465.00 | 0 | 0 | < 0.001 |

Primary research data, 2025

These results indicate a statistically significant reduction in dysmenorrhea pain intensity following dark chocolate consumption among seventh-grade female students.

## DISCUSSION

### Effect of Dark Chocolate Consumption on Dysmenorrhea Intensity among Junior High School Girls

The present study demonstrates a meaningful reduction in primary dysmenorrhea intensity following dark chocolate consumption among seventh-grade students. This finding supports the growing body of evidence that non-pharmacological, nutrition-based interventions may effectively alleviate menstrual pain in adolescent populations (Ferina et al., 2023; Nuha et al., 2023).

In this study, dark chocolate with a cocoa content of at least 70% was administered at a total dose of 30 grams per day, divided into three intakes, during the first and second days of menstruation. Pain intensity was assessed prior to the initial consumption on the first day of menstruation and again after completion of the two-day intervention period. This timing was chosen to capture changes in pain intensity during the early menstrual phase, when dysmenorrhea symptoms are typically most pronounced. The observed reduction in pain scores suggests that repeated intake of dark chocolate during this critical period may enhance its analgesic effect.

effectiveness of dark chocolate in this study can be explained through a combination of physiological and developmental mechanisms. Early adolescence, particularly the years immediately following menarche, is characterized by hormonal immaturity and heightened prostaglandin activity, which increases uterine contractility and pain sensitivity. Magnesium contained in dark chocolate has been shown to reduce smooth muscle contraction and neuromuscular excitability, thereby lowering menstrual pain intensity (Diamanti & Facchinetti, 2020; Mazza et al., 2025). Additionally, Flavonoids present in cocoa have been shown to improve uterine (uteroplacental) blood flow, as evidenced by decreased uterine artery pulsatility indices following consumption of flavonoid-rich chocolate in pregnant women, indicating enhanced hemodynamics. Moreover, cocoa flavonoids exert anti-inflammatory actions by reducing pro-inflammatory cytokines and inhibiting key inflammatory pathways such as NF-κB, COX-2 and iNOS. These combined vascular and anti-inflammatory effects may further contribute to modulation of pain responses (Feo et al., 2020; von Wowern & Olofsson, 2018).

The pain reduction observed in this study is consistent with previous findings conducted among adolescent and young female populations in Indonesia. Some study reported similar decreases in dysmenorrhea intensity following daily dark chocolate consumption during menstruation. The relatively greater pain reduction in junior high school students may be influenced by age-related psychological factors, including heightened emotional sensitivity and limited coping strategies for menstrual discomfort, which make palatable and comforting interventions particularly effective (Ferina et al., 2023; Harahap, Haslinah, & Pasaribu, 2023; Nuha et al., 2023).

However, the present study differs from earlier research in terms of administration pattern and setting. While previous studies generally applied a single daily dose, this study divided the daily intake into three scheduled administrations under supervision within a school environment. This approach may have improved adherence and maintained more stable exposure to the bioactive components of dark chocolate throughout the day, potentially contributing to the observed pain reduction. In addition, the focus on early adolescents distinguishes this study from prior research that predominantly involved late adolescents or university students, suggesting that developmental stage may influence responsiveness to nutrition-based interventions.

Beyond physiological mechanisms, psychological responses also play a critical role in pain perception. Dark chocolate is known to stimulate the release of endorphins and serotonin, neurotransmitters associated with mood regulation and natural analgesia (Asih et al., 2020; Safari, Hemmatinafar, Suzuki, Koushkie Jahromi, & Imanian, 2025; Ulya, Herlina, & Yunika, 2023). This psycho-neurobiological interaction is especially relevant in adolescents, whose pain experiences are strongly shaped by emotional state and expectancy. Similar patterns have been reported in adolescent behavioral health studies, where positive perception and motivation significantly influence health-related outcomes (Riyadi, Marmi, Madury, & Farid, 2025).

From a community nursing and midwifery perspective, these findings have important implications. Dysmenorrhea has been identified as a leading cause of school absenteeism and diminished educational performance among adolescent girls, affecting both attendance and concentration during academic activities (Sawyer, Fraser, Lawlor, Sharp, & Howe, 2025). Integrating dark chocolate consumption into school-based menstrual health education represents a feasible, culturally acceptable, and low-risk strategy to support adolescent well-being. This approach aligns with promotive and preventive care models in adolescent

reproductive health and reduces reliance on pharmacological analgesics, which may cause undesirable side effects.

Furthermore, evidence from Indonesian community-based nursing studies highlights the importance of combining physiological interventions with supportive educational approaches to enhance adolescents' self-care capacity and health behavior adaptation (Marmi & Riyadi, 2025a). Providing adolescents with simple, evidence-based alternatives empowers them to manage menstrual discomfort independently while fostering positive attitudes toward reproductive health.

Nevertheless, several limitations of this study should be acknowledged. First, the pre-experimental design without a control group limits causal inference, as changes in pain intensity cannot be solely attributed to the intervention. Second, the relatively small sample size and single-school setting may restrict the generalizability of the findings. Third, pain intensity was assessed using self-reported NRS scores, which are inherently subjective and may be influenced by individual perception. In addition, potential confounding factors such as dietary intake outside the intervention, stress levels, and physical activity were not controlled. Finally, the short duration of observation prevents conclusions regarding the long-term effectiveness of dark chocolate consumption across multiple menstrual cycles.

Despite these limitations, the present findings contribute valuable preliminary evidence supporting dark chocolate as a complementary, non-pharmacological option for managing primary dysmenorrhea in early adolescents. Future studies employing randomized controlled designs, larger and more diverse samples, and comparative interventions are recommended to clarify optimal dosage, timing, and long-term outcomes, as suggested in recent adolescent health research (Marmi & Riyadi, 2025b). Despite these limitations, the present findings contribute valuable preliminary evidence supporting dark chocolate as a complementary, non-pharmacological option for managing primary dysmenorrhea in early adolescents. Importantly, nurses play a critical role in the execution of this intervention, particularly in school and community health settings. Nurses can assess menstrual pain, provide evidence-based education on safe dark chocolate consumption, monitor adherence and potential adverse responses, and integrate this approach into promotive and preventive adolescent health programs. Through nurse-led health education and supportive care, this intervention may be implemented in a structured, ethical, and adolescent-centered manner, reinforcing the role of nurses as key agents in non-pharmacological pain management and menstrual health promotion.

## CONCLUSION

Dark chocolate consumption was associated with a significant reduction in the intensity of primary dysmenorrhea among seventh-grade adolescent girls. The observed decrease in pain scores before and after the intervention indicates that dark chocolate may be considered an effective and feasible non-pharmacological option for managing menstrual pain in adolescents. Based on these findings, it is recommended that school health nurses, community nurses, and adolescent health program coordinators consider incorporating dark chocolate consumption into menstrual health education and supportive care strategies as part of promotive and preventive services. Although the findings suggest a beneficial effect, further studies using controlled experimental designs are recommended to confirm causality and strengthen the evidence base.

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