Effectiveness of Core Strengthening V/S Diet Including Core Muscles Strengthening with Primary Dysmenorrhea among Collegiate Students - An Experimental Study

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ABSTRACT

Primary dysmenorrhea is a common gynecological condition characterized by painful menstruation in the absence of pelvic pathology, affecting up to 93% of females globally and approximately 70.2% in India. It significantly impacts daily activities, emotional well-being, and quality of life. The pain is primarily caused by increased uterine prostaglandins leading to muscle ischemia and cramps. Research highlights that non-pharmacological interventions, including core strengthening exercises and dietary management, can effectively reduce pain severity. This article explores the role of physical activity and nutritional habits in managing primary dysmenorrhea, emphasizing their potential to improve menstrual health, reduce discomfort, and enhance overall well-being.

Objective: To find out the effectiveness of the core muscle strengthening including diet in Primary Dysmenorrhoea

Method: Subjects were recruited based on inclusion and exclusion criteria using the WaLIDD scale, with scores above 5 qualifying for participation. Out of 61 respondents, 44 met the criteria, and informed consent was obtained. Core muscle strength was assessed using the plank test. After explaining the study, 30 individuals agreed to participate and were randomly divided into two groups: Group A performing six CMS exercises and Group B combining six CMS exercises with dietary management. The intervention lasted six weeks, with sessions four times per week. Assessments using the WaLIDD scale and plank test were conducted after menstrual cycle. Data were compiled, analyzed, and results compared.

Results: These findings support the null hypothesis there were no statistically significant differences in effectiveness between the two interventions. This suggests that both protocols were equally effective in improving lumbar function and core endurance among participants.

Conclusion: The study concludes that both interventions are equally effective in managing primary dysmenorrhea, suggesting that CMS alone or with dietary support can serve as a viable non-pharmacological treatment option to improve menstrual health among young females with Primary Dysmenorrhea.

Keywords: Primary dysmenorrhea, WaLIDD, Plank test, Core muscle strengthening, Diet.

INTRODUCTION

Primary dysmenorrhea is a painful menstruation of significant magnitude so as to incapacitate the everyday activities in the absence of any pelvic pathology. It is one of the most common complaint in females and most common gynecological problem worldwide, with a prevalence of 63 % to 93%. In India 70.2 adolescent girls suffer from dysmenorrhea and 60% of them have disrupted daily routine.[1]

Dysmenorrhea has a great impact on quality of female life. It can cause psychological problems in some females and can result in loneliness and inactive participation in activities. One reason for primary

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dysmenorrhea is an increase in the production of uterine prostaglandins F2 (PFG) which results in uterine contractions and ischemia. Results of various studies have shown that with regular physical activity the intensity of symptoms and pain has decreased.[2,3]

The main cause for menstrual pain is ischemia. Uterine contractions are caused due to release of prostaglandins during menstruation. Hence the blood supply to the uterine muscles gets constricted and muscles go into spasm. Due to this there is rise in tension. This intern produces ischemia of muscles leading to cramps. Prevalence of dysmenorrhoea in Indian female population is about 70.2%.[3]

Various studies have demonstrated that regular physical activity can help reduce the severity of symptoms and pain. Non-pharmacological treatments for primary dysmenorrhea include exercises to strengthen both the upper and lower extremities, aerobic activities, and physiotherapy techniques such as hot pack applications, TENS, Pilates, and connective tissue massage.[4,5]

It is a proven fact that physical activities enhance the functioning of both pelvic and extra-pelvic organs by regulating metabolism and boosting blood circulation.[6] It was previously understood that the goal of core strengthening is to integrate the principles of lumbar stabilization and how instability can lead to pain and injury, particularly during PD [7.] The lumbar portion of our body is designed in such a way that it bears maximum force of our body at the small portion and thus most of the menstrual pain occurs at the region. If a specific region of the lumbar spine is compromised and unable to effectively manage functional loads, it can result in referred pain in the abdomen, lower back, and thigh, these are the regions that are commonly affected in female with PD. While the body is generally adapted to withstand the biomechanical demands of daily activities, the added strain of the menstrual cycle can exacerbate discomfort. Therefore, targeting and strengthening the core musculature through specialized exercises is crucial for mitigating these symptoms.[8]

Core muscle strengthening plays a crucial role in managing primary dysmenorrhea by stabilizing the pelvis, reducing muscle tension, and improving overall posture, which can alleviate menstrual pain[9,10.] As a result, a well-conditioned core can offer both pain relief and improved mobility, making it an effective non-pharmacological approach for managing primary dysmenorrhea.[11]As per the research, it showed that women who was involved regularly in exercises have comparatively less pain and positive effect than those who don't. Strengthening exercises promote the release of endorphins in the brain, which enhances the pain threshold through their analgesic properties. [12,13]

As college girls are in the stages of completion of growth and sexual maturation, the positive health of this section is essential for the proper development of a country. Inadequate nutrition affects students' health and academic success. College students are at risk as they make poor dietary choices that can cause significant health problems.[14] College girls do not know the nutritional content of the food they eat and then academic responsibilities and other factors distract their eating pattern. Increased snacking, lifestyle changes, stress, peer pressure, eating habits, higher intake of junk food, and poor hygiene contribute to the poor health status of college girls. These factors are key contributors to issues like weight loss, obesity, and other nutritional deficiencies. One significant result of the physiological changes and nutritional neglect during this time is Anemia.[15]Diet plays a major role in menstruation. Therefore, it is important to include vegetables, fruits, cereals and nuts in diet. While vegetables and fruits are vital source of nutrients and fibers in anyone's life, they also play a role in menstrual cycle. In the study conducted by Martinez et al suggests that subjects who included more vegetables and fruits in diet had fewer menstrual irregularities and less menstrual cramps.[16] Consumption of cereals, pulses and nuts are also required to replenish energy sources during menstruation. Study conducted by Mohamadirizi has shown that there is a relationship to nutritional status and menstruation[17]

As per research, nutritional deficiency has significant impact on women health by that causes symptoms of Dysmenorrhea, various conditions like Iron Deficiency, Magnesium Deficiency, Vitamin D Deficiency**,** Vitamin B Deficiencies and so on. To overcome these deficiencies, intake of proper diet can reduce the symptoms. Researches has shown great impact of some food to be added during menstruation to manage the symptoms are following: Omega 3 fatty acid such as fish. Include diet high in vegetables i.e. five serves daily, fruits (two serves daily), nuts, seeds, fish, low fat dairy food, proteins such as legumes and eggs and also

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wholegrain such as rice. Lean meat such as red meat or chicken can be included as it is high in iron and proteinIntake of calcium rich food should be increased such as nuts,low fat dairy product etc. Drink more water to maintain hydration. Reduce caffeine intake as in coffee, increased intake of caffeine can cause irritability, poor sleep and menstrual cramps. Avoid salt intake to reduce fluid retention, abdominal bloating, breast swelling and pain. Avoid saturated fats such as butter, cream and potato chips.[18]

On managing menstrual related symptoms, specifically fresh, unprocessed foods, avoiding foods rich in refined carbohydrates or fats, salt, alcohol and simulating beverages has been reported[19]. Reports of micronutrients, such as zinc, to provide anti-inflammatory and neurotrophic factors have been stated[18]. Further dietary interventions could ameliorate inflammation such as fruits, vegetables and food legumes which contain high levels of phytochemicals that show anti-inflammatory effects.[20,14]

MATERIALS AND METHODS

This experimental study was carried out at Career Point University, Kota, between November 2024 and April 2025. The intervention spanned 6 weeks, with treatments given four times per week. A sample of 30 participants was selected using a randomized controlled trial (RCT) design, and the primary researcher handled all data collection. Initially, 61 individuals completed Google Forms to assess their WALIDD Score, with 44 fulfilling the inclusion criteria (score > 5). Each of these 44 individuals then underwent a Plank test to record their duration. Before participating, all potential subjects received a comprehensive explanation of the study protocol and provided written informed consent; ultimately, 30 agreed to participate. Inclusion criteria were regular menstruation, moderate primary dysmenorrhea, not being overweight or obese, not using hormone treatment/therapy, an age between 17 and 23 years, and a WALIDD Score > 5. Exclusion criteria included menstrual-related dysfunctions (e.g., amenorrhea, endometriosis, PCOS, pregnancy, eating disorders), pelvic pain, use of contraceptives or allergy medication, cardiovascular or respiratory problems, and a history of trauma. Participants, aged 17–23 years, were recruited after giving consent and meeting the inclusion criteria. The study utilized basic materials such as paper, pens, a stopwatch, a couch, the Exercise Therapy Lab, and Google Forms.

Ethics:

An Ethical consent for an experimental study had been granted by the Ethical Student Committee of Career Point University, Kota, Rajasthan.

Procedure

The study started with synopsis presentation and ethical clearance from the ethical committee. Participants were selected according to the inclusion and exclusion criteria of the study. The study was explained and intervention was performed after the written consent of the samples. The intervention protocol was built in order to determine the improvement of CMS and Symptoms of Primary Dysmenorrhea patients when rehabilitation was given.

Pre-intervention:

Subjects were recruited in study according to inclusion and exclusion criteria via WaLIDD scale. Subjects who scored more than 5 were included in this study. 61 individuals filled this questionnaire out of which 44 individuals scored > 5. Informed consent was obtained from the participants in first assessment. With use of assessment form and data collection form was assessed the subject and include in the study. Those 44 individuals were assessed by plank test to find out core muscle strength. All the subjects were educated about the procedure and expectations of the research study and familiarized to the tests and results. After this, 30 subjects agreed to participate in this. After selecting the subject on the basis of above scales a protocol was formed. Participants were divided into two group by randomized sampling method (Group A and Group B). One group had to perform core strengthening exercise and another group had to perform same including diet within duration of four times a week, once daily for six weeks.

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Intervention:

Group A (n = 15) + B (n = 15)

i. Pelvic Bridging Exercise –Subjects began by lying supine on the floor with their feet flat on ground, knees fully flexed, toes facing forward and hands on the floor by their sides, palms facing down. Pushing through the heels, subjects lifted their pelvis off the ground to form a plank. Repeat this exercise 10 times of two sets with 1 to 2 minute rest between sets.[22] (Fig 1)

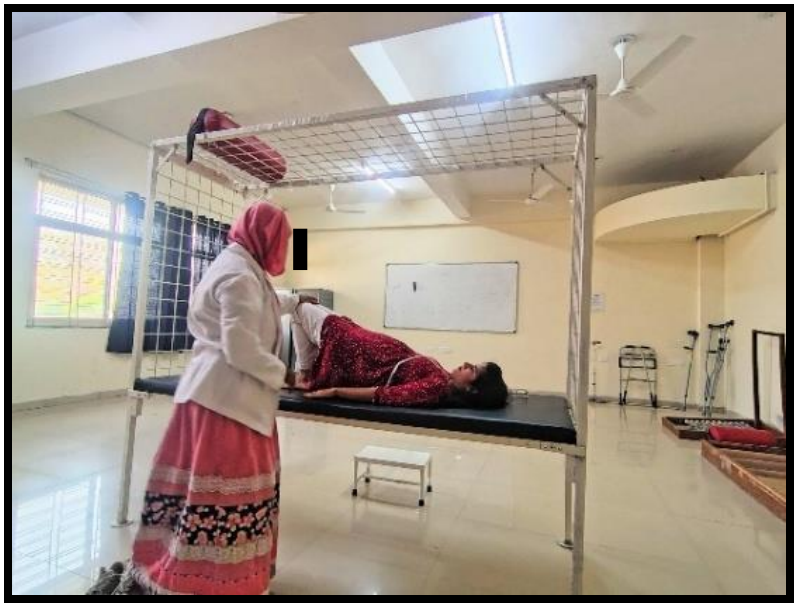

Fig 1: subject doing pelvic bridging

ii. Bicycle Crunches – Subjects lie flat on the floor with your lower back pressed to the ground and knees bent. Your feet should be on the floor and your hands are behind your head. Contract your core muscles, drawing in your abdomen to stabilize your spine. Hold your head gently with your hands. Pull your shoulder blades back and slowly raise your knees to about a 90-degree angle, lifting your feet from the floor. Exhale and slowly, at first, go through a bicycle pedal motion, bringing one knee up towards your armpit while straightening the other leg, keeping both elevated higher than your hips. Rotate your torso so you can touch your elbow to the opposite knee as it comes up. Twist to the other side, while drawing that knee towards your armpit and the other leg extended until your elbow touches the alternate knee. Repeat this exercise 10 times of two sets with 1 to 2 minute rest between sets.[22] (Fig 2)

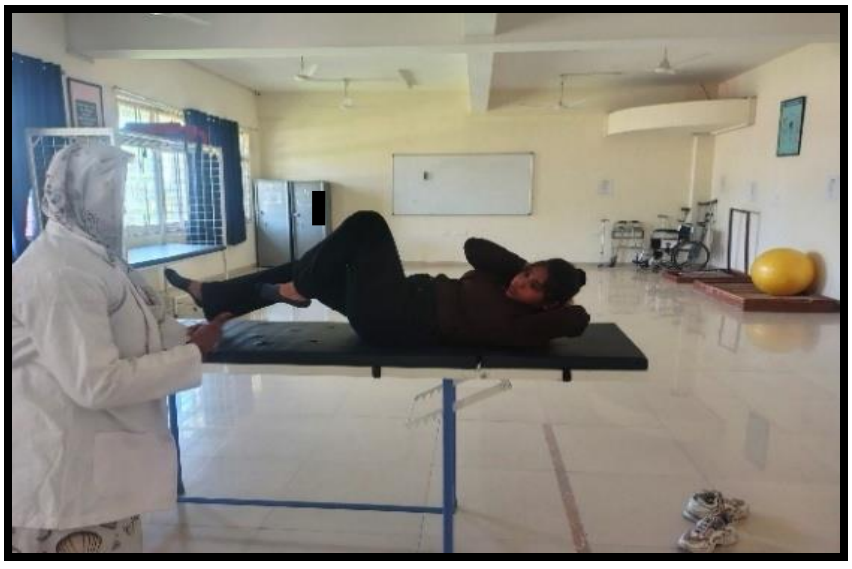

Fig 2: Subject doing bicycle crunches.

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iii. Straight leg raises – Lie flat at on back on either a bed or on the floor. Placing other foot flat at on the bed. (This helps to stabilize pelvis and protects lower back). Straighten the other knee. Tighten the muscle on the top of the thigh of the straight leg and slowly raise the entire leg 12 to 18 inches off the bed. Slowly lower the leg and relax. Repeat this exercise 10 times of two sets with 1 to 2 minute rest between sets.[25] (Fig 3)

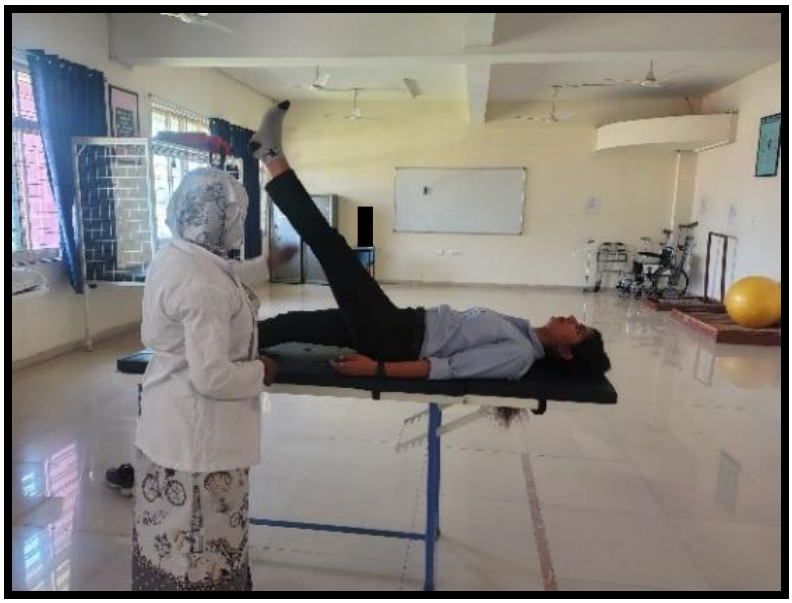

Fig 3: Performing active knee extension with hip flexion (SLR)

iv. Russian twists – Subject will began with Lying down with knee bent and feet flat on the ground. Elevate your upper body to create a V shape with your thighs. Begin to twist side to side while maintaining balance on your buttocks. Keep your back straight at all times and twist your torso only from the ribs up. Repeat this movement until the set is complete. Use a slow, controlled motion to target the muscles. Repeat this exercise 10 times of two sets with 1 to 2 minute rest between sets.[26,27](Fig 4)

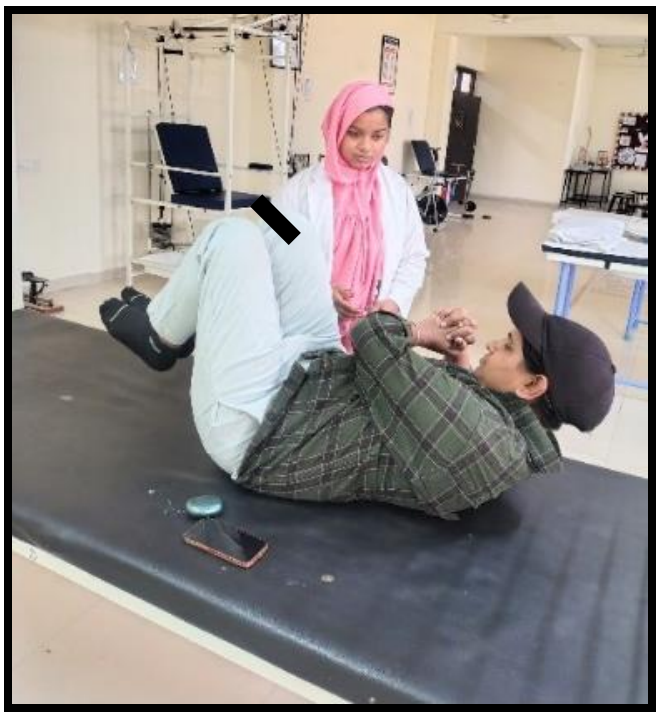

Fig 4: Twisting at right with legs and head little elevated

v. Bird Dog – Start in quadruped position (table top position). Reach one arm forward and opposing leg straight back. Align lead arm, head, hips and leg. Hold for 10 seconds then switch sides, performing 2 sets per side.[28,29,30](Fig 5)

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Fig 5: Bird-dog with left arm and right leg

vi. Planks – Participants were instructed to assume a position with the shoulders and elbows flexed at 90o. They had to maintain a straight, strong line from head to toes with no lowering of the hips and keep the neck in a neutral position. They were required to keep their elbows directly beneath their shoulders, while ensuring there was no rounding of the shoulders or elevation of scapula off the thorax. Participants were also told to contract their core musculature and gluteal muscles slightly to remain stable, while maintaining normal breathing patterns. Investigator observed all planks to ensure proper body positioning, any planks that did not meet the above criterion were repeated.[31.32](Fig 6)

Fig 6: Subject doing plank exercise.

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Group B (n = 15)

Dietary management – The subjects were asked to maintain the diet protocol for 6 week following 2 menstrual cycles and at last the score will be obtained based on this.

• Drink 3 - 4 litres of water daily [33]

• A bowl full of fruit (any fruit)[34]

• Seeds and Dryfruits[34,35]

• Protein rich diet like lentils, chickpeas, paneer, eggs, nuts.[34,36]

• A glass of milk daily bedtime. [34,36,37]

• Avoid eating spicy, junk and oily food.[38]

• Avoid drinking sugar based drink.[39]

•Avoid using ibuprofen and other analgesics for pain relief.[40]

Post-intervention:

Subjects were assessed again after menstrual cycle via WaLIDD score and plank test. Subject fulfilled the scales and got form back, compiled the data and sent for evaluation. Data analysis was performed, both the data were compared and results were obtained.

Data Analysis

This study aimed to determine the improvement of PD when CMS exercises and diet was given to two different groups The tools used in this project included Python (Version 3.8+) as the core programming language, along with several key libraries. Pandas (Version 1.3+) was utilized for data manipulation, cleaning, and statistical calculations, while NumPy (Version 1.21+) supported numerical operations and array handling. For visualizations, Matplotlib (Version 3.5+) was used for basic plotting, such as histograms and scatter plots, and Seaborn (Version 0.11+) was employed for more advanced visualizations, including boxplots, heatmaps, and regression plots. Additionally, SciPy (Version 1.7+) was used to perform statistical t-tests, ANOVA, and Correlation analysis. All work was carried out in Jupyter Notebook to enable interactive documentation and code execution.

RESULTS

Both interventions (applied to Group A and Group B) were equally effective in improving performance on both the WaLIDD and Plank tests. Both Group A and Group B demonstrated improvements in WaLIDD scores and plank test times from pre to post-intervention. Specifically, Group A's mean WaLIDD score decreased from 8.533 (Table 1) to 6.8 (Table 1) and plank time increased from 26 (Table 1) to 37.13 (Table 1) seconds, while Group B's mean WaLIDD score decreased from 8.067 (Table 2) to 6.667 (Table 2) and plank time increased from 32.467 (Table 2) to 46.467 (Table 2) seconds. Despite slight baseline differences, such as Group B having stronger initial plank endurance Plank Pre: Group A 26.0±18.43 (Table 3), Group B 32.47±17.70 (Table 3), independent samples t-tests revealed no statistically significant differences between Group A and Group B for any pre- or post-intervention scores, with all p-values exceeding 0.05 (Table 4). Furthermore, ANOVA on improvement scores for both WaLIDD F=0.29, p=0.60 (Table 5) and plank tests F=0.89p=0.35 (Table 5), as well as subsequent age-stratified ANOVA analyses (Tables 6&7), consistently showed no significant differences between the two groups, indicating that any interventions applied did not result in measurably distinct outcomes between the groups. Overall, the study yielded Null Hypothesis in terms of significant differences between the groups, implying that both interventions provided comparable benefits.

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Individual Group Analysis

Table 1 - Descriptive Statistics of Group A

Metric	Walidd_Pre	Walidd_Post	Plank_Pre	Plank_Post
Count	15	15	15	15
Mean	8.533	6.8	26	37.13
Std	2.065	1.971	18.43	24.919
Minimum	5	4	5	10
25%	7.5	6	11.5	17.5
50%	8	7	22	29
75%	10	7	35	54.5
Maximum	12	11	62	90

Table 2 - Descriptive Statistics of Group B

Metric	WaLIDD_Pre	WaLIDD_Post	Plank_Pre	Plank_Post
Count	15	15	15	15
Mean	8.067	6.667	32.467	46.467
Std	1.79	1.63	17.69	26.15
Minimum	5	4	5	10
25%	7	5.5	20	34
50%	8	7	30	40
75%	9	7.5	42.5	55
Maximum	11	10	74	124

Comparative Analysis

Table 3: Descriptive Statistics Comparison between Group A and Group B.

Metric	Group A	Group B	Key Difference
WaLIDD Pre	8.53 ± 2.07	8.07 ± 1.79	Group A had slightly higher baseline variability
Plank Pre	26.0 ± 18.43	32.47 ± 17.70	Group B started with stronger baseline endurance
Plank Post	37.13 ± 24.92	46.47 ± 26.15	Group B's gains inflated by outliers

a. Independent Samples t-Tests

Table 4: Independent Samples Group A vs Group B

Test Variable	**t-value**	**p-value**	**Significance (α=0.05)**
WaLIDD Pre-scores	0.84	0.41	Not Significant
WaLIDD Post-scores	0.17	0.87	Not Significant
Plank Pre-scores	-0.70	0.49	Not Significant
Plank Post-scores	-1.01	0.32	Not Significant

b. ANOVA (Improvement Scores)

Table 5: Improvement Scores of Plank test and WaLIDD score

Improvement Metric	**F-value**	**p-value**	**Significance (α=0.05)**	**Partial η² (Effect Size)**
WaLIDD Improvement	0.29	0.60	Not Significant	0.01 (Trivial)
Plank Improvement	0.89	0.35	Not Significant	0.03(Small)

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c. Age-Stratified ANOVA (Post-hoc Analysis)

Table 6: WaLIDD Improvement by Age Group

Age Group	Group A Mean	Group B Mean	p-value	Significance
18-19	1.67 ± 1.21	1.60 ± 1.14	0.91	Not Significant
20-21	1.78 ± 1.39	1.25 ± 1.04	0.32	Not Significant

Table 7: Plank Improvement by Age Group

Age Group	Group A Mean	Group B Mean	p-value	Significance
18-19	9.50 ± 8.50	15.20 ± 27.87	0.56	Not Significant
20-21	12.00 ± 12.53	13.00 ± 25.10	0.90	Not Significant

DISCUSSION

This study aimed to investigate the comparative effectiveness of core muscle strengthening exercises alone versus core muscle strengthening exercises combined with dietary management in alleviating primary dysmenorrhea among college-going females. The results indicate that both interventions led to statistically significant improvements in WaLIDD scores (Working ability, Location, Intensity, Days of Pain, and Dysmenorrhea) and Plank test times, signifying reduced pain and improved core endurance. However, the study found no statistically significant difference between the two groups, suggesting that both approaches were similarly effective in managing primary dysmenorrhea. The analysis was conducted across multiple statistical dimensions, including within-group changes, between-group comparisons, age-stratified improvements, and interaction effects.

T-tests and ANOVA test results in WaLIDD Score Improvements shows Group A improved by 1.73 points on average, while Group B improved by 1.40 points. These improvements were consistent within groups, as indicated by similar pre- and post-intervention standard deviations (~2.0 in Group A and ~1.6 in Group B). However, between-group differences were not statistically significant ($p > 0.05$).

ANOVA test confirmed trivial effect sizes in Plank test showing Group A improved by 11.13 seconds, while Group B showed a larger gain of 14.0 seconds. Although Group B had a higher average post-test performance, this was largely inflated by an extreme outlier (124 seconds), as reflected in their higher post-test standard deviation (26.15 vs 24.92 in Group A). Again, no statistically significant differenceswere found between groups ($p = 0.32$).

These findings support the null hypothesis there were no statistically significant differences in effectiveness between the two interventions. This suggests that both protocols were equally effective in improving lumbar function and core endurance among participants.

Age was analyzed both as a continuous variable (via correlation) and as a categorical variable (via stratified ANOVA). The findings showed No statistically significant age-related differences in WaLIDD or Plank test improvements across age groups (18–19 and 20–21 years). Group A showed a significant correlation between age and Plank improvement ($r = -0.52$, $p = 0.0474$), suggesting that younger participants improved more in core endurance within this group. However, this trend was not replicated in Group B. The interaction effects between group and age were not significant, indicating that age did not influence the comparative effectiveness of the interventions.

The histograms and boxplots confirmed that most participants improved in both metrics, although the magnitude of improvement varied, especially in core endurance.

In our study, we observed that six week sessions of Core Muscle Strengthening (CMS) produced measurable effects on pain perception and physical performance in women with primary dysmenorrhea, particularly as reflected in improvements in WaLIDD scores and plank endurance time. These outcomes—most notably the

hypoalgesic effect and enhanced functional performance—are consistent with findings from previous research that investigated the effects of CMS exercises and diet on PD. Similar to those studies, our results suggest that targeted physical interventions, even over a short duration, can lead to reductions in perceived pain and improvements in functional outcomes. However, it is important to note that while our findings align with studies demonstrating the efficacy of therapeutic interventions in modulating pain and increasing core stability and strength, some research has reported contrasting outcomes, particularly in terms of clinical significance and sustainability of effects. These discrepancies may be attributed to variations in methodology, sample characteristics, intervention intensity, or outcome measures used across studies.

Core Strengthening Exercises and Dysmenorrhea

The findings of this research align strongly with existing literature supporting the efficacy of core strengthening exercises in mitigating primary dysmenorrhea. Our results, showing significant improvements in WaLIDD scores and Plank test times in Group A (core strengthening only), resonate with the conclusions of several previous studies. Çelik et al. (2024)[10] demonstrated that core exercises significantly reduced menstrual pain intensity and improved the quality of life in teenagers with primary dysmenorrhea. Similarly, Sharma and Augustina (2022)[9] concluded that core muscle strengthening is an effective non-pharmacological intervention, leading to reduced pain levels, improved muscle flexibility, and enhanced overall menstrual comfort.

The exercises employed in this study, such as pelvic bridging, bicycle crunches, straight leg raises, Russian twists, bird dog, and planks, are well-documented for their ability to strengthen key core musculature (Czaprowski et al., 2013 [21]; Juker et al., 1998[23]; Losavio et al., 2023 [28]; McGill & Karpowicz, 2009[26]; Selvakumar et al., 2021)[31]. The observed improvements in plank test times in our study directly reflect enhanced core endurance, a critical factor in stabilizing the lumbar spine and pelvis, thereby reducing strain on areas commonly affected by dysmenorrhea (Bill & Halvorson, 2010)[11]. This is further supported by the work of Saleh et al. (2016) [8] and Kaur et al. (2014)[14], who found core strengthening exercises to be particularly effective, even more so than stretching exercises, in managing primary dysmenorrhea. Agrawal and Ahmed (2021)[1] also highlighted the importance of core strengthening as a non-pharmacological treatment for sedentary young women.

The physiological mechanism behind this improvement is likely multifaceted. As noted in the introduction, physical activity, including core strengthening, promotes the release of endorphins, which possess analgesic properties, thereby elevating the pain threshold (Daley, 2003)[6]. Furthermore, improved core stability can reduce muscle tension and improve overall posture, directly alleviating menstrual pain by minimizing excessive strain on the lower back, abdominal area, and pelvic region.

Dietary Management and Dysmenorrhea

While Group B, which received both core strengthening and dietary management, also showed significant improvements, the lack of a statistically significant difference compared to Group A warrants further discussion regarding the impact of diet in this specific study context. The dietary recommendations provided in this study focused on increasing water intake, consuming fruits, seeds, dry fruits, protein-rich foods, and dairy, while avoiding spicy, junk, oily, and sugary foods, and reducing caffeine. These recommendations are largely consistent with broader nutritional advice for managing menstrual symptoms.

Brown et al. (2023)[13], in their systematic review, highlighted the importance of omega-3 fatty acids and magnesium supplementation in reducing pain intensity and improving quality of life for women with dysmenorrhea. They also noted the benefits of fiber-rich diets and antioxidants from fruits and vegetables in managing hormonal fluctuations and inflammation. Mohamadirizi and Kordi (2023)[16] found that diets high in processed foods and sugary items correlated with greater menstrual distress, while diets rich in fruits, vegetables, and whole grains were associated with lower distress. John et al. (2021)[17] also concluded that a balanced diet and regular exercise significantly reduce menstrual pain.

The thesis also emphasizes the role of specific nutrients like electrolytes, Vitamin D, Calcium, Zinc, and Curcumin in managing dysmenorrhea symptoms, citing their anti-inflammatory and muscle-relaxing properties (Mrityunjaya et al., 2020[18]; Matsas et al., 2023 [35] ;Bajalan et al., 2019) [36]. While the theoretical basis for dietary

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intervention is strong and supported by literature, the current study's design might not have been sensitive enough to capture the additional benefits of dietary management when combined with an effective exercise regimen over a six-week period. It is possible that the impact of dietary changes, while beneficial, might manifest more subtly or over a longer duration, or that the specific dietary protocol used was not sufficiently distinct or rigorously adhered to by participants to show a statistically significant additive effect. The study by Kaur ML (2021)[14] on the nutritional status of college girls in Haryana, revealing nutrient deficiencies, underscores the general importance of diet, but its direct impact as an additional intervention in this specific study's timeframe might have been masked by the strong positive effects of the core exercises.

LIMITATION OF THE STUDY

a small sample size (n=15 per group) and the short six-week duration, may have prevented the detection of nuanced differences, particularly given the influence of outliers and high individual variability in responses, as well as challenges in monitoring dietary adherence and consistent exercise participation.

FUTURE RESEARCH

Despite not finding a significant difference between the intervention groups, the study highlights the strong potential of non-pharmacological methods like core strengthening and healthy diet in managing primary dysmenorrhea, offering college-aged women holistic alternatives to medication. Future research should address limitations by employing larger sample sizes and longer intervention periods to detect subtle, long-term effects. More detailed and individualized dietary assessments, alongside qualitative data collection, are crucial for a deeper understanding of dietary impact and participant experiences. Furthermore, mechanistic studies could uncover the physiological interplay of diet and exercise, and direct comparisons with pharmacological treatments would provide valuable insights into their relative efficacy.

CONCLUSION

Based on the analysis, both Group A and Group B showed statistically significant improvements in WaLIDD scores and Plank test times. Despite these individual group improvements, no statistically significant differences were found between the two groups across any measure, indicating similar effectiveness of their respective interventions. While core endurance and WaLIDD measures consistently improved, individual responses, especially in plank test improvements, showed high variability. Correlation analysis indicated that improvements in one measure didn't strongly predict improvements in the other, and age was not a significant influencing factor. However, baseline scores were strong predictors of post-test scores. Visual analysis confirmed that most participants benefited, with similar improvement patterns observed in both groups.

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