Original Article

Effects of Pelvic Floor Muscle Training on Peak Expiratory Flow Rate and Muscle Strength in Postpartum Women - An Experimental Study

[1]Rajani kumar Gupta, [2]Somyata C Satpathy Sarma, [3]Sonia Lakhotia, [4]Phurailatpam Jeny Sharma, [5]Rohit Sharma

[1]Physiotherapist, Mullazama nursing and home healthcare, Dubai, [2]Associate Professor, The Assam Royal Global University, Guwahati, Assam, [3]Assistant Professor, The Assam Royal Global University, Guwahati, Assam, [4]Assistant Professor, The Assam Royal Global University, Guwahati, Assam, [5]Assistant Professor, The Assam Royal Global University, Guwahati, Assam

How to cite this article: Rajani kumar Gupta, Somyata C Satpathy Sarma, Sonia Lakhotia, Phurailatpam Jeny Sharma, Rohit Sharma. Effects of Pelvic Floor Muscle Training on Peak Expiratory Flow Rate and Muscle Strength in Postpartum Women - An Experimental Study. Indian Journal of Physiotherapy and Occupational Therapy / Vol 19 No. 4, October - December 2025

Abstract

Background: The pelvic floor muscles primarily protect the end of pelvic organs andare also involved in breathing during speaking, deep breathing and coughing. The diaphragm and pelvic floor have a symbiotic relationship,and the pelvic floor muscle contraction protects the endpelvicorgans against increased abdominal pressure under the body's certain reactions such as deep breathing and coughing and helps breathing by relieving anal and urethral obstructions. Pregnancy affects the Pelvic floor muscle strength which may affect the respiratory function. Peak Expiratory Flow Rate is defined as the maximal flow achieved during expirationdelivered with a maximal force starting from maximal lung inflation. HET's MMT is a unique transvaginal/transrectal manual muscle testing scale exclusively designed for the evaluation of pelvic floor muscles.Therefore, the study intends to measure the effect of training of pelvic floor muscles on the peak expiratory flow rate and the strength of PFM.

Objective: The objective of the study is to measure the effectiveness of pelvic floor muscle training on peak expiratory flow rate and strength of pelvic floor muscles in post-partum women andto determine the correlation between pelvic floor muscle strength and pulmonary function.

Methodology: 15 subjects fulfilling the inclusion criteria were selected for the study. Baseline data pre pelvic floor muscle strength and pelvic expiratory floor rate were measured using HET's MMT and peak flow meter. Kegel's exercises were given to all the 15 subjects for a period of 6 weeks again post pelvic floor muscle strength and pelvic expiratory flow rate was measured.

Results: The present study wasan experimental study. After the data analysis, the resultshowed significant improvement as the mean pre and post value of PFMS and PEFR from -0.13 to 0.73 and 452L/min to 476L/min respectively. Spearman's row was used for correlation between PFMS and PEFR,r =0.689 which shows a moderate correlation of PFMS and PEFR.

Conclusion: The present study reveals that there is a significant effectiveness of pelvic floor muscle exercise on pelvic floor muscle strength and peak expiratory flow rate and a moderate positive correlation between PFM strength and PEFR.

Keywords: Kegel's exercise, post-partum women, pulmonary function, Peak expiratory flow rate, urinary incontinence.

Corresponding Author: Somyata C Satpathy Sarma, Associate Professor Department of Physiotherapy The Assam Royal Global University NH-37, opp. Tirupati Balaji Temple, Betkuchi, Guwahati, Assam 781035

E-mail: somyata.satpathy@gmail.com

Submission: May 2, 2025 **Revision:** June 30, 2025 **Published date**

Introduction

Pelvic floor lies in funnel shaped pelvic Cavity bounded by bones, ligaments and muscles. These group of muscles are present in both males and females. They form a sling or hammock across thebase of the pelvis that separates the pelvic cavity above from the perineal region below .[1]In females the pelvic floor mainly consists of two main muscles the levator ani and the coccygeus .They are designed to keep the pelvic organs bladder, uterus and rectum in place.[2] These muscles are involved in breathing, coughing, speaking, regulating storage and evacuation of urine and stool .The diaphragm and pelvic floor have a symbiotic relationship,when we inhale,our diaphragm moves down so that the air from atmosphere can enter inside the lungs,as diaphragm descends down the pelvic floor also relaxes and goes down and allows space for the abdominal contents and when we exhale the diaphragm elevates and the pelvic floor also elevates and therefore pelvic floor muscles works in coordination with diaphragm, these muscle also contract together with abdominal muscles and helps in increasing and generating the intraabdominal pressure allowing the diaphragm to move upward.[3,4,5] Therefore understanding the synergy between these muscles is important to provide better pelvic health including control of incontinence, prolapse, pelvic pain and bowel dysfunction. Pregnancy stretches the abdominal muscles and also the load on the PFM increases due weight of foetuswhich affects the efficacy of PFM and increases the load on the back muscles leading to backache, Urinary Incontinence, poor posture.[6,7] Vaginal birth places the levator ani under tissue stretch ratios of up to 3.3 and the pudendal nerve under strains of up to 33%, respectively thereby increasing the risk of levator ani defects leading to genital organ prolapse and urinary incontinence and may also alter the respiratory function.[8]

Respiratory function following postpartum is also altered due to hormonal changes and mechanical effects. Hormonal changes are one of the main cause of ventilatory changes in respiratory functions. Mechanical effects that occur with pregnancy are progressive uterine distension which causes decrease in lung volume and chest wall changes occurs which displaces the diaphragm upwards.[9] Peak expiratory flow rateis the maximal flow achieved during expiration, determined by size of the lungs, elasticity, strength of the lung and speed of the respiratory muscles and is mainly affected in obstructive lung diseases,therefore it is one of the important measure of lung function.[10]

Park et al. (2015)[11]and Talasz et al. (2010)[12] have studied the effect of PFM on the pulmonary function and PFMS in females of young age group. But there is lack of data regarding the effect of PFM exercises on Pulmonary Function and Pelvic floor muscle strength in the postpartum women following vaginal delivery. Han D et al attempted to identify the effects of one-time Kegel exercises on pulmonary function and reported that the vital capacity was improved in certain categories. However, one-time Kegel exercises may not be sufficient for reinforcing the PFM.[13]

Therefore, the purpose of this study was to examine the effects of self-disciplined Kegel exercises performed for 6 weeks on PFM strength which was assessed by using HET'S MMT and determine whether PFM reinforcement could improve pulmonary function by assessing Peak expiratory flow rate.

Material and Methodology

15 Postpartum women with normal delivery enrolled for the study were recruited by convenient sampling based on the inclusion and exclusion criteria after obtaining the informed consent. The study was carried out at various maternity hospitals ofGuwahati. Approval for the study was taken bythe institutional ethical committee, College of Physiotherapy and Medical Sciences as per the ethical guidelines for biomedical research on human subjects with reference number CPMS/DV/ SSHUS/1232/JUL21.

Inclusion and Exclusion Criteria

Post-Partum women of age group 25-30 with normal delivery, having no history of neurological, musculoskeletal, or cardiorespiratory diseaseand

not participating in any other form of program were included and postpartum women having multiple pregnancies, with complicated pregnancies,were excluded.

Assessment Parameters

Base line data Pre Pelvic floor muscle strength was measured by HET's MMT with intra rater reliability 0.92 and inter rater reliability 0.93.The scale had a grading from 3(Strong upward and inward pull against resistance) to -3 Asymptomatic penetration(laxity) with a baseline value 0 which indicates the baseline tone of the pelvic floor musclesand Peak Expiratory Flow Rate(PEFR) which ranges from 400 to 700 L/min in healthy adults were measured using and Peak flow meter. Pelvic floor muscle strength and Peak expiratory flow rate was measured again after 6 weeks exercises.

Methodology

Prior to the conduction of experimental study, an explanation of the entire procedure was given to the subjects and education on the functioning of pelvicfloormuscles as well as the benefits of pelvic floor muscle exercise was given to the subjects.

Estimated Sample size: 30

$n=(Z_{1-\alpha}/2+Z_{1-\beta)/d}{}^{2}$

$n=^{2}$

$n= (5/.4)^2=29.1$

- $Z_{1-\alpha}/2=1.96$ *(Z-value for 95% confidence level)*
- $Z_{1-\beta}=1.28$*(Z-value for 90% power)*
- d=0.6*(Effect size, Cohen's d – moderate effect size)*

To assess Peak ExpiratoryFlow rate subject made to sit straight,hold the mouth piece of the device tightly with lips and then take a deep breath and blow out the air as hard and as quickly as possible ensuring complete emptying of lungs as shown in Fig 1. The procedure was repeated thrice and the best reading was considered .

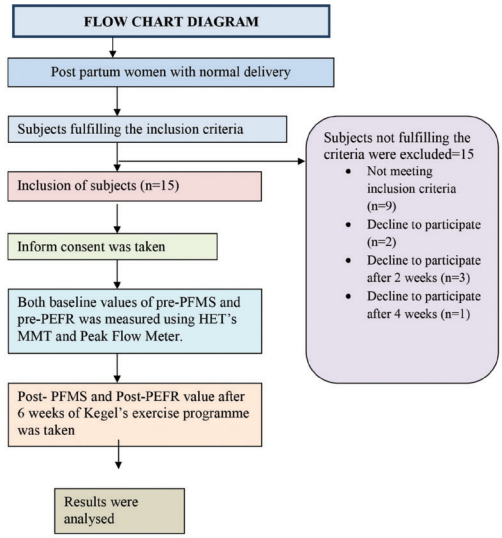

Figure 1: Flow diagramfor the steps of conduction of the experimental study.

To assess pelvic floor muscle strength Subject was made to lie down in crook lying position, maintaining the sterility,index and middle finger was inserted in the vaginal opening,the subject was asked to tighten the muscles around the fingers and the baseline strength of the pelvic floor muscles was recorded.Kegel's exercise(to increase the strength of pelvic floor muscles) was taught to the subjects in which they were asked tohold the pelvic floor muscles as tightly as they can for 8-10 seconds, then relax for 8 seconds and 8 repetitions were performed. The Subjects were asked to continue the exercises every day at home for a period of 6weeks for 3 times per day as shown in Fig 2Weekly 3 sessions were supervised, and verbal feedback was obtained at the end of every week.

Figure 2: Subject performing the peak expiratory flow test.

Figure 3: Performing Kegel's Exercise

Statistical Analysis

- Statistical analysis was done using SPSS software version 25. Normality check was done using Shapiro-wilk test and Kolmogorov-Smirnov. The difference between the pre and post values for variables PEFR and Pelvic floor muscle strength was assessed using Nonparametric test – Wilcoxon signed-rank test Correlational analysis to study the correlation between PEFR and strength of Pelvic floor muscles Spearman's rho test was used. Statistical Significance was set at P < 0.05 .P< 0.001 is considered highly significant .

Results and Interpretations

Table 1. Normality check

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	15	27	35	30.67	2.469
Pre_PFMS	15	-3	2	-.13	1.807
Post_PFMS	15	-3	3	.73	2.251
Pre_PEFR	15	380	580	452.00	72.526
Post_PEFR	15	400	600	476.00	73.756

*Significant at p<0.05 **Significant at p<0.01 ***Significant at p<0.001

Table 1. Shows that the pre and post values of PFMS & PEFR do not follow normality assumption. So, we must use nonparametric tests for the analysis.

Table 2. Wilcoxon sign rank test

Test Statistics			
	Z	Asymp. Sig. (2-tailed)	Remark
Post_PFMS - Pre_PFMS	-1.968[b]	0.041	*
Post_PEFR - Pre_PEFR	-3.520[b]	0.000	***

*Significant at p<0.05 **Significant at p<0.001 ***indicates as P is 0.000 it is highly significant.

Table 2 shows that there is significant difference between pre and post values of PFMS & PEFR.

Table 3: Correlation between pfms and pefr

Correlations				
	Post_PFMS			
	Correlation Coefficient	Sig. (2-tailed)	N	Remark
Post_PEFR	.689**	0.004	15	**

Table 3 shows r **value is Significant at p<0.01, here P value is 0.004 which indicates r value is significant and as r value is 0.689 indicates positive moderate correlation peak expiratory flow rate and Pelvic floor muscle strength, suggests if the strength of PFMS increases the PEFR should increase.

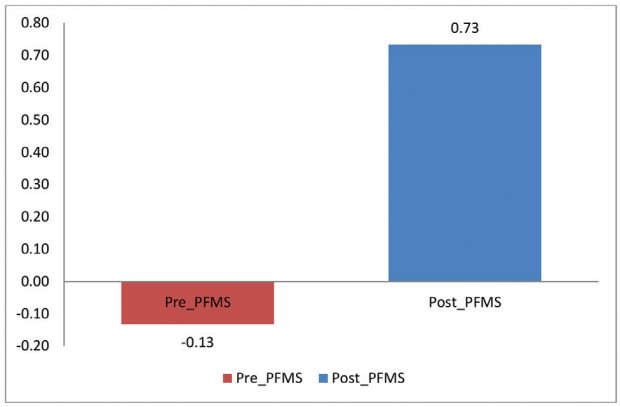

Figure 1: Graphical Presentation for Mean of Pre and Post Pfms

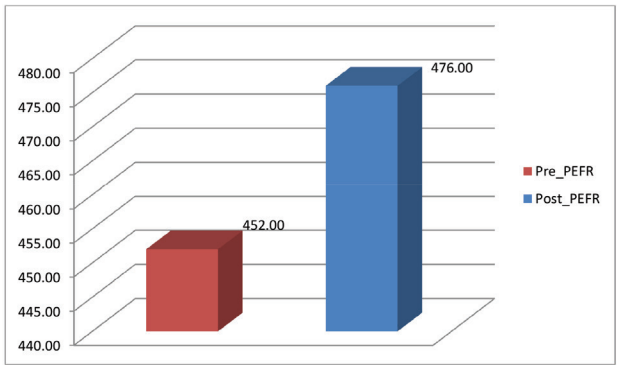

Figure 2. Graphical Presentation for Mean of Pre and Post Pefr

Discussion

On analysing the pre and post intervention mean of PEFR and PFMS the results shows that post intervention significant improvement in the pelvic floor muscle strength and peak expiratory flow rate with P< 0.001was seen after 6 weeks of regular strengthening of pelvic floor muscles and a positive moderate correlation with r = 0.68 between Pelvic floor Muscle Strength and Peak Expiratory Flow Rate which indicates that as the strength of pelvic floor muscles also increases the peak expiratory flow rate also increases thereby helping with forceful expiration .As we know in normal breathing, during inspiration the diaphragm contracts and moves downwards while relaxes and moves upwards during expiration.[13] However, when forced expiration or coughing occurs, the anterior and lateral abdominal muscles contract, thereby generating pressure that strongly moves the diaphragm upward.[13,14] Contraction of Pelvic floor muscles contribute to maintain the abdominal pressure. PelvicFloor Muscles and deep abdominal muscles are involved in breathing through their coordinated contractions[15]. Han D et.al (2015)[16] explained the effect of pelvic floor muscle exercises on pulmonary function and concluded thatthere is a symbiotic relationship between pelvic floor muscles and diaphragm, and they work in coordination to provide better pelvic health. As in our study we have seen that strengthening of pelvic floor muscles increased the peak expiratory flow rate which is an important measure of lung function mainly for obstructive lung diseases as per the GINA[17] (Global Initiative for Asthma)guidelines. Also helps to monitor the respiratory condition as the PEFR will fall with inflammation and exacerbation. Therefore training of pelvic floor muscles becomes very important for a pregnant women already suffering with Asthma also for females with who have undergone vaginal delivery and Caesarean section as the pelvic floor muscles are stretched throughout pregnancy and the abdominals becomes weaker due to Caesarean section .Eventually preventing urinary incontinence and pelvic organ prolapse in later phase of life .

Conclusion: The study concludes that training the pelvic floor muscles will help in not only preventing from the risk of urinary incontinence and prolapse of uterus but also helps in improving the respiratory function by improving the peak expiratory flow rate

Limitations of the Study: The results of current study were based on convenient Sampling and had a small sample size. There was no follow up to determine long term effects of the treatment and the duration of intervention was short.

Future Recommendations: Study can be done with larger sample size. Follow up can be taken to determine long term effects of the treatment

Funding Sources: None

Ethical Clearance/Statement of Ethics: *College of Physiotherapy and Medical Sciences,Ethicalclearence: CPMS/DV/SSHUS/1232/JUL/21. Date :19/07/2021*

Declaration of Conflicts of Interest Statement: None

References

1. Continence foundation of Australia.
2. Bharucha AE. Pelvic floor: anatomy and function. Neurogastroenterol Motil. 2006 Jul;18(7):507-19.
3. Talasz H, Kremser C, Kofler M, Kalchschmid E, Lechleitner M, Rudisch A. Phase-locked parallel movement of diaphragm and pelvic floor during breathing and coughing-a dynamic MRI investigation in healthy females. Int Urogynecology J. 2011 Jan;22(1):61-8.
4. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. Int Urogynecol J Pelvic Floor Dysfunct. 2002;13(2):125-32.
5. Talasz H, Kremser C, Talasz HJ, Kofler M, Rudisch A. Breathing, (S)Training and the Pelvic Floor-A Basic Concept. Healthcare (Basel). 2022 Jun 2;10(6):1035.
6. El Bandrawy, A.M., Mohamed, M.N., Kamal, H.A.H., Hamada, H.A., Abbas, R., & Mohamed, M.A.E-R. (2020). Effect of global postural correction exercises on stress urinary incontinence during pregnancy: A randomized controlled trial. *Journal ofHuman Sport and Exercise, 15*(3proc), S869-S878.
7. Tim, S.; Mazur-Bialy, A.I.The Most Common Functional Disorders and Factors Affecting Female Pelvic Floor. Life 2021, 11,1397. https://doi.org/10.3390/life11121397.
8. Ashton-Miller JA, Delancey JO. Functional anatomy of the female pelvic floor. Ann N Y Acad Sci. 2007 Apr; 1101:266-96.
9. Chauhan G, Tadi P. Physiology, Postpartum Changes. [Updated 2022 Nov 14]. In: Stat Pearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK555904.
10. Saladi L, Abraham J**.** Peak Flow Rate Measurement. [Updated 2023 Jul 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538338/
11. Park H, Hwang B, Kim Y. The impact of the pelvic floor muscles on dynamic ventilation maneuvers. J Phys Ther Sci. 2015 Oct;27(10):3155-7. doi: 10.1589/jpts.27.3155. Epub 2015 Oct 30. PMID: 26644664; PMCID: PMC4668155.
12. Talasz H, Kofler M, Kalchschmid E, Pretterklieber M, Lechleitner M. Breathing with the pelvic floor? Correlation of pelvic floor muscle function and expiratory flows in healthy young nulliparous women. Int Urogynecology J. 2010 Apr;21(4):475-81. doi: 10.1007/s00192-009-1060-1. Epub 2009 Dec 8. PMID: 19997721.
13. Bordoni B, Purgol S, Bizzarri A, Modica M, Morabito B. The Influence of Breathing on the Central Nervous System. Cureus. 2018 Jun 01;10(6):e2724.
14. McCool FD, Manzoor K, Minami T. Disorders of the Diaphragm. Clin Chest Med. 2018 Jun;39(2):345-360.
15. Talasz H, Kremser C, Talasz HJ, Kofler M, Rudisch A. Breathing, (S)Training and the Pelvic Floor-A Basic Concept. Healthcare (Basel). 2022 Jun 2;10(6):1035. doi: 10.3390/healthcare10061035. PMID: 35742086; PMCID: PMC9222935.
16. Han D, Ha M. Effect of pelvic floor muscle exercises on pulmonary function. J Phys Ther Sci. 2015 Oct;27(10):3233-5.
17. Global Initiative for Asthma. Global strategy for asthma management and prevention [Internet]. 2024 update. Fontana (WI): GINA; 2024 [cited 2025 Jun 3]. Available from: https://ginasthma.org/gina-reports/