

PREVALENCE OF PRIMARY DYSMENORRHEA, ITS INFLUENCE ON QUALITY OF LIFE, AND EFFECTIVENESS OF AN AEROBIC EXERCISE INTERVENTION AMONG FEMALE COLLEGE STUDENTS: A RANDOMIZED CONTROLLED STUDY

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ABSTRACT

Background

Primary dysmenorrhea is one of the most prevalent gynecological disorders affecting adolescent girls and young women worldwide. Characterized by painful menstrual cramps without identifiable pelvic pathology, it frequently interferes with educational performance, psychological wellbeing, social relationships, and overall quality of life. Although pharmacological therapies remain the standard management approach, prolonged use of analgesics may produce adverse effects and does not always provide sustained relief. Consequently, non-pharmacological interventions, particularly aerobic exercise, have gained increasing attention as economical, safe, and easily accessible alternatives. Exercise improves blood circulation, stimulates endorphin secretion, reduces prostaglandin activity, and promotes psychological wellbeing, making it a promising intervention for menstrual pain management among collegiate women.

Objectives

The present study aimed to determine the prevalence of primary dysmenorrhea among collegiate female students, assess its impact on quality of life, and evaluate the effectiveness of a structured aerobic exercise package in reducing menstrual pain and improving quality of life. The study also explored the association between dysmenorrhea severity and selected demographic and menstrual variables.

Methodology

A two-phase research design consisting of a descriptive cross-sectional survey followed by a randomized controlled experimental trial was employed among female college students in Surat City, Gujarat. During Phase I, participants were screened for primary dysmenorrhea using standardized assessment tools. Eligible students with moderate to severe dysmenorrhea were randomly allocated into intervention and control groups. Baseline demographic characteristics, menstrual history, pain intensity, and quality of life were assessed using validated questionnaires and standardized pain assessment scales. Participants assigned to the intervention group performed a supervised aerobic exercise package for twelve weeks, whereas the control group continued routine activities without structured exercise. Outcome variables were reassessed following completion of the intervention. Descriptive statistics, paired and independent sample t-tests, chi-square tests, repeated measures analysis, and correlation analyses were performed to determine statistical significance.

Results

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The study demonstrated that primary dysmenorrhea affected a substantial proportion of collegiate female students. Participants reported considerable impairment in physical functioning, emotional wellbeing, academic productivity, social interaction, and daily activities during menstruation. Following implementation of the aerobic exercise intervention, the experimental group exhibited statistically significant reductions in menstrual pain intensity compared with baseline and the control group ($p < 0.001$). Significant improvements were observed across all quality-of-life domains, including physical health, emotional wellbeing, vitality, academic participation, and social functioning. Demographic variables such as age at menarche, family history of dysmenorrhea, duration of menstrual flow, and physical activity patterns demonstrated significant associations with dysmenorrhea severity.

Conclusion

The findings indicate that primary dysmenorrhea substantially compromises the quality of life of collegiate women. A structured aerobic exercise package proved to be an effective, inexpensive, and non-pharmacological strategy for reducing menstrual pain and enhancing physical, psychological, and social wellbeing. Incorporating aerobic exercise into routine health promotion programs within educational institutions may improve menstrual health and reduce absenteeism among young women. Nursing professionals can play a significant role in educating students regarding lifestyle-based interventions for menstrual pain management.

Keywords: Primary dysmenorrhea, aerobic exercise, menstrual pain, quality of life, collegiate students, women's health, nursing intervention, randomized controlled trial.

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INTRODUCTION

Menstruation is a normal physiological process experienced by women during their reproductive years and serves as an important indicator of reproductive health. Despite being a natural biological event, menstruation is often accompanied by several physical and psychological symptoms that adversely affect daily functioning. Among these conditions, primary dysmenorrhea is recognized as one of the most common gynecological disorders affecting adolescents and young adult women. It is characterized by recurrent cramping lower abdominal pain occurring before or during menstruation in the absence of identifiable pelvic pathology. The pain frequently radiates to the lower back and thighs and is often associated with nausea, vomiting, fatigue, headache, dizziness, diarrhea, and mood disturbances.

Globally, the prevalence of primary dysmenorrhea ranges between 45% and 95%, depending upon the population studied, diagnostic criteria, and assessment methods. In India, numerous epidemiological studies have reported prevalence estimates exceeding 70% among adolescent girls and college students. Despite its high prevalence, menstrual pain remains underreported because many young women consider it a normal part of menstruation or hesitate to seek professional healthcare due to cultural beliefs, embarrassment, or

limited awareness regarding available treatment options.

Primary dysmenorrhea has considerable academic, social, psychological, and economic implications. Severe menstrual pain contributes to absenteeism from educational institutions, reduced classroom concentration, impaired academic performance, decreased participation in extracurricular activities, sleep disturbances, anxiety, irritability, and diminished overall quality of life. These consequences may accumulate over time, affecting educational achievement and psychosocial development during adolescence and early adulthood.

The pathophysiology of primary dysmenorrhea is primarily attributed to excessive production of uterine prostaglandins during menstruation, resulting in increased uterine contractions, ischemia, and stimulation of pain receptors. Conventional management mainly involves non-steroidal anti-inflammatory drugs and hormonal therapies. While effective, these pharmacological approaches may be associated with gastrointestinal discomfort, contraindications, poor adherence, and recurrence of symptoms after discontinuation. Consequently, increasing attention has been directed toward complementary and non-pharmacological

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interventions that promote long-term symptom control without significant adverse effects.

Aerobic exercise has emerged as one of the most promising lifestyle interventions for managing menstrual pain. Regular exercise enhances pelvic blood circulation, stimulates endogenous endorphin release, reduces inflammatory mediators, decreases stress levels, and improves physical fitness. Evidence from randomized clinical trials suggests that structured aerobic exercise significantly alleviates menstrual pain intensity while improving emotional wellbeing and quality of life. However, evidence among Indian collegiate populations remains limited.

Considering the increasing burden of primary dysmenorrhea and the need for safe, cost-effective, and sustainable interventions, the present study was undertaken to determine the prevalence of primary dysmenorrhea among collegiate female students in Surat City, assess its impact on quality of life, and evaluate the effectiveness of a structured aerobic exercise package. The findings are expected to provide evidence supporting nursing-led health promotion strategies aimed at improving menstrual health and overall wellbeing among young women.

METHODOLOGY

Research Design

The present investigation employed a **two-phase quantitative research approach** to comprehensively examine primary dysmenorrhea among collegiate female students. Phase I consisted of a descriptive cross-sectional survey to determine the prevalence of primary dysmenorrhea and evaluate its influence on quality of life. Phase II utilized a randomized controlled experimental design to assess the effectiveness of a structured aerobic exercise package in reducing menstrual pain and improving quality of life. This sequential design enabled both epidemiological assessment and intervention evaluation within the same study population, thereby strengthening the scientific rigor and practical applicability of the findings.

Study Setting

The study was conducted in selected degree colleges affiliated with universities in Surat City, Gujarat, India. The participating institutions represented diverse academic disciplines, including arts, science, commerce, engineering, and professional education, ensuring adequate representation of female students from various socioeconomic and educational backgrounds.

Study Population

The target population comprised collegiate female students aged 18–25 years enrolled in undergraduate and postgraduate programs. Students who experienced regular menstrual cycles and fulfilled the diagnostic criteria for primary dysmenorrhea were considered eligible for participation in the intervention phase.

Sample Size and Sampling Technique

The study was implemented in two phases.

During **Phase I**, approximately **600 female students** were screened using a structured questionnaire to estimate the prevalence of primary dysmenorrhea. The sample size was determined based on the expected prevalence reported in previous epidemiological studies, with adequate statistical precision and confidence.

Following screening, students diagnosed with moderate to severe primary dysmenorrhea were considered for **Phase II**. A total of **200 eligible participants** were randomly allocated into two equal groups:

- Experimental Group (n = 100)
- Control Group (n = 100)

Simple random allocation using a computer-generated randomization sequence ensured equal probability of selection while minimizing allocation bias.

Inclusion Criteria

Participants were included if they:

- were female students aged between 18 and 25 years;
- had regular menstrual cycles (21–35 days);
- experienced clinically diagnosed primary dysmenorrhea for at least the previous six months;
- reported moderate or severe menstrual pain according to the Numeric Pain Rating Scale;
- were willing to participate voluntarily and provide written informed consent.

Exclusion Criteria

Students were excluded if they:

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- had secondary dysmenorrhea associated with pelvic pathology;
- were diagnosed with gynecological disorders such as endometriosis, pelvic inflammatory disease, adenomyosis, or uterine fibroids;
- were pregnant or married with childbirth history;
- had chronic systemic illnesses limiting physical activity;
- regularly participated in structured aerobic fitness programmes during the previous six months.

Description of the Intervention

Participants in the experimental group underwent a **Structured Aerobic Exercise Package** specifically designed for menstrual health promotion. The intervention was developed following an extensive review of current literature and recommendations from physiotherapists, obstetricians, gynecologists, sports medicine specialists, and nursing experts.

The exercise package consisted of:

- five-minute warm-up stretching;
- brisk walking and rhythmic aerobic movements;
- low-impact cardiovascular exercises;
- pelvic flexibility and lower limb strengthening exercises;
- breathing and relaxation exercises during cool-down.

Each exercise session lasted approximately **40 minutes**, three times per week, for **12 consecutive weeks**. Sessions were conducted under direct supervision to ensure safety, adherence, and uniformity. Attendance registers and weekly compliance records were maintained throughout the intervention period.

Participants assigned to the control group continued their routine daily activities and received no structured exercise programme during the study period. Following completion of data collection, educational guidance regarding menstrual health and aerobic exercise was provided to the control group as an ethical consideration.

Instruments for Data Collection

Data were collected using standardized instruments consisting of five sections:

Section I: Demographic Profile

Information regarding age, educational status, socioeconomic background, body mass index, dietary habits, residence, and physical activity level.

Section II: Menstrual Characteristics

Age at menarche, menstrual cycle length, duration of menstrual flow, family history of dysmenorrhea, menstrual regularity, and analgesic consumption.

Section III: Numeric Pain Rating Scale (NPRS)

Pain intensity was assessed using the 11-point Numeric Pain Rating Scale ranging from 0 (no pain) to 10 (worst imaginable pain).

Section IV: Quality of Life Questionnaire

Quality of life was evaluated using a standardized multidimensional instrument measuring physical functioning, emotional wellbeing, vitality, social relationships, academic performance, and psychological health.

Section V: Intervention Compliance Checklist

Attendance records and adherence to prescribed aerobic exercise sessions were monitored using a structured compliance checklist.

Validity and Reliability

Content validity of all instruments and the intervention protocol was established by a panel comprising experts in obstetrics and gynecological nursing, community health nursing, physiotherapy, epidemiology, and biostatistics. Suggestions provided by the experts were incorporated before final implementation.

A pilot study involving 30 participants was conducted to evaluate the feasibility of the methodology. Internal consistency reliability of the quality-of-life questionnaire demonstrated satisfactory reliability (Cronbach's $\alpha > 0.85$), while test-retest reliability for the pain assessment tool indicated excellent stability.

Data Collection Procedure

Formal administrative permission was obtained from the participating educational institutions before commencement of the study. Eligible students were informed about the purpose, procedures, benefits, and voluntary nature of participation. Written informed consent was obtained from all participants.

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Baseline assessments of demographic characteristics, menstrual profile, pain intensity, and quality of life were completed before randomization. The aerobic exercise programme was subsequently implemented for the experimental group over twelve weeks. Post-intervention assessments were conducted immediately after completion of the programme using the same standardized instruments.

Statistical Analysis

Data were coded, verified, and analyzed using **IBM SPSS Statistics (Version 26.0)**.

Descriptive statistics including frequency, percentage, mean, and standard deviation summarized demographic and clinical characteristics. Inferential statistics were selected according to data distribution and study objectives.

The following statistical tests were applied:

- Chi-square test to determine associations between categorical variables.
- Independent samples t-test to compare mean scores between experimental and control groups.
- Paired t-test to evaluate within-group pretest and posttest differences.
- Mann-Whitney U test and Wilcoxon signed-rank test for non-parametric variables where appropriate.
- Pearson's correlation coefficient to determine relationships between pain intensity and quality-of-life scores.
- Multiple regression analysis to identify predictors of dysmenorrhea severity.

A **p-value < 0.05** was considered statistically significant, while **p < 0.001** indicated a highly significant difference.

RESULTS

Results

The findings are presented under the following sections: demographic characteristics of the participants, prevalence of primary dysmenorrhea, menstrual characteristics, quality of life assessment, effectiveness of the aerobic exercise package, association between selected variables and dysmenorrhea severity, and correlation between pain intensity and quality of life. Statistical analysis was performed using descriptive and inferential statistics. A significance level of $p < 0.05$ was considered statistically significant.

Table 1. Demographic Characteristics of Participants (N = 200)

Variable	Experimental (n=100)	Control (n=100)
Mean age (years)	20.41 ± 1.63	20.58 ± 1.71
Urban residence	68 (68%)	70 (70%)
Rural residence	32 (32%)	30 (30%)
Undergraduate students	82 (82%)	80 (80%)
Normal BMI	66 (66%)	69 (69%)
Regular physical activity	24 (24%)	22 (22%)
Family history of dysmenorrhea	58 (58%)	61 (61%)

Interpretation: The experimental and control groups were comparable with respect to demographic characteristics, indicating successful randomization.

Table 2. Prevalence of Primary Dysmenorrhea Among Screened Students (N = 600)

Severity	Frequency	Percentage
No dysmenorrhea	96	16.0
Mild	168	28.0
Moderate	216	36.0
Severe	120	20.0

Interpretation: The overall prevalence of primary dysmenorrhea was **84.0%**, with moderate dysmenorrhea being the most common category.

Table 3. Pretest and Posttest Pain Scores

Group	Pretest Mean ± SD	Posttest Mean ± SD	Paired t	p value
Experimental	7.82 ± 1.04	3.14 ± 1.18	24.63	<0.001
Control	7.76 ± 1.09	7.21 ± 1.16	1.88	0.063

Interpretation: Participants receiving the aerobic exercise intervention demonstrated a highly significant reduction in menstrual pain compared with the control group.

Table 4. Comparison of Quality of Life Scores

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Group	Pretest Mean $\pm$ SD	Posttest Mean $\pm$ SD	Mean Difference	<i>p</i> value
Experimental	54.72 $\pm$ 7.43	78.95 $\pm$ 6.61	24.23	<0.001
Control	55.16 $\pm$ 6.98	57.31 $\pm$ 6.72	2.15	0.091

Interpretation: Quality of life improved significantly following the aerobic exercise programme, whereas no statistically significant improvement was observed in the control group.

Table 5. Domain-wise Improvement in Quality of Life (Experimental Group)

Domain	Pretest Mean	Posttest Mean	<i>p</i> value
Physical health	11.8	18.6	<0.001
Emotional wellbeing	10.4	16.9	<0.001
Academic performance	9.9	15.8	<0.001
Social functioning	11.1	15.7	<0.001
Vitality	11.5	17.9	<0.001

Interpretation: Significant improvements were observed across all quality-of-life domains after completion of the intervention.

Table 6. Association Between Dysmenorrhea Severity and Selected Variables

Variable	χ^2	<i>p</i> value
Age at menarche	9.84	0.020*
Family history	12.76	0.005*
Duration of menstruation	11.43	0.009*
BMI	2.14	0.344
Residence	1.61	0.446
Educational level	0.89	0.641

*Significant at $p < 0.05$.

Interpretation: Dysmenorrhea severity showed statistically significant associations with age at menarche, family history, and duration of menstrual bleeding.

Table 7. Correlation Between Pain and Quality of Life

Variables	Correlation (<i>r</i>)	<i>p</i> value
Pain intensity vs Quality of Life	-0.73	<0.001

Interpretation: A strong negative correlation indicates that increasing menstrual pain was associated with deterioration in quality of life.

Table 8. Independent *t*-Test Comparing Posttest Scores

Outcome	Experimental Mean $\pm$ SD	Control Mean $\pm$ SD	<i>t</i> value	<i>p</i> value
Pain score	3.14 $\pm$ 1.18	7.21 $\pm$ 1.16	19.47	<0.001
Quality of life	78.95 $\pm$ 6.61	57.31 $\pm$ 6.72	21.85	<0.001

Interpretation: Post-intervention outcomes were significantly better among participants receiving the aerobic exercise package.

Table 9. Multiple Regression Analysis Predicting Dysmenorrhea Severity

Predictor	β	<i>p</i> value
Family history	0.32	<0.001
Age at menarche	-0.24	0.004
Physical activity	-0.28	0.001
BMI	0.07	0.238

Interpretation: Family history and lower physical activity levels were significant predictors of greater dysmenorrhea severity.

Summary of Findings

The descriptive survey demonstrated that primary dysmenorrhea was highly prevalent among collegiate female students, affecting more than four-fifths of the screened population. Moderate dysmenorrhea constituted the largest proportion of cases, emphasizing the widespread burden of menstrual pain within the study population. Baseline comparisons confirmed that both study groups were statistically comparable regarding demographic characteristics, thereby minimizing selection bias.

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The randomized controlled intervention revealed that participants who completed the structured aerobic exercise programme experienced a substantial reduction in menstrual pain intensity. The mean pain score declined by nearly 60%, whereas only minimal changes were observed among participants in the control group. Improvements in pain were accompanied by marked enhancement in overall quality of life, including physical functioning, emotional wellbeing, academic performance, vitality, and social participation.

Inferential statistical analyses further demonstrated significant associations between dysmenorrhea severity and age at menarche, family history, and menstrual duration. Correlation analysis identified a strong inverse relationship between pain intensity and quality of life, indicating that greater menstrual pain was associated with poorer health-related outcomes. Regression analysis suggested that family history and lower habitual physical activity independently predicted dysmenorrhea severity.

Overall, the findings provide strong evidence that a structured aerobic exercise package is an effective non-pharmacological intervention for reducing menstrual pain and improving health-related quality of life among collegiate female students.

**DISCUSSION, CONCLUSION,
IMPLICATIONS, LIMITATIONS, ETHICAL
CONSIDERATIONS, AND REFERENCES**

Discussion

The present study investigated the prevalence of primary dysmenorrhea, its influence on the quality of life, and the effectiveness of a structured aerobic exercise package among collegiate female students in Surat City. The findings demonstrate that primary dysmenorrhea remains a significant public health concern among young women, adversely affecting physical, emotional, academic, and social well-being. Furthermore, the study provides strong evidence supporting aerobic exercise as an effective non-pharmacological intervention for menstrual pain management.

The prevalence of primary dysmenorrhea observed in the present study was considerably high, indicating that menstrual pain continues to affect a large proportion of college-going women. Similar prevalence has been reported in studies conducted in India and other developing countries, where dysmenorrhea has consistently been identified as one of the leading causes of absenteeism, decreased academic performance, and reduced quality of life among adolescents and young adults. Variations in

prevalence across studies may be attributed to differences in geographical settings, lifestyle patterns, nutritional status, pain perception, and diagnostic criteria.

The present investigation also demonstrated that dysmenorrhea negatively influenced multiple dimensions of quality of life. Participants experiencing severe menstrual pain reported limitations in physical activities, emotional instability, sleep disturbances, fatigue, poor classroom concentration, and reduced participation in recreational and social activities. These findings corroborate previous international research, which has consistently shown that menstrual pain affects educational achievement, interpersonal relationships, psychological well-being, and overall health-related quality of life.

One of the major findings of this study is the significant reduction in menstrual pain following implementation of the structured aerobic exercise programme. Participants in the intervention group experienced a substantial decline in pain intensity compared with the control group. The observed improvement can be explained by several physiological mechanisms. Regular aerobic exercise enhances pelvic blood circulation, promotes oxygen delivery to uterine tissues, stimulates endogenous endorphin secretion, reduces prostaglandin synthesis, decreases sympathetic nervous system activity, and improves muscular relaxation. Collectively, these mechanisms contribute to reduced uterine ischemia and diminished pain perception during menstruation.

The intervention also resulted in significant improvements across all domains of quality of life. Enhanced physical fitness, increased emotional resilience, better sleep quality, reduced stress, improved academic attendance, and greater participation in routine activities were observed among participants receiving aerobic exercise. These findings are consistent with randomized controlled trials and systematic reviews that have identified exercise therapy as an effective complementary approach for managing primary dysmenorrhea.

Association analysis revealed that age at menarche, duration of menstrual flow, and family history significantly influenced dysmenorrhea severity. These findings support the multifactorial nature of primary dysmenorrhea and emphasize the importance of both biological and hereditary factors. Furthermore, the strong negative correlation between pain intensity and quality of life indicates that reduction in menstrual pain is directly associated with improved overall well-being.

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Despite the encouraging findings, certain limitations should be acknowledged. The study was conducted among students from selected colleges in Surat City, which may limit the generalizability of the findings to other populations. Self-reported pain assessment may have introduced reporting bias. Dietary habits, stress levels, sleep quality, and hormonal variations were not controlled completely and may have influenced menstrual pain. Long-term follow-up was also beyond the scope of the present investigation.

Overall, the findings support the incorporation of structured aerobic exercise into routine menstrual health promotion programmes. Nursing professionals, educators, physiotherapists, and public health practitioners should encourage regular physical activity as a safe, cost-effective, and evidence-based strategy for managing primary dysmenorrhea.

Conclusion

Primary dysmenorrhea is highly prevalent among collegiate female students and significantly affects their physical health, psychological well-being, academic performance, and social functioning. The findings of this study demonstrate that a structured aerobic exercise package effectively reduces menstrual pain intensity while significantly improving health-related quality of life. As a simple, economical, non-pharmacological, and easily implementable intervention, aerobic exercise represents an excellent strategy for promoting menstrual health among young women.

The study also highlights the important role of nursing professionals in educating adolescent girls and college students regarding menstrual health, lifestyle modification, and evidence-based self-management strategies. Integration of structured exercise programmes within educational institutions may substantially reduce absenteeism, improve productivity, and enhance overall quality of life.

Nursing Implications

Nursing Practice

- Nurses should routinely assess menstrual health during adolescent and young women's health programmes.
- Exercise counselling should become part of menstrual health education.
- Community health nurses should organize awareness programmes on non-pharmacological pain management.

Nursing Education

- Undergraduate nursing curricula should incorporate evidence-based menstrual health management.
- Students should receive practical training regarding exercise-based interventions.

Nursing Administration

- Colleges should establish menstrual wellness programmes.
- Health promotion clinics should include menstrual counselling services.

Nursing Research

- Multicentric randomized controlled trials are recommended.
- Comparative studies involving yoga, Pilates, stretching, and aerobic exercise should be undertaken.
- Longitudinal follow-up studies should evaluate long-term effectiveness.

Limitations

- Conducted only among selected colleges in Surat City.
- Self-reported pain assessment may introduce recall bias.
- Long-term follow-up was not performed.
- Lifestyle variables including diet, stress, and sleep were not fully controlled.
- Findings cannot be generalized to all female populations.

Recommendations

1. Replicate the study with a larger sample across multiple states.
2. Compare aerobic exercise with yoga and physiotherapy interventions.
3. Conduct longitudinal studies to determine long-term effectiveness.
4. Develop institution-based menstrual wellness programmes.
5. Evaluate cost-effectiveness of exercise interventions in community settings.

Conflict of Interest

The authors declare that there are **no conflicts of interest** regarding the publication of this research.

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The study was conducted without receiving any financial assistance from governmental, commercial, or non-governmental funding agencies.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Administrative permission was obtained from the participating educational institutions. Written informed consent was obtained from all participants before data collection. Confidentiality, anonymity, voluntary participation, and the right to withdraw from the study at any stage were ensured throughout the research process. The study complied with the ethical principles outlined in the Declaration of Helsinki.

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