Effectiveness of dark chocolate in reducing dysmenorrhea pain intensity in adolescent girls: A systematic literature review

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ABSTRACT

Background: *Dysmenorrhea is pain during menstruation that usually occurs in the lower abdomen, waist, and even back. According to WHO (2022), it increased to 2,398,563 people with the incidence of dysmenorrhea almost 73% of that number. The prevalence of dysmenorrhea in Indonesia is 107,673 people (64.25%), consisting of 59,671 people (54.89%) experiencing primary dysmenorrhea and 9,496 people (9.36%) experiencing secondary dysmenorrhea. There are pharmacological and non-pharmacological methods to manage dysmenorrhea pain. In the treatment of dysmenorrhea, painkillers and non-steroidal anti-inflammatory drugs (NSAIDs) can be used. As for non-pharmacological therapies, one of them is the consumption of certain herbs including dark chocolate.*
Objectives: *To further study "The effectiveness of Dark Chocolate on reducing the intensity of dysmenorrhea pain in adolescent girls" which is expected to help reduce the intensity of dysmenorrhea pain by utilizing herbs, one of which is dark chocolate which is favored by almost all ages with various benefits and delicious taste.*
Methods: *This type of research is a Systematic Literature Review by searching journals using the Scopus, Pubmed, DOAJ, CORE, and Google Schoolar databases. journal searches are specific to the years 2019-2024 and the literature selection process uses the PRISMA diagram with journal criteria that use Quasy Experimental research designs. The article selection process uses the Mendeley application.*
Results: *Four out of 1,115 articles found that there was a decrease in dysmenorrhea pain intensity after being given a dark chocolate intervention 35gr – 95gr when pain or the beginning of menstruation.*
Conclusions: *This Study Conclude that consuming dark chocolate can reduce dysmenorrhea pain intensity in adolescent girls.*

KEYWORD*: chocolate; dark chocolate; dysmenorrhea; menstrual pain;*

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INTRODUCTION

Although menstruation is a natural event, many adolescents experience menstrual disorders, one of which is experiencing pain during menstruation. This complaint is called dysmenorrhea (1). Dysmenorrhea is pain during menstruation that usually occurs in the lower abdomen, waist, and even back. It can also be lower abdominal cramps that radiate to the back or legs. The pain felt during dysmenorrhea is due to an imbalance of the hormone progesterone in the blood. (2). This is a problem that women often complain about when consulting with doctors or medical personnel. In connection with the presence of dysmenorrhea, it will affect the unstable psychological condition. (3).

Based on data from the World Health Organization (WHO) in 2020, the incidence of dysmenorrhea in the world is very high, around 1,769,425 women in the world experience severe dysmenorrhea (Herawati, 2021) in the journal (4)According to WHO in 2021, the prevalence of dysmenorrhea ranged from 1.7% to 97% in 106 studies with a total of 125,249 female respondents (Azima, 2022) in the journal (4). In 2022 the number of women of childbearing age according to WHO (2022), increased to 2,398,563 people with the incidence of dysmenorrhea almost 73% of that number (Oktorika, 2022) in the journal (Kasi et al., 2024). (4). The prevalence of dysmenorrhea in Indonesia amounted to 107,673 people (64.25%), consisting of 59,671 people (54.89%) experiencing primary dysmenorrhea and 9,496 people (9.36%) experiencing secondary dysmenorrhea (Herawati, 2017) in the journal (5).

There are pharmacological and non-pharmacological methods to manage dysmenorrhea pain. In the treatment of dysmenorrhea, painkillers and non-steroidal anti-inflammatory drugs (NSAIDs) such as mefenamic acid, ibuprofen, piroxicam, and others can be used. As for non-pharmacological therapies, they can include the use of cold and warm compresses, acupressure and relaxation therapy, and the consumption of certain herbs, such as red ginger, carrots, and dark chocolate. (Fahlapi & Nurhidayati, 2024). The nutritional content of dark chocolate is rich in magnesium, vitamins A, B1, B2, D, E, potassium, and sodium. Magnesium contained in dark chocolate has a direct effect on vascular pressure and can regulate the entry of calcium into uterine smooth muscle cells, so magnesium affects the contraction and relaxation of uterine smooth muscle. Therefore, magnesium in dark chocolate suppresses inflammation by inhibiting the formation of prostaglandins, thereby reducing pain intensity.

Several previous studies have discussed the effects of dark chocolate to reduce the intensity of dysmenorrhea pain, as has been done by Febriansyah, et al (2021) and Hasiani, et al (2024). However, although these studies have made important contributions, there are still gaps in the dosing of different types of chocolate regarding the effectiveness of dark chocolate in reducing the intensity of dysmenorrhea pain, several studies recommend the administration of dark chocolate ranging from doses of 35 grams to 95 grams. Therefore, this study aims to fill the gap by analyzing the effectiveness of dark chocolate in reducing dysmenorrhea pain intensity in adolescent girls.

MATERIALS AND METHODS

This type of research is a Systematic Literature Review, which is a review of relevant and high-quality research results, and is carried out systematically consisting of steps of identification, selection, assessment and synthesis of these research results, which aim to obtain a reliable and reliable conclusion on one research question. Systematic review is a

research method that aims to evaluate, identify, and analyze all previous research results related and relevant to a particular topic, specific research, or current phenomenon of concern. The facts presented are comprehensive and balanced because systematic reviews are used to synthesize relevant research findings. The systematic stage was conducted by identifying scope review questions using the PICOS framework (Population: Adolescent girls with dysmenorrhea, Intervention: dark chocolate, Comparison: no dark chocolate, Outcome: decreased dysmenorrhea pain intensity, Study Design: Quasy experiment) to help facilitate the search process and identify key concepts in an effective search strategy. The quality criteria of the selected articles are articles with SINTA 1 to SINTA 4 and there are also articles indexed by SCOPUS.

Relevant articles were identified by setting inclusion and exclusion criteria. The inclusion criteria were: 1) Articles published between 2019-2024. 2) Articles published in Indonesian and English. 3) Articles that are *open access* and are research journals. 4) Articles that discuss the administration of dark chocolate as a dysmenorrhea treatment. 5) Articles that have a clear intervention. 6) Articles with quasy experiment design. Exclusion criteria were: 1) Opinion articles, review papers, letters, book reviews, reports, unpublished documents, guidelines, or those published in peer-reviewed literature and gray journals. 2) Articles that are not open access. 3) Articles published in the year <2019. 4) Articles that did not address chocolate administration for dysmenorrhea. 5) Articles that provided a combination intervention, not just dark chocolate 6) Articles with research designs other than quasy experiment. The article search used Scopus, PubMed, DOAJ, CORE, and Google Scholar databases. The article search strategy uses keywords with the help of Boolean operators (AND, OR), the article search strategy is as follows:
"((Chocolate OR Dark Chocolate)) AND (Dysmenorrhea OR Dysmenorrhea OR Menstrual Pain))". The article selection process used the Mendeley Application.

RESULTS AND DISCUSSION

RESULTS

The data-based article selection process found 1,115 articles from various databases. A total of 1,094 articles were excluded due to duplication, non-research journal type, articles exceeding the last 5 years, and inaccessibility, leaving 21 articles identified. Based on abstract and full text screening, 17 articles were excluded because 10 articles had a study design other than a quasy experiment, and did not provide a clear dose of intervention, then 7 articles were excluded because they provided a combination intervention, not just dark chocolate. The final result of the article selection was 4 (four) articles that were relevant to the research conducted. The prism of the flow chart in selecting articles is as follows:

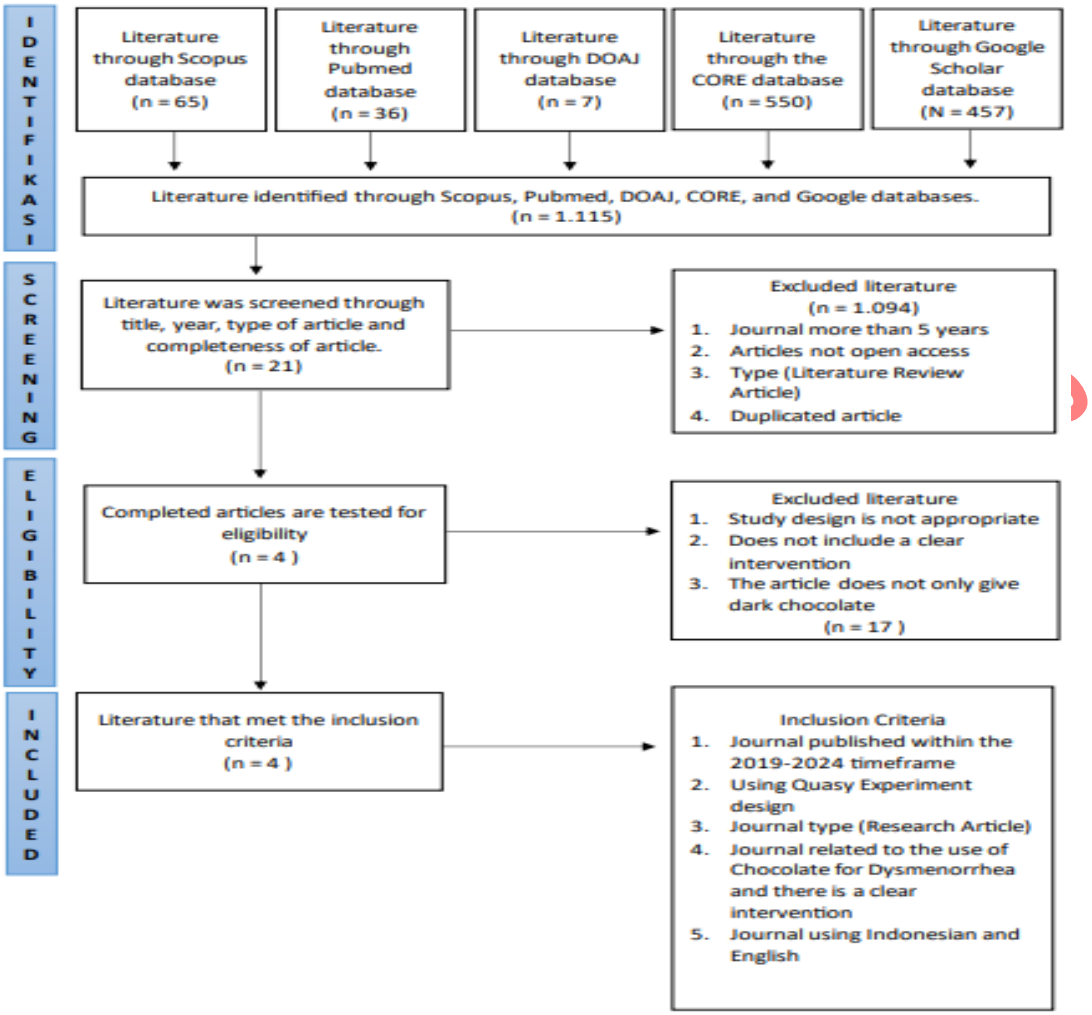

Figure 1. PRISMA diagram

DISCUSSION

The four articles that have been selected were then performed by data mapping in two stages, which were data charting and critical appraisal. The data charting process was conducted as follows:

Year	Author	Aims	Population and Samples	Method	Result
2021	Febriansyah et al	Knowing the effect of dark chocolate on reducing primary dysmenorrhea	All female students of Saleha Midwifery Academy Banda Aceh, who	Quantitative research with Quasi-experimental research type. The design	Before given dark chocolate, as many as 4 people (13.3%) felt severe

		pain.	experienced menstrual pain, totaled 56 people. the sample amounted to 30 people, students who met the criteria, namely those experiencing primary dysmenorrhea and were willing not to use other therapies both pharmacological and non-pharmacological.	used is one group pretest-posttest design. The sampling technique was purposive sampling, the statistical test used Wilcoxon.	pain. However, there was a decrease in pain levels after giving dark chocolate to as many as 9 female students (30%) did not feel pain after giving the intervention. Based on the results of data analysis with Wilcoxon test shows that the significance value (Sig.) of 0.000 < (α=0.05).
2023	Ferina et al	This study aimed to assess the effect of dark choco- late on reducing dysmenorrhea in adolescents.	All adolescents in one polytechnic in Bandung who experienced primary dysmenorrhea aged 17-21 years old. The sample size for each group was 20 people. The total number of respondents included in this study was 40 people. Inclusion criteria were defined as	Quasy experiment with pretest-postest control group design. Sampling used purposive sampling technique. An unpaired para-metric test, the independent t-test, was used if the data followed a normal	The results of statistical tests conducted using the Mann-Whitney Test. The results of the analysis showed that there was no significant difference in the characteristics of the study subjects based on age between the group given dark chocolate in the morning (AM) and the control group. The p-value obtained was 0.675,

	follows: polytechnic female students in Bandung who experienced dysmenorrhea with a score > 5 (maximum score WaLLID	distribution. If the normal distribution assumption is not met, the Mann-Whitney test is used.	which was greater than The significance level is 0.05 (D>0.05). The results of statistical tests conducted using the Wilcoxon Sign Rank Test. The results of the analysis showed a significant difference in pain intensity in adolescents with dysmenorrhea before and after being given dark chocolate. The p-value obtained is less than 0.001 (p<0.001), which is less than or equal to the significance level of 0.05 (p<0.05). statistical test results with using the Friedman Test at the 95% confidence level showed a significant difference in pain intensity in

			adolescents.
			dysmenorrhea
			who were given dark chocolate from the beginning
			intervention until day 5. A p-value of less than 0.001 (p<.001) indicates that pain intensity changed significantly over five days (p<0.05). A p-value of less than 0.001 (p<0.001), indicating that pain intensity changed significantly over five days (p<0.05).
			There was a significant difference in the pain intensity of those who received dark chocolate from the beginning, the first day, the second day, to the fifth day. The p value obtained was less than 0.001 (p<0.001), indicating that the pain intensity changed significantly over the five-day period

					(p<0.05).
2024	Hasiani, et al	Knowing the Effect of Giving Hot Dark Chocolate on Dysmenorrhea in Adolescents Class IX girls at SMPN 1 Muara Gembong Bekasi in 2024.	Adolescent girls in class IX at SMPN 1 Muara Gembong, namely: class 9.1; 16 people, class 9.2; 16 people, class 9.3; 15 people, 9.4; 16 people, 9.5; 15 people, a total of 78 people. The sample was 30 people, 15 interventions and 15 controls.	This research is Quasy - Experimental with two groups pretest - posttest. using the Purposive Sampling technique. The instruments used were the Numeric Rating Scale and observation sheets. Data were analyzed using the Paired T-test and Independent T-test.	Before the intervention had an average pain scale of 7.67 and the control group had an average pain scale of 7.60, while the dysmenorrhea pain scale. after the intervention was 4.67 in the intervention group and 7.00 in the control group. In the intervention group there is a difference in the average value of the dysmenorrhea pain scale with a sig value of 0.000 <0.05, which means that there is an effect of giving hot dark chocolate in reducing the dysmenorrhea pain scale in class IX adolescent girls at SMPN 1 Muara Gembong Bandung City in 2024.
2024	Idealistiana, et al	Knowing the effect of Dark Chocolate on dysmenorrhea in adolescent girls in class	Adolescent girls class IX SMPN 1 Teluknaga, class XI SMAN 75 Jakarta, class X SMAN 1	This quasi-experiment research used a pre and post test with two group design.	The average pain scale score before being given dark chocolate was 5 (moderate pain), while after being

	IX SMPN 1 Teluknaga, class XI SMAN 75 Jakarta, class X SMAN 1 Cikarang Barat in 2023.	Cikarang Barat. The sample in this study amounted to 34 respondents. 17 intervention group respondents and 17 control respondents.	The sampling technique used purposive sampling. The instrument used a numeric rating scale sheet. Data were analyzed using Paired T Test and Idependent T Test.	given an average pain scale score of 3 (mild pain). The results of the analysis obtained a p-value of 0.000. There is an effect of giving dark chocolate on dysminorrhea pain in adolescent girls

Based on the results of the 4 articles analyzed, it was found that dark chocolate can be a non-pharmacological therapy for dysmenorrhea. Based on research conducted by Febriansyah et al (2021), that giving dark chocolate is effective in reducing dysmenorrhea. There was a decrease after giving 72% dark chocolate 1 bar of 35 grams. Where 30% of female students did not experience pain after the intervention. Pain measurement using the Numeric Rating Scale (NRS) observation sheet. In line with research conducted by Ferina et al (2023) that there was a decrease in dysmenorrhea after being given a dark chocolate intervention of 35 grams of 72% dark chocolate for the first 5 days. Pain measurement using the WALIDD questionnaire.

Based on research conducted by Hasiani, S et al (2024) conducted in Bekasi, that the provision of hot dark chocolate intervention as much as 85 grams to adolescent girls is proven to have an effect on dysmenorrhea. Where the initial pain scale was 7.67 to 4.67. Measuring pain intensity using the Numeric Rating Scale (NRS) observation sheet. As for other studies, according to research by Idealistiana et al (2024), that giving dark chocolate as much as 95 grams can reduce the intensity of dysmenorrhea pain in adolescent girls, where the initial average experienced moderate pain, after being given dark chocolate intervention became mild pain.

Effect of Dark Chocolate to reduce dysmenorrhea pain intensity

Chocolate is a processed food product derived from cocoa beans from the cacao plant or Theobroma cacao. Dark chocolate can also be used as an ingredient in several types of food and is in demand by children and adults. (7). Dark chocolate contains more

cocoa beans when compared to other types of chocolate, which causes dark chocolate to be rich in polyphenolic compounds that contribute greatly to giving dark chocolate its bitter taste and deep black color(8).

Based on the results of the 4 studies, it can be seen that all studies have a p value <0.05. This shows that these studies show significant results regarding the effect of dark chocolate in reducing menstrual pain. As in the research conducted by Febriansyah et al (2021), the results of the Wilcoxon test show that the significance value (Sig.) of 0.000 < (α = 0.05). This is also in line with the research of Idealistiana et al (2024) The results of the analysis obtained a p-value of 0.000. There is an effect of giving dark chocolate on dysminorrhea pain in adolescent girls. This can occur because dark chocolate is rich in calcium, potassium, sodium, magnesium and vitamins A, B1, C, D, and E, magnesium (9). Dark chocolate has magnesium content that can relax muscles and provide a sense of relaxation that can control bad *mood*, where magnesium stimulates the brain to synthesize collagen and neurotransmitters to release endorphin hormones. This endorphin hormone functions to inhibit pain impulses. The endorphin hormone will become a natural analgesic and natural tranquilizer so that it can reduce the intensity of pain such as menstrual pain. Consuming dark chocolate has serotonin which acts as an anti-depressant, this can cause feelings of pleasure and alertness and can help reduce aches and pains experienced, including pain during menstruation. Consuming dark chocolate can also make blood pressure normal. Dark chocolate also contains caffeine, which is a central nervous stimulant, and theobromine, as well as a smooth muscle stimulant. Smooth muscle includes blood vessels and uterus (10).

Dosage of Dark Chocolate

Based on the results of the analysis of the 4 articles above, several doses were found in the provision of dark chocolate interventions. In the research of Febriansyah et al (2021), the intervention provided was 1 bar of 72% dark chocolate as much as 35 grams for consumption. In addition, in Ferina et al., 2023 (11) namely dark chocolate is given as much as 35 grams of 72% dark chocolate to be consumed during the first 5 days of menstruation. While the research of Hasiani S et al. (2024), namely giving in the form of hot dark chocolate drinks as much as 85 grams of hot dark chocolate. Meanwhile, according to research by Idealistiana et al. (2024) dark chocolate was given as much as 95 grams.

In these four studies, all showed the effect of dark chocolate on reducing dysmenorrhea pain. According to (10) Dark chocolate is a quality chocolate that is judged by the percentage of high solid chocolate content and low sugar content. The United States government sets a minimum chocolate paste content of 35% for dark chocolate, while European standards set a minimum of 43%.

Dysmenorrhea Pain Measurement

Based on the results of the analysis of the 4 articles, 3 articles used the numeric rating scale (NRS) observation sheet, while 1 article used the WALIDD questionnaire. The numeric rating scale itself is a scale used instead of a word description tool. Patients rate pain between a scale of 0-10. The number 0 means no pain while the number 10 means the most severe pain (Ministry of Health, 2022). As in Febriansyah et al., 2021 (12) Before the intervention, there were 17 female students experiencing mild pain (1-3), 9 female students experiencing moderate pain (4-6), 4 female students experiencing severe pain (7-9). After being given the intervention, 9 people experienced mild pain (1-3), 18 people experienced moderate pain (4-6) and 3 people experienced severe pain (7-9). So that the average pain scale is significantly different between before (4.13) and after giving dark chocolate (1.33). In line with Hasiani et al., 2024 (13) All respondents revealed experiencing dysmenorrhea on the first and second days of menstruation with an average moderate pain scale (4-6) as many as 70% of respondents and a controlled severe pain scale (7-9) as many as 30% of respondents, Before the intervention had an average pain scale of 7.67, while the dysmenorrhea pain scale after the intervention was 4.67.

Based on Idealistiana et al., 2023 (7) The average pain scale score before being given dark chocolate 5 (moderate pain), while after being given an average pain scale score of 3 (mild pain). Whereas in Ferina etn al., 2023 (11) used pain scale measurements with the WALIDD questionnaire. According Teherán et al., 2018 (14) WALIDD stands for (working ability, location, intensity, days of pain, dysmenorrhea) score was designed to diagnose dysmenorrhea. Where the results of the study were a significant decrease in pain intensity in the recipient of the dark chocolate intervention from the beginning, the first day, the second day, to the fifth day.

Dark Chocolate on Reducing Dysmenorrhea Pain Intensity

According to Febriansyah, et al (2021) that giving dark chocolate can reduce pain intensity because there is a decrease from severe pain to no pain. This is also in line with Ferina, et al (2023) which shows that in the dark chocolate intervention group for five days and experienced a decrease in pain intensity. Likewise, in the research of Hasiani, et al (2024) and Idealistiana, et al (2024) that the dark chocolate intervention group experienced a decrease in pain from severe to moderate and mild levels which indicates the influence or effect of giving dark chocolate in reducing dysmenorrhea pain.

In line with the research of Hajati, A., et al (2023) that giving chocolate can reduce pain intensity compared to those who are not given chocolate (15). In dealing with dysmenorrhea, it can indeed use pharmacological drugs in the NSAID class, but several studies report that herbal medicines are more effective in relieving pain than NSAIDs. Some non-pharmacological and herbal therapies that can reduce pain are warm water compresses, gentle rubbing of the abdomen (effleurage massage), acupressure,

acupuncture, aromatherapy, exercise, herbs to improve nutrition (16). One of the nutritional improvements is using dark chocolate (17). Dysmenorrhea itself is caused by increased levels of prostaglandin hormones (18).

The choice of dark chocolate intervention is because dark chocolate contains analgesics, antipyretics and anti-inflammatory and blocks the increase of prostaglandins in the body, thereby reducing dysmenorrhea (19). In addition, dark chocolate contains more cocoa beans when compared to other types of chocolate, which causes dark chocolate to be rich in polyphenolic compounds that have a function as anti-inflammatory (17). In addition, dark chocolate also contains magnesium which plays an active role in reducing pain. Magnesium contained in dark chocolate has a direct effect on vascular pressure and can regulate the entry of calcium into uterine smooth muscle cells, so magnesium affects the contraction and relaxation of uterine smooth muscle. Magnesium can suppress inflammation by inhibiting the formation of prostaglandins so that pain can be reduced (20).

Dark chocolate also contains a lot of calcium and carbohydrates that can trigger the production of serotonin, which is a nerve conductor. The process of increasing serotonin levels in the body can affect pain reduction, this condition occurs due to the feedback mechanism in carbohydrate regulation. Dark chocolate also stimulates the release of endorphin, a natural hormone produced by the brain that produces feelings of good mood, one of the ingredients in dark chocolate is tryptophan and essential amino acids needed by the brain to produce serotonin which regulates mood or feelings of happiness, from high serotonin levels, psychoactive substances in chocolate can create a more relaxed feeling (21).

CONCLUSION AND RECOMMENDATION

This study concluded that the administration of dark chocolate is effective and significant in reducing the intensity of dysmenorrhea pain in adolescent girls. Several research gaps were identified in this study, including: (1) All doses listed in the study showed significant results, therefore a clearer exact dose is needed regarding the dose of chocolate administration. (2) The provision of dark chocolate is mostly in the form of chocolate bars, so there needs to be special attention related to the sugar content in the chocolate bar, so as not to increase the risk of diabetes in adolescents. Based on these research gaps, the author hopes that this can be a reference for future researchers to conduct further research related to home visiting programs that involve the research gaps above.

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