Research Article

Non-pharmacological Randomised Control Trial: Green Coconut (*Cocos nucifera* L.) Water to Reduce Dysmenorrhea Pain

(Percobaan Kontrol Acak Non-farmakologis: Air Kelapa Hijau (*Cocos nucifera* L.) untuk Mengurangi Nyeri Dismenore)

Fajar Ari N¹, Oktaviana Manda P², Yuseva Sariati³

^{1,3}Departement of Nutrition Faculty of Medicine University of Brawijaya Malang

²Departement of Midwifery Faculty of Medicine University of Brawijaya Malang

ABSTRACT

Dysmenorrhea is a common cause of pain in young women. The discomfort of dysmenorrhea causes unstable emotions, sleep disturbances, diet changes, and increased stress and depression that can degrade women quality of life. This non-pharmacological Randomized Controlled Trial aimed to obtain the optimal dose of green coconut water as a magnesium source for reducing dysmenorrhea pain. Twenty-one participants divided into three groups. Treatment group 1 obtained 330 ml of green coconut water, treated group 2 obtained 165 ml of green coconut water, and the control group obtained 330 ml of mineral water where each dose repeated three times every 4 hours. VAS questionnaire used to measure the value of pain intensity before and after administration. The 330 ml green coconut water dose is the effective dose compared to control (VAS=4.14, p=0.000), while another dose has a weak effect (VAS=1.86, p=0.124). This finding proves that green coconut water can be a non-pharmacological alternative in handling dysmenorrhea pain.

Keywords: Green coconut water, magnesium, pain intensity, primary dysmenorrhea

ABSTRAK

Dismenore adalah penyebab umum nyeri pada wanita muda. Ketidaknyamanan dismenore menyebabkan emosi tidak stabil, gangguan tidur, perubahan pola makan, dan meningkatnya stres dan depresi yang dapat menurunkan kualitas hidup wanita. Uji Acak Terkendali non-farmakologis ini bertujuan untuk mendapatkan dosis optimal air kelapa hijau sebagai sumber magnesium untuk mengurangi nyeri dismenore. Dua puluh satu peserta dibagi menjadi tiga kelompok. Kelompok perlakuan 1 memperoleh 330 ml air kelapa hijau, kelompok perlakuan 2 memperoleh 165 ml air kelapa hijau, dan kelompok kontrol memperoleh 330 ml air mineral di mana setiap dosis diulang 3 kali setiap 4 jam. Kuesioner VAS digunakan untuk mengukur nilai intensitas nyeri sebelum dan sesudah pemberian. Dosis air kelapa hijau 330 ml adalah dosis efektif dibandingkan dengan kontrol (VAS=4.14, p=0.000), sementara dosis lain memiliki efek yang lemah (VAS=1.86, p=0.124). Temuan ini membuktikan bahwa air kelapa hijau dapat menjadi alternatif non-farmakologis dalam menangani nyeri dismenore.

Kata kunci: Air kelapa hijau, dismenore primer, intensitas nyeri, magnesium

Correspondence: Fajar Ari N. Departement of Nutrition Faculty of Medicine University of Brawijaya Malang, Jl. Veteran Malang Jawa Timur Tel. 081330736005 Email: fajar_arinugroho.fk@ub.ac.id

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INTRODUCTION

Dysmenorrhea is a common symptom experienced by women due to primary and secondary gynecological disorders (1). This menstrual complaint was felt mainly in the pelvic section characterized by painful uterine cramp (1-3). Dysmenorrhea is often complained by women compared to other gynecological disorders and is considered as the most common morbidity contributor among women in reproductive age (4-7).

It is widely known that women tend not to report dysmenorrhea complaint because it is assumed as a normal problem (8) and is also believed as taboo in several cultures. So, most dysmenorrhea cases are improperly handled (4). The pain experienced by women can be so severe that it disturbs their life. Untreated severe cases can decrease women's productivity and quality of life (9-13). Bad mood, anxiety, sleep disorders (14), eating disorders, and stress are considered as examples of negative dysmenorrhea effect (15).

Primary dysmenorrhea should be considered an important problem. Several recent studies recorded that 45-93% of women in reproductive age experience this pain (1-6) where young women reported the greatest morbidity rates. In 2016, a preliminary study conducted on the Midwifery students of Faculty of Medicine, Universitas Brawijaya found 14 female students from 20 subjects' surveyed experienced primary dysmenorrhea. No medication reported in all cases was found due to the anxiety of drug addiction (17,18). This shows the fact that dysmenorrhea problem should be noticed.

One alternative of pain relievers for primary dysmenorrhea is magnesium consumption. Several studies reported magnesium affects contractility, tone, and relaxation of the uterine muscles as well as controlling the release of prostaglandins which are very important in the control of dysmenorrhea. However, the efficacy still requires strong validation (3). Magnesium is easily found as a part of the main mineral constituent of coconut water electrolytes after potassium and sodium. Every 100 ml of coconut water is estimated to contain approximately 20-30 mg of magnesium. In addition, currently, coconut water has been becoming a natural commercial beverage trend with a potential to prevent and cure various health problems (19-21).

Based on the potential of magnesium role in primary dysmenorrhea, we conducted a randomized control trial (RCT) to explore this assumption by using green coconut water. The result obtained is expected to offer support to green coconut water as a better alternative treatment of primary dysmenorrhea.

METHODS

Dosing and Reduction of Bias

The basis for determining the dosage of coconut water was the milligram of magnesium to reduce the intensity of pain in primary dysmenorrhea. As much as 300 mg of magnesium was needed to treat dysmenorrhea in which every 100 mg was taken in every 4 hours. Then, the proportion of doses was converted into ml of coconut water based on magnesium content and was given to the treatment group. A single plantation in Batu, Malang, Indonesia was chosen in order to reduce possible bias from variations in the magnesium content of coconut plants.

Procedures

In this non-pharmacological Randomized Control Trial (RCT), the selected subjects were divided into three groups, namely experimental dose I, experimental dose II, and control group. Twenty-one female students aged 18-24 years old who had had primary dysmenorrhea in one menstrual cycle participated from August to September 2016. The diagnosis of primary dysmenorrhea was based on the following criteria: a). the subject's first onset of pain experienced just after menarche, b). a lower pelvic or abdominal pain that was usually associated with the onset of menstrual flow and lasts 8-72 hours, c). a report of back and thigh pain, headache, diarrhea, nausea, and vomiting that may be present. This study did not use laboratory tests or other supporting examinations to determine the case. Each group received a specific dose of green coconut water. The experimental group I received a total of 980 green coconut water in which 330 ml must be consumed every 4 hours in a span of 12 hours on one day of dysmenorrhea cycle. The experimental group II obtained a smaller total dose of 490 ml in which 165 ml must be consumed every 4 hours. While the control group received mineral water with the same dosage and rule as treatment group 1. Then pain intensity data from all participants collected by the Visual Analog Scale (VAS) questionnaire, then the different intensity of pain before and after the intervention was assessed. The Health Research Ethics Committee, Faculty of Medicine, Universitas Brawijaya approved all procedures in this study (No. 300/EC/KEPK-S1-KB/08/2016).

Statistical Analysis

One Way ANOVA test continued with Post Hoc test and followed by Pearson Correlation relationship test (IBM®SPSS 20, IBM Corporation) were used as statistical analysis for Pretest-Posttest data results. The significance level for all variable was set at $p < 0.05$.

RESULTS

The data were declared normal and homogeneous ($p = 0.06$ and $p = 0.222$, respectively). Furthermore, the One Way ANOVA test result significantly showed the effect of coconut water on dysmenorrhea pain reduction in the intervention groups compared to the control group ($p = 0.000$). The dose of 330 ml of coconut water noted the biggest pain difference value (VAS=4.14) compared to other groups (Table 1). This high value proved that this dose was the most effective dose to reduce primary dysmenorrhea pain.

Table 1. The mean pain difference value of dysmenorrhea respondents

	N	VAS
330 ml	7	4.14
165 ml	7	1.86
Control	7	0.71
Total	21	2.24

N: number of respondents; VAS: the difference value of decreased pain before and after intervention from Visual Analog Scale measurement.

Subsequently, the doses contributed significantly to reducing the pain was then clarified by the post hoc test. compared each group with control and tested among the

groups. The 330 ml dose showed a noticeable decline of pain rather than control ($p=0.000$) compare with other dose groups ($p=0.124$) (Table 2). While when tested, the effective dose group also had significant differences between the groups in reducing dysmenorrhea pain ($p=0.002$).

Table 2. Post Hoc test

Group	p	Significance
330 ml vs control	0.000	Yes
165 ml vs control	0.124	No
330 ml vs 165 ml	0.002	Yes

Furthermore, a very strong relationship between the effective dose of green coconut water and dysmenorrhea pain reduction evidenced by the value of Pearson correlation ($r=0.816$) (Table 3). This means green coconut water was 66.7% factor explaining pain reduction in dysmenorrhea primer.

Table 3. Pearson correlation test

	Dose	Pain Difference Value
r	1	0.816**
p	.	0.000
N	21	21

DISCUSSION

Primary Dysmenorrhea in Young Women

This study involved young women average aged 21 years with complaints of primary dysmenorrhea. This age is in the range where the prevalence of dysmenorrhea commonly high. The age profile in this study has similarities with other studies (4,10,12,22,23). Some studies associated the age of dysmenorrhea prevalence with the impact of depression and the onset of menarche in young women (4,24), however, the prevalence of dysmenorrhea indeed found mostly in the productive age (1) where young women are the part of this period. Although, there was no collecting data that may ascertain the same factors involved in this RCTs.

The Effect of Green Coconut Water Intervention for Decreasing Primer Dysmenorrhea Pain in Young Women

Large quantities of prostaglandin release have been agreed triggering pain in dysmenorrhea. Two types of prostaglandins namely PGF $_{2\alpha}$ and PGE $_2$, which released during menstruation, mediate myometrium contraction (3), vasoconstriction, and hypersensitization to induce pain in the nerve (25). Until recently, the use of prostaglandin inhibitors therapy has become the main choice for treating dysmenorrhea. However, long-term use of these NSAIDs group may result in infertility (26) and 15% user has experienced no medical benefits even experienced intolerance (25). Whereas alternative treatments such as using oral contraceptives increase the risk of venous thromboembolism (27), and pain management such as acupressure (28) is considered ineffective.

Magnesium is widely known to have a role as a pain reliever, including dysmenorrhea. Magnesium is not only reducing premenstrual syndrome symptom but also have proven in declining primary dysmenorrhea severity (29). Other studies related to magnesium and calcium corroborate reported the effective effect on pain suppression (30,31). Furthermore, magnesium can function as vasoconstriction relieve (32) that can be very useful in dysmenorrhea treatment.

The results obtained from the treatment group showed a significant decrease in pain intensity of dysmenorrhea ($p=0.000$). The effective dose of green coconut water can produce the biggest difference in pain reduction before and after administration when compared with control (VAS=4.14, $p=0.000$). While another dose, which was 165 ml, only gave a weak impact to encounter pain from primer dysmenorrhea (VAS=1.86, $p=124$). Another RCT also agreed with magnesium's ability to relieve dysmenorrhea pain. Administration of magnesium and calcium in young women suffering from dysmenorrhea were shown to have a stronger pain reduction effect than calcium alone (-1.9 95% CI -2.2 to -1.7, $p<0.001$ vs. -0.9 95% CI -1.2 to -0.6, $p<0.001$) (29). The estimated total magnesium (Mg) of the effective dose was about 297 mg calculated from one-day administration. Even though this number is slightly less than the suggested amount (300 mg) to reduce dysmenorrhea pain (300 mg) (33), but the dose in this study has proven to have a similar effect.

Magnesium cannot directly reduce the amount of prostaglandin that is produced in large quantities during dysmenorrhea. This active mineral will work together with other minerals such as calcium, sodium, and potassium through activation of voltage-gated channels closing. Closing activity through the induction of N-methyl-D-aspartate (NMDA) receptors on cells will block calcium ion flow. When NMDA is blocked and calcium ion is not able to pass through the channels, an antinociceptive response will be active (3,34). Antinociceptive will generate central sensitization and abolish hypersensitivity on the central nervous system, so the effect from pain stimulus will not be recognized. This neuronal activity will occur several times until the pain dismisses for a certain period (3,35). In dysmenorrhea cases, those processes will gradually decrease the pain in the pelvis. Whereas, magnesium effect on calcium can influence cell membrane control in smooth muscle. When magnesium level increases by intervention, smooth muscle relaxation and vasodilation will happen together with a lower calcium activity. As a result, dysmenorrhea pain will decrease (36).

On the other hand, another possible mechanism of magnesium in pain management is the relationship between magnesium deficiency and menstrual complaint. Low magnesium level is frequently found in dysmenorrhea. A study has shown that young women who experience dysmenorrhea significantly have lower magnesium level compared to normal ones (37). Magnesium deficiency increases angiotensin-II mediator synthesis and thromboxane, and prostaglandin vasoconstriction production. All of these components play a role in dysmenorrhea pain (36). This finding also further confirms that dysmenorrhea is caused by magnesium deficiency.

Although evidence from other studies that report the role of magnesium as an anti-pain for dysmenorrhea is very limited in number, all existing studies have agreed with the results

of the RCT of this study. The results of this study indicate that green coconut water with magnesium content

effectively reduces the pain and is beneficial as a non-pharmacological alternative to dysmenorrhea treatment.

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