

**THE EFFECTIVENESS OF 90-90 BALLOON BLOWING EXERCISE
ON PEAK EXPIRATORY FLOW RATE, PAIN AND QUALITY OF LIFE
IN PRIMARY DYSMENORRHEA – A RANDOMIZED CONTROLLED
TRIAL**

By

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Dissertation submitted to the
Utkal University, Bhubaneswar, Odisha

In partial fulfillment
of the requirements for the degree of
MASTER OF PHYSIOTHERAPY (MPT)
In
CARDIO-PULMONARY PHYSIOTHERAPY

Under the guidance of
Dr. Arpita Panda
Associate professor



**Abhinav Bindra Sports Medicine & Research Institute,
Bhubaneswar, Odisha**

2023

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I hereby declare that this dissertation/thesis entitled “**The EFFECTIVENESS OF 90-90 BALLOON BLOWING EXERCISE ON PEAK EXPIRATORY FLOW RATE, PAIN AND QUALITY OF LIFE IN PRIMARY DYSMENORRHEA- A RANDOMIZED CONTROLLED TRIAL**” is a bonafide and genuine research work carried out by me under the guidance of **Dr. Arpita Panda, Associate professor, ABSMARI.**

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LIST OF ABBREVIATIONS

1. **PD**- Primary Dysmenorrhea
2. **WHO**- World Health Organization
3. **ZOA**- Zone of Apposition
4. **COPD**- Chronic Obstructive Pulmonary Disease
5. **PEFR**- Peak Expiratory Flow Rate
6. **NPRS**- Numerical Pain Rating Scale
7. **VAS**- Visual Analog Scale
8. **QOL**- Quality of Life
9. **MDQ**- Menstrual Distress Questionnaire
10. **BMI**- Body Mass Index
11. **RCT**- Randomized Controlled Trial
12. **MCID**- Minimal Clinically Important Differences
13. **SD**- Standard Deviation
14. **SPSS**- Statistical Package for Social Science
15. **MD**- Mean difference
16. **IQ**- Inter quartile range

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ABSTRACT

EFFECTIVENESS OF 90-90 BALLOON BLOWING EXERCISE ON PEAK EXPRATORY FLOW RATE, PAIN AND QUALITY OF LIFE IN PRIMARY DYSMENORRHEA- A RANDOMIZED CONTROLLED TRIAL

Background: Primary dysmenorrhea or painful menstruation without pelvic pathology is the most common gynecological problem in young women and adolescents. The painful symptoms can affect women's quality of life, interfering with their education, work, personal and family relationship. The physiological changes due to hormones during the menstrual cycle may alter the respiratory functions which can worsen the symptoms. Various studies have shown pulmonary functions such as peak expiratory flow rate is highest in the leuteal phase and lowest during the menstrual phase of menstrual cycle. Balloon blowing exercises with hip and knee flexed to 90⁰ with a ball between the knees provide optimal Zone Of Apposition of the diaphragm .The exercise contract diaphragm, abdominal and pelvic floor muscles simultaneously, might be helpful in reducing symptoms of PD. The aim of this study was to see the effect of 4 week of 90-90 balloon blowing exercise on Peak expiratory Flow Rate, Pain and Quality of Life during the menstrual phase in women with primary dysmenorrheal.

Methods: 36 girls aged between 18-25 years who have primary dysmenorrhea were randomly assigned to Control Group or Group A (n=18), and Experimental group or Group B (n=18). Control group received core strengthening exercise where as experimental group received core strengthening and 90-90 balloon blowing exercise.

Each training intervention consisted of 30 minutes of exercise and 10 minutes of warm up and 5 minutes of cool down. Peak expiratory flow rate, pain intensity and Quality of life were assessed before and after the 4 weeks of intervention using peak flow meter, NPRS and Menstrual Distress Questionnaire respectively.

Results: Within the group analysis showed significant differences in all outcome measures (PEFR < NPRS and MDQ) but between the group analysis has showed significant improvement only in MDQ (Quality of life) ($p < 0.05$).

Interpretation and conclusion: Our results indicate that 4 weeks of 90-90 balloon blowing exercise can improve the quality of life, but not the peak expiratory flow rate during the menstrual phase in women with Primary dysmenorrhea.

Keywords: Primary dysmenorrhea; Pulmonary function; Quality of life; 90-90 Balloon blowing exercise

INTRODUCTION

Menstrual cycle is a periodic uterine bleeding which indicates a periodic loss of endometrial lining of the uterus. Uterine bleeding occurs for about 4-5 days with an average blood loss of 35ml¹. The entire duration of menstrual cycle can be divided into four phases, 1. Menstrual phase (from day 1-5), 2. Follicular phase (from day 1-13), 3. Ovulation phase (day 14), leuteal phase (from day 15-28). These phases are regulated by the sex hormones- estrogen, progesterone, from the ovary and also by the gonadotropins- leutinizing and follicle stimulating hormones from the anterior pituitary². A female has an average of 450 menses throughout her lifetime¹.

Dysmenorrhea is painful menstrual bleeding. The term dysmenorrhea, derived from the Greek terms dys (difficulty), mens (month), and rhoia (flow) means difficult menstrual flow³. Dysmennorhea is classified in 1992 by the World health Organization within 10th revision of the International Statistical Classification of Disease and Related Health Problems as primary, secondary and non specific⁴.

Primary dysmenorrhea (PD) is defined as menstrual pain in the lower abdominal area before or during menstruation, without signs of pelvic pathology and starting between 1 and 2 years of menarche or between 6 and 12 months later, it can remain until 40 years of age, even continuing during menopause. The prevalence of PD is highest in 16- 25 years of age group. Women with this problem report the most common symptoms of pain in the lower abdomen, swollen abdomen, sadness, depression, irritability, mastalgia, lower backpain, nausea, vomiting and diarrhea^{3,4}.

Primary dysmennorhea occurs because of reduced blood supply to the uterus results in spasticity of the same. Release of prostaglandins and other inflammatory mediators in the uterus are thought to be the primary reason for dysmennorhea. The

increase in the level of prostaglandins leads to ischemia and uterine contractions⁵.

Some studies also linked hormonal levels such as progesterone, estrogen and vasopressin as reasons for dysmenorrhea. Increasing level of prostaglandin leads to uterine contractions, uterine ischemia and increased sensitivity to pain fibres and ultimately causes pelvic pain⁶.

According to WHO primary dysmenorrhea is prevalence in between 16.8% and 81.0%. Although dysmenorrhea is not a life threatening condition but it can affect the quality of life of women⁷. In severe cases it leads to disability and inability to function in the absence of school or workplace. PD results a significant negative impact on academic performance, restrictions on daily activities and sports or social and sexual relationship⁸.

Different treatment methods are currently used to control dysmenorrhea and those are categorized as medical and non-medical. The medical approaches are administration of prostaglandin synthase inhibitors, nonsteroidal anti-inflammatory drugs (NSAIDs) or oral contraceptives. But long term use of these medications can lead to various side effects such as gastrointestinal ulceration, nausea, vomiting, malabsorption, diarrhea^{5,6}.

During the different phases of menstrual cycle, rhythmic changes occur in the levels of ovarian hormones especially progesterone and estrogen⁹. These changes are responsible for various physiological changes such as pulmonary functions in women's body. The variation in the pulmonary functions during different phases of menstrual cycle follows a cyclical pattern which could be due to the action of various hormones¹⁰. H Y Dogru et al. (2021) suggested that primary dysmenorrhea can be associated with autonomic dysfunction affecting pulmonary functions. In fact in

women with asthma, the symptoms triggered during premenstrual and menstrual phases of their menstrual cycle¹¹. It may be because of receptors of sex steroid hormones are located in the lung tissue affecting the pulmonary functions as well¹². Moreover, decreased parasympathetic activity is shown in leuteal phase in women with primary dysmenorrhea¹³.

Several published research studies have shown that exercise reduces the intensity and duration of symptoms in primary dysmenorrhea^{3, 4, 5, 6, 7, 8}. Exercise releases endorphins, which are “feel good hormones” thereby, easing the symptoms of dysmenorrhea¹⁴. Core strengthening exercises can be given as weak core muscles have been associated with the occurrence of primary dysmenorrhea¹⁵. The exercises strengthen the rectus abdominis, internal and external obliques, pelvic floor muscles and erector spine and thereby, improve stability posture and release endorphins which reduce the symptoms of dysmenorrhea¹⁶.

Zone of apposition (ZOA) is the cylindrical or dome shaped part of the diaphragm. Spinal misalignment can lead to decreased ZOA which can result in inefficient respiration¹⁷. Suboptimal ZOA can be resulted from weak core, increased lumbar lordosis and anterior pelvic tilt, low back pain which are thought to be the reason for primary dysmenorrhea. Balloon blowing exercises with hip and knee flexed to 90° with a ball between the knees provide optimal ZOA of the diaphragm that may help to address low back pain¹⁷. Good lung function is a sign of healthy lung and reflect good quality of life¹⁸. 90- 90 Balloon blowing exercise has been proved to improve PEFr in both healthy individuals and patients (COPD, Asthma).

NEED OF THE STUDY

- Aside from physical health, dysmenorrhoea disturbs the Quality Of Life (QOL) and productivity of young females. Various studies showed that PD is considered as one of the leading cause of absenteeism from school or work. Despite its high prevalence and impact on daily activities it is often inadequately treated and Many women consider pain is a normal part of the menstrual cycle and do not seek medical treatment, despite the considerable distress they experience⁵.
- Studies have provided evidence to various protocols in PD. Still those studies have proved the lack of satisfaction among the females with PD. Further studies are therefore needed to evaluate the impact of exercises on females with PD.² Fatemeh Oraki et al. suggested to investigate effect of respiratory interventions on respiratory parameters in women with PD.¹² You Hoon Jeon et al. suggest breathing exercises should be carried out in menstrual phase to improve lung functions¹⁰. As 90-90 balloon exercise contract diaphragm, abdominal and pelvic floor muscles simultaneously it might be helpful in reducing symptoms of PD. But there are no studies which incorporate this exercise in PD.

AIM OF THE STUDY

- To observe the effect of 90- 90 balloon blowing exercise on peak expiratory flow rate, pain, quality of life and in women with primary dysmenorrhoea.

OBJECTIVES OF THE STUDY

- To observe the effectiveness 90- 90 balloon blowing exercise on PEFr by using peak flow meter in patients with PD.
- To observe the effectiveness 90- 90 balloon blowing exercise on pain intensity by Numerical Pain Rating Scale (NPRS) in patients with PD.
- To observe the effectiveness of 90- 90 balloon blowing exercise with on quality of life by Menstrual Distress Questionnaire (MDQ).

HYPOTHESES

Null Hypothesis

There will be no significant effect of 90- 90 balloon blowing exercise on PEFR, pain intensity and QOL in PD.

Alternative Hypothesis

There will be significant effect of 90- 90 balloon blowing exercise on PEFR, pain intensity and QOL in PD.

REVIEW OF LITERATURE

- Vidhi D Thakkar, Sweety Shah (2023) conducted a study on “Effect of abdominal exercise on peak expiratory flow rate in normal healthy female individual”. 45 healthy Females aged between 18-40 years and having fair abdominal muscle endurance were included. 4 weeks of abdominal muscle exercise program was given. Before and after exercise program PEF and abdominal endurance was checked. Result showed significant improvement of PEF and abdominal endurance. They concluded that abdominal muscle exercise can improve pulmonary function performance¹⁹.
- Hira Saeed Khan et al. (2022) conducted a cross- sectional comparative on university student to compare the respiratory parameters during different phases of the menstrual cycle. Adult healthy non pregnant females aged between 18- 24 years were included. All females with menorrhagia, dysmenorrhea, irregular menstruation, smokers, obese, anaemia, individuals with RTI, drugs such as bronchodilators, oral contraceptive pills, anti tuberculosis medication and individual with history of cardiopulmonary disease were excluded. Pulmonary function test during menstrual (1-5th day) and luteal (19-22nd day) cycle phases of menstrual cycle using Power lab AD tools 15: HT computerised spirometer. The results shows average value PEF and FEV1/FVC were highest in leuteal phase and lowest in the menstrual phase. The study concluded that pulmonary functions as well as respiratory efficiency are significantly improved in leuteal phase compared to menstrual phase of menstrual cycle. The reason could be the bronchodilator effect of progesterone, its level remains higher during this phase⁹.

- H Y Dogru et al. (2021) conducted a prospective cross-sectional study to investigate the impact of primary dysmenorrhea on pulmonary function tests. A total of 55 women of mean age 22.38 and BMI 21.80 were included in the study. The participants were divided into control and PD groups. Estrogen and progesterone levels at different phases of menstrual cycle were detected by venous blood test and pulmonary function tests were done in the laboratory. The comparison between group PD and group control among estrogen and progesterone, pulmonary function test, the result showed significant difference between the menstrual and leuteal phase but there is no significant difference between follicular and leuteal phase. This study concluded that primary dysmenorrhea can impair spirometric measurements and also respiratory functions⁷.
- Remedios López-Liria et al.(2021) conducted a systemic review and meta-analysis to describe the effectiveness of different physiotherapy techniques in the treatment of PD. Various data bases were searched for RCTs and articles not related to the treatment of PD or using pharmacology as the main treatment were excluded. Only twelve articles were selected from 692. The physiotherapy techniques used in those studies were massage, aerobic dance, pelvic floor exercises, electrotherapy, stretching, core strengthening, progressive relaxation. Meta- analysis shows benefits of physiotherapy treatment for pain relief compared with no intervention or placebo. The study concluded that physiotherapy can give overall health benefits also the risk of side effect is low⁴.

- Johnson and Mathew (2019) conducted a study with the aim to know the effect of core strengthening exercise on Peak expiratory flow rate and pain on primary dysmenorrhea in obese undergraduate females. 30 female subjects age between 18-25 years with BMI 25-29.9 kg/m² having PD included in the study. The outcome measures were PEFR, VAS, WaLIDD. The subjects perform core strengthening exercise for 30 min a day for 4 days a week for 8 weeks. The pre and post data were analysed and it showed significant difference in the outcome measure. They conclude that core strengthening exercise can be used to improve pulmonary functions and pain in PD¹⁶.
- Paloma Carroquino-Garcia et al.(2019) conducted a systemic review and meta-analysis to study the efficacy of physical exercise in decreasing the pain intensity, duration of pain and improving quality of life in PD. Various data bases were searched between February 2017 to March 2017. They include RCTs conducted on women who were 16-25 years old and have PD, studies that assessed intensity and duration of pain and quality of life. 16 studies were in the systematic review and 11 included in the meta- analysis. The methodological quality of the studies were evaluated by PEDro scale.They conclude that 8- 12 weeks of therapeutic exercises is useful in PD. They suggest that more studies are necessary to measure quality of life in women with PD⁵.

- Fatemeh Oraki et al. (2019) conducted a study on “The effect of Different phases of the menstrual cycle on respiratory indices in women with primary dysmenorrhea”. It was an cross- sectional study on 15 women aged 18-25 years with primary dysmenorrhoea to see the respiratory parameters by using capnograph during different phases of menstrual cycle. The end-tidal CO₂ level decreased and the respiratory rate increased in the menstrual phase in comparison to other 2 phases. They conclude that respiratory indices differ in various phase of menstruation in women with PD which may be due to pain in menstrual phase and progesterone in leuteal phase. They recommend to investigate effect of respiratory interventions on respiratory parameters in women with PD¹².
- Shreeya Dilip Berde et al. (2019) conducted a study on “Effect of core strengthening exercise and chair aerobic exercises in primary dysmenorrhea”. 50 subjects were selected based on the selection criteria and divided in two groups; group A with core strengthening and group B with chair aerobics. All subjects performed exercises for 4 days per week for 8 weeks. The outcome measures were NPRS for pain intensity and Moos Menstrual Distress Questionnaire (MDQ) for QOL. After 8 weeks of intervention the core strengthening group shows significant improvement than the chair aerobics⁸.

-

- KyoChul Seo and Misuk Cho (2018) conducted a study to investigate pulmonary function before and after the performance of 90- 90 balloon blowing exercise among female university students. 14 healthy females divided into 2 groups. The control group performed diaphragmatic breathing and the interventional group performed balloon blowing exercise in 90- 90 bridging position for 30 min a day five times a week for 4 weeks. Pulmonary function was measured with digital equipment before and after the exercise program period. The results suggests that the training group resulted in significant changes in forced vital capacity, vital capacity, peak expiratory flow rate and forced expiratory volume at one second. Independent t- test showed statistically significant difference between the experimental and control groups¹⁵.

METHODOLOGY

Study Design: Randomized control trial

Study Setting: Utkal signature, Bhubaneswar.

Study population: women with primary dysmenorrhea

Sample size: 36

Sampling technique: purposive sampling (Non-random sampling)

Study duration: 6 months

Sample size estimation

Sample size calculation was done by using the formula for experimental studies

$$n=2k \times SD^2/d^2$$

Where n= Number of samples

k =Power

SD= Standard Deviation

d = MCID value

$$k = 10.5$$

$$SD = 16.44$$

$$d = 18.8$$

$$n = 2k \times SD^2/d^2$$

$$= 2 \times 10.5 \times (16.44)^2 / (18.8)^2$$

$$= 16.05 \text{ added 2 dropouts}$$

$$= 18 \text{ per group}$$

2 groups are there, so total 36 subjects

PROCEDURE

This study was reviewed and approved by the Institutional Ethical Committee. A total of 50 samples were selected by using purposive sampling by word of mouth. 36 subjects were selected based on the inclusion and exclusion criteria.

Inclusion criteria:

- Women having regular menstrual cycles (28- 30 days)
- Normal Menstrual period (3-8 days)
- Age- 18- 35
- Experiencing pain at a severity of at least 5 on the Numerical Pain Rating Scale (NPRS)
- Subjects those who are given consent

Exclusion criteria:

- Irregular menstrual cycle
- Pregnancy
- Use of intrauterine device (IUD), oral contraceptive pill (OCP)
- Known genital diseases (Urinary tract infection, vaginal infection)
- Secondary dysmenorrhoea
- Chronic disorders (heart disease, respiratory, kidney, asthma, anaemia, epilepsy, migraine, nervous disorders)

- History of spinal surgery, spinal or pelvic fracture, hospitalization for severe trauma, psychological problems
- Those who smoked cigarettes, consumed alcohol, took painkillers, undertook regular exercise.

Randomization: Block randomization method was used. 36 subjects were equally allocated into group A (control) or B (intervention). 2 boxes each contained 18 piece of paper (9 A and 9 B). The subjects were unaware of the group allocation until the time of intervention. Once they were assigned to the groups the study protocol was explained to all and their informed consent was obtained. After that the demographic data, anthropometrics were taken and pre-assessment such as NPRS, peak expiratory flow rate, menstrual distress questionnaire were taken.

Outcome measures

1. Peak Expiratory Flow Rate (PEFR)

Peak Expiratory Flow Rate is the maximum flow rate generated during forceful exhalation, starting from full lung inflation. PEFR is measured using peak expiratory flow meter which is a portable easy to use device that measures how well the lungs are able to expel the air. PEFR is very sensitive and accurate index of airway obstruction and the strength of respiratory muscles. The normal range of PEFR for male is 450-550 L/min and for female 320-470 L/min²⁰.

Procedure: The marker was moved to the bottom of the number scale. Subjects were asked to stand up straight and take a deep breath. Then while holding their breath they are asked to placed the mouth piece in their mouth between the teeth

and close the lips around it. They were instructed not to put their tongue against or inside the hole. Then they are asked to blow out as hard as possible they can in a single blow. The procedure was repeated for two more times and the highest of three trials was noted as person's PEFR²¹.



FIG 1 Use of Peak flow meter

2. Numerical pain rating scale (NPRS)

The numerical pain rating scale is a subjective measure in which individuals rate their pain on eleven point numeric scale. The scale is composed of 0 (no pain at all) to 10 (worst pain) ²².

3. Menstrual distress questionnaire (MDQ)

It is a self-reporting questionnaire used in assessment, follow up and treatment of premenstrual and menstrual symptoms. The questionnaire has 46- items which are divided into subscales: pain, water retention, negative affect, autonomic reaction, concentration, behavior change and arousal. The subject has to rank each item from 1 (no experience of symptoms) to 6 (acute or partially disabling).

The NPRS and MDQ score were taken on the 2nd day of the menstrual cycle before treatment and after the treatment²³.

Materials used

1. Yoga mat
2. Balloons
3. 4 inch rubber ball
4. Low couch
5. Peak flow meter
6. Weighing machine
7. Stadiometer



FIG 2 Materials used

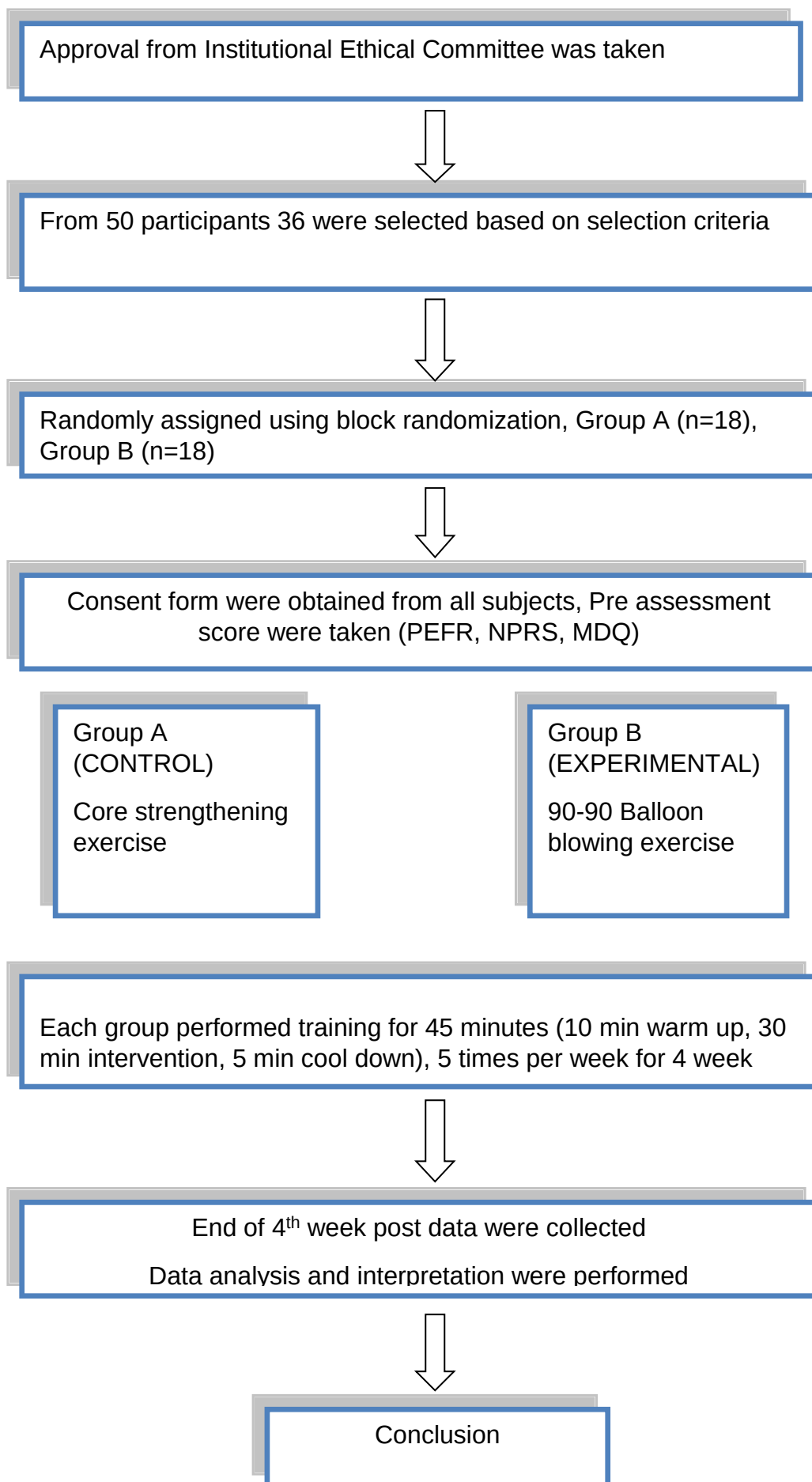


FIG 3 Flow chart of the Procedure

Intervention

The study participants were divided into two groups:

Group A: core strengthening exercise

Group B: core strengthening exercises with 90-90 balloon blowing exercise

Both the groups were mandated to perform a warm up exercise before the intervention and cool down after the exercises. The warm up include jogging and dynamic stretching for 10 min and cool down include slow walking and static stretching for 5 min.

Group A- Exercise training (Core strengthening exercise)

Table1.1 Exercise for Group A

Type	Exercises	Hold , Repetitions	sets	Total duration
Core strengthening	1. Pelvic bridging 2. Plank 3. Cat camel 4. Single leg abdominal press Phase I Phase II 5. Double leg abdominal press 6. Curl up	5sec, 10 reps 5 sec, 10 reps 5 sec,10 reps 5 sec, 5 reps 5 sec, 5 reps 5 sec, 10 reps 10 reps	1 st and 2 nd week 1 set 3 rd and 4 th week 2 sets	30 min

Procedure for core strengthening exercise

1. Pelvic bridging: the subjects were requested to lie supine and with knee flexed and then raise the pelvis upward till the comfort then hold the position for 5 sec and repetitions was 10 times.
2. Plank: the subjects were requested to lie prone and then by putting the weight on elbows and toes lift the body upward, hold this position for 5 sec and 5 times.
3. Cat and Camel: the subjects were requested to prone kneel and then take a deep breath from nose while making a hump in the back (cat and breathe out from mouth while curving the spine (camel) 10 times.
4. Single leg abdominal press: this exercise is having further 2 phases. The subjects were requested for supine lying and then both knees flexed. For phase 1 keep the hand inner side of the knee (applying force inward) and knee is moving inside. For phase 2 keep the hand outer side of the knee (applying force inward) and knee is moving outside. Repetitions 5 for each side.
5. Double leg abdominal press: the subjects were requested to lie supine and bending both knees towards chest and by both hands opposite force (toward the feet) and isometric contraction. Repeat for 10 times.
6. Curl up: the subjects were requested to lie supine and mild knee flexed and clasp both hands behind the head and move the body towards the knee 10 times.



Pelvic bridging



Plank



Single leg abdominal press phase-1



Single leg abdominal press phase-2



Double leg abdominal press



Curl- up



Cat- Camel exercise



FIG 4 Core strengthening exercises

Group B- Exercise Training (Core strengthening + 90-90 Balloon Blowing exercise)

Table1.2 Exercise for Group B

Type	Exercises	Hold, Repetitions	Sets	Total duration
Core strengthening	1. Pelvic bridging 2. Plank 3. Cat camel 4. Single leg abdominal press Phase I Phase II 5. Double leg abdominal press 6. Curl up	5sec, 5 reps 5 sec, 5 reps 5 sec, 5 reps 5 sec, 5 reps 5 sec, 5 reps 5 sec, 5 reps 10 reps	1 st and 2 nd week 1 set 3 rd and 4 th week 2 sets	10 min
Balloon blowing exercise	Balloon blowing in 90-90 hemibridge position		1 st week 3 sets, 2 nd 5 sets, 3 rd and 4 th week 10 set	20 min

Procedure for 90-90 Balloon Blowing exercise

1. In the experimental group participants were asked to lie on their back and place their feet on a wall, and to flex their knees and hips at a 90 degree angle.
2. A 5 inch rubber ball was inserted between the knees so that inside that the inside and back of the thighs felt the pressure of the ball.
3. Then the hips were lifted from the ground to tilt the pelvis backward.
4. While the balloon was held with the one hand, the other hand was raised above the head.
5. Maintaining this posture, the participants inhaled through the nose with tongue on the roof of the mouth then exhale through the mouth into the balloon.
6. Inhalation was 3-4 sec in duration and exhalation was 5-8 sec, followed by a 2-3 sec of pause.
7. The participants were instructed not to grab the opening of the balloon too tightly to allow air in the balloon to enter the mouth cavity nor to use cheek muscles to blow into the balloon.
8. After the fourth breaths in participants were requested to pinch the balloon neck and remove it from the mouth, let the air out of the balloon.
9. Then they are instructed to relax and repeat the sequence.



FIG 5 90-90 Balloon Blowing exercise

STATISTICAL ANALYSIS

In this study the statistical analysis was done using Statistical Package for the Social Science IBM (SPSS, Version 22). **The level of significance was set at $p < 0.05$.**

Descriptive statistics was performed to assess the mean and inter-quartile of specific groups. **Normality** of the data was assessed using **Shapiro-Wilk test**. **Interferential statistics to find out the difference within group was done using Wilcoxon Signed-rank test and** analysis between the two groups was done using **Mann-Whitney U test**.

RESULTS

Table 2.1 Mean Age analysis

Group	Median	IQ
Control	20	3
Experimental	22	3

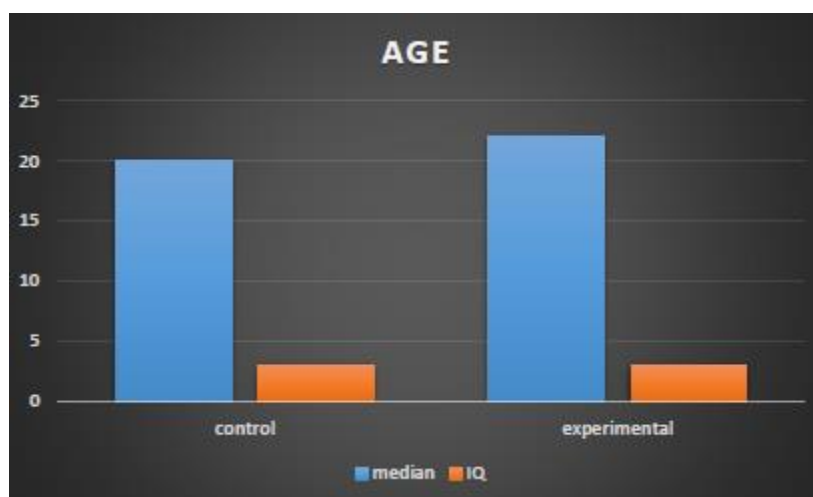


FIG 3.1 Graphical Presentation of Mean age

Table 2.2 Mean BMI Analysis

Group	Median	IQ
Control	22	3
Experimental	22	4

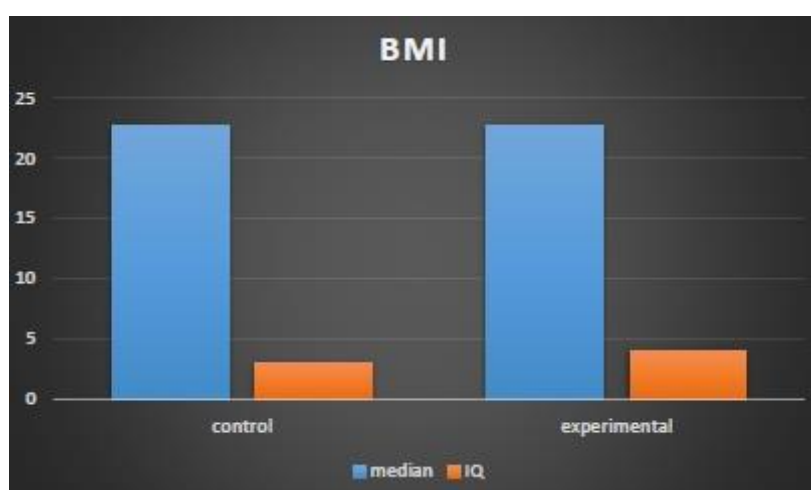


FIG 3.2 Graphical presentation of Mean BMI

Within the group Analysis

Table 2.3. Within Group PEFR

Group	Pre	Post	p	Mean
Control	290	300	0.005	10.00
Experimental	290	300	0.001	10.00



FIG 3.3 Graphical presentation of Within group PEFR

Within the group analysis for NPRS was done by Signed-rank test. The result shows significant change in control group ($p < 0.05$) and experimental group ($p < 0.05$).

Table 2.4 Within Group NPRS

Group	Pre	Post	p	Mean
Control	7	6	0.00	1
Experimental	8	6	0.00	1

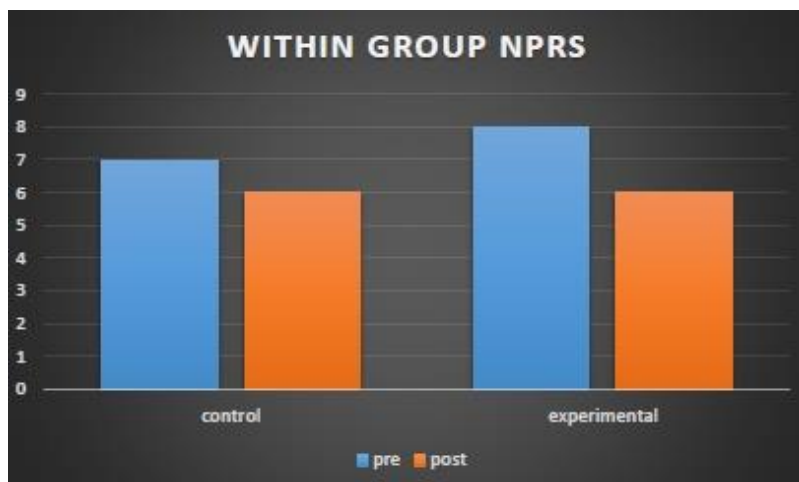


FIG 3.4 Graphical presentation of Within Group NPRS

Within the group analysis for NPRS was done by Signed-rank test. The result shows significant change in control group ($p < 0.05$) and experimental group ($p < 0.05$).

Table 2.5. Within group MDQ

Group	Pre	Post	p	Mean
Control	100	93	0.00	8
experimental	101	89	0.00	11



FIG 3.5 Graphical Presentation of Within group MDQ

Wilcoxon Signed-rank test was done for within group change for MDQ. The statistics shows significant difference in both control($p < 0.05$) and experimental group($p < 0.05$)

Table 2.6 Between Group Analysis

Outcome	Mean diff	p value
PEFR	1.118	0.329
NPRS	2.118	0.59
MDQ	4.62	0.00

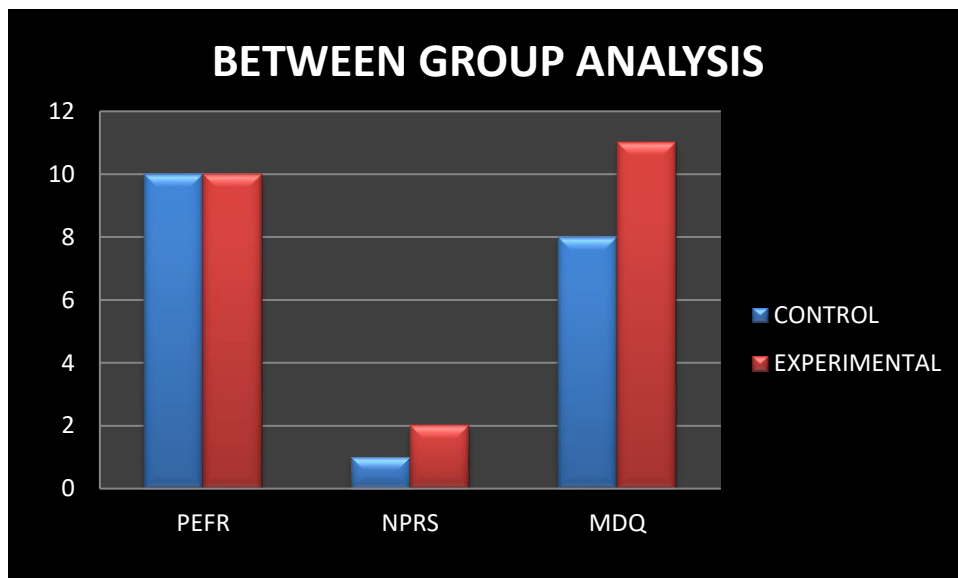


FIG 3.6 Graphical presentation of Between group analysis

Between group analysis was done by Mann-Whitney U test. The result shows significant difference for MDQ ($P < 0.05$) and no statistical difference for PEFR and NPRS ($p > 0.05$).

DISCUSSION

The objective of this present study was to find out the effect of 4 weeks of core strengthening exercise and 90-90 balloon blowing exercise on PEFR, pain intensity and QOL in menstrual phase of women with primary dysmenorrhea. 36 subjects with were divided into control group (mean age=20 and mean BMI=22) and experimental group (mean age=22, mean BMI=22). The pre and post analysis showed significant changes in the outcome measures PEFR, NPRS and MDQ in both the groups but between the group analysis showed significant results only for MDQ ($p<0.05$).

PEFR

Present study indicates that subject showed significant improvement in PEFR in both the control and experimental group after 4 weeks of intervention (MD= 10 and $p<0.05$). Diaphragm is a part of core muscles and both are used for postural stability and respiration. During expiration, abdominal muscles contract to increase the intra-abdominal pressure, which in turn push the diaphragm in cephalic position. This result raised pleural and alveolar pressure which drives air out of the lungs. DePalo et al. found that diaphragm is actively recruited in core strengthening exercises. Hence diaphragm is facilitated by the core strengthening exercises. Diaphragm and also the abdominals strengthening achieved by core exercises helps in maintaining an optimum length tension relationship of diaphragm, thereby increasing lung and chest wall compliance. **Johnson and Mathew** had done a similar study where core strengthening exercise showed significant effect on PEFR¹⁶. **Thakkar et al.** conducted a study where abdominal exercise showed significant effect on PEFR in healthy college going females¹⁹.

Balloon blowing is a resistance exercise most likely increased contraction of the diaphragm and the intercostals muscles which are active during respiration. This exercise enhances the expansion of chest and activity of abdominal muscles in bridge position. The zone of apposition (ZOA) is the dome shaped area of the diaphragm. When ZOA is suboptimal it may affect the pulmonary function^{17, 18}. Weak core, increased lumbar lordosis, low back pain may be the reason for decreased pulmonary function in PD as they all can result in decreased ZOA. 90-90 balloon blowing exercise has been proved to improve PEFr as it provides optimal ZOA by improving the posture. **KyoChul Seo and Misuk Cho** had done a study where 90-90 balloon blowing exercise showed significant effect on PEFr in healthy university female student¹⁵.

But there are no significant changes between the two groups. This may be due to both the exercises act similarly. Both exercises activate the diaphragm. More studies are needed to know the significance of these interventions on primary dysmenorrhea.

NPRS

Both the groups showed significant effect in reducing pain intensity. This improvement may be due to the increase blood flow and metabolism of the uterus during exercise as both the exercise contract the pelvic floor muscles. Stress tends to enhance sympathetic activity and may increase pain during menstrual phase. Exercise may decrease sympathetic activity and relief the stress by releasing endorphins which raise the pain threshold^{14, 15}. Some studies suggest increase lumbar lordosis in women with PD may be the reason for pain. 90-90 balloon blowing exercise provide lumbar stabilization and promote optimal spinal posture¹⁷.

MDQ

Exercise improves blood flow and also releases endorphins which increase relaxation reduce stress and symptoms of dysmenorrhea. In this present study both the intervention showed significant result in MDQ score (Control group MD=8, $p<0.05$ and Experimental group MD=11, $p<0.05$), but it is more significant in the experimental group (MD=4.26, $p<0.001$) when both the groups are compared. The possible reason may be being a deep breathing exercise balloon blowing exercise focuses on pain, mood processing, and autonomic functioning while the core exercise focuses only pain. Joshi et al. (2019) conducted a study where they suggested that deep breathing exercises can be more effective to improve MDQ score than coherent breathing exercise.

Primary dysmenorrhea or painful menstruation without pelvic pathology is the most common gynecological problem in young women and adolescents. The painful symptoms can affect women's quality of life, interfering with their education, work, personal and family relationship. The results of this study have shown that both core strengthening exercise and 90-90 balloon blowing exercise can improve the quality of life and pain in women with primary dysmenorrhea. To know the effect of these exercises on PEFr and the underlying cause further studies are needed with greater sample size.

CONCLUSION

This present study concluded that 4 weeks of 90-90 balloon blowing exercise improves peak expiratory flow rate, reduces pain and improves quality of life during the menstrual phase of women with primary dysmenorrhea. Hence this exercise can be used to reduce the symptoms of primary dysmenorrhea as it is easy to perform.

But when it is compared with the core strengthening exercise results are not significant. Further studies are recommended with more sample size and more duration of intervention.

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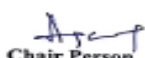
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ANNEXURE-1

ETHICAL COMMITTEE CLEARANCE CERTIFICATE

 ABHINAV BINDRA Sports Medicine & Research Institute A Unit of the Abhinav Bindra Foundation Trust Recognized by BMET Health & PW Dept., Govt. of Odisha, Affiliated to Utkal University Recognized by Odisha State Council for Occupational Therapy and Physiotherapy	Head Office: Plot No.-107, Sector-82 JPL Industrial Area, Sahibzada Ajit Singh Nagar, Punjab - 140306 +91 99156 31755 principal@absmari.com	
 Reference No. – ABSMARI/IRB/10/2023 Date: 22 nd June 2023 <u>INSTITUTIONAL REVIEW BOARD</u> To Ms Baishalee Behera, Post Graduate student, Department of Physiotherapy, Abhinav Bindra Sports Medicine and Research Institute (ABSMARI). This is to certify that your proposal for the study titled "Effectiveness of 90-90 Balloon Blowing Exercise on Peak Expiratory Flow rate, Pain and Quality of Life in Primary Dysmenorrhea. – A Randomized Controlled Trial" has been taken for discussion in the meeting held on 20 th May 2023. Following the meeting, the committee approves the proposal and it has no objection on the study being carried out. You are advised to familiarize yourself with the ICMR guidelines on biomedical research in human subjects and also adhere to the principles of Good Clinical Practice. You are hereby directed to submit the final report to the committee, on completion of the study. Any case of adverse reactions should be informed to this ethics committee and action will be taken thereafter. Any such adverse reactions during the course of the study are the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof. We wish you all the best for your study.		
 Member Secretary		 Chair Person
 Utkal Signatura, Plot No 273, NH-5, Panch, Bhubaneswar, 752101 Phone: 6370703650, 6370703651		

ANNEXURE-2

CONSENT FORM

CONSENT FORM	
Title of the study- EFFECTIVENESS OF 90-90 BALLOON BLOWING EXERCISE ON PEAK EXPIRATORY FLOW RATE, PAIN AND QUALITY OF LIFE ON PRIMARY DYSMENORRHEA – A RANDOMIZED CONTROLLED TRIAL I have been informed by Miss. Baishalee Behera; pursuing MPT (Cardio) conducting the above-mentioned study under the guidance of Dr. Arpita Panda, Associate Professor, Department of Physiotherapy ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR. I have no objection and will be a part of that group. I also understand that the study does not have any negative implication on my health. I understand that the information produced by the study will become a part of the institute's record and will be utilized, as per confidentiality regulations of the institute. I am also aware that the data might be used for medical literature and teaching purposes, but all my personal details will be kept confidential. I am well informed to ask as many questions as I can to Miss. Baishalee Behera either during the study or later. I understand that my assent is voluntary and I reserve the right to withdraw or discontinue the participation from the study at any point of time during the study. I have explained to MR/MISS/MRS _____ the purpose of the research, the procedure required in the language he/she could understand to the best of my ability. (Investigator) _____ (Date) _____	I confirm that Ms. Baishalee Behera (investigator) has explained to me in the language I can understand, the purpose of the study and the procedure. Therefore, I agree to give my assent for the participation as a subject in this study and I will be accountable for the decisions. (Signature) _____ (Date) _____

Activate Windows
Go to Settings to activate Windows

ANNEXURE-3

ASSESSMENT FORM

ASSESSMENT FORM																					
DEMOGRAPHIC DATA: Name- Age- Address- Phone number- Height – Weight- Day of Menstrual Cycle- GROUP - EXAMINATION Date of examination- • Menstrual- • Follicular- • Leuteal- <table border="1"><thead><tr><th>Day of Menstruation</th><th>PEFR</th></tr></thead><tbody><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></tbody></table>	Day of Menstruation	PEFR							Date of examination- • Pre test- • Post test – <table border="1"><thead><tr><th>Test</th><th>PRE INTEVENTION SCORE</th><th>POST INTRVENTION SCORE</th></tr></thead><tbody><tr><td>PEFR</td><td></td><td></td></tr><tr><td>NPRS</td><td></td><td></td></tr><tr><td>MDQ</td><td></td><td></td></tr></tbody></table> Activate Windows Go to Settings to activate Windows	Test	PRE INTEVENTION SCORE	POST INTRVENTION SCORE	PEFR			NPRS			MDQ		
Day of Menstruation	PEFR																				
Test	PRE INTEVENTION SCORE	POST INTRVENTION SCORE																			
PEFR																					
NPRS																					
MDQ																					

ANNEXURE-4

MASTERCHART

sr no.	age	height	weight	BMI	group	PEFR			NPRS			MDQ	
						pre	post		pre	post		pre	post
1	19	161	51	19.7	1	280	280	0	8	7	1	102	94
2	18	158	61	24.4	1	300	300	0	7	6	1	100	91
3	22	158	63	25.2	1	290	290	0	8	7	1	101	92
4	20	152	63	27.3	1	300	310	-10	7	6	1	100	92
5	22	149	53	23.9	1	280	290	-10	7	5	2	101	93
6	19	158	65	26.0	1	310	320	-10	6	6	0	98	90
7	19	153	49	20.9	1	300	300	0	7	5	2	99	94
8	20	161	54	20.8	1	270	280	-10	9	8	1	103	95
9	23	152	52	22.5	1	290	290	0	8	7	1	101	95
10	22	162	56	21.3	1	300	300	0	6	5	1	98	89
11	21	163	60	22.6	1	290	300	-10	8	7	1	102	97
12	23	160	60	23.4	1	310	310	0	6	5	1	99	93
13	20	163	55	20.7	1	300	300	0	7	5	2	100	91
14	22	158	59	23.6	1	270	270	0	8	7	1	101	94
15	23	150	49	21.8	1	290	300	-10	7	6	1	99	92
16	20	154	54	22.8	1	280	290	-10	8	6	2	101	94
17	19	155	58	24.1	1	280	280	0	8	7	1	103	95
18	20	152	52	22.5	1	290	300	-10	7	5	2	100	92
19	22	152	56	24.2	2	280	290	-10	8	6	2	100	89
20	23	160	60	23.4	2	290	290	0	9	7	2	102	97
21	24	148	57	26.0	2	280	290	-10	8	6	2	102	92
22	22	163	50	18.8	2	270	270	0	9	8	1	103	91
23	23	152	55	23.8	2	300	310	-10	7	6	1	101	91
24	19	160	54	21.1	2	300	300	0	7	5	2	99	89
25	23	158	62	24.8	2	310	310	0	6	4	2	98	88
26	22	161	56	21.6	2	280	300	-20	9	7	2	102	90
27	20	149	59	26.6	2	270	280	-10	9	8	1	102	91
28	21	167	55	19.7	2	280	290	-10	8	6	2	100	88
29	19	163	49	18.4	2	300	310	-10	8	7	1	99	89
30	22	165	61	22.4	2	290	300	-10	7	5	2	101	89
31	21	152	59	25.5	2	310	310	0	6	4	2	98	87
32	23	158	60	24.0	2	280	290	-10	8	7	1	102	90
33	19	161	53	20.4	2	290	290	0	7	7	0	100	89
34	20	157	48	19.5	2	290	300	-10	8	6	2	101	89
35	22	160	59	23.0	2	290	300	-10	8	6	2	102	88
36	22	154	53	22.3	2	300	300	0	8	6	2	102	89