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Effects of Two Non-pharmacological Pain Relief Interventions on the Severity of Pain among Adolescent Girls Complaining from Primary Dysmenorrhea

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Abstract: **Primary Dysmenorrhea Is A Common Gynecologic Disorder Among Young Females.**

Aim: To assess the effect of two non-pharmacological pain relief interventions on the severity of pain among adolescent girls complaining of primary dysmenorrhea.

Study design: Quasi-experimental research design.

Setting: Karmouz; Zizenia; and Alamrhia Secondary Commercial Schools for Girls, Alexandria, Egypt.

Sample size: Purposive sampling of 90 female students with moderate to severe primary dysmenorrhea from November 2019 to February 2020 according to certain inclusion criteria. Participants were randomly divided into three equal groups: two experimental groups (knee–chest position group & heat compresses group) and one control. Samples were randomized to knee–chest position, heat compresses, and control groups (n = 30 each) via simple random sampling technique.

Tools: Self-administered structured questionnaire, Verbal Multidimensional Scoring system (VMS), and Visual Analog Scale (VAS).

Results: No statistically significant reduction in VAS score in the two studied groups compared to control group before intervention in same menstrual cycle, but a highly statistically significant difference between them after intervention use in the same menstrual cycle and second menstrual cycle (p = <0.001).**

Conclusion: Knee–chest position and heat compresses reduce dysmenorrhea pain intensity level. Dry heat compresses were more effective than knee–chest.

Recommendation: Encouraging all females with dysmenorrhea to use dry heat compresses and knee–chest position to release dysmenorrheal pain, avoiding overreliance on pharmacological painkillers.

Keywords: **Dysmenorrhea, Non-pharmacological interventions, Pain, Adolescent girls, Knee–chest position, hot compresses.**

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1. INTRODUCTION

1.1. Primary Dysmenorrhea

Dysmenorrhea is one of the most prevalent gynecological disorders that refer to chronic, repeated pain felt mainly in the hypogastrium and radiates to the inner and front aspect of the thighs happening just before or during menstruation, typically beginning soon after menarche once regular ovulation is established (Abadi Bavil et al., 2018). Primary dysmenorrhea takes place when there is no indication of pelvic or hormonal pathology, while secondary dysmenorrhea happens when the pain is due to detectable pathological disorders containing ovarian cysts, endometriosis, intrauterine devices, or pelvic inflammatory disease (Charu et al., 2012; Grandi et al., 2012).

Anticipated risk factors for dysmenorrhea consist of early menarche, long and heavy menstrual flow, null-parity, and cigarette smoking; the prevalence of primary dysmenorrhea also declines after the first delivery. Low-fat, vegetarian diets have been associated with diminished symptoms, while cigarette smoking is associated with increased dysmenorrhea (Ameade et al., 2018; Iacovides et al., 2015).

Dysmenorrhea is one of the most common gynecological disorders among adolescent girls (Acheampong et al., 2019). Previous studies show rates of dysmenorrhea ranging from 75–83% (Ameade et al., 2018; Chauhan & Kodnani, 2016), but some have reported that as many as 90% of adolescent females and more than 50% of menstruating women globally suffer from it, with 10–20% describing their pain as “severe” and “distressing” (KJ Berkley, 2013). Dysmenorrhea is a reason for repeated short-term school and work absenteeism in females of reproductive age (Femi-Agboola et al., 2017). About 10–15% of females experience monthly severe menstrual pain, with associated negative impacts on normal daily functions at school, work, or home (Rani et al., 2016). Despite this substantial effect on their general wellbeing and quality of life, only a small number of women with dysmenorrhea seek treatment, as the majority believe it will not help (Fatima et al., 2017; Wong, 2018).

Management approaches for primary dysmenorrhea consist of pharmacological as well as non-pharmacological methods. Pharmacological interventions may not be completely effective, and have undesirable side effects for about 15% of females with primary dysmenorrhea. In addition, many young females do not wish to use medication for dysmenorrhea as they believe that it may affect their fertility or cause some types of dependence (Rizk, 2013). Moreover, management of dysmenorrhea with non-steroidal anti-inflammatory drugs (NSAIDs) and oral contraceptives is accompanied with side effects such as nausea, breast tenderness, intermenstrual spotting, and visual or hearing disturbances. About 20–25% of females report that their menstrual pain is not decreased or controlled by NSAIDs alone (Barcikowska et al., 2020).

Non-pharmacological interventions have been suggested for attaining relief from dysmenorrhea symptoms, including acupuncture and acupressure, biofeedback, heat management, transcutaneous electrical nerve stimulation, and relaxation techniques (Ameade et al., 2018). Furthermore, the use of heat is one of the oldest management methods, traditionally used to ease menstrual pain in many cultures. Heat increases the blood flow into the area of application via vasodilatation, leading to smooth muscle relaxation and declined pain perception (Ouda et al., 2017; Potur & Kömürcü, 2014). On the other hand, several physical exercises and positions have been suggested to eliminate menstrual pain, such as knee–chest position, targeted during the active menstrual period (Mahishale et al., 2013).

Nurses have the important role of delivering health education to females about non-pharmacological interventions for alleviating dysmenorrhea, including pain assessment; information about physiological effects of local hot application on reducing dysmenorrhea; procedure; location; duration; interval; and safety precautions of hot therapy. Females should not use heating devices for more than thirty minutes at a time, and should reassess skin condition during hot application (Ameade et al., 2018). Intervention with knee–chest position can also be used in conjunction with a hot moist pack for decreasing pain and menstrual distress in primary dysmenorrhea (Mahishale et al., 2013).

1.2. Study Significance

Dysmenorrhea is one of the most important issues in women’s health that may have a negative impact on social relationships, psychological status, and school or work activities (Iacovides et al., 2015). Estimated dysmenorrhea prevalence is high, ranging from 45–93% of women during their reproductive age, and the highest rates are recorded in adolescents. Adolescent and older women generally conceptualize such pain as a natural and inevitable part of the

menstrual cycle, and rarely seek treatment. Most women simply endure this pain as a normal part of their lives, and do not report it or seek medical consultation, remaining untreated (KJ Berkley, 2013; Petraglia et al., 2017). However, dysmenorrhea has profound lifestyle impacts, including significantly increasing school or college absenteeism; less sports participation; low academic performance; and decreased socialization with peers (Awed et al., 2013).

In Egypt, dysmenorrhea is the most prevalent menstrual disorder, with rates of 93% reported among adolescent girls in Giza City (Abdelmoty et al., 2015), and 77.3% of secondary school girls in Assiut City (Goda et al., 2020). Although the literature suggests that perimenstrual positions and dry–hot compresses are indicated for primary dysmenorrhea, no specific therapy has been studied or recommended for clinical implication in Alexandria City, Egypt. The current study addresses this research gap, investigating the application of knee–chest position and dry–hot compresses as non-pharmacological interventions for relieving the pain of menstrual cramps. Both methods are cheap and have no side effects, unlike conventional painkillers. The results of the current study shed light on the effectiveness of non-pharmacological pain relief interventions on the severity of pain among adolescent girls complaining of primary dysmenorrhea.

1.3. Operational Definitions

- **Knee–chest position**

The weight of the body is maintained by the knees and chest, with the buttocks elevated, with the head turned to one side, and the arms flexed, so the upper part of the body may be supported partially by the elbows. Participants are asked to keep this position for 5 minutes, and to repeat it 10 times per day during the menstrual cycle, with a rest period of ten seconds before each repetition.

- **Dry–hot compresses**

A warm compress bottle (about 40°C) covered with a towel is placed on the lower abdomen (under the navel) on the days of menses for 15-25 minutes, and is removed when the compress starts to be cold. The appropriate temperature can be measured by the wrist or lip. The bottle must be taken off after 25 minutes and then be reapplied (when hot) again after waiting 10 minutes.

1.4. Aim

To assess the effect of two non-pharmacological pain relief interventions on the severity of pain among adolescent girls complaining of primary dysmenorrhea.

1.5. Objectives

- To evaluate the effect of practicing knee–chest position on the severity of pain among adolescent girls complaining of primary dysmenorrhea.
- To evaluate the effect of applying hot compresses on the severity of pain among adolescent girls complaining of primary dysmenorrhea.
- To evaluate the effect of practicing knee–chest position on daily activities and need for taking painkillers to relieve primary dysmenorrhea.
- To evaluate the effect of applying hot compresses on daily activities and need for taking painkillers to relieve primary dysmenorrhea.
- To identify adolescent girls' opinions regarding the effectiveness of knee–chest position and hot compresses in reducing the level of dysmenorrhea pain.

1.6. Research Hypotheses

- H1: There is a significant difference between the pre and post interventional level of dysmenorrhea pain among adolescent girls in knee–chest position and control groups.
- H2: There is a significant difference between the pre- and post-interventional level of dysmenorrhea pain among adolescent girls in the hot compress and control groups.

- H3: There is a significant difference between students' daily activities and their need for taking painkillers to relieve primary dysmenorrhea before and after practicing knee–chest position.
- H4: There is a significant difference between students' daily activities and their need for taking painkillers to relieve primary dysmenorrhea before and after applying hot compresses.
- H5: There is a significant difference about the opinion of participants regarding the effectiveness of knee–chest position and dry–hot compresses in reducing dysmenorrhea pain level.

2. METHODS

2.1 Research Design

The present study was a randomized controlled trial.

2.2 Settings and Subjects

The study was carried out in Alexandria, the second-largest city in Egypt, and a major economic center of the Mediterranean. It has a population of 5,379,488. There are 11 governmental commercial secondary schools for girls affiliated to the Ministry of Education in Alexandria, serving Egyptian citizens only. The study was conducted at three randomly selected schools, namely: Karmouz; Zizenia; and Alamrhia Secondary Commercial Schools for Girls. Sample size was calculated using the Stephen Thompson formula for sample size calculation, in consultation with a statistician [confidence interval (CI) = 95.0%, confidence limit = 0.05]. According to the sample size formula, and considering the potential for attrition, 90 students were included in this study. They were randomly and equally allocated to one of the three groups using envelope method (30 students were recruited in each group considering, including 10 students from each school in each group randomly). Group A: knee–chest position group; Group B: hot compresses group; Group C: control group (no intervention given).

Students' classes and grades (first, second, and third) in each school were selected randomly using systematic random sample. Only students with moderate to severe primary dysmenorrhea were eligible to be included in the current study, subject to the following inclusion criteria: free from any gynecological disorders, agreed to participate in the study, did not use medications for pain relief during the course of the study, had a menstrual cycle with an interval of 21–35 days; duration from 2–6 days; and without skin condition that could be made worse by hot compresses. Exclusion criteria included: married; pregnant, or taking hormonal contraceptives.

2.3 Data Collection Tools

The study data was collected using the four tools described below.

2.3.1 Tool I: Bio-Socio-Demographic Characteristics

This tool was developed by the researcher based on a review of relevant, current, and updated literature. It comprises three parts.

- **Part I: Socio-demographic characteristics**

Age, academic year, telephone number, weight, and height.

- **Part II: Menstrual history**

Age of menarche, regularity of menstruation, duration of menstruation, amount of menstrual flow, number of pads changed per day, and expected date of coming menstruation.

- **Part III: Dysmenorrhea history**

Family history and first occurrence of dysmenorrhea, onset of pain during menstruation, duration of dysmenorrhea, site and type of menstrual pain, and previous pain relief interventions during menstruation.

2.3.2 Tool (II): Visual Analog Scale (VAS) (Larroy, 2002)

VAS was used to assess menstrual pain. It is based on the theory that pain intensity is continuous, without jumps or intervals. During dysmenorrhea, students were asked to express their severity of pain on a scale of 0-10 on the pain ruler, with 0 indicating no pain and 10 meaning the most severe pain that an individual might experience. The classification of pain was done according to the scores of pain (no pain: 0, mild: 1-3, moderate: 4-7, severe: 8-10).

2.3.3Tool (III): Verbal Multidimensional Scoring system (VMS) (Direkvand-Moghadam, 2012)

VMS was used to evaluate students' daily activity, systemic symptoms, and need for taking painkillers during menstruation. The grading system ranges from zero to three, comprising four grades: painless = (0), menstruation with pain but unusual use of painkillers or limit to normal activity = (1), moderate pain during menstruation with effect on daily activity and use of painkillers = (2), and severe pain during menstruation with extensive restriction to daily activity and ineffective use of painkillers = (3).

2.3.4 Tool (IV): Follow-Up Card

This included the researcher' telephone number, and Arabic instructions for participants concerning the relevant intervention.

2.3.5 Tool (IV): Effectiveness Opinion

One attached question assessed participants' opinions regarding the effectiveness of the two non-pharmacological interventions.

2.3.6 Tools' Validity and Reliability

The three tools were translated into Arabic language and back-translated by the researchers. They were revised by three experts in maternity nursing sciences to ensure their validity. The opinions of the latter were elicited regarding the tools' format layout, consistency, and scoring system. According to the experts' suggestions, minor modifications were made. The total research tools' item content validity index (I-CVI) was 0.821, with a content validity ratio (CVR) of 0.809. A reliability test was done during a pilot study (with 9 students) before actual data collection, to examine the internal consistency of the tools' questions. The Cronbach's alpha coefficient was = 0.891.

2.4 Ethical considerations

The participants' rights were maintained throughout the course of data collection by clarifying to them the aim and the significance of the study and their role. The researchers were obtained written informed consent at the beginning of data collection from students and ensured that they had a clear understanding of the study before they volunteered to participate; the researchers notified all participants that they had the right to withdraw from the study at any time, and that their decision to participate, to subsequently decline, or to decline to participate from the outset would not affect their education or other statutory rights. They were reassured that any obtained information would be confidential. Furthermore, participants were informed that there were no risks or harms of both study interventions (knee–chest position and hot compresses). The interview was carried out in a private room in each school.

2.5 Field Work

Field work included three phases, described below.

2.5.1 Phase I: Preparatory Phase

- The researchers reviewed the literature related to the current study, then prepared and designed tools for data collection.
- The study was approved by the Ethical Committee at the Faculty of Nursing, Port Said University. An official approval letter was directed to Alexandria Directorate of Education, and subsequently to the directors of the chosen schools, explaining the permission to carry out the study.

- The researchers collaborated with school administrators to plan for data collection procedures as well as to prepare a separate place for interviewing the studied sample.

- Finally, a pilot study was carried out with 10% (n = 9) of the total study participants, who were subsequently excluded from the study sample. The pilot study was conducted at the previously mentioned settings to test the clarity of the study tools and estimate the required time to fulfill the questionnaire.

2.5.2 Phase II: Implementation Phase

- The data collection was carried out from beginning of November 2019 to the end of February 2020, and was conducted during school hours, at the end of class or at break time.

- This phase started by selecting 30 participants from each school who met the inclusion criteria and explaining the nature of the study as well as taking their approval to participate in the study prior to data collection. Girls who agreed to participate were randomly and equally distributed to three groups at each school: Group A: knee–chest position group, Group B: hot compresses group, and Group C: control group (for whom no intervention was given).

- All participants in all study groups were asked to fill out the questionnaire (tools I, II, and III) based on last menstrual period history, systemic symptoms, and necessity of painkillers, and their menstrual pain level was self-assessed.

- Students in Group A were asked to use knee–chest position during the coming menstruation by maintain the weight of the body by the knees and chest, with the buttocks elevated, the head turned to one side, and the arms flexed so the upper part of the body may be supported partially by the elbows. The students are asked to keep this position for 5 minutes, repeated 10 times per day during the menstrual cycle, with a rest period of ten seconds given after each repetition. Students in Group B were asked to apply warm compress bottle to the lower abdomen (under the navel) during the days anteceding the coming menstruation. Full instructions for use were explained to them. The bottles had to be covered with a towel before application on the skin, and temperatures of approximately 40°C were recommended. The appropriate temperature can be measured by the wrist or lip. Compresses had to be removed after 15 to 25 minutes, or when the compresses start to feel cold. The bottle is removed after 25 minutes, and then replaced again after a 10-minute interval. Participants may need to rewarm the compresses every 5 minutes. The hot compresses can be applied as often as needed. Group C was instructed to continue using the usual self-care measures.

2.5.3 Phase III: Evaluation Phase

The students in the three groups were followed up by the researcher through telephone calls. Tools II and III were completed for second time for all participants after they applied the instructed interventions via calls.

2.6 Statistical Analysis

Statistical analysis was conducted using statistical software SPSS IBM Version 22 for Windows. Quantitative data were presented as frequency, percentage, mean and standard deviation (SD). Chi-square, ANOVA, Paired T test, and correlation matrix were used to estimate the degree of association, and P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

3. RESULTS

The comparison of bio-socio-demographic characteristics of the participants by their study groups is shown in Table 1. The mean age of participants in knee–chest position group was 17.166 ± 1.533 years, compared to 16.533±1.195 years among hot compresses group, and 17.233±1.534 years among the control group, with significant differences (ANOVA test = 2.201, P = 0.117). More than half of participants in the knee–chest position and control groups were in their first academic year in the commercial secondary school (respectively 56.67% and 53.34%), while 80% of participants in the hot compresses group were also in their first academic year in the commercial secondary school, with significant differences ($X^2 = 5.715$, P = 0.221).

The mean weight of participants in the knee–chest position, hot compresses, and control groups were 65.300±8.917, 64.300±6.438, and 59.133±9.522 (respectively), with significant relation (ANOVA test = 4.658, P = 0.011). Table 1 also shows that participants' mean height in the knee–chest position, hot compresses, and control groups were 160.400±9.951, 158.883±5.66, and 159.700±5.567 (respectively), with significant differences (ANOVA test = 0.461, P = 0.632).

Table 1: Comparison of study participants' bio-socio-demographic characteristics by group (n = 30 each)

Variable	*Knee–chest position*		*Hot compresses*		*Control*		*ANOVA, X^2 test P-value*
	No.	*%*	*No.*	*%*	*No.*	*%*	
Age (years)							
15- 17- 19-21	13 10 7	43.34 33.33 23.33	18 9 3	60 30 10	11 11 8	36.66 36.66 26.67	2.201 0.117
Mean ± SD Min-Max	17.166±1.533 15 - 20		16.533±1.195 15 -19		17.233±1.534 15-20		
Academic year							
1st year 2nd year 3rd year	17 5 8	56.67 16.66 26.67	24 3 3	80 10 10	16 5 9	53.34 16.66 30	5.715 0.221
Weight (kg)							
50- 60- 70- 80-90	12 14 2 2	40 46.66 6.67 6.67	9 17 4 0	30 56.67 13.33 0	13 14 2 0	43.34 46.67 6.66 0	4.658 0.011*
Mean ± SD Min-Max	65.300±8.917 54 - 90		64.300±6.438 53 - 79		59.133±9.522 60 - 74		
Height (cm)							
140- 150- 160- 170-180	1 17 10 2	3.33 56.67 33.33 6.67	1 19 10 0	3.33 63.34 33.33 0	2 17 11 0	6.67 56.67 36.66 0	0.461 0.632
Mean ± SD Min-Max	160.400±9.951 148-180		158.883±5.66 150-169		159.700±5.567 150 - 170		

P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

Table 2 compares study participants' menstrual history by study groups. The results indicate that the mean age of menarche among the knee–chest, hot compresses, and control groups were 12.4, 12.6, and 12.3, respectively. The majority of study participants in the knee–chest, hot compresses, and control groups have regular menstruation (76.6%, 80%, and 66.67%, respectively). Regarding duration of menstruation, over three-quarters of participants in the three groups mentioned that their menstrual duration ranged from 3 to 7 days. In addition, the majority reported moderate menstrual flow. The results also revealed that there is no significant relation between the three groups.

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Table 2: Comparison of study participants' menstrual history by group (n = 30 each)

Variable	*Knee–chest position*		*Hot compresses*		*Control*		X^2 *P-value*
	No.	*%*	*No.*	*%*	*No.*	*%*	
Age of menarche (years)							
9- 12- 15-18	7 21 2	23.34 70 6.66	5 24 1	16.67 80 3.33	9 17 4	30 56.67 13.33	0.374 0.689
Mean ± SD Min-Max	12.400±1.40443 9.00 - 15.00		12.600±1.13259 10.00 - 15.00		12.300±1.53466 10.00 - 16.00		
Regularity of menstruation							
Regular Irregular	23 7	76.66 23.34	24 6	80 20	20 10	66.67 33.33	1.518 0.468
Duration of menstruation (days)							
3-7 More than 7	25 5	83.33 16.67	23 7	76.66 23.34	24 6	80 20	0.147 0.812
Menstrual flow							
Light Moderate Heavy	2 26 2	6.67 86.66 6.67	1 26 3	3.33 86.67 10	3 24 3	10 80 10	1.355 0.852
Number of pads/ day							
< 4 4-8 8^+	9 17 4	30 56.67 13.33	6 21 3	20 70 10	7 22 1	23.34 73.33 3.33	3.86 0.543

P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

Table 3 compares participants' dysmenorrhea history by group. The results revealed that above 60% of participants in the knee–chest position group had no family history of dysmenorrhea, while 23.3% and 46.6% of their counterparts in the hot compresses and control groups did (respectively). Over 50% of participants in the knee–chest position group experienced dysmenorrhea with onset of menarche, while 73.3% and 53.33% in the hot compresses and control groups (respectively) experienced dysmenorrhea after one or two years of menarche. Regarding the onset of pain during menstruation, 63.33%, and 53.33% of participants in the knee–chest position and hot compresses groups (respectively) stated that onset of menstrual pain began on the first day of menstrual flow, while 46.65% of participants in the control group mentioned that they experienced pain the day before menstruation.

All participants in the knee–chest position group (100%) and most in the hot compresses and control groups (90% and 93.3%, respectively) reported that the lower abdomen is the common site of menstrual pain. The majority of participants in the knee–chest position (93.3%), hot compresses (93.3%), and control (86.33%) groups described menstrual pain as "cramping".

Concerning previous pain relief interventions during menstruation, warm compresses were reported by 66.6% and 83.3% of participants in the knee–chest position and hot compresses groups respectively, while 56.6% in the control group reported using herbal drinks to relieve menstrual pain. The results also indicated that there is no significant relationship between the three groups.

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Table 3: Comparison of study participants' dysmenorrhea history by group (n = 30 each)

Variable	*Knee–chest position*		*Hot compresses*		*Control*		X^2 *P-value*
	No.	*%*	*No.*	*%*	*No.*	*%*	
Family history of dysmenorrhea							
None	19	63.33	7	23.33	14	46.67	
Mother	2	6.67	4	13.33	2	6.67	10.253
Sister	5	16.67	11	36.67	7	23.33	0.114
Mother and sister	4	13.33	8	26.67	7	23.33	
First occurrence of dysmenorrhea relative to menarche onset							
Onset with menarche	16	53.34	8	26.67	14	46.67	4.844
1-2 years after menarche	14	46.66	22	73.3	16	53.33	0.304
Onset of pain during menstruation (days relative to menstrual flow)							
Day before	6	20	9	30	14	46.66	5.510
1st day	19	63.33	16	53.33	11	36.67	0.239
2nd day	5	16.67	5	16.67	5	16.67	
Duration of dysmenorrhea (days)							
< 1	5	16.67	5	16.67	5	16.67	3.988
1-2	19	63.33	14	46.66	20	66.66	0.408
3+	6	20	11	36.67	5	16.67	
**Site of menstrual pain							
Lower abdomen	30	100	27	90	28	93.33	
Back	24	80	24	80	26	86.66	31.892
Legs, pelvic pain	17	56.66	16	53.34	18	60	0.373
Other	8	26.66	20	66.66	17	56.66	
**Type of menstrual pain							
Cramping	28	93.33	28	93.33	26	86.33	16.007
Sharp	16	53.34	14	46.66	22	36.67	0.313
Dull	4	13.33	11	36.67	13	43.33	
**Previous pain relief interventions during menstruation							
Rest	19	63.33	20	66.66	16	53.34	
Warm	20	66.66	25	83.33	16	53.34	
Breathing	5	16.66	6	20	5	16.66	
Medical advice	3	10	3	10	2	6.66	25.376
Practice exercises	1	3.33	1	3.33	0	0	0.707
Take herbal drinks	18	60	17	56.66	17	56.66	
Don't make anything	6	20	2	6.66	8	26.66	

** Total is not exclusive because of expectation of > 2 answers from participants

P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

Table 4 compares participants' VAS scale items by group. The results revealed a statistically significant reduction between before and after intervention VAS scores among the knee–chest position group (t = 8.361, p = 0.00) and hot compresses group (t = 12.36 & P = 0.00), but there was no significant difference for the control group.

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Table 4: Comparison of study participants' VAS pain scale items by group (n = 30 each)

VAS pain rating	*Knee–chest position*		*Hot compresses*		*Control*	
	Before	*After*	*Before*	*After*	*Before*	*After*
	No. (%)	*No. (%)*	*No. (%)*	*No. (%)*	*No. (%)*	*No. (%)*
No	0 (0.0)	3 (10.0)	0 (0.0)	2 (6.7)	0 (0.0)	0 (0.0)
Mild	8 (26.7)	17 (56.6)	2 (6.7)	23 (76.7)	6 (20.0)	5 (16.6)
Moderate	13 (43.3)	10 (33.4)	22 (73.3)	5 (16.6)	17 (56.6)	21 (70.0)
Severe	9 (30.0)	0 (0.0)	6 (20.0)	0 (0.0)	7 (23.4)	4 (13.4)
Mean±SD	6.10±2.21	3.10±1.66	5.96±1.49	2.86±1.40	5.90±2.01	5.53±1.87
PTPV	8.361; 0.00*		12.363; 0.00*		1.385; 0.177	

PTPV = Paired T test, P-value. P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

Table 5 compares participants' VMS scale item scores by group. There are significant differences between before and after intervention in the knee–chest position (t = 10.790, p = 0.00) and hot compresses (t = 15.099, p = 0.00) groups. No significant difference was found between the before and after intervention scores for the control group. The results also indicated that after the intervention, 60% of participants in the knee–chest position group and hot compresses group did not complain of menstrual pain; moreover, 36.6% and 40% (respectively) reported menstruation with pain, but unusual use of painkillers or limitations to normal activity.

Table 5: Comparison of study participants' VMS scale items by group (n = 30 each)

Knee–chest position		**Hot compresses**		**Control**	
Before	After	Before	After	Before	After
No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Painless					
0 (0.0)	18 (60.0)	0 (0.0)	18 (60.0)	2 (6.6)	4 (13.4)
Menstruation with pain but unusual use of painkillers or limit to normal activity					
16 (53.3)	11 (36.6)	10 (33.4)	12 (40.0)	18 (60.0)	18 (60.0)
Moderate pain during menstruation with effect on daily activity and use of painkillers					
6 (20.0)	1 (3.4)	11 (36.6)	0 (0.0)	6 (20.0)	5 (16.6)
Severe pain during menstruation with extensive restriction of daily activity and ineffective use of painkillers					
8 (26.6)	0 (0.0)	9 (30.0)	0 (0.0)	4 (13.4)	3 (10.0)
Mean ± SD					
1.66±0.80	0.43±0.56	1.96±0.80	0.40±0.49	1.40±0.81	1.36±0.764
Paired T test, P-value					
10.790; 0.00*		15.099; 0.00*		1.000; 0.326	

P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

Table 6 compares participants' opinions regarding the effectiveness of the two non-pharmacological interventions by group. Statistically significant differences was found among knee–chest position group and hot compresses group (P = 0.004). Half of participants in the hot compresses group stated that hot compresses are very effective to relieve menstrual pain, and 56.6% in knee–chest position group stated that it was partially effective to relieve menstrual pain.

Table 6: Comparison of study participants' opinions regarding the effectiveness of two non-pharmacological interventions by group

Variable	Knee–chest position	Hot compresses	Test P-value
Very effective Partially effective Not effective at all	6 (20%) 17 (56.6%) 7 (23.4%)	15 (50%) 15 (50%) 0 (00%)	10.982 0.004*

P-value was considered statistically significant if ≤ 0.05, and highly significant if ≤ 0.01.

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4. DISCUSSION

Dysmenorrhea is a cyclical and debilitating process that profoundly affects women worldwide, with immense socio-economic consequences. In coping with this pain some females resort to bed rest, while others are able to stay in work with the support of painkillers. Due to negative side effects, the implications of long-term, regular use of painkillers, and aversion among many women to pharmacological methods, many studies have explored using non-pharmacological interventions in the management of primary dysmenorrhea (Abadi Bavil et al., 2018; Ouda et al., 2017). The current study assessed self-rated pain scores among adolescent girls complaining of primary dysmenorrhea before and after practicing knee–chest position or applying dry–hot compresses interventions, with a view to evaluate the effectiveness of these therapies to reduce pain severity. The three groups were allocated randomly and had no apparent differences in their bio-socio-demographic characteristics except their body weight. The age range of the total sample was from 15 to 20 years, which is slightly higher than the sample of a similar study carried out among adolescent girls (14.67 ± 1.7 years) (Abdelmoty et al., 2015).

Our participants' mean age of menarche was slightly more than 12 years in all study groups. The majority of participants have regular menstruation, with duration of menstrual flow ranging from 3-7 days, and menstrual intervals of 21-35 days. They reported losing a moderate amount of menstrual flow, and no significant relationships were observed between the three groups in terms of all aspects of menstrual history. In general, our participants mainly reported normal menstrual patterns, which could be attributed to the normal range of their body weight and height. Our results are in line with a recent study carried out among university students in Saudi Arabia. Nevertheless, an earlier study carried out among adolescent girls in Egypt revealed that abnormal menstrual lengths occurred among 43% of study respondents (Abdelmoty et al., 2015).

Other studies carried out in Ghana and Kuwait (Acheampong et al., 2019; Al-Matouq et al., 2019) reported a significant association between early age of menarche and dysmenorrhea, which could be due to the fact that early menarche reflects longer exposure to uterine prostaglandins, which plays a major role in dysmenorrhea through increasing uterine contractility, resulting in pain. Adolescents' girls have a liability to vary in their menstrual duration due to immaturity of the hypothalamic ovarian axis, which needs about two years after menarche to attain maturity (Akin et al., 2004).

In the present study, about half of participants in the three groups experienced menstrual pain on the first day of menstruation, and it persisted for 1-2 days. The vast majority felt cramping menstrual pain in the lower abdomen and back. No significant relationship was found between the three groups and items of dysmenorrhea history. This can be attributed to the fact that we allocated the participants in each group randomly, which reflects the homogeneity of groups. In fact, several studies have demonstrated a positive relationship between having irregular periods and amount of menstrual flow with dysmenorrhea (Hong Ju et al., 2014; Latthe et al., 2006). Other studies revealed that irregular menstrual period and amount of menstrual flow were found to be negatively associated with dysmenorrhea among high school girls (Al-Kindi & Al-Bulushi, 2011; Al-Matouq et al., 2019). Both the flow of menstruation and dysmenorrhea are thought to be determined by prostaglandins. In case of increased blood flow, prostaglandins can disturb the homeostatic mechanism of the endometrium, thus increasing blood flow. Moreover, platelets aggregation and/or various coagulation factors are affected by prostaglandins, leading to the increase of menstrual blood flow (Rani et al., 2016).

In our study, approximately two-thirds of the participants in the knee–chest group, the vast majority of participants in the hot compresses group, and slightly more than half of the control group used warm compresses as an intervention to relieve menstrual pain, and a minority in the three groups sought medical advice. None of them practiced exercises to relieve pain associated with menstruation. Another study carried out among Cairo University students in Egypt mentioned that the majority of students did not seek medical advice for dysmenorrhea (Kamel et al., 2017). Al-Matouq (2019) mentioned that easier access to healthcare services in Kuwait could explain the higher proportion of adolescents seeking medical care for dysmenorrhea compared to other settings (Al-Matouq et al., 2019).

Many studies (Blakey et al., 2010; Gurpreet et al., 2018; Nunes et al., 2014) revealed that adolescent girls with dysmenorrhea did not practice physical activity. Measuring physical activity among young adults is difficult, and could result in substantial non-differential misclassification, which can explain the lack of practicing physical activity among our study participants. In addition, a study in Japan reported that physical activity is inversely associated with

dysmenorrhea (Kazama et al., 2015), which could be explained by reverse-causality (girls with dysmenorrhea and heavy blood flow may refrain from exercise and other physical activities).

Considering the severity of dysmenorrhea, it is apparent from the results of our study that most students in all study groups suffered from moderate dysmenorrhea, while around a quarter of them suffered from severe dysmenorrhea, and a few complained of mild menstrual pain before intervention. This result is consistent with previous studies, which reported that more than half of participants had moderate pain (Abdelmoty et al., 2015; Gangwar et al., 2014; Nunes et al., 2014).

In addition, in the current study, the intervention groups reported a significant decrease in menstrual pain in the second menstrual period after using knee–chest position and applied hot compresses. Pain of primary dysmenorrhea significantly decreased in both knee–chest position and hot compresses groups more than in the control group, corroborating (Ouda et al., 2017), who reported that heat application was an effective method for relieving primary dysmenorrhea pain. In addition, another study showed that topical heat reduces dysmenorrheal pain (Akin et al., 2004).

Regarding the effect of knee–chest position in this study, (Mahishale et al., 2013) illustrated that this intervention can be used in conjunction with hot moist pack to decrease pain and menstrual distress in primary dysmenorrhea. (Rima Gupta et al., 2013) indicated that the non-pharmacological intervention of active exercises was effective in the management of dysmenorrhea, and such procedures were preferred by patients to over-the-counter painkiller medications. This might be due to knee–chest position acting as a non-specific analgesia by improving pelvic blood circulation, and stimulating the release of beta-endorphin. Knee–chest position leads to the avoidance and regression of dysmenorrhea by decreasing stress and improving mood. Previous studies reported that the treatment of dysmenorrhea includes (but is not limited to) the use of a heating pad (Ouda et al., 2017; Potur & Kömürcü, 2014), which supports our findings. Other studies reported a significant effect of non-pharmacological pain relief methods in decreasing menstrual pain (Awed et al., 2013; Patel et al., 2015; Rakhshaee, 2011; Rizk, 2013; Tugay et al., 2007). Therefore, health education about non-pharmacological pain relief methods for the treatment of dysmenorrhea is urgently required.

Finally, our results indicated that there was significant affirmation among participants in the knee–chest position and hot compresses groups on the effectiveness of these methods in reducing dysmenorrhea. No significant side effects were detected or stated, and both interventions were found to be non-invasive, safe, non-drug methods. For these reasons we plan to conduct our study as a home-based intervention taught to every woman suffering from dysmenorrhea in order to support them to reduce the negative impacts of these symptoms on their academic, social, and personal lives.

5. LIMITATIONS

Despite the accurate design of the current study, some limitations remain. The study subjects were recruited from only three commercial secondary schools in the second-largest city in Egypt, comprising a relatively homogenous group, which limits the generalizability of the findings for broader populations of women.

6. CONCLUSION

In light of the current study results, the researchers concluded that there is a significant effect of knee–chest position and hot compresses on decreasing the severity of pain among adolescent girls complaining of primary dysmenorrhea. The participants in our study were satisfied with the two non-pharmacological interventions, and it can be assumed that working women and other female students may also benefit from the two methods.

7. RECOMMENDATIONS

It recommended to highlight the need for culturally sensitive menstrual health education programs focused on non-pharmacological methods for the management of primary dysmenorrhea, and to promote school-based screening services targeting this important segment of the population. Low willingness to seek medical advice among this patient group must be counteracted by active involvement and engagement among reproductive health specialists, gynecologists, pediatricians, teachers, and school nurses. This study also identifies the need for utilization of the influential role of mass media to raise awareness and facilitate the dissemination of menstrual health information, especially among uneducated adolescents.

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