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Effectiveness of Pilates over Conventional Physiotherapeutic Treatment in Females with Primary Dysmenorrhea.

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Abstract
Background: *Incidence of Primary dysmenorrhea is very high among the females of reproductive age group. It is responsible for the school, college and work absenteeism because of pain and discomfort.*
Objective: *The objective of the present study was to find out the effectiveness of Pilates in reducing the pain and improving Quality of Life in females with primary dysmenorrhea.*
Method*s: The Experimental study consists of 50 subjects between the age of 18 to 30 years randomly selected as per the inclusion and exclusion criteria. The participants were divided equally by alternate sampling method .25 subjects were in group A (pilates group) and the other 25 in group B (conventional). Group A received pilates and group B received conventional physiotherapy treatment. Outcome measures were pain (VAS) and Quality of Life (Menstrual Distress Questionnaire) which was measured before and after intervention.*
Results: *The result showed that there was highly significant changes pain (group A-Pre-7.44 and post-5.88), (group B- Pre-7.92 and post 7.16) and Quality of Life (group A- pre-43.72 and post-35.04) (group B- pre-41.96 and post-39.06) ($p<0.001$) after 12 weeks of Pilates than conventional physiotherapy treatment.*
Conclusion: *Pilates reduces the pain as well as improves the Quality of Life in females with Primary Dysmenorrhea.*
Keywords*: Primary dysmenorrhea, Pilates, Conventional Physiotherapy treatment*

I. Introduction

Adolescence is the time period of life between puberty and psychophysical maturity. Adolescent girls form a vulnerable group especially in India where female child is neglected.[1] It is a time where crucial endocrinological, metabolic, somatic and psychological changes occur in girls. Menstruation is the hallmark of puberty for girls. Menstruation is a normal physiological process that begins during adolescence and may be associated with various symptoms occurring before or during the menstrual flow. The normal menstrual cycle relies on action and interaction of hormones released from hypothalamus-pituitary and ovaries. These hormones have an effect on endometrium.[2] Menstruation is also referred as periods because it occurs periodically, at specific time intervals. Menarche is the first menstrual period or first menstrual bleeding at a mean age of 13 years.[1] The length of menstrual cycle is 24-32 days. The length of menstrual flow is 3-7 days and amount of flow $\leq$ 80ml.[2] The definition of menstruation is the "Visible manifestation of cyclic, physiologic uterine bleeding due to shedding of endometrium every 28±7 days in response to hormones". It is a natural phenomenon that occurs throughout the reproductive years in every woman's life during which the blood loss per cycle is not greater than 50±30 ml with or without discomfort.[3] It is the most commonly remembered milestone of puberty for most of the girls that occurs during the period of puberty.[4] Menstruation is more closely related to bone age than to chronological age. For the past couple of decades the age of menarche is gradually declining with improvement of nutrition and environmental condition. Women on an average undergo 400 menstrual cycles prior to menopause.[5]

The organs which play an important role in the menstrual cycle are brain, pituitary gland, uterus, cervix, ovaries, fallopian tubes and vagina. The ovaries secrete two important female hormones, estrogen and progesterone. Other hormones that are involved in menstrual cycle are follicle stimulating hormone (FSH) and luteinizing hormone (LH).[6]

The menstrual cycle occurs in two distinct phases. The first phase is the follicular phase or the proliferative phase Estrogen and Progesterone are at their lowest during menstruation. During follicular phase, the uterine lining or endometrial lining both sheds through menstruation and begins a period of regrowth and thickening in preparation for an embryo if conception takes place. The follicular phase lasts about 10 -14 days or until ovulation occurs. The second phase of menstruation is called luteal phase which begins when ovulation occurs. During ovulation, the ovaries release a single egg from one ovary during each menstrual cycle. Ovulation is a process that begins when the level of luteinizing hormone surges and ends 16-32 hours later with the release of an egg from ovary. The luteal phase continues until day one of next menstrual period. Estrogen

and progesterone levels rise during luteal phase. These hormones work together, which leads to change in the endometrial lining if conception occurs. When conception, or pregnancy does not occur level of estrogen and progesterone decrease causing the endometrial lining to shed through menstruation.[6]

There are several types of menstrual disorders which are irregular periods that affect frequency of menstruation like polymenorrohea is defined as cyclic bleeding where the cycle is reduced to an arbitrary limit of less than 21 days and remains constant at that frequency. Oligomenorrhea is defined as menstrual bleeding occurring more than 35 days apart and which remains constant at that frequency. Amenorrhea literally means absence of menstruation. In addition there are pain related problems during menstruation such as dysmenorrhea (cramps or painful menstruation and irregular periods that affect quantity of menstruation which are hypomenorrhea (a diminution of the flow or a shortening of the duration of menstruation) and menorrhagia (an abnormally heavy and or prolonged menstrual period). The term dysmenorrhea comes from the Greek 'difficult monthly flow'. It is used to describe pain associated with menstruation. According to Textbook of Gynecology by Dutta, the definition of primary dysmenorrhea includes cases of painful menstruation of sufficient magnitude so as to incapacitate day to day activities. The true incidence and prevalence of primary dysmenorrhea is not clearly established in India.[6] In a study done on dysmenorrhea in different settings the prevalence of dysmenorrhea in adolescent girls was 54% which was also same as reported by other Indian and Western countries.[7]A dysmenorrhea incidence of 33.5% among adolescent girls in India was reported by Nag George and Bhaduri found dysmenorrhea to be a common problem in India with prevalence of 87.87%.[8] Dysmenorrhea causes significant difficulty in everyday activities. It is the most common cause of persistent short term school absence and of work absence in women under 30 years old.[9] Dysmenorrhea can be present with different kinds of pain, including throbbing, dull, nauseating, burning or shooting pain. Dysmenorrhea may precede menstruation by several days or may accompany it, and it usually subsides as menstruation tapers off. The risk factors for dysmenorrhea include menstrual factors for dysmenorrhea, parity, diet, exercises, smoking and psychological factors. Dysmenorrhea can be classified as primary or spasmodic dysmenorrhea and secondary dysmenorrhea. Primary dysmenorrhea is defined as painful menstruation in the absence of pelvic pathology. Secondary dysmenorrhea is painful menses secondary to underlying organic diseases of pelvic organs.[6] Vasopressin increases uterine contractility and causing ischemic pain as a result of vasoconstriction. Elevated vasopressin levels have been reported in women with primary dysmenorrhea. The uterine pain is referred to the cutaneous distribution of lower abdominal wall in front, groin, upper and medial aspects of thighs at the knees, posteriorly to the sacral area and buttocks while that from the cervix to the lower sacral area.[10]

Primary dysmenorrhea is the more common type of dysmenorrhea which is due to the production of prostaglandins. These are natural substances made by cells in the inner lining of the uterus and other parts of the body. The prostaglandins made in the uterus make the uterine muscles contract and help the uterus to shed the lining that has built up during the menstrual cycle. If excessive prostaglandins are produced, the girl may have excessive uterine contraction accompanied with pain or dysmenorrhea with her menstrual cycle. Prostaglandins can also cause headache, nausea, vomiting and diarrhea. Hormonal and endocrine theory, uterine contractions, uterine bleeding, cervical obstruction and psychological factors are also involved in the pathophysiology of primary dysmenorrhea.[11]

Secondary Dysmenorrhea is menstrual pain occurring in the presence of pelvic pathology. Causes of secondary dysmenorrhea are chronic pelvic infection, pelvic endometriosis, uterine fibroid, endometrial polyp, IUCD in utero and pelvic congestion. These females are usually in thirties; more often parous. Females with secondary dysmenorrhea presents with the pain, situated in the back and in front without any radiation. It appears 3-5 days prior to the period and relieves with the start of bleeding. The onset and duration of pain depends on pathology producing the pain.[6] Dysmenorrhea can be misdiagnosed and underlying pathology is missed if initial laboratory studies and physical examination with close follow-up care are not provided. Anxiety, depression or both may result. Infertility secondary to underlying pathology is a possible complication.[12]

The dysmenorrhea can be treated medically, surgically or by conservative methods. Medical treatment for dysmenorrhea includes Non steroidal anti-inflammatory (NSAIDs) or Oral contraceptive pills (OCPs) both reduces the symptoms by reducing myometrial activity. 64-100% females get relief from NSAIDs. By preventing ovulation, OCPs suppress the progesterone driven proliferation of the secretory endometrium. This results in a decrease in prostaglandin synthesis and the volume of the menstrual fluid.[13] Surgical intervention includes interruption of pelvic nerve pathways which can also be used as a last resort treatment.[14] General Measures for primary dysmenorrhea includes assurance, circular massage with fingertips around the lower abdomen , drinking warm beverages and having a light but frequent meals, to follow a diet which is rich in complex carbohydrates to avoid alcohol and caffeine . The various alternative modalities used are heat fomentation, Microwave Diathermy, TENS, Yoga, Ayurveda and Homeopathy, Relaxation techniques such as meditation can be practiced.[15] Thiamine, magnesium and vitamin E should be included in diet which may be effective in relieving the symptoms.[16] Conservative therapy in the form of exercise acts as non-specific

analgesic for short-term relief of pain. Aerobic exercises have been proved to reduce pain in primary dysmenorrhea.[18] Active stretching exercise will increase the blood flow and metabolism of the uterus during exercise may be effective in the reduction of dysmenorrheal symptoms.[19] The study on primary dysmenorrhea, it was concluded that physical exercises are used as a curative as well as preventive measures in treatment of primary dysmenorrhea. Various remedial exercises have also been advocated for dysmenorrhea such as floor polishing movements, bending, twisting, swaying, rowing movements and similar other routine during menstruation.[20] Nowadays, Pilates is new emerging exercise form which is used to relieve the symptoms of dysmenorrhea.

Microwave Diathermy (MWD) reduces menstrual blood flow. Symptoms like nausea, backache, headache, vomiting, hot flushes also get reduced when treated with MWD.[21] Yoga has a very important role in reducing the intensity of pain in primary dysmenorrhea. There are various studies which show that there is improvement in daily activities. There is reduction in absenteeism at work place or college. Relaxation techniques reduces pain intensity as well as tension during primary dysmenorrhea.[22] TENS is effective in reducing dysmenorrheal symptoms. TENS reduces menstrual flow, diarrhea, clot formation and fatigue.[23] Ayurvedic treatments like chaturbeeja shows significant improvements in duration and intensity of pain, tenderness in breasts, headache. It also shows improvements in symptoms like nausea, vomiting, anorexia, diarrhea and constipation. Other treatments of ayurveda like shirodhara, etc are also used to relieve symptoms of primary dysmenorrhea.[24] Homeopathic medicines like Abroma Augusta, Abrotanum, relieves intolerable pain , regulates menstrual cycle, cures headache and vomiting.[12]

Pilate's exercises belong to a group of Body-Mind Exercises, where the focus is on controlled movement, posture, and breathing pattern. Pilates improves mental and physical well-being, increases flexibility, and strengthens muscles through controlled movements done as mat exercises to tone and strengthen the body. The method combines principles of exercises from the Eastern cultures and the Western cultures. Pilates developed a comprehensive method of stretching and strengthening exercises both of them together aim to create a strong and limber body as well as a strong will of mind that can control the body. This is true for the Pilates Method, which may be said to have key principles. These principles are centering, concentration, control, precision and breathing.

Pilates is the fastest growing exercise regimen in the U.S. and Canada. Pilates is also beneficial to the post-natal women. Rudolf .H Moos (1968) developed the Menstrual Distress Questionnaire (MDQ). This questionnaire is composed of seven factors that Moos found to be stable and recurrent (pain, concentration, behavioral change, autonomic imbalance, water retention, negative effect, arousal), as well as a control factor composed of menopausal symptomatology.[2]

II. Methods

The research design used for the study was experimental study. The 60 female participants with primary dysmenorrhea were referred from Obstetrics and Gynecology Department to the Community Physiotherapy Department, Pravara Rural Hospital (Tertiary Hospital), Loni, Taluka – Rahata, District-Ahmednagar, Maharashtra state, India. The following criteria were used for inclusion in this study: females of 18-30 years of age presenting with primary dysmenorrhea and the exclusion criteria were : Married women having a child, smoking ,having gynaecological diseases ,pelvic diseases, not attending two consecutive sessions of any physical activity like swimming, fitness centre ,being under drug or physiotherapy treatment .[26] The study received ethical approval from the Institutional Ethical Committee (Ref. no. PIMS/CPT/IEC/2015/1485). The participants were screened, they were requested to participate in the study. The participants were briefed about the nature of study, the duration of intervention and the intervention being used in the language best understood by the patient. They were encouraged to clarify queries regarding the study, if any. An informed written consent form was then obtained from the participants. The demographic data was obtained and a detailed assessment was done. Participants were subsequently allocated into two groups based on the method of simple random sampling. The study variables like pain intensity and quality of life of group A and group B were assessed before the intervention as given below;

Pain was assessed by asking the patients to quantify their pain on an 11-point Visual Analogue Scale (0 to 10). The Quality of life was assessed by giving MDQ- Menstrual Distress Questionnaire

The two groups were as follows: Group A (Experimental Group) and Group B (Conventional Group). The interventions were given for the duration of 3 days a week. Hot pack was common for both the groups.

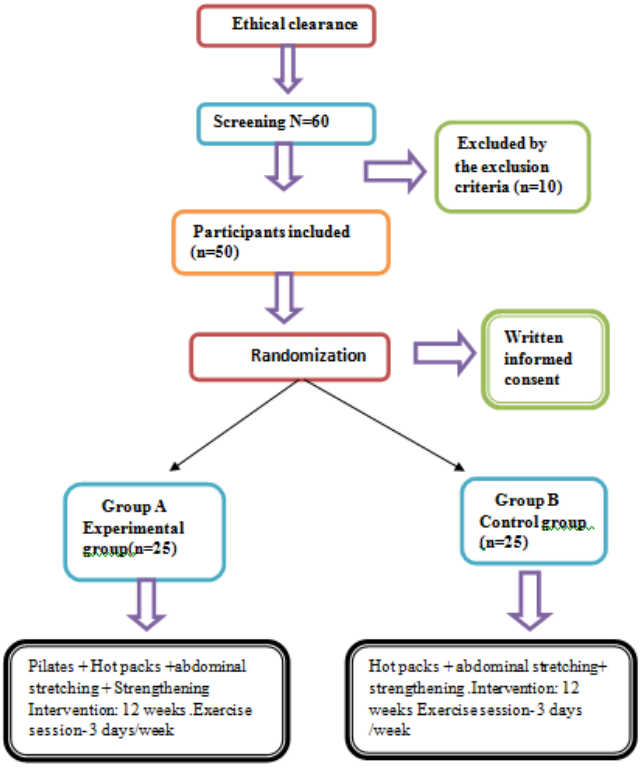


Figure 2.1 Flow chart representing the procedure of selection of participants

Hot pack was applied in supine position on lower abdomen for 15 minutes for the duration of 3 days a week.[27] Thorough instructions were given to the participants, that she should feel mild comfortable heat and any discomfort in the form of increased perception of heat should be informed.

In Group A:

- Participants were oriented to wear comfortable clothes to prevent compressing and/or impairing circulation, in addition to avoid watches or bracelets to prevent skin injuries.[28]
- Along with Hot packs this group was treated with Pilates + conventional physiotherapy treatment for 30 minute session for 3 days/week**.**
- Hip mobility exercise: Participant's position: Crook lying. Participants were instructed to breathe in while moving knee out and breathe out while coming back to neutral. Then physiotherapist added one more component in this exercise, breathe in while sliding leg to straighten knee and breathe out as coming back to neutral. Then participants were instructed to breathe in with combination of these movements and breathe out as coming back to normal. Physiotherapist had given instruction to repeat the same on the other side.
- Leg Floats: Participants were asked to be in crook lying position. They were instructed to breathe in while moving leg to 90-90 position and breathe out while straightening leg. Participants were taught to breathe in while getting leg back to neutral to 90-90 position and breathe out while bringing leg back to normal.
- Chest lift: Participants were in crook lying position .Then they were asked to draw abdominals up and in as they breathe in and roll chest forwards as they breathe out. This position was held for six breaths and they were instructed to exhale and roll back to neutral.
- Single leg stretch: In crook lying position, participants were instructed to lift both the legs to 90-90 position and place hands on knees, breathing normally. They were asked to extend leg while breathing out and return to 90-90 position while breathing in.
- Double leg stretch: Participants were asked to be in crook lying position. Then they were instructed to lift both the legs to 90-90 position and place hands on knees, breathing normally. As they exhaled, extend arms and legs and roll forwards slightly. They were told to raise arms towards ceiling as they breathe in, circle arms sideways back to the hips as they breathe out. Participants were asked to bend their knees and return to starting position as they inhaled.
- Pelvic curl: In crook lying position, participants were asked to breathe out as they lift their pelvis off the floor. Then they were instructed to breathe in as they hold the position and breathe out as they unroll the spine and return to starting position.

- Plank: Participants were in four point kneeling position. They were asked to transfer some more weight on their hands. While breathing in they were told to straighten one leg and the other knee was still touching the ground and breath out as they straighten their leg and come in push up position.[25]
- All the pilates as well as abdominal stretching and strengthening exercises were done for 10 repetitions. Patient can take a rest period as per their convenience.

In Group B

- Along with Hot packs this group was treated with conventional physiotherapy treatment of a 30 minute session for 3 days/week.
- The participants were asked to stand ,and bend your trunk forward from the hip joint so that the shoulders and back were positioned on a straight line and the upper body was placed parallel to the floor ,duration of holding time was 5 sec , repetitions was 10 times.
- The participants were requested to stand then raise 1 heel off the floor, then repeat the exercise with the other heel alternatively. The exercise was performed 10 times
- The participants were asked to lie down in the supine position so that the shoulder, back and feet were kept on the floor. In this position the knees were bent with the help of her hands and reached to her chin, the repetition frequency was 10 times.
- Cat and Camel: The participants were requested to prone kneel and then take a deep breath from nose while making hump in the back (cat) and breathe out from mouth while curving the spine (camel) 10 times.
- Single leg abdominal press: This exercise is having further 2 phases, The subject were requested for supine lying and then both knees flexed 1(phase1).keep the hand inner side of the knee(applying force outward)and knee is moving inside.2.(phase2)keep the hand outer side of the knee(applying force inward) and knee is moving outside. Repetitions 10 for each side.[19]

III. Results

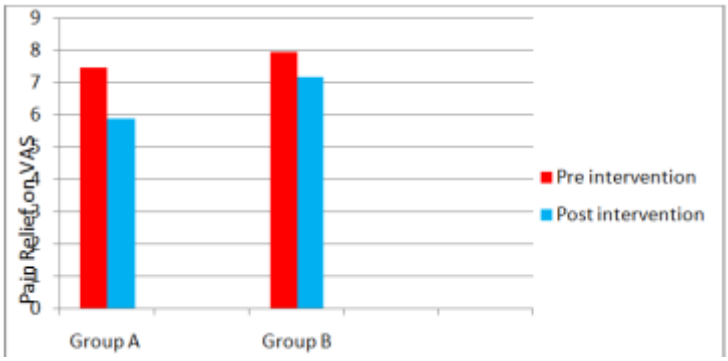
The objectives of this study were to find out effectiveness of Pilates in reducing the Pain and Quality Of Life in females with primary dysmenorrhea**.** The results were analyzed on the basis of the data obtained pre and post intervention using Visual Analogue Scale (VAS Scale) and MDQ-Menstrual Distress Questionnaire to check the Quality Of Life. Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired "t" test used for comparing the data within each group and unpaired "t" test for comparing the data between the groups (Experimental and Control group).

IV. Demographics:

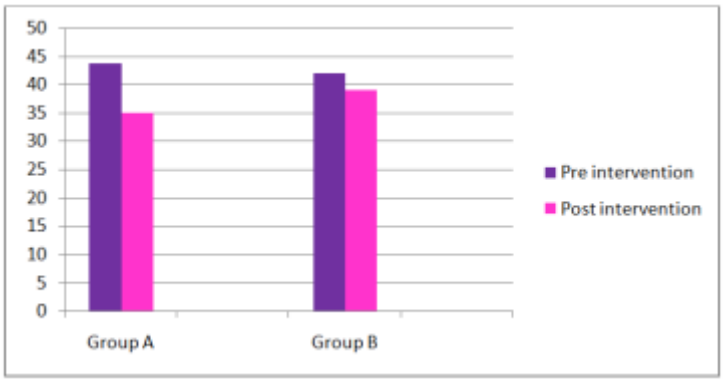
A total of sixty participants were taken from March 2015 to November 2015.The participants were divided into two groups Group A- (Experimental group) with twenty-five participants and Group B-(Control group) with twenty-five participants. However ten participants (ten participants were excluded as per exclusion criteria) The mean age of participants in group A was 21.96±2.73 years and in group B was 22.08 ± 2.76 years. This is suggestive that both the groups were similar on their baseline demographic data.

GROUP A	21.96
GROUP B	22.08

Table 1.1 shows values of mean age of Group A& Group B



Graph 1 shows mean pain values according to VAS. Menstrual pain in Group A and Group B before treatment was 7.44 ± 0.96, 7.92± 0.86 respectively and after treatment it was 5.88±1.36, 7.16± 1.17 with $p < 0.001$, showing significant difference before and after treatment with pilates and conventional physiotherapy treatment.



Graph 2 shows mean values of Quality Of Life according to MDQ. Quality Of Life in Group A and Group B before treatment was 43.72 ± 2.32, 41.96± 2.79 respectively and after treatment it was 32.04± 3.45, 39.6± 3.13 with $p < 0.001$, showing significant difference before and after treatment with pilates and conventional physiotherapy treatment.

Pilates shown effects on each and every domain of MDQ-Menstrual distress questionnaire which was used in this study. It had shown highly significant changes that is improvements in behavior change, negative affect and concentration. Eventually it decreased the absenteeism from schools, colleges and work places which was because of pain, impaired quality of life thereby increasing participant's efficiency. It changed the previous mindset of avoiding exercises during menstruation because it will worsen the symptoms.

V. Discussion

The present study aimed at finding out the effects of Pilates over conventional physiotherapeutic treatment in reduction of Pain and improvement in Quality of Life in females with primary dysmenorrhea. The results of the present study showed there was significant difference in Pain intensity and Quality Of Life after twelve weeks of treatment between the groups (Experimental group and Control group) in females with primary dysmenorrhea.

The mean baseline value for pain in group A was 7.44 ± 0.96 and in group B was 7.92 ± 0.86. After intervention the mean value of pain among participants in both group A and B were 5.88 ± 1.36 and7.16 ± 1.17 respectively.

In group A pre- intervention values of mean of Quality Of Life were 43.72 ±2.31. After intervention, the mean value of Quality Of Life was 35.04±3.45 for the participants in group A.

In group B pre- intervention values of mean Quality Of Life was 41.96± 2.79. After intervention, the mean value of Quality Of Life was 39.6± 3.13 for the participants in group B.

The results of the present study also showed significant improvement in Quality Of Life (QOL) after twelve weeks of treatment in both the groups.

The results of the present study also showed that Pilates and Conventional physiotherapy treatment are more effective in reduction of pain and improvement of QOL in females with primary dysmenorrhea than only conventional physiotherapy treatment.

Pain Relief:

Visual Analogue Scale was used to measure the pain intensity before and after twelve weeks of intervention.

Group A - The mean baseline value for pain in group A was 7.44 ± 0.96 and after intervention the mean value of pain among participants in group A was 5.88 ± 1.36.The Experimental group showed marked reduction of pain after the twelve week of intervention.

The physiological basis for dysmenorrhea is associated with increased levels of prostaglandins, which results in uterine contraction and ischemia. Falling progesterone level during the luteal phase leads to these elevations, specifically of PGF2α and PGE2. The role of prostaglandin synthesis inhibitors is in reducing painful symptoms accompanying menstrual discharge. It seems that women who exercise have a reduced incidence of dysmenorrhea. These may be due to exercises have hormonal effects on the lining of the uterus, or increased level of circulating endorphins. The severity of dysmenorrhea decreased with decreasing duration of menstruation.[29] Regular exercise results in release of endorphins hormones in brain that raise the pain threshold and improves mood of exercising subjects. Physical activities increase blood flow to the uterus so improved blood flow to the pelvis relieves ischemia and ultimately reduces the pain.[29]

These patients may have increased their pain threshold due to the adjustment of endogenous pain control mechanisms. The body would start to secrete more neurotransmitters, such as nor epinephrine, serotonin, encephalin and dopamine, which would act to inhibit and control pain[14].

Group B- The mean baseline value for pain in group B was before intervention 7.92± 0.86 and 7.16 ± 1.17. Control group (conventional physiotherapy treatment) showed a smaller amount improvement in pain reduction

Quality Of Life:

MDQ- Menstrual Distress Questionnaire was used to measure Quality Of Life before and after twelve weeks of intervention. The mean baseline value for Quality Of Life in Group A before intervention was 43.72 ±2.31 and after intervention 35.04 ± 3.45. In group B, the mean baseline value for Quality Of Life pre intervention was 41.96 ± 2.79 and post intervention 39.6± 3.13. Control group showed a smaller amount improvement in Quality Of Life.

Primary dysmenorrhea is not a real threat to life, but can have an effect on the quality of life and in case of severity it may lead to disability and inefficiency. On the other hand dysmenorrhea can cause psychological problems resulting in loneliness and inactive participation in social activities. In many countries primary dysmenorrhea is the leading cause of recurrent short term school and work absenteeism in young girls and women.[30]

Group A showed significant improvement in Quality Of Life in females with primary dysmenorrhea. Control group showed not much improvement in Quality Of Life as well.

The findings of the above study are in accordance with study done by Abbaspour Z, Rostami M, Najjar Sh**.** In that study physical exercise reduces the symptoms of primary dysmenorrhea thereby improving Quality of life in females with dysmenorrhea.[29] Pilates shown effects on each and every domain of MDQ-Menstrual distress questionnaire which was used in this study. Pilates exercises belong to a group of Body-Mind Exercises, where the focus is on controlled movement, posture, and breathing. Pilates improves mental and physical well-being, increases flexibility and strengthens muscles through controlled movements. According to pilates principles like centering, precision, concentration, breathing it basically acted on each and every body part of the participants like physical as well as psychological. It had shown highly significant changes in concentration, negative affect and behavioral change.

As one of its principles is concentration naturally the participants were concentrating on exercise session fully. So pilates helped them to get deviated from their pain and suffering and engaged them in learning some new technique of exercise. Another component of the MDQ was negative affect especially irritability because of menstruation. This is because exercises increased blood flow to the pelvic organs thereby causing wash out of the waste products pain and blood clots which formed in menstruation. It decreased pain and discomfort of menstruation. Exercises release endorphins in the blood which improved mood of the participants.

.Most study results are similar to those obtained in our study with Pilates, which would improve pelvic blood flow, decreasing muscle stresses, providing the stretching of all involved structures with consequent pain relief.

The current study showed that there was a significant improvement in Pain as well as Quality Of Life in group A ($p < 0.01$) after twelve weeks of intervention. There was slight improvement in Pain & Quality Of Life in group B as compared to group A. The possible cause of similarity in both the group will be both the therapeutic intervention work on pain get theory.

VI. Conclusion

The present study concludes that the Pilates along with Conventional Physiotherapeutic Treatment can be effective treatment for relieving pain and improving quality of life in females with primary dysmenorrhea.

VII. Limitations Of The Study

In the present study, follow up sessions were not included. The current study has only focused on the females with pain due to primary dysmenorrhea. So the findings are applicable to females within this category only. The study was not blinded.

VIII. Recommendations

Study should be conducted with a larger sample size and with a long term follow up. Also, future studies should aim at establishing the long-term effects of Pilates in females who are suffering from primary dysmenorrhea.

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