Research Article

Efficacy of Long-Distance Versus High-Intensity Running in Alleviating Primary Dysmenorrhea: A Survey of Adolescents

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ABSTRACT

Primary dysmenorrhea is known as cramping pain occurring before or during a period in the absence of pelvic pathology. Exercise, and specifically running, is one of the most effective and well-known methods to relieve primary dysmenorrhea, but how different intensities affect period pain remains unknown. Which is why this paper studied the effects long-distance running and high-intensity running had on period pain in adolescents living in Texas. In this paper, a survey was sent to a high school and a middle school to collect data on adolescents aged 14 to 17 who have some level of period pain and have had their period for at least two years with no diagnosed abnormal menstrual conditions. In the end, long-distance running was found to provide more relief on average; however, high-intensity running was found to provide relief for a few people, sometimes to a higher degree than long-distance running. This finding indicates that further research on different exercise intensities is needed to help people get the most relief for primary dysmenorrhea using exercise.

Keywords: Primary dysmenorrhea; Adolescents; Long-distance running; High-intensity running; Menstruation

INTRODUCTION

What is Primary Dysmenorrhea and Menstruation

Menstruation is controlled by the Hypothalamic-Pituitary-Gonadal (HPG) Axis through the gonadotropin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH). The GnRH release from the hypothalamus to the pituitary gland, and the gonadotropins (FSH and LH) stimulate granulosa and theca cells of the ovaries to initiate the production of androgen, estrogen, and inhibin, which is regulated by positive and negative feedback signaling during the menstrual cycle (1). A woman's average menstrual period is 3 to 8 days, with a menstrual cycle usually being 28 days (2). During a menstrual period, women might experience what is known as dysmenorrhea. There are two types: secondary dysmenorrhea caused by an abnormal menstrual condition and primary dysmenorrhea caused by uterine contractions stimulated by prostaglandins (3). Primary dysmenorrhea or menstrual cramps that occur without underlying medical conditions can range

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from being slightly bothersome to very distracting. The pain from this process is something a majority of the population experiences, with the overall prevalence reaching up to 94% in women and up to 90% in young women aged 17 to 24 (4).

Impacts of Dysmenorrhea in Adolescents

The prevalence of dysmenorrhea in adolescents who menstruate is up to 93% (5). Menstrual cramps can adversely affect a person's social, school, and work life as it can cause irritability and be a distraction from activities of daily life. The pain caused by the uterus contracting during menstruation can cause many students to miss school and affect their concentration negatively because of severe pain. The occurrence of dysmenorrhea is a big problem in adolescents because it hinders their ability to focus on school. Pain from menstruation has been shown to negatively impact the performance of 41% of students in school (6). Even though primary dysmenorrhea is more prevalent in adolescents, little is known about treatments for period pain in their age group.

Exercise to Treat Primary Dysmenorrhea

Because of the inconvenience period cramps can cause, many people seek out medication or non-pharmacological remedies to soothe their pain. Exercise can be an inexpensive, accessible, and effective way to reduce period pain with minimal side effects (7, 8, 9, 10). Unfortunately, research is lacking on how different types of exercise can alleviate period pain, especially among teens who menstruate. Long-distance running can be described as running continuously at a slow to moderate pace whereas high intensity running is done in bursts of intense exercise at a strenuous pace with rest in between. High intensity running and long-distance running have proven to provide significant relief for primary dysmenorrhea, making it the focus of this research. So far, research shows that intensity and volume of running is directly related to the pain level of primary dysmenorrhea (11). It was stated that primary dysmenorrhea significantly decreased after moderate intensity aerobic exercise as opposed to other intensities (12). This study also includes individuals who get minimal exercise and have period pain to understand the effects running at both intensities has on primary dysmenorrhea. Individuals who avoided exercise experienced longer and heavier periods with higher levels of fatigue and pain than those who exercised regularly (13,14). Even though long-distance running is less intense than high intensity running, it is stated in many research papers that both intensities of running offer the same amount of relief from primary dysmenorrhea albeit in different ways (15). Moderate exercise like long-distance running boosts anti-inflammatory cytokines and reduces prostaglandin levels, whereas intensive exercise reduces menstrual flow and alleviates pain intensity (16). Furthermore, intense exercise, low oxygen levels, and acidic conditions can trigger the release of beta endorphins, a natural pain-relieving agent, which could reduce the pain caused by menstruation (17). Although there is some research as to how running affects primary dysmenorrhea, these effects have not been well researched in an adolescent population. The objective of this study is to compare two different intensities of running (high intensity running and long-distance running) in order to find the intensity that decreases primary dysmenorrhea in adolescents the most. Overall, we hypothesized that long-distance running would have more alleviating effects on primary dysmenorrhea compared to high intensity running.

LITERATURE REVIEW

View Figure 1 (PRISMA Sort) for details on how the literature review papers were selected. A literature review was performed on 12 papers published in the last 5 years focused on understanding the impact of primary dysmenorrhea on adolescents' lives and the relationship between intensity of pain and exercise.

Jingjie and colleagues studied the impact different exercise levels would have on period pain in non-athlete females aged 15 to 43 (18). Study participants did not take hormonal contraceptives and experienced regular menstruation with moderate or severe primary dysmenorrhea. The paper reported that aerobic exercise could shorten the pain duration as well as alleviate the pain intensity of primary dysmenorrhea using standard mean difference to measure pain intensity and weighted mean difference for pain duration. Of the types of aerobic exercise, low intensity exercise was found to be the most effective in alleviating primary dysmenorrhea followed by high intensity exercise, with moderate intensity exercise being the least effective. In support of these findings, the paper written by Tsai and colleagues showed that relaxation exercises had the lowest risk of dropout and by the 8th week aerobic activity was the 5th most effective in alleviating primary dysmenorrhea out of 6 different exercise interventions (19). The population

of this journal was made up of female participants with primary dysmenorrhea who underwent trials that quantitatively assessed their pain intensity before and after exercise. Similarly, Shreif *et al*. studied the differences in primary dysmenorrhea between female athletes who participated in sports of various intensity and non-athletes 18-28 years along with their use of over-the-counter analgesics for their pain (20). They

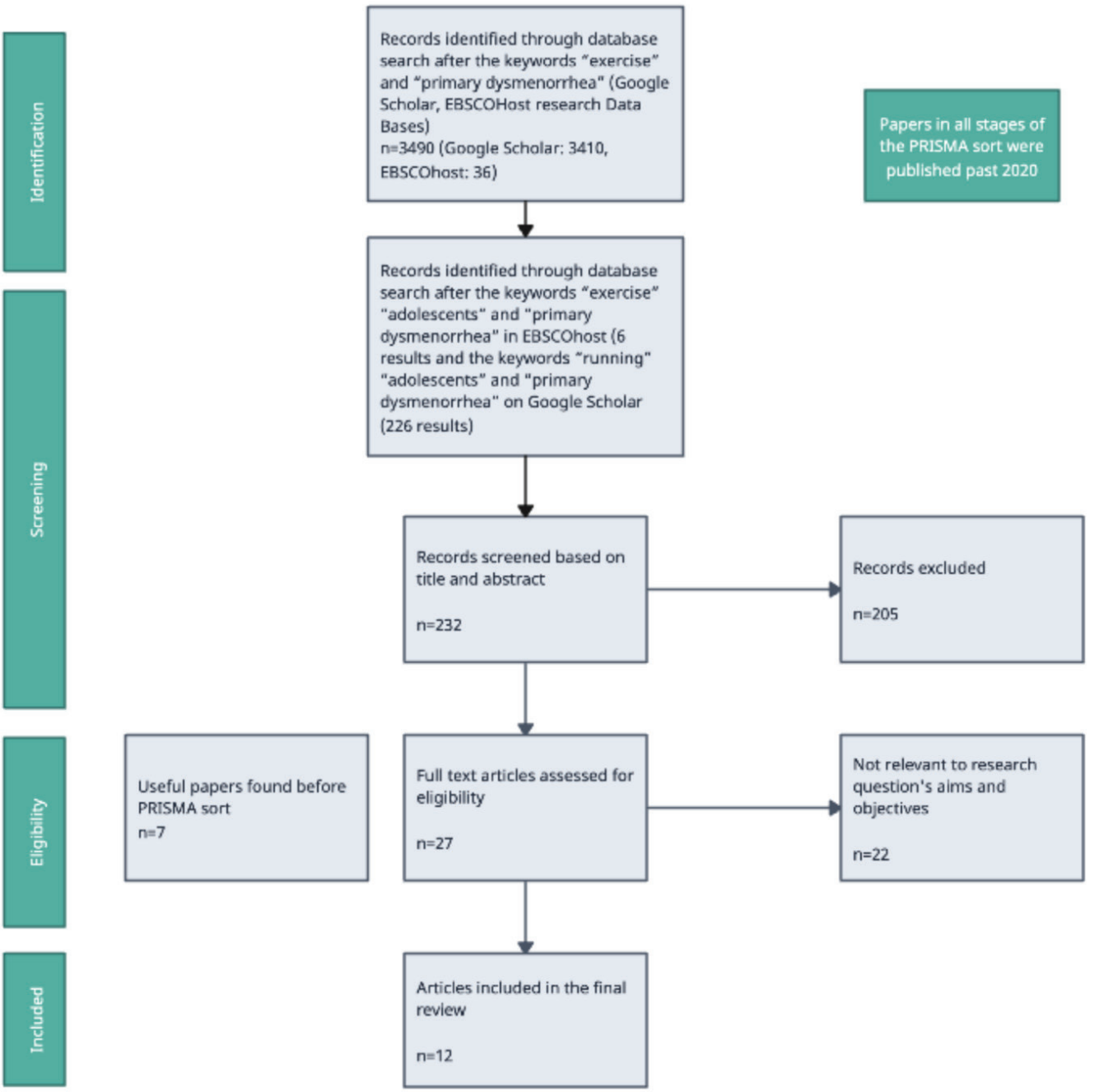

Figure 1. PRISMA sort (Participants in the research papers were mainly 12-43 years old. Out of the 12 papers collected, five of the papers are specifically on adolescents and how primary dysmenorrhea disrupts their lives or how exercise helps relieve the pain).

measured the BMI of the participants, kept track of the workouts they did, and used a visual analogue scale (VAS scale) to track the changes in period pain. The females in the athletic group suffered 28.2% (VAS scale) and 26.8% on the work ability, location, intensity, and days of pain of dysmenorrhea scale (WaLIDD scale) less from severe pain than the non-athletic group, and the number of females who required the use of analgesics was 30.6% lower than individuals in the non-athletic group. Likewise, a review paper written by Jaleel and colleagues explores the effectiveness of pharmacological and non-pharmacological (including exercise) methods in alleviating pain in individuals who menstruate and have primary dysmenorrhea (21). The paper declared that pain relief from exercise is caused by the opioid and non-opioid systems in the body, and hormonal changes that occur during exercise. The study published by Owoicho and colleagues aimed to understand premenstrual syndrome, physical, emotional and behavioural symptoms that starts during the week preceding menstruation and are alleviated when the menstruation begins, and primary dysmenorrhea in female adolescents 13-16 years in Kano, Nigeria (22). 79 participants recruited for the study were split into experimental and control groups where the experimental group was asked to participate in a jogging exercise program and control group did not participate in exercise. Quality of life questionnaires, anthropometric, and physiologic tests performed over this 12-week jogging program concluded that aerobic exercise did improve premenstrual symptoms and primary dysmenorrhea in adolescents. This finding was corroborated by Zhuo *et al*., further strengthening the conclusions of their findings (23). This paper reviewed quasi-experimental and cross-sectional review papers that reported greater premenstrual syndrome and primary dysmenorrhea pain alleviation for females who participate in exercise. Interestingly this work postulated that elevated serum progesterone levels modulating levels of gamma aminobutyric acid (GABA) and serotonin might induce positive effects on mood and stress - contributing to exercise induced analgesia. In terms of other articles that have aimed to delineate the biological underpinnings of exercise induced analgesia, Dong *et al*. proposes that they are the main mediators of primary dysmenorrhea and Traditional Chinese Medicine (TCM) is effective in alleviating primary dysmenorrhea (24). The population for a paper written by Setyowati and colleagues is adolescents and adults with primary dysmenorrhea. The paper used a literature study model to look into how different types of exercise affect primary dysmenorrhea (25). Unfortunately, running or jogging only reduced pain on the primary dysmenorrhea scale by 0.47 while stretching exercises were found to be the most effective with pain reduction of 5.26 on the primary dysmenorrhea scale. A paper written by Huang *et al*. used a randomized controlled trial to investigate the effects HIIT exercise may have on alleviating primary dysmenorrhea in female university students (26). The control group had 15 individuals, and the dysmenorrhea group had 30; the dysmenorrhea group was split into dysmenorrhea with 15 individuals and dysmenorrhea + HIIT with 15 individuals. The filled out Premenstrual Syndrome Questionnaire, the Menstrual Distress Questionnaire, and the Short Form McGill Pain questionnaires, did blood samples 3 days before their period and had their physical fitness evaluated before and after exercise intervention. After the 10-week exercise intervention, menstrual cramping symptoms were shown to be significantly ameliorated in the DysmenHIIT group and Dysmen group with various other symptoms alleviated in only the DysmenHIIT group according to the questionnaires. In the blood test, hormone levels of the dysmenorrhea + HIIT group were significantly higher after exercise and their levels of PGF2 and PGF2a (plays a role in the metabolism of prostaglandins that cause pain and discomfort) were significantly lowered after exercise. Similarly, a paper written by Kolić *et al*. looks at how a woman's menstrual cycle impacts her physical activity (27). The paper utilized a mixed-methods design where they had their participants fill out an online questionnaire that looked into the symptoms the participants experienced on their menstrual cycles. The population was split into two groups: 44 avoiders of exercise and 84 non-avoiders of exercise. They concluded that individuals who don't exercise experience longer and heavier periods that have more painful symptoms. Another paper written by Wal and colleagues explores the impact different non-pharmacological remedies have on primary dysmenorrhea and other symptoms associated with menstruation (28). The paper is a literature review that looked at clinical trial databases, systematic reviews on gynecology in the Cochrane library, Pubmed, science direct, and other databases. The population is individuals who menstruate. It was concluded that yoga and other physical activity contributed to ameliorating primary dysmenorrhea and 75% of women who exercise regularly do not experience high levels of it.

METHODS AND MATERIALS

Study participants demographics

A survey created on Google Forms was distributed among teenagers 13-18 years old who have some level of primary dysmenorrhea. The data was collected from Westlake High School in Austin, and a response from a student at Hill Country Middle School who fit the inclusion factors was collected as well. It was distributed through text; girls on the Westlake track and cross-country teams were asked to send the form to their teammates, and individuals from both schools who didn't participate in exercise were asked to distribute it to their peers who menstruate and get minimal exercise. Participants excluded from the study were those who were diagnosed with abnormal medical conditions and those who did not experience any period pain. This was chosen as an exclusion factor due to the secondary dysmenorrhea that abnormal menstrual conditions cause. Another exclusion factor is those who experience no period pain because this paper is about measuring pain before and after running to determine which intensity provided more relief. Similarly, participants were asked if their periods were regular and they were included in the study as long as they were not diagnosed with any abnormal menstrual conditions and had period pain that was measurable.

Participant anonymity and health information and confidentiality

In appendix A there is a link to the survey that was sent out to the participants. At the very beginning of the survey there is a labeled consent form that informed participants that there were no incentives for participating in the study. Similarly in the consent form section, there is a question that asks the participants if they have read the consent form and accept the risks. The consent form states that there are no risks that stem from participating in the research and there are no direct benefits either. The survey was anonymous and no names, contact details, or other identifiable information were collected.

Period pain metrics

The teenagers were asked to look back on their previous runs and asked to report the difference in period pain after their runs. The scale for reporting general pain asked for their level of pain and the scale after the runs asked for the change in pain. To run a proper mean difference test and have the same scales, the scores reported after the runs were represented differently. 0-1 (pain decreases to the point its barely there) was represented as a score of -2; 2-3 (the pain decreases a little bit) represented as a score of -1; 4-5 (The pain is mostly the same as it was before the workout) represented as a score of 0; 6-7 (the pain got slightly worse) was a score of 1; 8-9 (the pain got significantly worse) was a score of 2; 10 (the pain becomes unbearable) was a score of 3. These new scores were then added to the individual's general pain to get an estimate on what their pain level would be on the pain scale after their runs. Figure 2 and Figure 3 compare period pain level before and after long-distance running and high-intensity running respectively.

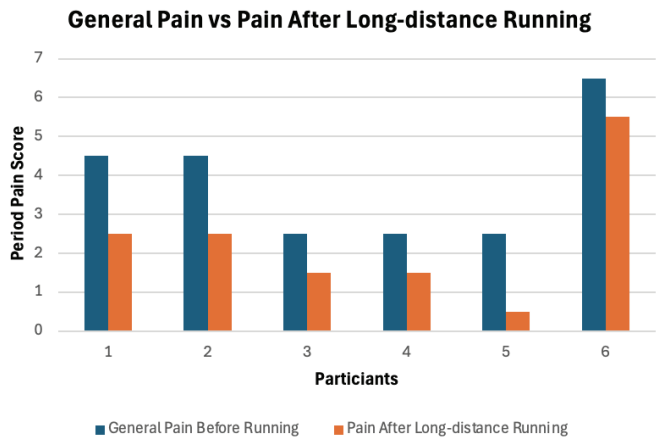

Figure 2. General period pain before running and the pain on the pain scale after long distance running.

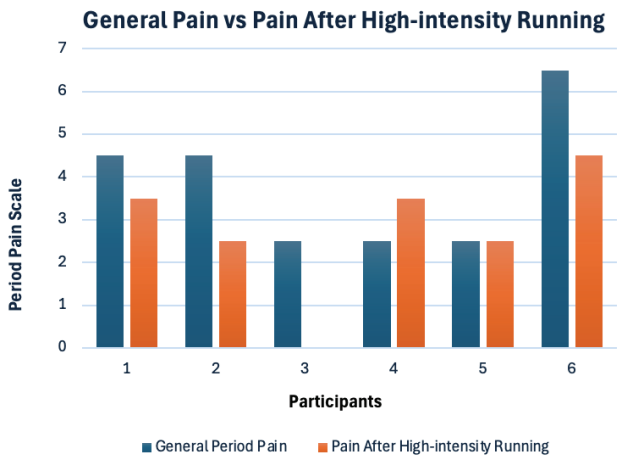

Figure 3. General period pain before running and the pain on the pain scale after high-intensity running.

Data and statistics

Some of the most crucial questions on the survey asked the participants about their general level of period pain on a scale of 1-10 and how that pain decreased on that scale after a long-distance run or high-intensity run. The change in period pain from different intensities of running was measured by the mean difference on a 10-cm visual analogue scale (29). Similarly, another test known as the Wilcoxon Signed-Rank Test was run on the data to compare the pain relief differences between long-distance running and high-intensity running within the same participants. The null hypothesis stated that the median difference in pain relief between long-distance and high-intensity running is zero which implies that there would be no difference in the amount of pain relief participants get from the different intensities of running. On the other hand, the alternative hypothesis stated that the median difference in pain relief between the two running types is not zero which implies that there is a difference between the amount of pain relief participants get from the different intensities of running.

RESULTS

This paper includes eleven participants: six exercise and have a general level of period pain prior to working out, two don't exercise and have some level of period pain, and three exercise and don't have any period pain. For the six who exercise, five do both long-distance and high-intensity running, and one participant does only long-distance running. General period pain levels were measured on a scale of one through ten, and the change to the general level of period pain was measured after high-intensity running and long-distance running. The baseline pain scores of the six individuals who exercise in sequential order are 4-5 (moderate pain), 4-5 (moderate pain), 2-3 (mild pain), 2-3 (mild pain), 2-3 (mild pain), 6-7 (severe pain). Because of different scales, the after run period pain scale was substituted for values that were added to or subtracted from the general pain level. View the survey questions in appendix A for more information regarding the formatting of the pain scale questions. The pain scale after running was assigned these numbers: 0-1: -2, 2-3: -1, 4-5: 0, 6-7: 1, 8-9: 2, 10: 3. Figure 2 compares the individual differences in each participant before and after long distance running. All of the participants found relief from their period pain after long distance running. Figure 3 shows the individual differences in period pain after high intensity running. While most participants found relief, participant 4's period pain level increased and participant 5's pain level stayed the same after high intensity running. On the contrary, participant 5 experienced the most period pain relief from long distance running with participant 4 experiencing the 2nd most relief alongside participant 3. Interestingly, participant 6 experienced more pain relief from high intensity running than from long-distance running. Changes to period pain levels after high intensity running are more varied on average compared to long distance running. Based on the mean difference test results from Table 1, long-distance running decreases period pain more than high–intensity running, the average decrease being 1.5. The data collected for high-intensity running indicates a decrease of period pain on

Table 1. Change in period pain scale after runs

Person ID	General Period Pain Before Any-Running	Change in Period Pain from Long-Distance Running	Change in Period Pain from High-Intensity Running
1	2.5	-1	N/A
2	2.5	-2	0
3	2.5	-1	1
4	4.5	-2	-1
5	4.5	-2	-2
6	6.5	-1	-2
Average	3.83	-1.50	-0.8
Mean Difference		-0.7	

the scale by 0.8: significantly lower than that of long-distance running. For the Wilcoxon signed rank test, the p-value was 0.2652 which is greater than α=0.05 indicating that we failed to reject the null hypothesis, meaning we can't detect a difference in significance of period pain between long distance and high intensity running.

DISCUSSION

This study investigated whether long-distance running relieved period pain more effectively than high-intensity running. The results from the mean difference test indicate that long-distance running is more effective in decreasing period pain on average, but high-intensity running also has the same or better effect on a few individuals. The survey responses for long-distance running indicate that period pain decreased on average, and the effects on period pain were fairly consistent. This is understandable because research suggests that the intensity and volume of running are directly related to the pain level of primary dysmenorrhea (30). This means that lower intensity runs will provide more relief on average for period pain. While responses to high-intensity running were varied, and participants experienced different changes to their period pain, some still felt relief from their pain when they looked back on their high-intensity running. This might be because the intensive exercise reduced menstrual flow and alleviated pain intensity in the individuals who experienced relief (31). Furthermore, intense exercise, low oxygen levels, and acidic conditions can trigger the release of beta endorphins, a natural pain-relieving agent which could reduce the pain caused by menstruation (32). The Wilcoxon signed rank test reported that the difference in period pain relief between long distance and high intensity running were mostly negligible with the data from the survey. The small population size and the varying responses to the effects of high-intensity running on period pain warrant more research as to what the pain level is after high-intensity running for the average adolescent population. Based on this, a future research paper could be on various high-intensity exercises and their effect on period pain in adolescents. If there are still many varying responses after further research and investigation, it is important to look into the different factors that could be changing the effectiveness of high-intensity running on period pain.

This research paper reveals a little bit about how exercise and specifically different types of running affect period pain in teens aged 13-18 but, the sample size of this study was limited. Unfortunately, of the 15 people who responded only 8 participants qualified for the inclusion factors, which is why this study cannot be applied without further testing. On the other hand, many people were not part of the inclusion factor because many of the respondents did not have period pain to begin with. This might be a result of long-term effects on dysmenorrhea conditioned through frequent running. It would be recommended in future research to include a question about how long a person has been running at various intensities in the survey questions. Similarly, there should be a question about whether or not the person takes birth control or menstrual cycle-altering medication, and how long they have been taking it. The last change that could be made is that the pain scales should match. The general pain scale asked participants about their level of pain while the scales after long-distance running and high-intensity running asked for their change in pain from the general level. Instead of this the long-distance and high-intensity scales should ask about the pain level on the scale after running. The pain relief provided by long distance running and high intensity running were proven negligible by the Wilcoxon test most likely due to sample size. Given the limitations of this study, further research is required.

CONCLUSION

Primary dysmenorrhea inhibits many individuals from performing their daily activities free from pain. It is known that exercise can relieve period pain, but what is not as well known is what intensity is most effective. Originally, the assumption was that long-distance running would be more effective in decreasing pain than high-intensity running due to the strenuous intensity involved. However, the Wilcoxon test in our study found that the pain relief difference between both moderate long-distance running and high-intensity running are negligible indicating that they provided nearly the same amount of pain relief. Our mean difference test indicated that long-distance running is effective for almost everyone and reduces period pain significantly. Whereas high-intensity running has varying effects depending on the person but contrary to the hypothesis, high-intensity running decreases pain in some people. The small sample size of this study was not enough to fully apply to the general population of menstruating

individuals (particularly adolescents), and a study with a larger sample size is needed. Future recommendations for studies would be a focus on high-intensity running along with other forms of high-intensity exercises and how it impacts period pain.

FUNDING SOURCES

This study was not supported by any sponsor or funder.

CONFLICT OF INTERESTS

The author declares that there are no conflicts of interest regarding the publication of this article.

APPENDIX A

https://docs.google.com/forms/d/e/1FAIpQLSeKPTJnuekjtmo9zz0UVs7AR6KPUFoNSzncQPTdcFeNkLq0-w/viewform

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