

Effect of Postnatal Exercises on Pulmonary Function and Quality of Life in Immediate Postpartum Mothers

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Abstract: *Introduction:* The postpartum (or postnatal) period begins immediately after childbirth as the mother's body, including hormone levels and uterus size, returns to a non-pregnant state. The World Health Organization (WHO) describes the postnatal period as the most critical and yet the most neglected phase in the lives of mothers and babies; most maternal and newborn deaths occur during this period. *Materials and Methods:* Study design was Phase: Interventional study, Subjects: More than 90 postpartum females from Vadodara. Inclusion Criteria was Women aged between 18 and 35 years, Primi and multi-parous women, Subjects included with vaginal delivery. *Results:* Pulmonary Function Test (PFT) in terms of FEV1, FVC AND FEV1/FVC and Maternal Quality of Life (M-QOL), age, were presented as mean \pm SD. SNC and MNC were compared across different group by performing one way analysis of variance (ANOVA). Categorical variable was expressed in percentage Statistics. $P < 0.001$ was considered as level of statistical highly significance. *Discussion:* Postnatal exercise plays a significant role in Pulmonary Function Test (PFT) and Maternal Quality of Life (MQOL) in postpartum mothers. So, we have tried to analyze the effect of Postnatal exercise on Pulmonary Function Test (PFT) by Winspiro Software and Maternal Quality of Life (MQOL) assessed by the maternal postpartum Questionnaire (MPQ) in postpartum mothers. *Conclusion:* We found that there is a significant effect of post-natal increase in FEV1, FVC and FEV1/FVC in immediate postpartum mothers. We found that there is a significant effect of post-natal increase on QOL in immediate postpartum mothers.

Keywords: Vaginal delivery, Postnatal exercise, Maternal Quality of Life, Pulmonary Function Test

1. Introduction

The postpartum (or postnatal) period begins immediately after childbirth as the mother's body, including hormone levels and uterus size, returns to a non-pregnant state.¹ The terms puerperium, puerperal period, or immediate postpartum period are commonly used to refer to the first six weeks following childbirth.² The World Health Organization (WHO) describes the postnatal period as the most critical and yet the most neglected phase in the lives of mothers and babies; most maternal and newborn deaths occur during this period.³

In scientific literature, the term is commonly abbreviated to PX, where x is a number; for example, "day P5" should be read as "the fifth day after birth". This is not to be confused with the medical nomenclature that uses G P to stand for number and outcomes of pregnancy (gravidity and parity).

The Benefits of Post Natal Exercises:

Exercising after you have your baby can improve your physical and mental wellbeing. It can:

- Help restore muscle strength and firm up your body
- Make you less tired because it raises your energy level and improves your sense of wellbeing
- Promote weight loss
- Improve your cardiovascular fitness and restore muscle strength
- Condition your abdominal muscles
- Improve your mood, relieve stress and help prevent

postpartum depression.

When to Start Post Natal Exercises:

Gentle exercise (such as walking) can generally be started as soon as comfortable after giving birth. Start when you feel up to it. Some women will feel able to start exercising early.¹⁴ Talk with your doctor about when is a good time for you to restart an exercise program.

Six weeks after giving birth, most of the changes that occur during pregnancy will have returned to normal. If you had a caesarean birth, a difficult birth, or complications, it may take a little longer to feel ready to start exercising.¹⁵ If you did not exercise during pregnancy, start with easy exercise and slowly build up to harder ones.

Keep in mind your lower back and core abdominal muscles are weaker than they used to be. Your ligaments and joints are also more supple and pliable, so it is easier to injure yourself by stretching or twisting too much. Avoid any high-impact exercises or sports that require rapid direction changes.¹⁶

Types of post natal exercises:

Recommended postnatal exercise includes:

- Brisk walking
- Swimming
- Aqua aerobics
- Yoga
- Pilates

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- Low impact aerobic workouts
- Light weight training
- Cycling.

Woman of all ages are enjoying the benefits of regular physical activity and more so would like to continue exercising even during pregnancy. Exercises are globally considered to have a positive effect on health and wellness. It is associated with decreased incidence of physical and mental diseases and improvement in functional capabilities.^(11,12) With urbanization and family, work and domestic pressures, there has been awareness about the positive effects of physical activity on one's health. But still a large percentage of population remains sedentary. It was found out that women tend to take less time out for exercising than men and more so with respect to pregnant women. Lately, pregnancy is recognized as a special time for behavior modification and is no longer considered as a condition for confinement.

Pulmonary function testing (PFT) is a complete evaluation of the respiratory system including patient history, physical examinations, and tests of pulmonary function. The primary purpose of pulmonary function testing is to identify the severity of pulmonary impairment.²³ Pulmonary function testing has diagnostic and therapeutic roles and helps clinicians answer some general questions about patients with lung disease. PFTs are normally performed by a respiratory therapist, respiratory physiologist, physiotherapist, pulmonologist, and/or general practitioner.

Indications:

Pulmonary function testing is a diagnostic and management tool used for a variety of reasons, such as:

- Chronic shortness of breath
- Asthma
- Chronic obstructive pulmonary disease
- Restrictive lung disease
- Preoperative testing
- Impairment or disability
- Early morning wheezing

Measurements:

Spirometry

Spirometry includes tests of pulmonary mechanics – measurements of FVC, FEV1, FEF values, forced inspiratory flow rates (FIFs), and MVV. Measuring pulmonary mechanics assesses the ability of the lungs to move huge volumes of air quickly through the airways to identify airway obstruction.

The measurements taken by the spirometry device are used to generate a pneumotachograph that can help to assess lung conditions such as: asthma, pulmonary fibrosis, cystic fibrosis, and chronic obstructive pulmonary disease. Physicians may also use the test results to diagnose bronchial hyperresponsiveness to exercise, cold air, or pharmaceutical agents.⁵⁶ Complications of spirometer: Spirometer is a safe procedure; however, there is cause for concern regarding untoward reactions. The value of the test data should be

weighed against potential hazards. Some complications have been reported, including pneumothorax, increased intracranial pressure, fainting, chest pain, paroxysmal coughing, nosocomial infections, oxygen desaturation, and bronchospasm.

Lung volumes:

There are four lung volumes and four lung capacities. A lung's capacity consists of two or more lung volumes. The lung volumes are tidal volume (VT), inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and residual volume (RV). The four lung capacities are total lung capacity (TLC), inspiratory capacity (IC), functional residual capacity (FRC) and vital capacity (VC).

Maximal respiratory pressures

Measurement of maximal inspiratory and expiratory pressures is indicated whenever there is an unexplained decrease in vital capacity or respiratory muscle weakness is suspected clinically. Maximal inspiratory pressure (MIP) is the maximal pressure that can be produced by the patient trying to inhale through a blocked mouthpiece. Maximal expiratory pressure (MEP) is the maximal pressure measure during forced expiration (with cheeks bulging) through a blocked mouthpiece after a full inhalation. Repeated measurements of MIP and MEP are useful in following the course of patients with neuromuscular disorders.

Diffusing capacity

Measurement of the single-breath diffusing capacity for carbon monoxide (DLCO) is a fast and safe tool in the evaluation of both restrictive and obstructive lung disease.

Oxygen desaturation during exercise

The six-minute walk test is a good index of physical function and therapeutic response in patients with chronic lung disease, such as COPD or idiopathic pulmonary fibrosis.^{25,26,27}

Arterial blood gases

Arterial blood gases (ABGs) are a helpful measurement in pulmonary function testing in selected patients. The primary role of measuring ABGs in individuals that are healthy and stable is to confirm hypoventilation when it is suspected on the basis of medical history, such as respiratory muscle weakness or advanced COPD.

ABGs also provide a more detailed assessment of the severity of hypoxemia in patients who have low normal oxyhemoglobin saturation. "Maternal quality of life" refers to women's satisfaction of their position in life, based on cultural status, expectations, values, attitudes, goals, and living standards. Hence the need to pay attention to more specific dimensions of quality of life in the postpartum period is being sensed.²⁷

The postpartum period consists of the first six weeks following childbirth. This period is a critical period associated with a series of changes in the mother that have social, mental and physical effects on her life.²⁷ Coping with all these changes affects the quality of life and health status of postpartum women. Any additional changes may lead to a remarkable increase in psychological problems, such as

depression.²⁷

It is necessary to study the predictors of life quality in the early postpartum period. Early diagnosis, timely care and intervention can improve the health of mother and baby. Preterm infants' mothers reported a significantly lower quality of life than the mothers of term infants. Postpartum hemorrhage affects women's quality of life through anemia and the resulting fatigue.²⁷

A few of the challenges that patients may face in this period include difficulty breastfeeding, postpartum blues or depression, anxiety, pain and physical discomfort, urinary incontinence, sleep deprivation, and socioeconomic strain (e.g., financial pressure to return to work).²⁸

Need of Study

During pregnancy, there are various changes in the body systems which are experienced by the mothers. The main four systems which are affected most in which Pulmonary and Respiratory system is one of them. The lung capacities are compromised which leads to pulmonary and functional stress which affects the quality of life of mothers. Postpartum, managing child with these changes become more stressful which leads to fatigue and reduces the functional capacity. The postpartum physiotherapy helps to reduce these stresses and improve the functional capacity and overall quality of life of mothers.

The need of the present study is to evaluate the specific changes after physiotherapy. There are literatures supporting the importance and effects of postpartum physiotherapy after 6 months physiotherapy but very few literatures assessed the immediate effect of postpartum physiotherapy after 3 months. So, this study will evaluate the pulmonary function and quality of life after Physiotherapy.

2. Material & Methodology

The study had been carry forwarded after the obtaining the Permission from the Institution and after the approval of University Ethical committee.

Materials and Methods

- Study design
- Phase: Interventional study
- Subjects: More than 90 postpartum females from Vadodara.
- Location of the Study: Parul Sevasharam Hospital Ami Hospital

Inclusion Criteria

- Women aged between 18 and 35 years.
- Primi and multi-parous women.
- Subjects included with vaginal delivery.

Exclusion Criteria

women not involved in any exercise regimen during pregnancy, obstetric complications, like postpartum hemorrhage-primary and secondary, pre-eclampsia, abruption, placenta Previa and marked rectus diastasis, other

medical conditions like,

- Hypertension
- Cardiac disease
- Diabetes,

Materials

- Systemic illness or infections,
- Pelvic diastasis study will approve by the Institutional Ethical Review Committee.
 - Pen
 - Score sheet
 - Maternal quality of life questionnaire
 - Stop watch
 - Spirometer

Outcome Measures

- Maternal quality of life
- Pulmonary functions.

Method Procedure

The study needs to be approved by the scientific and ethical committee of the Parul University. The twenty (20) women fulfilling the eligibility criteria are recruited for the study and written informed consent will be taken from the study.

The purpose of the study will be explained to the participant and an informed consent form will be obtained. Demographic details like name, age, height, weight, address and contact details will be recorded of all the twenty patients. All the twenty patients' pulmonary function test (PFT) and Maternal Quality of life (M QOL) will be evaluated before exercises and after exercises.

Then following intervention is framed for all the twenty patients and it will be carried out for three consecutive days beginning from the second day postpartum to fourth day postpartum period twice daily for duration of 30 minutes per session. Intervention included 10 minutes of brisk walking and strengthening exercises for muscles namely neck flexors, extensors, side flexors, rotators, abdominals, scapular retractors, depressors, shoulder external rotators, hip extensors, knee extensors and flexors and ankle dorsi-flexors and pelvic floor muscle exercises.

The maternal post-partum questionnaire will be used as subjective outcome measure for pre and post measurement. As an objective outcome measure another one will be pulmonary function test for pre and post criteria. It evaluates individual patient's health status, monitoring and comparing disease burden. It will be administered on the 1st day pre-intervention and on the 3rd day post intervention. Total scores will be calculated and pre and post scores will compare.

3. Data Analysis

Pulmonary Function Test (PFT) in terms of FEV1, FVC AND FEV1/FVC and Maternal Quality of Life (M-QOL), age, were presented as mean \pm SD. SNC and MNC were compared across different group by performing one way

analysis of variance (ANOVA). Categorical variable was expressed in percentage Statistics. $P < 0.001$ was considered as level of statistical highly significance.

SPSS Version 26.0 and Excel have been used to generate graphs and tables.

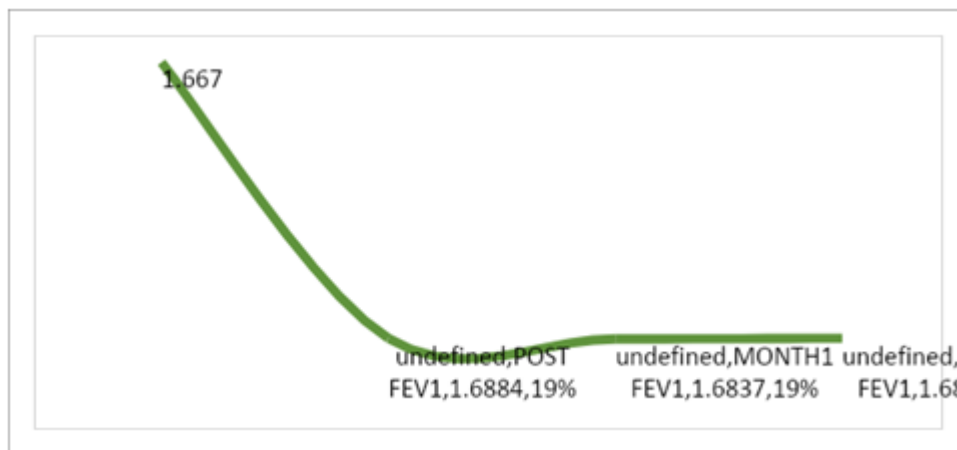
Statical Software: Data was analyzed on statistical software

Table 1: Showing Mean and Standard Deviation of FEV1

	N	Mean	Std. Deviation
PRE FEV1	70	1.667	0.2341
POST FEV1	70	1.6884	.24629
MONTH1 FEV1	70	1.6837	.24530
MONTH3 FEV1	70	1.6879	.24305

The table-1 is showing the mean and standard deviation of FEV1. The mean FEV1 score in the pre assessment was 1.667 ± 0.2341 and the post FEV1 was 1.68 ± 0.246 , the first

month follow up score was 1.683 ± 0.245 and the fifth week follow up FEV1 score was 1.687 ± 0 .



Graph 1: Showing Mean FEV1 Score of Pre and Post for First Month and Third Month

Table 2: Showing Pre Post Comparison in FEV1

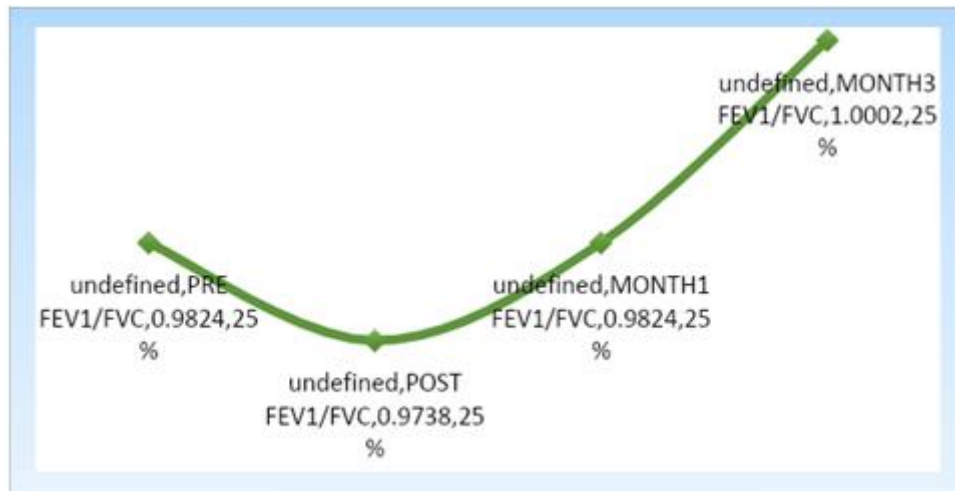
	Mean	N	Std. Deviation	Average difference	t value	P value
PRE FEV1	1.6677	70	.24391	0.0207	2.653	0.010, $P < 0.05$
POST FEV1	1.6884	70	.24629			
POST FEV1	1.6884	70	.24629	0.0047	1.192	0.237, $p > 0.05$
MONTH1 FEV1	1.6837	70	.24530			
MONTH1 FEV1	1.6837	70	.24530	0.0414	1.197	0.236, $p > 0.05$
MONTH3 FEV1	1.6879	70	.24305			
PRE FEV1	1.6677	70	.24391	0.016	2.033	0.044, $P < 0.05$
MONTH1 FEV1	1.6837	70	.24530			
PRE FEV1	1.6677	70	.24391	0.0201	2.483	0.015, $P < 0.05$
MONTH3 FEV1	1.6879	70	.24305			

Table-2 is showing the Pre and post comparison of FEV1. Comparison of FEV1 between pre and post has given an average difference of 0.020 with $p < 0.05$. This shows FEV1 score has significantly increased in post. Post FEV1 and first month FEV1 score shows an average decrement of 0.0047 which is not statistically significant. First month to third month comparison shows average increment of 0.041 in FEV1 score which is not statistically significant. Pre to first month has an average difference of 0.016, pre to third month has an average difference of 0.020 with $p < 0.05$

indicating statistically increment in FEV1.

Table 3: Showing Mean and Standard Deviation of FEV1/FVC

	N	Mean	Std. Deviation
PRE FEV1/FVC	70	.9824	.05893
POST FEV1/FVC	70	.9738	.18396
MONTH1 FEV1/FVC	70	.9824	.08351
MONTH3 FEV1/FVC	70	1.0002	.01665



Graph 3: Showing Mean and SD Of FEV1/FVC Score of Pre and Post for First Month and Third Month

The mean FEV1/FVC score in the pre assessment was 0.982 ± 0.058 and the post FEV1/FVC was 0.973 ± 0.183 , the first month follow up score was 0.982 ± 0.083 and the fifth week follow up FEV1 score was 1.0002 ± 0.0166 .

Table 4: Showing Pre Post Comparison in FEV1/FVC

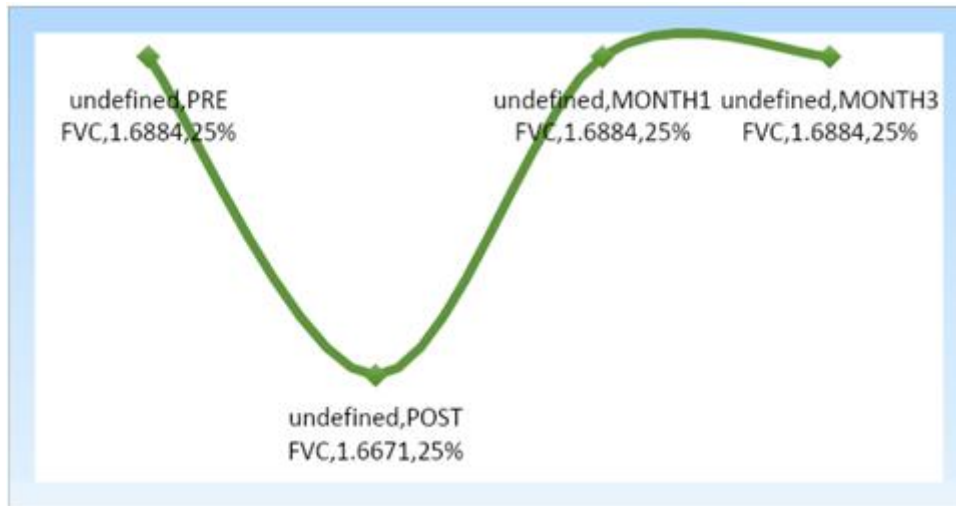
	Mean	NO	Std. Deviation	Average difference	t value	P value
PRE FEV1/FVC	.9824	70	.05893	0.008	0.357	0.772, p>0.05
POST FEV1/FVC	.9738	70	.18396			
POST FEV1/FVC	.9738	70	.18396	0.008	0.360	0.720, p>0.05
MONTH1 FEV1/FVC	.9824	70	.08351			
MONTH1 FEV1/FVC	.9824	70	.08351	0.017	1.754	0.084, p>0.05
MONTH3 FEV1/FVC	1.0002	70	.01665			
PRE FEV1/FVC	.9824	70	.05893	0.000	0.000	1.000, p>0.05
MONTH1 FEV1/FVC	.9824	70	.08351			
PRE FEV1/FVC	.9824	70	.05893	0.017	2.368	0.021, p<0.05
MONTH3 FEV1/FVC	1.0002	70	.01665			

Table-4 is showing the pre and post comparison of FEV1/FVC. Comparison of FEV1/FVC between pre and post has given an average decrement of 0.0082 with $p > 0.05$. This shows FEV1/FVC score does not differ significantly. Post FEV1/FVC and first month FEV1/FVC score shows an average increment of 0.008 which is not statistically significant. First month to third month comparison shows average increment of 0.017 in FEV1/FVC score which is not statistically significant. Pre to first month has an average difference of 0.000 which is not statistically significant and pre to third month has an

average difference of 0.017 with $p < 0.05$ indicating statistically increment in FEV1/FVC.

Table 5: Showing Mean and Standard Deviation of FVC

	N	Mean	Std. Deviation
PRE FVC	70	1.6884	.24629
POST FVC	70	1.6671	0.2433
MONTH1 FVC	70	1.6884	.24629
MONTH3 FVC	70	1.6884	.24629



Graph 5: Showing Mean FVC Score of Pre and Post for First and Third Month

Table-5 and graph-5 are showing the mean value of pre and post FVC after first and third month. The mean FVC score in the pre assessment was 1.688 ± 0.246 and the post FVC was 1.667 ± 0.243 the first month follow up score was 1.688 ± 0.246 and the fifth week follow up FVC score was 1.688 ± 0.246 .

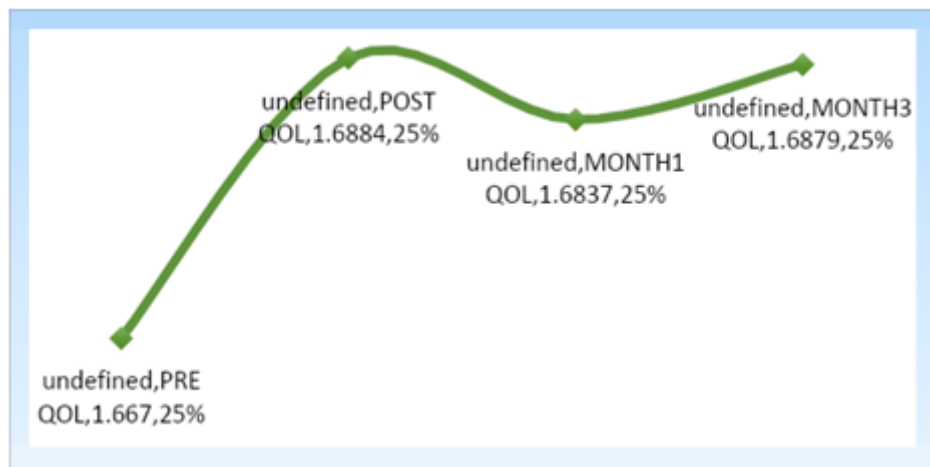
Table 6: Pre Post Comparison in FVC

	Mean	NO	Std. Deviation	Average difference	t value	Result
PRE FVC	1.6884	70	.24629	0.020	2.653	0.010,P<0.05
POST FVC	1.6677	70	.24391			
POST FVC	1.6677	70	.24391	0.020	2.653	0.010,P<0.05
MONTH1 FVC	1.6884	70	.24629			
MONTH1 FVC	1.6884	70	.24629	-	-	-
MONTH3 FVC	1.6884	70	.24629	-	-	-
PRE FVC	1.6884	70	.24629	-	-	-
MONTH1 FVC	1.6884	70	.24629	-	-	-
PRE FVC	1.6884	70	.24629	-	-	-
MONTH3 FVC	1.6884	70	.24629	-	-	-

Table-6 is showing pre and post comparison in FVC. Comparison of FVC between pre and post has given an average decrement of 0.020 with $p > 0.05$. This shows FVC score reduced significantly. Post FVC and first month FVC score shows an average increment of 0.020 which is statistically significant. Analysis shows from month1 to month3, pre to first month and pre to third month there is no difference in the mean FVC score.

Table 7: Showing Mean and Standard Deviation of QOL

	N	Mean	Std. Deviation
PRE QOL	70	1.667	0.2439
POST QOL	70	1.6884	.24629
MONTH1 QOL	70	1.6837	.24530
MONTH3 QOL	70	1.6879	.24305



Graph 7: Showing Mean QOL Score of Pre and Post for First Month and Third Month

Table-7 and the Graph-7 show the mean QOL score of pre and post for first and third month. The mean QOL score in the pre assessment was 1.667 ± 0.243 and the post QOL was 1.688 ± 0.246 the first month follow up score was 1.683 ± 0.245 and the fifth week follow up QOL score was 1.687 ± 0.243 .

Table 8: Pre Post Comparison in QOL

	Mean	No	Std. Deviation	Average difference	t value	Result
PRE QOL	1.6677	70	.24391	0.0207	2.653	0.010,p<0.05
POST QOL	1.6884	70	.24629			
POST QOL	1.6884	70	.24629	0.0047	1.192	0.237,p>0.05
MONTH1 QOL	1.6837	70	.24530			
MONTH1 QOL	1.6837	70	.24530	0.0414	1.197	0.236,p>0.05
MONTH3 QOL	1.6879	70	.24305			
PRE QOL	1.6677	70	.24391	0.016	2.039	0.044,p<0.05
MONTH1 QOL	1.6837	70	.24530			
PRE QOL	1.6677	70	.24391	0.0201	2.448	0.015,p<0.05
MONTH3 QOL	1.6879	70	.24305			

Table-8 shows the pre and post QOL SCORE. Comparison of QOL between pre and post has given an average difference of 0.020 with $p < 0.05$. This shows QOL score has significantly increased in post. Post QOL and first month QOL score shows an average decrement of 0.0047 which is not statistically significant. First month to third month comparison shows average increment of 0.041 in QOL score which is not statistically significant. Pre to first month has an average difference of 0.016, pre to third month has an average difference of 0.020 with $p < 0.05$ indicating statistically increment in QOL

4. Discussion

Postnatal exercise plays a significant role in Pulmonary Function Test (PFT) and Maternal Quality of Life (MQOL) in postpartum mothers. So, we have tried to analyze the effect of Postnatal exercise on Pulmonary Function Test (PFT) by Winspiro Software and Maternal Quality of Life (MQOL) assessed by the Maternal postpartum Questionnaire (MPQ) in postpartum mothers.

In this study pregnant women were taken as subjects according to inclusion and exclusion criteria. Their PFT and MQOL were being assessed by Winspiro Software and MQOL respectively before and after Postnatal exercises in postpartum mothers. This study proved that postnatal exercises played the significant role in PFT in terms of FEV1, FVC and FEV1/FVC and MQOL in postpartum mothers.

In this study Pulmonary Function Test was assessed by Winspiro Software in terms of FEV1.FVC and FEV1/FVC. The mean value of FEV1 before treatment was 1.5945 and after treatment means after postnatal exercise was 1.6785 (Table-2 & Graph-2). We found that there is a significant increase in the value of FEV1 after postnatal exercise. Moreover, earlier studies support that there is a significant improvement in Pulmonary Function Test in terms of FEV1 in postpartum mothers after postnatal exercises.

In this study we have also found PFT in terms of FVC before exercise and after exercise. The mean values of FVC before exercise and after exercise are 1.6440 and 1.7305 respectively (Table-3 & Graph-3). We also found that there is a significant increase in the value of FVC after postnatal exercise. There are many studies which support that there is a significant improvement in Pulmonary Function Test in terms of FVC in postpartum mothers after postnatal exercise.

In this study we have finally assessed the PFT in terms of calculated the ratio of FEV1/FVC. And results showed that the mean value of FEV1/FVC before exercise 97.0850 and after exercise was 97.1100 (Table-4 & Graph-4). Hence this study proved the significant improvement in Pulmonary Function Test in terms of the ratio of FEV1/FVC. There was a study done by **G Grindheim, a K Toska, b M-E Estensen,c,d LA**

Rosselanda (2011) conducted a longitudinal cohort study to observe the Changes in pulmonary function during pregnancy and their objective was to record any physiological changes in lung function during healthy pregnancies and finally they concluded that main outcome measures Forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow (PEF), also expressed as a percentage of predicted values according to age and height: i.e. FVC%, FEV1%, and PEF% in Forced vital capacity (FVC) increases significantly after 14–16 weeks of gestation.

In this study we also tried to find out the Quality of life in postpartum mothers which was assessed by Maternal Quality of Life Questionnaires (MQOL) before and after exercise and we found the mean value of MQOL before exercise was 159.40 and after exercise was 200.75 (Table-5 & Graph-5). This showed that there is a significant difference in pre and post QOL in postpartum mothers after postnatal exercise. A study done by **Ni Putu Dian Ayu Anggraeni et al** conducted the Effect of Exercise on Postpartum Women's Quality of Life. The aim of this systematic review is to explore the effect of exercise on postpartum women's quality of life and they have concluded that Yoga and Pilates are proven to effectively improve maternal well-being because this exercise focuses on increasing the physical, psychological and social support during the postpartum period.

So, postnatal exercises are very helpful and it played important role in Pulmonary Function Test and Quality of Life in postpartum mother.

5. Conclusion

We found that there is a significant effect of post-natal increase in FEV1, FVC and FEV1/FVC in immediate postpartum mothers. We found that there is a significant effect of post-natal increase on QOL in immediate postpartum mothers.

6. Limitation of the Study

- 1) Very narrow section of population within a specific geographical area.
- 2) Short duration study.
- 3) Variable list was not exhaustive.
- 4) Absence of measuring the psychological disorder.

7. Future Recommendations

- 1) Can use other scales [The Quality-of-Life Scale (QOLS), The McGill Quality of Life Questionnaire (MQOL), Health Related Quality of Life-14(HRQOL-14), Short Form-36(SF-36) for assessing the QOL.
- 2) Can use Peak Flow Meter and Spirometer to assess the PFT.
- 3) Antenatal Training can be given before checking the QOL.
- 4) Number of samples can be increased.
- 5) Can find the relationship between PFT and MQOL in postpartum mothers.

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