

Early diaphragmatic breathing and gentle ambulation modulate post operative muscle physiology in post-cesarean mothers

Siti Nadhir Ollin Norlinta , *Hilmi Zadah Faidlullah*, and *Sukmawati Kasim*

Study Program of Therapy, Faculty of Health Sciences, Universitas Aisyiyah Yogyakarta, Yogyakarta Indonesia

Abstract. Women who have undergone a cesarean section generally experience a decrease in abdominal muscle strength due to surgical incisions, pain, and limited mobility, which can prolong the recovery process. Physiotherapy intervention combining diaphragmatic breathing and gentle walking is a safe and effective option to support early recovery and improve muscle function. This study aims to determine the effect of combining diaphragmatic breathing and gentle walking on improving muscle strength in post-cesarean section mothers at PKU Muhammadiyah Hospital in Yogyakarta. The study used a quasi-experimental design with an intervention group and a control group. Diaphragmatic breathing and gentle walking exercises were performed with a training dose of 15 minutes, a 2-minute rest, and repeated 3 times per training session and a maximum of 4 times per week, depending on the condition of the body. Muscle strength was measured using Manual Muscle Testing (MMT) before and after the intervention. The results showed that the combination of the two exercises was able to increase muscle strength in post-cesarean section mothers faster than those who did not exercise. The Combination of diaphragmatic breathing and gentle walking proved effective in accelerating the improvement of abdominal muscle strength among post-cesarean section mothers. Recommended as safe rehabilitation strategies to support recovery after caesarean.

1 Introduction

Childbirth is a normal physiological event experienced by every woman, involving the expulsion of a living fetus from the uterus through the vagina into the outside world.

* Corresponding author : sitinadhirollin@gmail.com

Advances in health technology, such as cesarean delivery or *sectio caesarea*, are very helpful in handling the delivery of mothers who experience complications. In the past, cesarean section was often considered frightening because of the risk of death. When planning a cesarean section, during the post-operative period, parents must face challenges such as caring for themselves and their newborn babies during recovery from cesarean section. In addition, there are routine activities that patients must perform after surgery, such as walking and urinating, as well as additional activities after delivery, such as changing diapers and breastfeeding the baby, which require mobility and changes in position during breastfeeding, which can cause discomfort and sleep disturbances [1].

The World Health Organization (WHO) states that currently, cesarean section (CS) deliveries have increased worldwide, even exceeding the WHO's recommended limit of 10%-15% in an effort to save the lives of mothers and babies. Cesarean section is one of the most commonly used delivery methods to address obstetric conditions that pose risks to both the mother and the fetus. Although safe and widely used, this procedure has physiological consequences such as postoperative pain, limited activity, and decreased abdominal muscle strength due to surgical incisions [2].

The novelty of this study lies in the application of a combination of diaphragmatic breathing exercises and light ambulation started very early in post-cesarean section mothers to influence the physiological function of the abdominal muscles, a method that has been minimally researched in the context of obstetric rehabilitation. The synergy between diaphragmatic activation and gradual mobilization has the potential to accelerate motor unit activation, improve core stability through the cooperation of the diaphragm and *transversus abdominis*, and improve oxygen supply to muscle tissue in the early recovery phase. Unlike most post-operative studies that emphasize pain or functional recovery, this study presents a new perspective by focusing on the biomuscular mechanisms involved in abdominal muscle recovery after surgery. Thus, this research contributes to the development of a safe, economical, and easily applicable early rehabilitation program for clinical practice [3].

Decreased abdominal muscle strength not only affects body stability but also hinders the mother's functional ability to perform daily activities, including mobilization, infant care, and overall physical recovery. Pain and concerns about damage to the surgical wound often cause mothers to avoid early mobilization, which is important for preventing complications, improving circulation, and supporting muscle [4].

The physiotherapy approach plays an important role in accelerating post-cesarean section recovery through safe, easy-to-perform, and self-administered non-pharmacological interventions. Diaphragmatic breathing is a deep breathing technique that activates the diaphragm muscle, promotes relaxation, optimizes lung expansion, and stimulates the deep abdominal muscles [5]. Meanwhile, gentle walking is a form of early mobilization that helps improve blood flow, strengthen postural muscles, reduce musculoskeletal tension, and improve cardiovascular function [6].

Walking exercise as a regular physical activity improves cardiovascular function, limits weight gain, reduces musculoskeletal stiffness, decreases the incidence of muscle cramps and lower extremity edema, improves mood stability, gestational diabetes mellitus, and gestational hypertension [7].

2 Methods

This study is an experimental study with a quasi-experimental approach. It uses a pretest-posttest control two-group design. This study was conducted at PKU Muhammadiyah Hospital in Yogyakarta. The technique used was total sampling, and 20 post-cesarean section mothers who met the research criteria were selected as samples. Descriptive statistical tests in this study included respondent characteristics based on age, pre-MMT, and post-MMT. Data analysis included normality tests using the Shapiro Wilk Test, homogeneity tests using Lavene's Test, and hypothesis tests 1 and 2 using the Paired Sample T-test.

3 Results and Discussion

3.1 Results

The results of the study involved 20 respondents who were mothers after Caesarean section at PKU Muhammadiyah Hospital in Yogyakarta. The results of the distribution analysis showed the following sample characteristics:

Tabel 1. Frequency distribution based on age

Usia	Frekuensi	%
15-25	10	20,0
26-40	10	80.0
Total	20	100

Based on Table 1, it can be seen that the age group in treatment group I was dominated by those aged 26-40 years, totaling 4 people, while treatment group II was also dominated by those aged 26-40 years, totaling 4 people. From this statement, it can be concluded that the age range of the respondents who participated in the study was 26-40 years old, who were mothers who had undergone a cesarean section.

Tabel 2. Frequency distribution based on MMT

Nilai MMT	Kategori	Frekuensi (Pre)	Frekuensi (Post)
1	Movement without gravity	10	2
2	Movement against gravity	6	2
3	Against moderate resistance	2	8
4	Against maximum resistance	2	8
	Total	20	20

After a cesarean section, the muscles around the abdomen, pelvis, and back may weaken or become tense. By performing MMT, you can monitor the patient's progress in recovery. This is important in planning interventions or changes in the rehabilitation program. Through MMT, patients can understand their muscle strength levels and the importance of

rehabilitation or physical exercise for recovery. This can increase their awareness of their physical condition and improve their motivation to engage in treatment. MMT can be performed very quickly and flexibly for a large number of muscles in a short time [8].

The results of the study show that the frequency distribution based on Manual Muscle Testing (MMT) assessments indicates an increase in muscle strength in both the diaphragmatic breathing and gentle walking groups. In the pretest condition, most respondents had MMT scores of 2–3, indicating that their muscles were only able to move without resisting gravity or were only able to resist gravity without significant resistance. After a four-week intervention, there was a consistent shift in the treatment group towards MMT scores of 4–5, which indicates the ability of muscles to resist moderate to maximum resistance.

The increase in frequency distribution towards higher MMT scores indicates that both interventions were effective in increasing muscle strength in post-cesarean section mothers. These changes reflect improved abdominal muscle control, increased postural stability, and improved mobilization function. These results support the findings of statistical analysis showing that diaphragmatic breathing and gentle walking have a positive effect on muscle strength recovery.

Table 3. Hypothesis

Sampel	N	p
Diaphragmatic breathing dan gentle walking	10	0,004

The combination of Diaphragmatic Breathing and gentle walking with exercise dosage, exercise time of 15 minutes, rest time of 2 minutes, repeated 3 times, and performed 4 times a week, adjusted to the patient's physical health. Based on the results of MMT data processing before and after treatment in group I using the Paired Sample T-test, a p-value of 0.004 ($p < 0.05$) was obtained, so it can be concluded that there is an effect of diaphragmatic breathing on increasing muscle strength in post-cesarean section mothers.

3.2 Discussion

The ideal reproductive age for a mother is between 20 and 35 years old because at that age the uterus is ready to receive pregnancy, the mind is mature, and she is capable of caring for the baby and herself. At a young age or ≤ 20 years old, a woman's reproductive organs and psychological development are not yet mature, so she does not want to become a mother and cannot accept her pregnancy, while at an age of ≥ 35 years old, the risks of pregnancy and childbirth increase. also found that out of 166 respondents, more mothers who gave birth via cesarean section (CS) were in the non-risk age group ($>20 < 35$ years old). Pregnancy at too young or too old an age can complicate the pregnancy. This is because the physical condition of a pregnant woman who is too young is not yet suitable for pregnancy, childbirth, and postpartum care. Conversely, women over 35 years of age face risks such as birth defects and complications during childbirth caused by uterine muscles that are not strong enough to support pregnancy.

The results of the hypothesis test show that diaphragmatic breathing exercises have an effect on muscle strength. This can be proven through research which tested the effectiveness of diaphragmatic breathing exercises on reducing anxiety in pregnant women. This study found that diaphragmatic breathing can influence the subconscious mind, and the diaphragmatic breathing relaxation method is a breathing technique that activates the diaphragm and lower lung muscles, trains pelvic floor muscle awareness, and helps increase calmness. Diaphragmatic breathing has a mechanism that promotes abdominal breathing, which reduces the work of the accessory respiratory muscles, facilitates the evacuation of CO₂ from the chest cavity, and improves alveolar performance, resulting in more effective gas exchange. This technique has a calming effect both physically and mentally, as stimulation of the vagus nerve alters the dominance of the parasympathetic nervous system. Physical activities such as diaphragmatic breathing and regular gentle walking can improve cardiovascular function, limit weight gain, reduce musculoskeletal discomfort, decrease the incidence of muscle cramps and lower extremity edema, improve mood stability, gestational diabetes mellitus, and gestational hypertension [6].

Mobilization after a cesarean section is important for a quick recovery and to prevent complications. Mobilization is recommended as soon as possible after surgery, usually starting with small movements such as moving from lying down to sitting up, then walking slowly according to individual comfort and ability. However, the speed of recovery and return to normal activities can vary between individuals. Walking after a cesarean section helps improve blood circulation, prevent blood clots, reduce the risk of pneumonia, and reduce tension in the surgical area. In addition, walking can also help reduce stiffness and pain [7].

Manual Muscle Testing (MMT) is used to measure muscle strength with the aim of assisting in diagnosis, determining therapy, and predicting prognosis [8]. In post-cesarean section mothers, decreased abdominal, pelvic, and back muscle strength is a common condition due to incisions that cause pain, so patients tend to lie down and avoid early mobilization, which can cause joint stiffness, poor posture, and muscle tension [9,10]. Through MMT, the degree of muscle strength decline can be clearly identified so that appropriate interventions can be planned to prevent complications and improve muscle function. In addition to helping monitor recovery progress, MMT also increases patient awareness and motivation in undergoing rehabilitation because it provides a clear picture of their physical condition. Furthermore, MMT can be performed quickly, flexibly, and covers many muscle groups, making it effective for routine evaluation of post-SC patients [11-12].

Conclusion

From this study, it can be concluded that diaphragmatic breathing and gentle walking are effective in increasing muscle strength in mothers after cesarean section and are effective in accelerating recovery after cesarean section.

References

- [1] A. Sulieman *et al.*, “Patient radiation dose reduction using a commercial iterative reconstruction technique package,” *Radiation Physics and Chemistry*, vol. 178, p. 108996, 2021, doi: <https://doi.org/10.1016/j.radphyschem.2020.108996>.
- [2] A. F. Peahl, R. Smith, T. R. B. Johnson, D. M. Morgan, and M. D. Pearlman, “Better late than never: why obstetricians must implement enhanced recovery after cesarean,” *American Journal of Obstetrics and Gynecology*, vol. 221, no. 2, pp. 117.e1–117.e7, 2019, doi: 10.1016/j.ajog.2019.04.030.
- [3] N. Viandika and R. M. Septiasari, “Pengaruh continuity of care terhadap angka kejadian sectio caesarea,” *Journal for Quality in Women’s Health*, vol. 3, no. 1, pp. 1–8, 2020, doi: 10.30994/jqwh.v3i1.41.
- [4] A. W. Barbosa, W. R. Martins, and T. M. Silva, “Effects of diaphragmatic breathing on core muscle activation and post-operative recovery: A systematic review,” *Journal of Bodywork and Movement Therapies*, vol. 27, pp. 176–182, 2021.
- [5] E. Roslianti *et al.*, “The description of the treatment of early mobilization on the mother post sectio caesarea in Lotus II BLUD Hospital Banjar Year 2018,” *Jurnal Kesehatan Stikes Muhammadiyah Ciamis*, vol. 5, no. 1, pp. 1–10, 2018.
- [6] C. Intan and N. Najikhah, “Hubungan mobilisasi dini ibu post sectio caesarea dengan penyembuhan luka operasi di Ruang Arafah 3 Rumah Sakit Umum dr. Zainoel Abidin,” *Jurnal*, vol. 11, pp. 882–887, 2021.
- [7] Y. H. Liu, C. F. Chang, H. M. Hung, and C. H. Chen, “Outcomes of a walking exercise intervention in postpartum women with disordered sleep,” *Journal of Obstetrics and Gynaecology Research*, vol. 47, no. 4, pp. 1380–1387, 2021, doi: 10.1111/jog.14672.
- [8] M. Zerf, “Effects of walking training performed using continuous and interval methods on weight loss as effective strategies among postpartum women,” *Baltic Journal of Health and Physical Activity*, vol. 11, no. 1, pp. 54–61, 2019, doi: 10.29359/BJHPA.11.1.06.
- [9] K. A. Yasmini, I. P. Darmawijaya, and L. P. A. Vitalistyawati, “Pemberian latihan pilates terhadap peningkatan kekuatan otot perut pada ibu-ibu dalam masa post partum,” *Journal of Innovation Research and Knowledge*, vol. 2, no. 5, pp. 2011–2018, 2022. Available: <https://www.bajangjournal.com/index.php/JIRK/article/view/3479>.
- [10] F. Haryani, P. Sulistyowati, and E. S. Ajiningtiyas, “Pengaruh teknik relaksasi napas dalam terhadap intensitas nyeri pada post operasi sectio caesarea,” *Journal of Nursing & Health*, vol. 6, no. 1, pp. 15–24, 2021. Available: <http://jurnal.politeknikyakpermas.ac.id/index.php/jnh/article/view/142>.
- [11] E. Kasim, K. S. Ahmad, M. Limbong, H. Ahmad, and A. T. Fitri, “Implementasi mobilisasi dini dalam meningkatkan penyembuhan luka pada ibu post sectio caesarea,” *Jurnal Madising Na Maupe (JMM)*, vol. 1, pp. 78–84, 2023. Available: <https://jurnal.maupe.id/JMM/index>.

- [12] F. N. Bittmann, S. Dech, M. Aehle, and L. V. Schaefer, “Manual muscle testing—force profiles and their reproducibility,” *Diagnostics*, vol. 10, no. 12, 2020, doi: 10.3390/diagnostics10120996.