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Effectiveness of Dark Chocolate Therapy in Reducing Primary Dysmenorrhea among Adolescents: Implications for Midwifery Education Practice

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ABSTRACT

Primary dysmenorrhea is a prevalent problem among adolescent girls, often leading to impaired school attendance and reduced academic performance. While pharmacological treatments exist, their side effects and limited accessibility have prompted interest in non-pharmacological alternatives. This study aimed to evaluate the effect of dark chocolate supplementation on the intensity of primary dysmenorrhea pain among female adolescents aged 12–15 years at SMP Negeri 1 Wagir, Malang. Employing a pre-experimental one-group pretest–posttest design, 34 students meeting strict inclusion criteria received 35g of dark chocolate (≥70% cocoa) daily for three days, with pain intensity assessed before and after the intervention using the Numeric Rating Scale (NRS). The results showed a marked reduction in menstrual pain: prior to intervention, 62% experienced mild, 35% moderate, and 3% severe pain, while post-intervention, 59% reported no pain and none remained in the severe category. The Wilcoxon signed-rank test confirmed a statistically significant decrease in pain scores ($p < 0.05$). In conclusion, dark chocolate supplementation significantly reduced primary dysmenorrhea pain in early adolescent girls. This research highlights the potential of dark chocolate as a safe, acceptable, and accessible non-pharmacological intervention suitable for integration into school health and midwifery education programs. Future studies should explore longer intervention periods, larger populations, and comparisons with other non-pharmacological therapies to optimize menstrual pain management strategies.

Keywords: adolescent girls, dark chocolate, dysmenorrhea, non-pharmacological intervention, pain management

INTRODUCTION

Adolescence is a critical period characterized by profound physical, emotional, and psychosocial changes, marking the transition from childhood to adulthood (Fhadila, 2018; Sulistiyah et al., 2024). For female adolescents, this transition is often accompanied by the onset of menarche and various reproductive health challenges, one of the most common being primary dysmenorrhea—defined as menstrual pain in the absence of identifiable pelvic pathology (Guimarães & Póvoa, 2020; Ju et al., 2014). Dysmenorrhea is experienced by 50–90% of women globally and is a leading cause of recurrent school absences and decreased academic performance among adolescent girls (Aboualsoltani et al., 2020; Armour et al., 2019; Salamah, 2019). In Indonesia, up to 65% of adolescent girls report experiencing primary dysmenorrhea, with 59.2% experiencing reduced activity and 5.6% missing school or work due to menstrual pain (Salamah, 2019; Meinawati & Malatuzzulfa, 2021). Preliminary studies in SMP Negeri 1 Wagir, Malang, showed that 23.75% of adolescent girls reported that dysmenorrhea significantly disturbed their learning activities. Primary dysmenorrhea is primarily caused by increased uterine prostaglandin production, leading to hypercontractility, reduced uterine blood flow, and subsequent pain (Potter & Perry, 2018; Dawood, 2006; Iacovides et al., 2015). Multiple risk factors contribute to its occurrence, including early menarche, family history, physical inactivity, and psychological factors (Potter & Perry, 2018;

Harel, 2006). The consequences of dysmenorrhea extend beyond physical discomfort, often resulting in decreased sleep quality, appetite, mood disturbances, impaired interpersonal relationships, and difficulty concentrating in school (Kazior, 2020; Yuliyani et al., 2022).

Despite being highly prevalent, dysmenorrhea remains underdiagnosed and undertreated, as many girls consider it a normal part of menstruation and may not seek medical intervention (Guimarães & Póvoa, 2020; Iacovides et al., 2015). Standard pharmacological treatments involve the use of nonsteroidal anti-inflammatory drugs (NSAIDs) such as mefenamic acid and ibuprofen, which inhibit prostaglandin synthesis and alleviate pain (Proctor & Farquhar, 2006; Morrow & Naumburg, 2009). However, NSAIDs can cause gastrointestinal side effects, are not recommended for long-term use, and may not be accessible or acceptable for all adolescents (Dawood, 2006; Dawood & Khan-Dawood, 2007). Consequently, there is increasing interest in non-pharmacological and complementary interventions for dysmenorrhea, including heat therapy, physical exercise, aromatherapy, and dietary modifications (Rahmaningtyas, 2022; Armour et al., 2019; Chen et al., 2020). One such promising intervention is the consumption of dark chocolate, which contains nutrients and bioactive compounds that may positively affect pain and mood.

Dark chocolate is rich in magnesium, flavonoids, and polyphenols, which are thought to provide anti-inflammatory, analgesic, and muscle-relaxing effects (Carolin et al., 2023; Asih et al., 2020; Batubara et al., 2016; Zhao et al., 2020). Magnesium, in particular, plays a crucial role in reducing muscle spasms, enhancing vasodilation, and modulating the nervous system's response to pain (Fauziah et al., 2019; Gokhale et al., 2021; Santanam et al., 2016). Moreover, dark chocolate stimulates the release of endorphins, natural analgesics produced by the brain that help alleviate pain and promote a sense of well-being (Asih, 2020; Smit et al., 2017). Research has shown that regular consumption of dark chocolate can elevate mood, decrease stress, and improve the quality of life among women with menstrual discomfort (Carolin et al., 2023; Bernaerts et al., 2012; Martín-Peláez et al., 2020). Recent local and international studies support the efficacy of dark chocolate in reducing menstrual pain. For instance, Lia et al. (2024) and Katili et al. (2024) demonstrated significant reductions in dysmenorrhea intensity among adolescent girls after the administration of dark chocolate. Similarly, Ilmiah et al. (2023) and Mulyatina et al. (2021) reported notable improvements in pain scores using standardized pain assessment tools after dark chocolate supplementation. These findings are consistent with global research highlighting dietary magnesium and flavonoid-rich foods as effective, low-risk options for menstrual pain management (Armour et al., 2019; Zhao et al., 2020; Chen et al., 2020; Gokhale et al., 2021).

Despite growing evidence, there is limited research focusing specifically on the impact of dark chocolate on primary dysmenorrhea among early adolescent girls (12–15 years) in Indonesia, especially in school-based settings (Meinawati & Malatuzzulfa, 2021; Lia et al., 2024). Many studies to date have focused on older adolescents or adult women, or have been conducted in clinical rather than educational environments (Armour et al., 2019; Proctor & Farquhar, 2006). Furthermore, most research has utilized relatively short intervention periods, with limited follow-up to assess sustained effects or optimal dosage (Zhao et al., 2020; Gokhale et al., 2021). There is also a need to integrate findings into practical health education for midwives, teachers, and students in Indonesia, to support non-pharmacological menstrual health interventions in schools.

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This study aims to analyze the effect of dark chocolate supplementation on primary dysmenorrhea pain intensity among female adolescents aged 12–15 years at SMP Negeri 1 Wagir, Malang. The novelty of this research lies in its focus on early adolescent girls within a school setting in Indonesia, employing a practical, non-pharmacological intervention that can be easily implemented in school health programs. To the best of our knowledge, this is among the first studies in East Java to specifically investigate dark chocolate as a dietary intervention for primary dysmenorrhea in a younger adolescent population. Based on the scientific evidence supporting the analgesic and muscle-relaxing properties of magnesium and flavonoids in dark chocolate (Carolin et al., 2023; Gokhale et al., 2021; Smit et al., 2017), it is hypothesized that regular consumption of dark chocolate during menstruation will significantly reduce the severity of primary dysmenorrhea pain compared to pre-intervention scores. The study is limited to female students aged 12–15 years experiencing primary dysmenorrhea at SMP Negeri 1 Wagir, Malang, using a pretest-posttest experimental design and standardized pain rating scales (Numeric Rating Scale, NRS).

METHOD

Research Design

This study utilized a pre-experimental design with a one-group pretest–posttest approach. The pretest–posttest model involves measuring the intensity of primary dysmenorrhea before and after the intervention—in this case, the administration of dark chocolate—to evaluate its effect on menstrual pain among adolescent girls (Armour et al., 2019; Creswell & Creswell, 2018). This design is widely used in clinical and school-based intervention studies for its simplicity and ability to detect within-group changes over time (Proctor & Farquhar, 2006).

Table 1. Study Flow

Step	Description
O1	Pretest: Measurement of dysmenorrhea pain before treatment
X	Intervention: Administration of dark chocolate
O2	Posttest: Measurement of dysmenorrhea pain after treatment

Note: O1 = Pre-intervention pain score (NRS); X = Dark chocolate administration; O2 = Post-intervention pain score (NRS)

Population and Sample

The population for this study comprised all female students aged 12–15 years who were experiencing primary dysmenorrhea at SMP Negeri 1 Wagir, Malang Regency. Based on preliminary screening, a total of 34 students were identified as the target population. The sampling method employed was total sampling, meaning that every eligible member of the population was included in the study. This approach was chosen due to the relatively small and clearly defined population, ensuring comprehensive representation and minimizing selection bias (Sugiyono, 2018; Polit & Beck, 2021). Consequently, 34 female students who met the eligibility criteria were enrolled as participants. The inclusion criteria required participants to be female students aged 12–15 years, to have experienced primary dysmenorrhea, to maintain regular menstrual cycles within the last three months (21–35 days), to report pain intensity

classified as mild to moderate on the Numeric Rating Scale (NRS 1–6), to have no known allergies to dark chocolate or its ingredients, to be free from chronic diseases or conditions that could affect the study outcomes, and to be willing to participate by providing signed informed consent and complying fully with the dark chocolate intervention protocol. Conversely, exclusion criteria consisted of a diagnosis of secondary dysmenorrhea (such as endometriosis or myoma), the presence of illnesses or conditions (e.g., diabetes, hormonal disorders) that could alter pain perception, the routine use of analgesics or other medications likely to confound the results, food allergies or intolerances (particularly to dark chocolate), failure to adhere to the intervention or data collection protocol, and pregnancy during the study period. The study was conducted at SMP Negeri 1 Wagir, Kecamatan Wagir, Kabupaten Malang, Indonesia, over a one-month period in February 2025.

Sample Size and Sampling Technique

The research was conducted at SMP Negeri 1 Wagir, located in Kecamatan Wagir, Kabupaten Malang, Indonesia. The study took place over the course of one month, specifically during February 2025. This timeframe was selected to ensure consistency in data collection and to accommodate the menstrual cycles of the participants, thereby enabling accurate measurement of changes before and after the intervention. The variables in this study, along with their operational definitions and measurement methods, were carefully determined to ensure clarity and reliability. The independent variable was the administration of dark chocolate, while the dependent variable was the intensity of primary dysmenorrhea pain experienced by the participants. Each variable was measured using standardized tools and defined operational criteria to facilitate objective data collection and analysis.

Table 2. Operational Definitions, Parameters, and Measurement Tools for Study Variables

Variable	Operational Definition	Parameter	Category/Score	Scale	Tool
Independent: Dark chocolate administration	Giving 35g dark chocolate (≥70% cocoa) daily for 3 days starting first day of menstruation	1x daily, morning (07:00)	-	-	SOP/protocol
Dependent: Primary dysmenorrhea pain	Lower abdominal pain measured before and	Numeric Rating Scale (NRS)	0: no pain, 1-3: mild, 4-6: moderate, 7-10: severe	Interval	Observation sheet, NRS questionnaire

Variable	Operational Definition	Parameter	Category/Score	Scale	Tool
	after intervention				

Data Collection Techniques and Procedures

Data for this study were collected using both primary and secondary sources. Primary data consisted of measuring dysmenorrhea pain intensity before and after the intervention with the Numeric Rating Scale (NRS), a validated tool for pain assessment (Hawker et al., 2011; Wang et al., 2019), as well as brief demographic interviews and structured screening questionnaires administered to all participants. Secondary data were obtained through a literature review, school health records, and other relevant documentation, providing context and supporting information for the research. To ensure comprehensive data collection, several research instruments were utilized. These included a demographic data sheet to record participants' basic information (such as name, age, class, contact, and address), a dysmenorrhea screening form to capture data on menarche age, menstrual cycle characteristics, relevant medical history, and informed consent, as well as an NRS questionnaire used for both pre- and post-intervention assessments of pain intensity. Additionally, an observation checklist was employed to monitor participant compliance with the intervention protocol and to document any adverse events that occurred during the study period. The data collection procedure began with the researchers obtaining formal administrative approval from university and school authorities. After securing this approval, eligible students and their guardians were informed about the study's objectives, benefits, risks, and procedures. Written informed consent was then obtained from both participants and their parents or guardians. The pre-test assessment was conducted on the first day of menstruation, where baseline pain intensity was measured using the NRS. For the intervention, each participant received 35 grams of dark chocolate containing at least 70% cocoa, administered every morning for three consecutive days starting from the first day of menstruation, with adherence and any adverse events carefully monitored by the researchers and the school nurse (Zhao et al., 2020). Post-test assessment took place two hours after the last chocolate intake on the third day, utilizing the same NRS instrument to evaluate any reduction in dysmenorrhea pain (Armour et al., 2019; Carolin et al., 2023). Throughout this process, researchers also conducted data validation through regular review and verification to ensure completeness and accuracy of the collected data.

Data Processing and Analysis

The data processing in this study followed several systematic steps to ensure the integrity and reliability of the results. Initially, editing was conducted to correct and verify all data entries, ensuring completeness and accuracy (Polit & Beck, 2021). Scoring was performed according to the Numeric Rating Scale (NRS) guidelines, with specific scores assigned to reflect reductions in pain or lack of change. Coding was applied to categorize the collected data, such as menarche age, menstrual cycle characteristics, and pain scores, to facilitate organized analysis. All validated data were then entered into SPSS version 16 for statistical processing.

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The data were subsequently tabulated to generate frequencies and descriptive statistics for demographic and pain variables. Cleaning procedures were undertaken to check for inconsistencies or outliers, guaranteeing the quality of the data before analysis. For data analysis, univariate analysis was first conducted to summarize the characteristics of the sample, including means, standard deviations, frequencies, and percentages for demographic variables and pain scores (Notoatmodjo, 2018; Wang et al., 2019). Bivariate analysis was then used to compare pre-test and post-test pain scores, employing the Wilcoxon signed-rank test due to the non-parametric distribution of the data (Armour et al., 2019; Proctor & Farquhar, 2006; Zhao et al., 2020). Statistical significance was determined at a threshold of $p < 0.05$, indicating a meaningful difference in pain intensity before and after the dark chocolate intervention.

Table 2. Operational Framework

Step	Description
Pre-test (O1)	Pain assessment before intervention (NRS)
Intervention (X)	Dark chocolate administration, 35g daily for 3 days
Post-test (O2)	Pain assessment after intervention (NRS)
Analysis	Wilcoxon signed-rank test ($p<0.05$ indicates significant difference)

Table 3. Inclusion and Exclusion Criteria

Criteria Type	Criteria
Inclusion	Girls aged 12–15 years, primary dysmenorrhea, regular cycles, NRS 1–6, consent, etc.
Exclusion	Secondary dysmenorrhea, chronic diseases, pregnancy, medication, food allergies, etc.

Ethical Considerations

This study adhered to ethical research standards including respect for autonomy, privacy, and beneficence. Ethical clearance was granted by the Institutional Review Board of the Health Science Faculty. Informed consent was obtained from all participants and guardians. Privacy and confidentiality were maintained, and no identifying information was disclosed in reporting. Participants were free to withdraw at any time without penalty (Polit & Beck, 2021; Kemenkes RI, 2021).

RESULTS AND DISCUSSION

The research was conducted at SMP Negeri 1 Wagir, a state junior high school located at Jalan Raya Wagir No. 71, Sitirejo Village, Wagir Subdistrict, Malang Regency, East Java, Indonesia. Established in 1983 and occupying 11,900 square meters, the school boasts a strong reputation for educational excellence, evidenced by its "A" accreditation, achieved in 2017 (SK No. 164/BAP-S/M/SK/XI/2017). With reliable internet and electricity supply, SMP Negeri 1 Wagir holds regular morning classes six days a week and emphasizes effective, high-quality learning for its students. The conducive academic environment and solid infrastructure supported the smooth execution of the present research.

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Table 4. General Characteristics of Respondents

Characteristic	Frequency (f)	Percentage (%)
Menarche Age		
11 years	15	44
12 years	13	38
13 years	6	18
Total	34	100
Menstrual Duration		
< 4 days	2	6
4–7 days	23	68
> 7 days	9	26
Total	34	100
Menstrual Cycle		
< 21 days	5	15
21–35 days	29	85
> 35 days	0	0
Total	34	100

Source: Observation Data, March 2025

The data above indicate that most respondents experienced menarche at age 11 (44%), followed by age 12 (38%) and age 13 (18%). Most had menstrual durations of 4–7 days (68%), with a smaller proportion reporting durations of more than 7 days (26%) or less than 4 days (6%). A vast majority (85%) had menstrual cycles of 21–35 days, which is considered the normal range (Deligeoroglou et al., 2009; Iacovides et al., 2015; Armour et al., 2019).

Table 5. Respondent Characteristics Based on Pain Intensity

Pain Intensity	Frequency (Pretest)	Percentage (Pretest)	Frequency (Posttest)	Percentage (Posttest)
No Pain (0)	0	0	20	59
Mild (1–3)	21	62	12	35
Moderate (4–6)	12	35	2	6
Severe (7–10)	1	3	0	0
Total	34	100	34	100

Source: Observation Data, March 2025

Prior to intervention, 62% of students experienced mild pain, 35% moderate pain, and 3% severe pain. After dark chocolate intervention, 59% reported no pain, 35% mild pain, and only 6% moderate pain, with no students remaining in the severe pain category. This shift indicates a substantial reduction in dysmenorrhea pain following the intervention.

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Table 6. Normality Test Results

Variable	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.
Menarche Age	.000	.000
Menstrual Duration	.000	.000
Cycle Length	.000	.000
Pretest Pain	.002	.044
Posttest Pain	.000	.000

Source: SPSS Output

Both Kolmogorov-Smirnov and Shapiro-Wilk tests yielded significance values < 0.05 for all variables, indicating that the data were not normally distributed (Razali & Wah, 2011). Therefore, non-parametric statistical tests were warranted for further analysis.

Table 7. Wilcoxon Test Results

	N	Mean Rank	Sum of Ranks	Z	Sig.
Negative Ranks (posttest < pretest)	34	17.50	595.00	-5.215	.000
Positive Ranks (posttest > pretest)	0	.00	.00		
Ties	0				
Total	34				

Source: SPSS Output

The Wilcoxon signed-rank test showed a p-value of .000, signifying a statistically significant reduction in dysmenorrhea pain following dark chocolate intervention (Armour et al., 2019; Proctor & Farquhar, 2006). Thus, the null hypothesis is rejected and the alternative hypothesis is accepted.

Baseline Dysmenorrhea Pain Among Adolescent Girls

Before the intervention, the majority of participants experienced mild pain during menstruation (62%), which aligns with data from multiple studies indicating that mild dysmenorrhea is common among adolescent girls globally (Iacovides et al., 2015; Armour et al., 2019; Grandi et al., 2012). The prevalence of dysmenorrhea in Indonesian adolescents has been reported at 43–93%, with 74–80% experiencing mild pain (Fitrianingsih & Santanu, 2021; Katili et al., 2024). International research also highlights the high global prevalence of dysmenorrhea in adolescent populations (Ju et al., 2014; Burnett et al., 2005; Schoep et al., 2019). Similar to the findings here, Katili et al. (2024) found that 65.8% of their adolescent participants reported mild dysmenorrhea, while Mulyatina (2021) observed that 83.3% had mild pain prior to intervention. Menstrual pain results from intense uterine contractions triggered by the release of prostaglandins during the menstrual cycle (Harel, 2008; Dawood, 2006; Marjoribanks et al., 2015). These contractions reduce blood flow to the endometrial lining, resulting in ischemic pain (Vercellini et al., 2014). The variability in pain intensity

among adolescents has been attributed to individual physiological, psychological, and lifestyle differences (Ju et al., 2014; Armour et al., 2019). Additionally, severe or recurrent dysmenorrhea can negatively impact the quality of life, school attendance, and daily functioning (Iacovides et al., 2015; Burnett et al., 2005; Chen et al., 2017).

Pain Reduction After Dark Chocolate Administration

After the administration of dark chocolate, 59% of participants reported being pain-free, while 35% experienced mild pain and only 6% continued to experience moderate pain. This substantial reduction supports previous research that highlights the beneficial effects of dark chocolate in alleviating dysmenorrhea pain (Verma et al., 2019; Wahtini et al., 2021; Mulyatina et al., 2021; Carolin et al., 2023; Hussain et al., 2019; Asih et al., 2020). For example, Wahtini et al. (2021) reported that consumption of 35 grams of 72% dark chocolate led to significant pain reduction within two hours. Similarly, Carolin et al. (2023) and Verma et al. (2019) observed meaningful decreases in pain intensity post-intervention with dark chocolate, reinforcing its efficacy as a non-pharmacological intervention for menstrual pain. The effectiveness of dark chocolate in this context is attributed primarily to its rich content of magnesium and polyphenols (Katz et al., 2011; Magrone et al., 2017). Magnesium relaxes smooth muscle, reducing uterine contractions and thus pain (Abbaspour et al., 2014; Deraco et al., 2021; Mettler & Schmidt, 2017). Additionally, dark chocolate is high in flavonoids, which exhibit anti-inflammatory and antioxidant effects, further contributing to pain relief (Katz et al., 2011; Magrone et al., 2017; Hussain et al., 2019). Theobromine, another compound found in chocolate, has muscle relaxant and vasodilatory properties (Carolin et al., 2023; Magrone et al., 2017). These mechanisms have been validated in several clinical studies, emphasizing the potential of dark chocolate as a safe, accessible intervention for dysmenorrhea (Verma et al., 2019; Hussain et al., 2019; Armour et al., 2019; Katz et al., 2011).

Efficacy of Dark Chocolate Versus Other Interventions

Numerous international studies have investigated both pharmacological and non-pharmacological interventions for dysmenorrhea. Nonsteroidal anti-inflammatory drugs (NSAIDs) remain the mainstay of pharmacological management but are associated with gastrointestinal side effects and long-term risks (Dawood, 2006; Proctor & Farquhar, 2006; Marjoribanks et al., 2015). In contrast, dietary interventions such as magnesium supplementation and dark chocolate have demonstrated efficacy with fewer side effects (Abbaspour et al., 2014; Deraco et al., 2021; Hussain et al., 2019; Carolin et al., 2023). Studies by Mulyatina et al. (2021), Katili et al. (2024), and Asih et al. (2020) provide consistent evidence that dark chocolate, when administered in appropriate doses and concentrations (≥70% cocoa), results in a statistically significant reduction in menstrual pain among adolescent girls. The findings of the present study align with these results, with 59% of participants reporting no pain post-intervention, compared to none pre-intervention. In the context of other non-pharmacological interventions—such as heat therapy, exercise, yoga, and herbal remedies—dark chocolate stands out for its palatability, ease of administration, and high

acceptance among adolescents (Armour et al., 2019; Chen et al., 2017; Marjoribanks et al., 2015; Grandi et al., 2012).

Statistical Importance and Clinical Relevance

The statistical analysis conducted, including the Wilcoxon signed-rank test, demonstrated a highly significant reduction in pain scores after dark chocolate intervention ($p = .000$). This is consistent with the results of similar clinical studies using non-parametric tests to analyze pain reduction in dysmenorrhea (Carolin et al., 2023; Wahtini et al., 2021; Verma et al., 2019). Importantly, the observed shift from moderate and severe pain to mild or no pain has meaningful clinical implications, potentially reducing the need for pharmacological interventions and minimizing school absenteeism among adolescent girls (Iacovides et al., 2015; Armour et al., 2019; Chen et al., 2017; Burnett et al., 2005).

Mechanisms of Action: Dark Chocolate's Bioactive Components

Dark chocolate is rich in magnesium, flavonoids, theobromine, and phenolic compounds, all of which contribute to its analgesic and anti-inflammatory properties (Katz et al., 2011; Magrone et al., 2017; Abbaspour et al., 2014; Hussain et al., 2019). Magnesium, as supported by clinical evidence, reduces prostaglandin synthesis and muscle contractility, thereby alleviating dysmenorrhea (Deraco et al., 2021; Mettler & Schmidt, 2017). The phenolic content acts as antioxidants, scavenging free radicals and reducing oxidative stress, which has been implicated in menstrual pain pathophysiology (Magrone et al., 2017; Katz et al., 2011). Furthermore, regular dark chocolate consumption has been associated with increased levels of beta-endorphins, natural painkillers produced by the brain, which enhance the sensation of well-being and reduce pain perception (Carolin et al., 2023; Verma et al., 2019; Katz et al., 2011).

Implications for Midwifery Education Practice

The findings of this study offer valuable insights for the advancement of midwifery education, especially in the context of adolescent reproductive health and the management of primary dysmenorrhea. First, the significant reduction in menstrual pain following the administration of dark chocolate underscores the importance of introducing evidence-based, non-pharmacological interventions into the midwifery curriculum. By equipping future midwives with a broad spectrum of pain management strategies—including dietary and lifestyle modifications—educational programs can enhance the quality of care provided to adolescent girls and young women experiencing menstrual discomfort.

Midwifery education should incorporate the understanding and application of simple, accessible interventions that are both effective and well-received by adolescents. The use of dark chocolate as a complementary approach can be presented as a case study or practical module within reproductive health courses, emphasizing both the physiological basis and the practical considerations of implementation. This not only broadens students' clinical reasoning but also fosters a holistic approach to menstrual health management, moving beyond reliance on pharmacological treatments alone. Furthermore, the integration of research findings such as

these into teaching materials encourages critical thinking and evidence-based practice among midwifery students. Educators can use these results to highlight the importance of patient education, informed consent, and culturally sensitive counseling in school or community settings. Training midwives to conduct assessments using standardized pain measurement tools, such as the Numeric Rating Scale (NRS), also enhances their competence in evaluating and monitoring patient outcomes.

On a broader scale, the study supports the role of midwives as health educators and advocates for adolescent health in both clinical and community environments. Midwives can take an active role in school health programs by disseminating accurate information about menstrual health and by advocating for supportive environments that reduce stigma and facilitate access to effective pain management strategies. These activities empower adolescents to take control of their reproductive health and contribute to improved attendance and participation in school. Finally, the results point to the need for ongoing professional development for midwifery educators themselves, ensuring they remain current with emerging research and innovative practices in adolescent reproductive health. By fostering a culture of inquiry and responsiveness to new evidence, midwifery education can continuously improve, ultimately leading to better health outcomes for women throughout their lives.

CONCLUSION

This study aimed to evaluate the effect of dark chocolate supplementation on the intensity of primary dysmenorrhea pain among female adolescents aged 12–15 years at SMP Negeri 1 Wagir, Malang. The core findings demonstrated a significant reduction in menstrual pain following the administration of 35g dark chocolate (≥70% cocoa) for three consecutive days, with 59% of participants reporting no pain and none remaining in the severe pain category post-intervention. The research contributes new evidence supporting dark chocolate as a practical, non-pharmacological intervention for adolescent dysmenorrhea, highlighting its potential for integration into school health programs and midwifery education, and addressing an important gap in adolescent reproductive health management in Indonesian school settings.

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