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Supervised progressive resistance training in adolescent girls with primary dysmenorrhea

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Abstract

Background: Primary dysmenorrhea is a gynaecological condition amongadolescents and is accompanied by depression and anxiety. Although physical activity is recommended as a non-pharmacological strategy, evidence regarding changes following supervised progressive resistance training among adolescents remains limited.
Aims: This study aimed to examine changes in depression and anxiety symptoms following an 8-week supervised progressive resistance training program among adolescent girls with moderate-to-severe primary dysmenorrhea in Haramaya Town, Ethiopia.
Methods: A one-group pre-test–post-test quasi-experimental design was conducted with 41 adolescent girls aged 15–20 years from public high schools. Participants completed a supervised resistance training program three times weekly for eight consecutive weeks. Depression and anxiety symptoms were assessed using the Beck Depression Inventory-II (BDI-II) and Beck Anxiety Inventory (BAI) during days 1–3 of the menstrual cycle at baseline and during the first post-intervention menstrual cycle. Data were analyzed using Shapiro–Wilk tests, paired-samples t-tests, and Cohen's dZ for within-participant effect sizes.
Result: Significant pre-to-post reductions were observed in both outcomes. Mean BDI-II scores decreased from 32.54 ± 6.86 to 10.44 ± 7.25, $t(40) = 16.38$, $p < .001$, dz = 2.56. Mean BAI scores decreased from 33.22 ± 7.16 to 11.66 ± 7.75, $t(40) = 19.75$, $p < .001$, dz = 3.08. Descriptively, most participants shifted from moderate-to-severe depression and anxiety categories at baseline to minimal symptom categories after the program.
Conclusion: Participation in the 8-week supervised progressive resistance training program was associated with reductions in depression and anxiety symptoms. However, because the study did not include a control group, the findings should not be interpreted as evidence of causality. Supervised progressive resistance training may represent a promising complementary non-pharmacological approach for supporting psychological well-being among adolescents with primary dysmenorrhea.

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INTRODUCTION

Menstruation is a fundamental physiological process and a core indicator of female reproductive health. Despite its natural occurrence, menstrual disorders remain among the most prevalent gynecological complaints affecting adolescent girls and young women worldwide. Among these disorders is primary dysmenorrhea (PD), defined as recurrent, painful lower abdominal

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cramping during menstruation in the strict absence of macroscopically identifiable pelvic pathology (Armour et al., 2019). PD typically develops within 6 to 12 months after menarche during the transition into ovulatory cycles. The underlying biological model of PD is theoretically anchored in the hyper-production of endometrial prostaglandins (specifically $PGF2\alpha$ and $PGE2$), which induces uterine hypercontractility, local ischemia, and subsequent visceral nociceptive hypersensitivity (Yana & Öz, 2026). However, contemporary psychosomatic theories indicate that PD is not a localized uterine phenomenon; rather, it operates along a complex, bi-directional neuroendocrine and inflammatory axis (Iacovides et al., 2015). Within a biopsychosocial framework, recurrent menstrual pain contributes to central sensitization and persistent activation of the hypothalamic pituitary adrenal (HPA) axis, exacerbating systemic inflammation and dysregulating stress-responsive pathways that increase vulnerability to depression, anxiety, and maladaptive coping. Prolonged, predictable cyclic pain reshapes central nervous system pain processing, lowering pain thresholds and reinforcing pain catastrophizing, which is strongly associated with depressive and anxious symptoms.

Globally, epidemiological data indicate that the prevalence of PD ranges from 50% to 90% among reproductive-aged women, peaking severely within adolescent and young adult cohorts (Armour et al., 2019). Empirically, the functional toll of severe PD is extensive. It is established as a primary driver of recurrent school absenteeism, social withdrawal, impaired physical performance, and degraded sleep architecture among adolescent populations (Iacovides et al., 2015). Recent cross-sectional and cohort data confirm that adolescents with moderate-to-severe PD exhibit drastically lower quality-of-life scores and run a significantly higher risk of developing clinical depressive symptoms and generalized anxiety disorders compared to their pain-free peers (Situmorang et al., 2025). To manage this burden, conventional front-line interventions rely heavily on pharmacological therapies, primarily non-steroidal anti-inflammatory drugs (NSAIDs) and oral hormonal contraceptives. While effective for some, empirical studies highlight a high rate of clinical dissatisfaction due to incomplete pain reduction, symptom recurrence, and side effects including gastrointestinal distress, dizziness, and long-term metabolic or hormonal complications. These limitations underscore an urgent public health need for non-pharmacological, low-cost, and sustainable alternative strategies tailored specifically for developing adolescent bodies.

Physical exercise has emerged as a promising non-pharmacological modality to mitigate both the physical and emotional expressions of PD. Conceptually, the therapeutic action of exercise operates through distinct physiological and psychological pathways. Physiologically, structured movement enhances pelvic blood circulation, accelerates the clearance of localized prostaglandin accumulation, and downregulates systemic inflammatory cytokines. Concurrently, physical exertion stimulates the "endorphin hypothesis," triggering the release of central β-endorphins and neurotransmitters like dopamine and serotonin, which bind to mu-opioid receptors to suppress nociceptive pain signals and directly elevate mood states (Schuch et al., 2018). Exercise further modulates HPA-axis reactivity and autonomic balance, reducing stress-induced cortisol secretion and inflammatory amplification of menstrual pain. Regular physical activity substantially improves both depression and anxiety outcomes across diverse cohorts, reinforcing the mechanical utility of exercise as an essential strategy for mental health promotion (Jariono at al., 2026; Rebar et al., 2015). Contemporary models of exercise and mental health emphasize emotion regulation, self-efficacy, and stress buffering mechanisms as central pathways linking physical activity to psychological well-being. While historical research has predominantly evaluated aerobic exercises, yoga, or basic stretching (Akdeniz & Ince, 2026), recent network meta-analyses reveal that distinct exercise modalities yield highly divergent therapeutic effects. Specifically, structured, supervised resistance and strength training programs demonstrate uniquely favorable outcomes for long-term symptom management. A comprehensive meta-analysis by Jia et al., (2025) concluded that among various physical modalities, strength training emerged as the most efficacious intervention for reducing pain intensity and improving somatic symptoms in primary dysmenorrhea, with optimized effects observed when programs extend for at least 8 weeks. Resistance exercise induces profound muscular, neuromuscular, and cardiovascular adaptations that optimize body awareness, relieve chronic muscular tension, and suppress sympathetic nervous system hyperreactivity (Yana & Öz, 2026), while simultaneously fostering mastery experiences, self-esteem, and resilience that counteract pain catastrophizing and mood disturbances.

Despite the expanding literature linking physical activity to improved menstrual health, several important research gaps remain. Most previous interventions have focused on aerobic exercise, stretching, or yoga, leaving structured and progressive resistance training comparatively understudied, particularly among adolescents. In addition, prior studies have primarily evaluated menstrual pain and other physical symptoms, while depression and anxiety have received less attention despite their close and bidirectional relationship with recurrent pain. Existing evidence also originates predominantly from high-income Western and East Asian settings, and its applicability to low-resource contexts remains uncertain. In Sub-Saharan Africa, cultural attitudes toward menstruation, socioeconomic constraints, limited healthcare access, and differences in school environments may influence how adolescent girls experience and manage dysmenorrhea-related physical and psychological distress. Therefore, context-specific evidence is needed to determine whether supervised resistance training is associated with improvements in psychological well-being among adolescents with primary dysmenorrhea.

Addressing these gaps, the present study examined changes in depression and anxiety symptoms following an 8-week supervised progressive resistance training program among adolescent girls with moderate-to-severe primary dysmenorrhea attending public high schools in Haramaya Town, Ethiopia. The novelty of this study lies in combining progressive exercise prescription, direct supervision, school-based delivery, and psychological outcome assessment within an underrepresented adolescent population from a low-resource setting. By extending the focus beyond pain management to depression and anxiety, this study provides context-specific evidence regarding the potential role of supervised resistance training as a complementary non-pharmacological strategy for managing primary dysmenorrhea. It was hypothesized that participants would demonstrate significant reductions in depression and anxiety scores following the intervention

METHOD

Research Design

This study employed a one-group pre-test post-test quasi-experimental design over an 8-week intervention period to evaluate the effects of a structured strength exercise program on depression and anxiety among high school female students with primary dysmenorrhea. An a priori power analysis using a 0.05 significance level (α) and 80% statistical power (β) targeted a medium effect size, which established a baseline sample requirement that was inflated by 15% to yield a final target of 41 participants. Through a purposive sampling matrix deployed across public high schools in Haramaya Town, exactly 41 eligible students were screened and enrolled. Ultimately, all 41 participants completed the baseline evaluations, the 8-week supervised strength training intervention, and the post-intervention assessments, resulting in a 100% adherence rate and a 0% attrition rate.

Study Setting and Participants

This study was conducted across public high schools in Haramaya Town, Ethiopia, targeting unmarried female students aged 15–20 years with symptomatic primary dysmenorrhea. Out of 54 screened individuals, 41 eligible participants were purposively recruited after verifying exercise safety via the Physical Activity Readiness Questionnaire (PAR-Q). Inclusion required a history of primary dysmenorrhea, moderate-to-severe menstrual pain (score ≥ 4 on a 0–10 scale), a sedentary lifestyle (≤ 1 exercise session per week), and a commitment to the 8-week program. Conversely, exclusion criteria ruled out individuals with secondary dysmenorrhea, pelvic pathologies, pregnancy, chronic health conditions contraindicating resistance training, current use of hormonal contraceptives or regular analgesics, and comorbid psychiatric disorders. All participants enrolled voluntarily, with written parental consent and student assent secured for those under 18 years of age. Ethical approval was obtained from Haramaya University, and written informed consent from guardians and assent from participants were secured before data collection.

Intervention: Supervised Strength Exercise Program

The intervention consisted of an 8-week supervised, progressive full-body resistance training program performed three times weekly (Mondays, Wednesdays, Fridays) for 45–60 minutes per session in the school gymnasium, adhering to youth strength guidelines (ACSM, 2021; Oljirra et al., 2026; Mola et al., 2025). Each directly supervised session comprised a 10-minute dynamic warm-up, a 30–40-minute main strength phase utilizing bodyweight, resistance bands, and light dumbbells, and a 5–10-minute static stretching and breathing cool-down. The 8-week macrocycle progressed across four bi-weekly mesocycles: weeks 1–2 focused on foundation and stabilization (e.g., bodyweight squats, planks); weeks 3–4 targeted muscular endurance (e.g., goblet squats, band rows); weeks 5–6 applied progressive overload (e.g., dumbbell-weighted squats, presses); and weeks 7–8 utilized integrated full-body circuits. Training intensity was monitored continuously using the Category-Ratio Rating of Perceived Exertion (RPE) scale and adjusted based on individual tolerance (Faigenbaum et al., 2009; Reza et al., 2024), resulting in perfect compliance and maximum attendance across all 41 participants, with no dropouts.

Data Collection Instruments

The data collection instruments are as follows: (1) Socio-Demographic Questionnaire: A custom intake form collected baseline data on participant age, educational grade level, age of menarche, menstrual cycle regularity, duration of flow, prior pain management approaches, and general lifestyle habits; (2) Beck Depression Inventory-II (BDI-II): Depressive symptom severity was assessed using the validated 21-item Beck Depression Inventory-II (Beck et al., 1961). Items are scored from 0 to 3 (total range: 0–63), where higher values indicate greater severity. The instrument demonstrated high internal consistency in this study (baseline $\alpha = 0.91$; post-test $\alpha = 0.93$). (3) Beck Anxiety Inventory (BAI): Anxiety symptom severity was assessed using the 21-item Beck Anxiety Inventory (Beck et al., 1961). Each item is scored from 0 to 3, producing a total score ranging from 0 to 63, with higher scores indicating greater anxiety symptom severity. The instrument demonstrated strong internal consistency at baseline (Cronbach's $\alpha = 0.90$) and post-intervention (Cronbach's $\alpha = 0.92$); (4) Pain Intensity Assessment: To characteristically profile the sample's primary dysmenorrhea, menstrual pain was quantified via a 10-point Numerical Rating Scale (NRS) ranging from 0 ("no pain") to 10 ("worst imaginable pain") and stratified from mild (1–3) to very severe (9–10).

Data Collection Procedures

The data collection procedure is as follows: (1) Phase I (Pre-Intervention Assessment): Following recruitment and consent acquisition, baseline psychometric profiles (BDI, BAI) and menstrual pain intensity (NRS) were captured strictly during days 1 to 3 of the participant's menstrual cycle to standardize assessments during the acute phase of primary dysmenorrhea. (2) Phase II (Intervention Phase): Participants completed the 8-week, thrice-weekly supervised strength training program. Academic schedules were balanced to ensure no external physical training programs or therapeutic co-interventions were introduced. (3) Phase III (Post-Intervention Assessment): Following the final week of the intervention, participants were re-evaluated using the identical BDI and BAI inventories. To ensure clinical consistency, post-test metrics were collected strictly during days 1 to 3 of the participant's first post-intervention menstrual cycle.

Data Analysis

Statistical analysis was performed using IBM SPSS version 26.0. Continuous variables were expressed as means ± standard deviations (M ± SD), and categorical metrics were summarized using frequencies and percentages. Data normality was verified via the Shapiro-Wilk test and visual inspection of Q-Q plots. Because the psychometric scores met parametric assumptions, pre- to post-intervention changes were evaluated using paired-sample t-tests, with a two-tailed statistical significance threshold established a priori at $p < 0.05$. The magnitude of within-participant change was quantified using Cohen's *dz*, calculated by dividing the paired-samples t statistic by the square root of the sample size. Effect sizes of 0.20, 0.50, and 0.80 were interpreted as small, moderate, and large, respectively. Ninety-five percent confidence intervals for Cohen's *dz*were estimated using the noncentral t distribution. Precision of the mean differences was demonstrated using 95% confidence intervals.

RESULTS AND DISCUSSION

Results

A total of 41 participants completed the 8-week supervised progressive resistance training program and both the pre- and post-intervention assessments. Consequently, no outcome data were missing from the analyses. The intervention was delivered according to the study protocol under direct supervision, and no exercise-related adverse events were observed during the study period. Changes in BDI-II depression and BAI anxiety scores from baseline to post-intervention were analyzed using paired-samples t-tests. The results are presented in four sections: participant characteristics (Table 1), changes in depression scores (Table 2), changes in anxiety scores (Table 3), and changes in depression and anxiety severity categories following the intervention (Table 4).

Table 1. Sociodemographic and Menstrual Characteristics of Participants (N = 41)

Characteristic	Category	n (%)
Age (years)	15–16	12 (29.3)
	17–18	22 (53.7)
	19–20	7 (17.1)
Grade level	10th	15 (36.6)
	11th	11 (26.8)
	12th	15 (36.6)
Pain intensity	Moderate (4–6)	5 (12.2)
	Severe (7–8)	22 (53.7)
	Worst (9–10)	14 (34.1)
Menstrual cycle regularity	Regular	33 (80.5)
	Irregular	8 (19.5)
Age at menarche (years)	≤12	10 (24.4)
	13–14	24 (58.5)
	≥15	7 (17.1)

Note. N = 41. Values are presented as frequency (percentage).

Table 1 presents the baseline characteristics of the 41 participants. More than half of the participants were aged 17–18 years (53.7%), and most reported severe (53.7%) or worst (34.1%) menstrual pain. Regular menstrual cycles were reported by 80.5% of participants, and most experienced menarche between 13 and 14 years of age (58.5%). Overall, the sample predominantly comprised mid-to-late adolescent girls with moderate-to-severe primary dysmenorrhea.

Table 2. Comparison of Pre- and Post-Intervention BDI-II Depression Scores (N = 41)

Assessment	Mean ± SD	MD	95% CI of MD	t-value	df	p-value	Cohen's dz[95% CI]
Pre-test	32.54 ± 6.86	22.10	19.35–24.85	16.38	40	<.001	2.56 [1.92, 3.19]
Post-test	10.44 ± 7.25						

Note. MD = mean difference; CI = confidence interval; dz = Cohen's standardized effect size for paired samples (95% CI reported).

Table 2 compares depression scores before and after the 8-week supervised progressive resistance training program. Mean BDI-II scores decreased from 32.54 ± 6.86 at baseline to 10.44 ± 7.25 following the intervention, corresponding to a mean difference of 22.10 (95% CI: 19.35–24.85). This pre-to-post reduction was statistically significant ($t(40) = 16.38$, $p < .001$). A very large, standardized effect size was observed (Cohen's *dz* = 3.13, 95% CI [2.45, 3.80]), indicating substantial within-participant reductions in depressive symptoms over the study period.

Table 3. Comparison of Pre- and Post-Intervention BAI Anxiety Scores (N = 41)

Assessment	Mean ± SD	MD	95% CI of MD	t-value	df	p-value	Cohen's dz[95% CI]
Pre-test	33.22 ± 7.16	21.56	19.38–23.74	19.75	40	<.001	3.08 [2.34, 3.82]
Post-test	11.66 ± 7.75						

Note. MD = mean difference; CI = confidence interval; dz = Cohen's standardized effect size for paired samples (95% CI reported).

Table 3 presents the pre- and post-intervention anxiety scores. Mean BAI scores decreased from 33.22 ± 7.16 to 11.66 ± 7.75, representing a mean difference of 21.56 (95% CI: 19.38–23.74). The reduction was statistically significant ($t(40) = 19.75$, $p < .001$). A very large, standardized effect size was observed (Cohen's *dz* = 2.89, 95% CI [2.24, 3.53]), indicating substantial within-participant reductions in anxiety symptoms between baseline and post-intervention.

Table 4. Pre- and Post-Intervention Classification of Depression and Anxiety Severity

Severity	BDI-II cut-off	BDI-II Pre n (%)	BDI-II Post n (%)	BAI cut-off	BAI Pre n (%)	BAI Post n (%)
Minimal	0–13	0 (0%)	31 (75.6%)	0–7	0 (0%)	28 (68.3%)
Mild	14–19	2 (4.9%)	7 (17.1%)	8–15	3 (7.3%)	9 (22.0%)
Moderate	20–28	18 (43.9%)	3 (7.3%)	16–25	16 (39.0%)	4 (9.7%)
Severe	29–63	21 (51.2%)	0 (0.0%)	26–63	22 (53.7%)	0 (0.0%)

Note. Depression severity was classified using the Beck Depression Inventory-II (BDI-II) cut-off scores: minimal (0–13), mild (14–19), moderate (20–28), and severe (29–63) (Beck et al., 1996). Anxiety severity was classified using the Beck Anxiety Inventory (BAI) cut-off scores: minimal (0–7), mild (8–15), moderate (16–25), and severe (26–63) (Beck & Steer, 1993).

Table 4 summarizes changes in depression and anxiety severity categories before and after the intervention. At baseline, 95.1% of participants were classified as having moderate-to-severe depressive symptoms, whereas after the intervention, 75.6% were classified within the minimal depression category and no participants remained in the severe category. Similarly, 92.7% of participants initially exhibited moderate-to-severe anxiety, while following the intervention, 68.3% were classified as having minimal anxiety, and no participants remained in the severe anxiety category. These descriptive findings indicate a marked shift from higher to lower symptom severity categories and are consistent with the observed reductions in mean BDI-II and BAI scores. Given the one-group pre-test/post-test design, these findings should be interpreted as descriptive pre-to-post associations rather than evidence of causal intervention effects.

Discussion

The present study examined pre-to-post changes in depression and anxiety symptoms following an 8-week supervised progressive resistance training program among adolescent girls with primary dysmenorrhea. Significant within-participant reductions were observed in BDI-II scores, which decreased from 32.54 ± 6.86 to 10.44 ± 7.25, and in BAI scores, which decreased from 33.22 ± 7.16 to 11.66 ± 7.75. The corresponding within-participant effect sizes were very large for depression (Cohen's dz = 2.56) and anxiety (Cohen's dz = 3.08). These findings indicate that participation in the structured resistance training program was associated with substantial improvements in psychological symptoms, consistent with evidence supporting exercise as a potentially valuable non-pharmacological strategy for promoting mental health among adolescents and individuals experiencing chronic pain conditions (Conn, 2010; Heissel et al., 2023). Nevertheless, because the study did not include a control group, the observed changes should not be interpreted as definitive causal effects of the intervention.

The observed reduction in depressive symptoms is consistent with previous literature demonstrating the antidepressant potential of regular physical activity. Structured and supervised exercise programs may provide psychological benefits by supporting adherence, motivation, appropriate exercise execution, and consistent participation (Conn, 2010). Comprehensive reviews have also shown that exercise may produce meaningful reductions in depressive symptoms and may complement established treatments, including psychotherapy and pharmacological interventions, particularly among individuals with mild-to-moderate depression (Heissel et al., 2023). The present findings extend this evidence to adolescent girls with primary dysmenorrhea. This population may be especially vulnerable to emotional distress because recurrent menstrual pain can disrupt daily functioning, academic participation, sleep, and social activities (Iacovides et al., 2015; Unsal et al., 2010). However, the substantial decrease in depression scores should be interpreted cautiously because participants entered the study with relatively elevated baseline symptoms, creating considerable opportunity for improvement and possible regression toward the mean.

A similarly substantial reduction was observed in anxiety symptoms. This finding is consistent with previous research indicating that regular exercise may reduce anxiety symptoms by improving emotional regulation, decreasing physiological arousal, and strengthening psychological resilience (Herring et al., 2010; Kumar et al., 2025; Stonerock et al., 2015). Repeated exposure to normal exercise-related bodily sensations, such as increased heart rate, muscular tension, and changes in breathing, may also improve tolerance of physiological arousal and reduce sensitivity to sensations that are sometimes interpreted as threatening (Powers et al., 2015). In adolescents with primary dysmenorrhea, these adaptations may be particularly relevant because recurrent menstrual symptoms can contribute to emotional distress and reduced confidence in managing everyday activities. Broader psychosocial research among sport-science students and athletes also highlights the relevance of self-esteem, life satisfaction, psychological distress, and mental fatigue to overall well-being, although these studies were not conducted specifically among adolescents with primary dysmenorrhea (Cuhadar et al., 2026; Kara et al., 2026). Therefore, these references provide contextual support for the importance of psychological well-being but should not be interpreted as direct evidence regarding dysmenorrhea-related anxiety.

Several biological mechanisms may plausibly contribute to the observed psychological changes, although none were directly measured in the present study. Exercise has been associated with brain-derived neurotrophic factor regulation, neuroplasticity, neuronal survival, and synaptic functioning in brain regions involved in mood regulation (Hu et al., 2020). Regular physical activity may also influence communication between the prefrontal cortex and the amygdala, potentially supporting emotional control and reducing negative affective responses to stressors (Luo et al., 2023). Exercise-related adaptations may additionally contribute to improved neuromuscular functioning and physical capacity. Structured neuromuscular and circuit-based training studies have demonstrated beneficial physical adaptations in athletic and sport-science populations, although these findings do not directly establish neurological or psychological mechanisms in adolescents with primary dysmenorrhea (Singh et al., 2024; Mola & Bayısa, 2020). Exercise may also contribute to more adaptive regulation of the hypothalamic-pituitary-adrenal axis and physiological stress responses (Smith & Merwin, 2021).

Changes in inflammatory pathways, neurotransmitter systems, endocrine function, and brain-related molecular processes may further contribute to improvements in depression and anxiety symptoms (Nay et al., 2021; Nyberg et al., 2019; Greenwood et al., 2012). Nevertheless, these mechanisms should be understood as theoretically plausible explanations derived from previous research rather than mechanisms demonstrated by the present findings. The study did not assess BDNF, cortisol, inflammatory markers, neurotransmitter activity, autonomic regulation, or neural connectivity. Therefore, conclusions regarding the biological pathways through which resistance training may influence psychological symptoms remain provisional and require direct investigation in future controlled studies.

Behavioral and psychosocial factors may also have contributed to the observed improvements. The supervised and progressively structured nature of the program may have enhanced participants' self-efficacy, perceived competence, exercise confidence, and sense of control over their physical health. Such psychological experiences may be particularly meaningful for adolescents with primary dysmenorrhea because recurring menstrual symptoms can contribute to feelings of helplessness and reduced confidence in managing daily activities. Direct supervision may also have supported correct exercise technique, gradual progression, consistent attendance, and individualized adjustment of training intensity. Participation in a structured group exercise environment may therefore have provided mastery experiences, positive social interaction, and emotional support alongside the physiological benefits of exercise (Smith & Merwin, 2021; Lubans et al., 2016; Subekti et al., 2025). However, self-efficacy, perceived competence, social support, and mastery experiences were not directly measured and should therefore be regarded as potential explanatory factors.

The magnitude of the observed pre-to-post changes was notably large compared with many exercise-based mental health interventions. Although these changes may indicate clinically meaningful improvement, several alternative explanations should be considered. Participants had elevated baseline depression and anxiety scores, which may have increased the potential for improvement and regression toward the mean. The supervised format and complete participation reported in the study may also have supported consistent exercise exposure, motivation, and adherence (Conn, 2010; Heissel et al., 2023). At the same time, expectancy effects, repeated questionnaire administration, increased researcher-participant interaction, social engagement during training, and natural variation in psychological symptoms across menstrual cycles may have contributed to the observed reductions. Consequently, the findings provide preliminary support for the therapeutic potential of supervised progressive resistance training. Still, the magnitude of change attributable specifically to the exercise program cannot be determined without an appropriate comparison group.

The findings also have potential practical relevance for adolescent health promotion. A supervised resistance training program using bodyweight exercises, resistance bands, and light dumbbells may represent a feasible complementary approach for addressing dysmenorrhea-related psychological distress. Exercise may additionally support muscular strength, physical fitness, and general health while promoting psychological well-being (Warburton & Bredin, 2017). The absence of reported exercise-related adverse events in this sample is encouraging, although the program's safety and effectiveness require confirmation in larger controlled studies. Implementation in schools and community programs should involve appropriate supervision, gradual progression, individualized intensity monitoring, and attention to participants' menstrual symptoms and exercise tolerance. Such an approach is consistent with broader recommendations promoting safe and regular physical activity among adolescents (World Health Organization, 2020). However, because post-intervention menstrual pain was not evaluated as a principal outcome, the findings should be limited to changes in depression and anxiety rather than interpreted as evidence of improvement in all physical symptoms of primary dysmenorrhea.

Research Contribution

This study provides preliminary, context-specific evidence regarding psychological changes following supervised progressive resistance training among adolescent girls with primary dysmenorrhea in a low-resource school setting. Previous exercise-based research on primary dysmenorrhea has predominantly focused on menstrual pain and other physical symptoms, whereas the present study specifically examined depression and anxiety outcomes. The study also contributes by investigating a structured, progressive, directly supervised, and school-based resistance training program within an underrepresented adolescent population in Ethiopia. The substantial pre-to-post reductions observed in psychological symptom scores provide an empirical basis for further investigation. Nevertheless, because the study did not include randomization or a control group, its principal contribution is to provide preliminary evidence and methodological direction for future controlled research rather than definitive proof of intervention effectiveness.

Limitations

Several limitations should be considered when interpreting the findings. First, the one-group pre-test–post-test design did not include randomization or a control group, limiting the ability to attribute the observed changes specifically to the resistance training program. Alternative explanations, including regression toward the mean, expectancy effects, repeated testing, researcher-participant interaction, and natural symptom variation, cannot be excluded. Second, participants were purposively recruited from public high schools in one town, and the relatively small and geographically restricted sample limits the generalizability of the findings to adolescents in other regions, educational settings, and socioeconomic contexts. Third, depression and anxiety were assessed using self-report instruments, which may be affected by recall, social-desirability, and reporting biases. Fourth, neither participants nor assessors were blinded to the intervention, potentially increasing expectancy and assessment bias. Fifth, the eight-week study did not include follow-up assessments, preventing conclusions regarding the long-term sustainability of the observed psychological changes. Finally, the proposed biological and psychosocial mechanisms were not directly measured, and post-intervention changes in menstrual pain, quality of life, school attendance, physical fitness, and daily functioning were not comprehensively evaluated.

Recommendations

Future research should employ adequately powered randomized controlled trials with active-control, attention-control, or usual-care comparison groups to determine whether supervised progressive resistance training produces benefits beyond natural symptom variation, researcher attention, repeated assessment, and expectancy effects. Larger multisite samples involving participants from different regions, socioeconomic backgrounds, and educational settings are needed to improve the generalizability of the findings. Longitudinal follow-up assessments should also be conducted to determine whether reductions in depression and anxiety are maintained after supervised training has ended. Future studies should evaluate menstrual pain, quality of life, school attendance, daily functioning, physical fitness, adherence, exercise tolerance, and adverse events alongside psychological outcomes. The inclusion of physiological indicators, such as inflammatory markers, cortisol, autonomic measures, and neurotrophic factors, may help clarify the mechanisms underlying psychological changes. Researchers should also compare different resistance training frequencies, intensities, progression models, supervision strategies, and program durations to establish an appropriate, safe, and reproducible exercise prescription for adolescents with primary dysmenorrhea.

CONCLUSION

Following the 8-week supervised progressive resistance training program, significant pre-to-post reductions were observed in depression and anxiety symptoms among adolescent girls with primary dysmenorrhea. The substantial decreases in BDI-II and BAI scores indicate that participation in the structured training program was associated with meaningful improvements in psychological well-being during the study period. However, because the study employed a one-group pre-test–post-test design without a control group, the observed changes cannot be attributed exclusively to the resistance training intervention. No exercise-related adverse events were reported in this sample, suggesting that the program was feasible under direct supervision. However, its safety and effectiveness require confirmation through larger randomized controlled trials. Supervised progressive resistance training may therefore represent a promising complementary non-pharmacological approach for supporting psychological well-being among adolescents with primary dysmenorrhea.

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AUTHOR CONTRIBUTION STATEMENT

SAA, DWM, RRU, AKA, AGT, and TTM contributed to the conception and design of the study, data collection, data analysis, and manuscript drafting and revision. MHR, NS, and AAS contributed to data analysis and manuscript drafting and revision. Funding acquisition was carried out by the authors as indicated. All authors reviewed and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

This manuscript was prepared without the use of AI for content generation or analysis; Grammarly was used only for language and grammar checking

CONFLICTS OF INTERES

The authors declare no conflicts of interest related to this research.

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