

Research Article

Postpartum as the best time for physical recovery and health care

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Abstract

Aim: The current paper presents a subjective symptom survey regarding postpartum discomfort (Study 1) and a case study on postpartum care using the program developed based on the survey results (Study 2). Thereafter, health care during the postpartum period is discussed.

Methods: Study 1 analyzed 1638 postpartum women who completed the Subjective Fatigue Symptom Scale (SFSS) over the period from June 2012 to December 2019. Study 2 detailed the case of a 33-year-old primiparous woman who answered questions regarding the rehabilitation care program.

Results: The 1638 subjects included in Study 1 had a mean age of 32.4 ± 8.2 years and a mean postpartum duration of 4.3 ± 2.3 months. Subjective symptoms included lower back pain, shoulder stiffness, sleepiness, wanting to lie down, yawning, and eye strain. The case included in Study 2 showed certain psychological and physical changes following the exercise program. The results of Study 1 showed that motor system discomfort, such as stiff shoulders and lower back pain, occurred in women across all postpartum stages. Our results demonstrated that care and exercise geared toward improving motor system function are imperative after childbirth. Meanwhile, the results of Study 2 imply that our rehabilitation program based on postpartum physical conditions had positive psychological and physical effects.

Conclusion: Taken together, our results suggest that continuing rehabilitative care based on the physical condition during each postpartum stage facilitates improvement in mothers' physical and psychological discomfort.

Introduction

Drastic physical changes occur among women during pregnancy, childbirth and the postpartum period [1]. Accordingly, over 90% of women have been found to experience urinary incontinence and lower back pain, hip joint, and abdominal discomfort, skin sagging, muscle weakening, and other changes after giving birth. Given that a healthy delivery is vital during childbirth, the mother's body needs to ensure the patency of the birth canal. In doing so, involuntary movements due to hormone action cause pubic symphysis diastasis and place pressure on the sacrum and ischium, which consequently causes pressure on and injury to the muscles and ligaments around the bones [2]. One study

showed that childbirth can sometimes be expressed as "a physiological sprain" [3], while another considered childbirth to be "equivalent to a sports impediment" [4] Childbirth-induced physical injuries can be extensive and largely affect the quality of life.

Even well-trained women need physical care immediately after childbirth considering the discomfort they will have suffered. The Japan Institute of Sports Sciences has provided pre- and postpartum exercise programs for top female athletes on its website [5] and emphasizes the need for "postpartum care" exercises to recover physical function. However, determining whether ordinary women should initiate exercise soon after childbirth can be difficult.

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Submitted: December 12, 2022

Approved: December 30, 2022

Published: January 02, 2023

How to cite this article: Torashima S, Samukawa M, Tsujino K, Sawada Y. Postpartum as the best time for physical recovery and health care. *J Nov Physiother Rehabil.* 2023; 7: 001-007.

DOI: 10.29328/journal.jnpr.1001049

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Keywords: Postpartum; Health care program; Fatigue; Rehabilitation; Physical recovery





One study showed that tension symptoms in the lumbosacral region and pelvis can remain until 3 months postpartum, causing asymmetrical alignment of the left and right pelvis [6]. Some studies have reported that both cesarean and vaginal delivery might cause abdominal and lower back pain during the early postpartum stage (approximately 1 month) due to muscular damage and changes in fascial gliding [7], leading to difficulties with transversus abdominis muscle output [8]. Furthermore, working out during the early postpartum stage (i.e., less than 2 weeks to 1 month postpartum) may promote several complications (e.g., delayed uterine involution/perineal hemostasis [9], including subcutaneous hemorrhage associated with diastasis recti abdominis) [10]. Therefore, starting exercising immediately after childbirth is hardly recommended for ordinary women, who should instead gradually engage in postpartum rehabilitation exercises.

Given that the uterine involution, organ ptosis correction, and tissue recovery surrounding the pelvis (e.g., muscles and ligaments) occur around 1 to 1.5 months postpartum [11], care aimed at recovering whole-body strength and discomfort is needed starting from 2 months postpartum [12]. Additionally, newborns grow to be approximately three times their birth size 6 months after delivery, which may affect the mother's movement [1]. As such, "postpartum physical care programs" are needed for each postpartum stage. Understating the discomfort occurring during the postpartum period is essential for creating appropriate programs and verifying the effects of program implementation. Therefore, the first portion of the current study (Study 1) presented the results of a subjective symptom survey on postpartum discomfort, while the second portion (Study 2) detailed a case study of postpartum care using a program developed based on the survey results and discusses health during the Postpartum period.

The primary purpose of this research was to gain a comprehensive understanding of postpartum discomfort through a subjective symptom survey (Study 1). Research regarding the quantitative manifestations included herein has been considerably scarce despite being well worth the effort. For the past 8 years, our group has been developing health support courses (classes) for the postpartum period, meeting 10 – 30 mothers per course and over 200 mothers a year, "Through the current study, we would like to present 8 years' worth of data. Subsequently, to address the grievances determined in Study 1, we developed a "postnatal healthcare program" based on quantitative data together with medical personnel. In line with this, the second purpose of the present study was to consider methods for maintaining and improving postpartum health based on case reports that have continued to implement this program for the longest period of time and have seen major changes (Study 2). Considering that our multi-person survey had already been reported by Torashima, et al. [4,12,13] we would instead like to present a case report to increase awareness regarding the actual situation of postnatal health care.

Methods

Study 1: A subjective symptom survey with questionnaires

Research design: A survey research design based on a positivist perspective was adopted. The research method consisted mainly of a questionnaire survey, and the results of the questionnaire were converted into quantitative variables.

Participants: The sample consisted of 1721 postpartum mothers who attended health support lectures at local childcare support centers and public health centers in Japan. The center advertised the course on local bulletin boards and on the Internet to recruit participants. Because 83 participants returned home during the course and were unable to complete the questionnaire, the final sample size was 1638.

Participants indicated their current age, duration of postpartum months (2-3 months, 4-6 months, and 7+ months), and maternal age at birth.

Data Collection: This study was conducted between June 2012 and December 2019.

Ethical considerations: Before providing written informed consent to participate, each participant received an explanation about the study's purpose, significance, methodology, duration and data management protocol. Participation was entirely voluntary, and participants' anonymity was strictly maintained. Consent to participate was also obtained from each local parenting support center after providing written and verbal explanations of the study. The study was approved by the Research Review Board every three years.

Survey contents: The questionnaire collected data regarding the participant's age, postpartum duration (in months), and history of pregnancy and childbirth. This study used the Jikaku-sho Shirabe [13], a 25-item questionnaire developed by the Working Group for Occupational Fatigue to investigate subjective symptoms (e.g., shoulder stiffness and wanting to lie down) rated on a 5-point-scale ranging from "Very much applicable (5 points)" to "Not at all applicable (1 point)" for each item. This study showed high-ranking items based on the report on early parenthood presented by Sekijima [14].

Study 2: Psychological and physical changes induced by exercise program implementation

Subjects: Among the participants of Study 1, a 33-year-old primiparous woman was chosen after agreeing to become the subject of Study 2. The subject started playing volleyball in junior high school and competed at national championships multiple times until she graduated from university. She consistently played volleyball at the community level for 19 years even after university graduation until giving birth.



Upon leading her pregnancy at the age of 32, she discontinued playing volleyball and participated in the lecture 2 months postpartum after celebrating her 33rd birthday.

Survey contents: Immediately after participation, the patient was interviewed regarding her psychological and physical condition over the 8 months before participating in the health support lectures. The survey started in November 2016 during which the following four questions were asked:

Question 1: Subjective symptoms before and after participating in the lecture, that is, whether the subject felt discomfort and whether symptoms changed before and after the lecture, including concrete questions about the changes.

Question 2: Weight and body fat percentage before and after participating in the lecture, including measurement values.

Question 3: Psychological concerns before and after participation

Question 4: Exercises during the survey period.

Results

Study 1: A subjective symptom survey with questionnaires

The 1638 subjects included herein had a mean age of 32.4 ± 8.2 years and a mean postpartum duration of 4.3 ± 2.3 months. A total of 885 (54.1%) subjects belonged to the 4 – 6 months postpartum group, which was the largest group according to postpartum duration. Regarding the childbirth experience, 1458 women (89.0%) were primiparous, while 180 (11.0%) were parous. Table 1 summarizes the results of the subjective symptom survey during the early (2 – 3 months postpartum), middle (4 – 6 months postpartum) and later postpartum stages (after 7 months postpartum).¹⁵ In the early stage, “lower back pain” remains the most common symptom from 2012 to 2015, followed by “shoulder stiffness,

sleepiness, wanting to lie down, yawning, and eye strain.” By 2016, similar tendencies had been observed, except that “shoulder stiffness” had become the most common symptom, followed by “lower back pain.” In the middle stage, “getting irritated,” a new item added to the early stage, ranked fifth in 2012 – 2015 and sixth in 2016 – 2019. In the later stage, “getting irritated” was added to the items in both periods, while “feeling tired in the legs” ranked sixth in 2012 – 2015.

Study 2: Psychological and physical changes induced by exercise program implementation (Table 2)

The implemented exercise program (Question 4): As shown in Table 3, the practice program was modified according to postpartum duration and consisted mainly of stretching exercises for the most commonly reported discomforts for each month, which was performed 5 to 6 times a week. The interview contents regarding the exercise program are described as follows:

Immediately after the lecture (3 months postpartum): The subject performed 2 – 3 sets of breathing and stretching exercises known to prevent lower back pain and urinary incontinence during her spare time. The subject also performed balance ball bouncing for at least 5 min, which she used for putting her baby to sleep (at night).

4 – 6 months postpartum: Pelvis care and stretching exercises for lower back pain that were practicable during childcare (implemented for approximately 10s whenever practicable). Stretching exercises for stiff shoulders and self-care breathing (for 10s, repeated around two times in the morning and evening).

Although urinary incontinence had disappeared, she continued the exercises for 10s every morning given their firming effects on the buttocks. Balance ball exercises were performed daily for 7 min – 10 min in the morning and evening. Even after her baby went to sleep, she continued the exercises for approximately 20 min and added approximately 30 repetitions of sit-ups.

Table 1: Subjective symptom survey ($n = 1638$).

2016–2019	2–3 months postpartum	AVG (±SD)	4–6 months postpartum	AVG (±SD)	7–9 months postpartum	AVG (±SD)
Numbers	278		494		135	
1 st	Shoulder stiffness	3.9 (±1.0)	Shoulder stiffness	3.7 (±0.9)	Shoulder stiffness	3.4 (±0.8)
2 nd	Lower back pain	3.6 (±1.3)	Sleepiness	3.1 (±1.3)	Lower back pain	2.8 (±1.2)
3 rd	Sleepiness	3.4 (±1.2)	Wanting to lie down	3.1 (±1.2)	Wanting to lie down	2.8 (±1.1)
4 th	Wanting to lie down	3.2 (±1.3)	Lower back pain	3.0 (±1.3)	Sleepiness	2.8 (±1.2)
5 th	Yawning	3.0 (±1.1)	Eye strain	3.0 (±1.1)	Eye strain	2.4 (±1.2)
6 th	Eye strain	2.9 (±1.3)	Feeling irritated	2.9 (±1.3)	Feeling irritated	2.4 (±1.1)
2012–2015	2–3 months postpartum	AVG (±SD)	4–6 months postpartum	AVG (±SD)	7–9 months postpartum	AVG (±SD)
Numbers	193		391		147	
1 st	Lower back pain	4.2 (±0.9)	Shoulder stiffness	3.7 (±1.0)	Shoulder stiffness	3.3±0.9)
2 nd	Shoulder stiffness	3.6 (±1.3)	Lower back pain	3.4 (±1.3)	Lower back pain	3.1 (±1.4)
3 rd	Sleepiness	3.6 (±1.3)	Sleepiness	3.3 (±1.1)	Wanting to lie down	3.0 (±1.1)
4 th	Wanting to lie down	3.2 (±1.3)	Wanting to lie down	3.2 (±1.2)	Feeling irritated	2.9 (±1.2)
5 th	Yawning	3.2 (±1.1)	Feeling irritated	3.0 (±1.3)	Sleepiness	2.6 (±1.3)
6 th	Eye strain	3.9 (±1.3)	Eye strain	2.9 (±1.1)	Feeling tired in the legs	2.4 (±1.1)

Table 2:

Before attending the course (subjective symptoms; physical condition)	After attending the course (subjective symptoms; physical condition)	Action (approach)
Severe back pain (postpartum period ~)	Much improved	Two stretching exercises for back pain relief daily, 20 seconds each. Three deep breathing exercises (inhale for 4 seconds and exhale for 8 seconds) to relieve back pain and urinary leakage
Urinary incontinence immediately after delivery	Dramatic recovery	Three deep breathing exercises (inhale for 4 seconds and exhale for 9 seconds) to relieve back pain and urinary leakage Two exercises to stop urinary incontinence for 5 seconds, daily, morning and evening
Tendonitis from 2 weeks postpartum	Gradual improvement	Dynamic stretching and self-massage to relax wrists and elbows for 10 seconds each
Mastitis 1 month after delivery	Dramatic recovery	Daily stretching exercises around the chest for 10 seconds
Knee pain from 2.5 months postpartum	Gradual improvement	Training to increase leg muscle strength and prevent strain on the knees
Stiff shoulders 3 months before delivery	Much improved	Shoulder rotation 10 times and upward extension exercises for 20 seconds
Weight; 56.8 kg / %FAT, 31.2	Weight; 53.3 kg / %FAT, 25	Balance ball bounce exercises for 8-12 minutes daily

Table 3: Postpartum care program adapted in late childbirth.

Postpartum period/Items	Period Within 2 weeks	Period 1 month	Period 1–2 months	Period 2–3 months	Period 4–6 months	Period 7–9 months	After 9 months
Physical conditions	<ul style="list-style-type: none"> Several organs, including uterus or bladder, are not located in their original position (downward displacement), while the uterus has yet to recover its original size; this condition cannot be considered healthy. 	<ul style="list-style-type: none"> Organs, including the uterus or bladder, are gradually returning to their original position during this period, and the uterus recovers to its original size. However, this period also requires close observation for the occurrence of lower limb edemas. 	<ul style="list-style-type: none"> Urinary incontinence is often observed during this period. Edemas could occur at lower limbs. Disruption at the rectus abdominis muscle begins to heal. Pains around the sacral bone could occur during this period, often leading to lower back pain. 	<ul style="list-style-type: none"> Given that feeding while lying down with the baby or holding them is frequent performed during this period, pain at the coccyx could occur simultaneously with pain at the sacra bones, which can disrupt deep sleep. 	<ul style="list-style-type: none"> Babies gain three times their birth weight by this period, which increases the muscle load placed around the sacrum when holding the baby, often leading to lower back pain. Shoulder discomfort can also occur simultaneously during this period. 	<ul style="list-style-type: none"> The baby begins to make physical actions (e.g., rolling over or crawling) by this period, requiring the mother to make compensatory motions, which should enlarge the oblique diameter of the pelvis in both right and left directions, often leading to the pains around abdomen, lower back, and sacrum. 	<ul style="list-style-type: none"> The mother begins to help the baby walk during this period and needs to make frequent changes in her physical actions and postures. This suggests that mothers would increasingly experience shoulder discomfort or lower back pain during this period due to the physical hyperactivity This is also the period when the mother's menstruation returns to normal.
Care points	<ul style="list-style-type: none"> The first priority is to secure enough rest for the mother during exercise. A pelvic girdle (bleached cloth or belt should suffice) should be worn every day to secure the area where the thighbone meets the pelvis as tightly as possible→This should be mandatory in order to support the internal organs. 	<ul style="list-style-type: none"> Continue to secure enough rest for the mother (organ displacement may not have entirely recovered during this period; therefore, frequent standing-up motions should be avoided). Continue to tighten the pelvic girdle; the position of sacral bone or coccyx is not stable during this period. 	<ul style="list-style-type: none"> Begin care for pelvic floor muscles in order promote recovery following delivery and prevent urinary incontinence. Introduce breathing exercises to delay tiredness. 	<ul style="list-style-type: none"> Introduce additional exercises to firm up the pelvic floor muscles (practice breathing exercises again) →A smooth standing-up motion is effective for regulating intraabdominal pressure. Begin balance ball bouncing exercise to recover physical endurance. 	<ul style="list-style-type: none"> Muscle load around the pelvic floor muscle should drastically increase during this period; ensure proper care for the musculoskeletal system during stretching exercises. Add a few extra minutes of balance ball bouncing exercises for swift recovery of physical endurance. 	<ul style="list-style-type: none"> Thoroughly implement stretching exercises to remove stress around sacral bone or coccyx; perform exercises practicable in the standing posture whenever necessary. Increase the load of the balance ball bouncing exercise to promote both physical and muscle endurance. 	<ul style="list-style-type: none"> Implement pelvic bottom muscle exercises that are practicable outdoors to further tone and stabilize the pelvic floor muscles. Set the target time of balance ball bouncing exercise to more than 15 min in order to improve endurance.
Examples of exercise care practice							
Psychological care points	<ul style="list-style-type: none"> Make the best use of the 2-week check-ups. Do not hesitate to contact and consult the medical institute or public health nurse regarding any worries. 	<ul style="list-style-type: none"> Voice current health problems or concerns regarding baby's growth with the relevant medical service staff before receiving the 1-month check-up. 	<ul style="list-style-type: none"> Positively introduce another person's support to secure sound sleep (discuss the matter thoroughly with the partner). Sleep with the baby whenever possible. 	<ul style="list-style-type: none"> Make use of the support available at the local childcare support center or public health center to collect useful information to prevent isolated childcare. 	<ul style="list-style-type: none"> The mother experiences positive and negative fluctuations in her mental health during this period; positively participate in childcare seminar to prevent 24-h care duty. 	<ul style="list-style-type: none"> The baby's growth rate increases remarkably by this period; collect information regarding childcare/ social support to occasionally secure personal time (to prevent irritation). 	<ul style="list-style-type: none"> Review current concerns regarding the baby's physical and mental growth in preparation for the 1-year check-up. List down your own health concerns or issues as well.



7 – 8 months postpartum: Strength training while standing to prevent lower back pain (implemented 2 types of exercises for approximately ten repetitions). The subject performed almost the same exercises done during the 4 – 6 months postpartum period in her spare time.

Subjective symptoms (Question 1): Before participation: lower back pain, shoulder stiffness, urinary incontinence, tendonitis, mastitis, and knee pain. Subjective symptom scores were self-assessed using a 5-point scale for lower back pain, shoulder stiffness and knee pain.

After participation (8 months later): Lower back pain and shoulder stiffness gradually improved; urinary incontinence disappeared; minor fatigue was noted in the arms but no tendonitis, mastitis, or knee pain was observed.

Weight and body fat percentage (Question 2): The subject had a measuring instrument at her home through which she could measure her weight and body fat percentage once a week.

- **Before participation:** Weight and body fat percentages were 56.8 kg and 31.2%, respectively.
- **After participation:** Weight and body fat percentage decreased by 5.3 kg and 6.3%, respectively.

Psychological concerns before and after participation (Question 3):

- Before participation

“Because I hastened to resume sports activities, such as volleyball and performer exercises not suitable for the 2-month postpartum physical status, my lower back pain worsened, and I had growing anxiety about my health.”

“I thought that doing sports activities would help me recover my physical strength soon, but that was not the case at all. The situation stunned me and I felt a bit weak and miserable.”

“Because I ate various things while feeding my baby at night and often had sweets during the day, I put on weight fast.”

“I got fat and felt a lot of discomforts, which made me rush and regretful in any case. Looking back at it now, I felt that I might have had mild postpartum depression.”

- “Because it was hard to get my baby to sleep at night, I was exhausted and got irritated.
- After participation

“My weight and body fat both decreased. I had more confidence in returning to sports activities (7 months after childbirth).”

“I feel so good condition because my discomforts have almost disappeared (4 months after childbirth).”

“The primary reason why my lower back pain disappeared was that the lecture taught me how to reduce the load during childcare and practiced it every day. I felt that I was working out while holding and feeding my baby (4 months after childbirth).”

“Having done stretching exercises, I realized that I was not moving my body despite thinking I did (5 months after childbirth).”

“I set dates during which I exercised hard enough to sweat using a balance ball and did it while holding my baby (3 months after childbirth).”

Discussion

The results of Study 1 revealed that motor system discomforts, such as “shoulder stiffness and lower back pain,” occurred across all postpartum stages. Symptoms related to feelings of fatigue, such as “wanting to lie down,” had also been found across all postpartum stages, while “irritation,” a nervous system-related subjective symptom, was added to the discomforts after 4 months postpartum.

The results presented herein demonstrated that motor system care and exercise are essential above all after childbirth. Sekijima [15] reported that over half the women in their early parenthood (less than 18 months after childbirth) suffered from “lower back pain,” “shoulder pain,” and physical discomfort enough to make them want to lie down, which may lead to stress. As such, the aforementioned study emphasizes the importance of setting aside time to rest. Our research found results similar to those presented in the aforementioned study. When mothers had strong feelings of fatigue during the early postpartum period, setting aside time to lie down with the help of social support and their family is essential. Given that mobility near the sacroiliac joints increases considerably until 6 months postpartum, which compresses the nerves when holding and breastfeeding the baby, women are likely to experience lower back pain [3].

Therefore, securing opportunities to learn about postures that reduce pain during childcare is crucial.

The statements obtained in Study 2 imply that exercise according to postpartum physical condition implemented herein had positive effects on psychological and physical health. Indeed, Norman, et al. [16] emphasized the importance of postpartum exercise care (rehabilitation exercise) considering that long-term health lecture series eased discomforts experienced during the postpartum period (urinary incontinence and lower back pain) and promoted positive emotions.¹⁶ Our study subject experienced various changes that supported the findings of the aforementioned study, which suggests that exercise care intervention worked



effectively. Thus, we conclude that continuing rehabilitation care exercises based on the physical condition during each postpartum stage can help with psychological and physical recovery and effectively improve mothers' physical and psychological discomforts.

Although the subjective symptom survey in Study 1 found shoulder stiffness and lower back pain across all postpartum stages, studies have shown that symptoms vary depending on the postpartum stage.^{3,12} Given that environmental factors, such as lifestyle and childcare, vary among individuals, lecturers need to provide a comprehensive explanation and convey care while considering individual circumstances.² Table 2 summarizes the exercise care program implemented in Study 2 according to subjective discomforts in each postpartum stage. The exercise care program was implemented during the exercise intervention experiment in our preliminary research¹³ (Table 2). The subject included in Study 2 was able to perform the exercises voluntarily given her experience with exercise. However, future studies need to determine whether such exercises would have positive effects on individuals with no prior exercise experience. As part of physical education, opportunities to convey care and exercise for postpartum women are imperative. In Study 1, we paid careful attention to several postpartum circumstances and various postpartum mothers' views. Accordingly, the present findings highlight the practical effects of the postpartum exercise care program employed in Study 2. Given the drastic physical changes occurring during the postpartum period, the notion that "postpartum is the best time for care and exercise" needs to be disseminated. As such, more information regarding locomotor system upset in postpartum and exercise interventions are needed by "developing health fitness programs for the postpartum period" and "supporting the resumption of sports activities after childbirth among ordinary women."

In conclusion, the current paper presented the findings of a survey on subjective postpartum discomfort symptoms (Study 1) and a case study on postnatal care using a program developed based on the survey results (Study 2). Study 1 investigated postpartum discomfort symptoms among 1638 mothers after childbirth using the SFSS. The survey was conducted over an 8 - year period from 2012 to 2019. Accordingly, our results confirmed that almost no change occurred over 8 years.

The subjective symptoms experienced by mothers less than a year after childbirth were dominated by locomotor discomforts, such as lower back pain and shoulder stiffness, across the postpartum period, which embodies the physical changes occurring after childbirth reported in various previous reports and highlights the importance of rehabilitative care for the locomotor system. Meanwhile, Study 2, a case study, reported on the implementation of the rehabilitation care program and its impact. Accordingly, the subject had shown

positive psychological and physical changes through her "continuous" performance of the exercise program. This suggests the necessity of providing health care according to the postpartum stage.

Our findings support those published in previous research while presenting a groundbreaking step-by-step program for the first time.

Issues in the future

The purpose of this study was to first clarify the reality of postpartum mothers by following up on the long-standing SFSS survey (Study 1). Therefore, we did not provide a detailed classification of psychological or physical pain, but only a comprehensive overview first. Future work will require this detailed survey. And from that detailed survey, deeper insights will need to be sought. In addition, with regard to the protection of personal information, some institutions holding health courses are strict in some places. Therefore, it is necessary to select institutions that have prior approval to disclose information to the extent possible.

Acknowledgment

The authors would like to express their sincere gratitude to all the participants and research staff for their cooperation, without which this study would not have been possible

Author contribution

Conceptualization, Shizuka Torashima, Mina Samukawa, Kazumi Tsujino, and Yumi Sawada; Methodology, Shizuka Torashima, and Yumi Sawada.; Formal analysis, Shizuka Torashima and Mina Samukawa.; Investigation, Shizuka Torashima, and Yumi Sawada; Resources, Shizuka Torashima and Yumi Sawada; Writing-original draft preparation, Shizuka Torashima, Mina Samukawa, Kazumi Tsujino, and Yumi Sawada.; Writing-review and editing, Shizuka Torashima and Yumi Sawada; Supervision, Enago Publications.; Project administration, Shizuka Torashima; Funding acquisition, Shizuka Torashima, and Yumi Sawada. All authors have read and agreed to the published version of the manuscript.

Funding

This research was funded by KAKEN Grant-in-Aid for Scientific Research (Grant number: 17K12520).

References

1. Murkoff H. What to expect when you're expecting. Aspect, Tokyo. 2004; 2-12.
2. Uemura Y. Midwifery Care—Knowledge and practice of midwifery techniques leading the present to the future learning from history. Japan J. Perinat. Care 2019; 38: 788-794.
3. Gasquet BD. Akachan to isshoni! Perine no ekusasaizu: Osan no maekara shitteokitai sango no kotsubanteikingun to bodeitoritonto (Let's Do It with Your Baby! Perineal Exercises: Postpartum pelvic floor muscles and body treatment to learn before childbirth). Medicus Shuppan, Tokyo. 2013. 21-89. (in Japanese).



4. Torashima S. Understanding of physical conditions of postpartum women and proposal of implementation of postpartum exercise care - A questionnaire of 460 participants and a case study on the practice of health exercise guidance. *Project Research*. 2014; 29-41.
5. Japan Sports Agency Commissioned Project: Female Athlete Development & Support Projects: Strategic Support Program for Female Athletes: How to Support Female Athletes. <https://www.jpnsport.go.jp/jjss/Portals/0/images/contents/woman/research/20181018.pdf>, released in October, 2018. (Last accessed June 20, 2020). (in Japanese).
6. Sipko T, Grygier D, Barczyk K, Elias G. The occurrence of strain symptoms in the lumbosacral region and pelvis during pregnancy and after childbirth. *J Manipulative Physiol Ther*. 2010 Jun;33(5):370-7. doi: 10.1016/j.jmpt.2010.05.006. PMID: 20605556.
7. Ramin AN, Macchi VE, Porzionato AN, De Caro RA, Stecco CA. Fascial continuity of the pelvic floor with the abdominal and lumbar region. *Pelviperrineology* 2016; 35: 3-6.
8. Fan C, Guidolin D, Ragazzo S, Fede C, Pirri C, Gaudreault N, Porzionato A, Macchi V, De Caro R, Stecco C. Effects of Cesarean Section and Vaginal Delivery on Abdominal Muscles and Fasciae. *Medicina (Kaunas)*. 2020 May 27;56(6):260. doi: 10.3390/medicina56060260. PMID: 32471194; PMCID: PMC7353893.
09. Gluppe SL, Hilde G, Tennfjord MK, Engh ME, Bø K. Effect of a Postpartum Training Program on the Prevalence of Diastasis Recti Abdominis in Postpartum Primiparous Women: A Randomized Controlled Trial. *Phys Ther*. 2018 Apr 1;98(4):260-268. doi: 10.1093/ptj/pzy008. PMID: 29351646; PMCID: PMC5963302.
10. Sperstad JB, Tennfjord MK, Hilde G, Ellström-Engh M, Bø K. Diastasis recti abdominis during pregnancy and 12 months after childbirth: prevalence, risk factors and report of lumbopelvic pain. *Br J Sports Med*. 2016 Sep;50(17):1092-6. doi: 10.1136/bjsports-2016-096065. Epub 2016 Jun 20. PMID: 27324871; PMCID: PMC5013086.
11. Hayashi Y. Physiological changes in postpartum mother's body. *Japan J. Perinat. Care*. 2019; 38: 937-940. (Abstract in English).
12. Torashima S. A survey of the physical conditions from two to nine months postpartum first report: Comparing in advanced maternal age group and the other groups. *Japan J. Matern. Health* 2016; 57: 297-304. (Abstract in English).
13. Torashima S. The influence of a single course health promotion class on physical and mental condition—Empirical study with mothers in early parenthood. *Hokkaido Journal of Physical Education, Health and Sports Sciences*. 2018; 53: 15-26, (Abstract in English).
14. Working Group for Occupational Fatigue: Jikaku-sho Shirabe (A Subjective Symptom Survey). <http://square.umin.ac.jp/of/service.html>. 2002. (Last accessed on June 20, 2020).
15. Sekijima K. Physical conditions of mothers in early parenthood. *Japan J. Matern. Health* 2012; 53: 375-382. (Abstract in English).
16. Norman E, Sherburn M, Osborne RH, Galea MP. An exercise and education program improves well-being of new mothers: a randomized controlled trial. *Phys Ther*. 2010 Mar;90(3):348-55. doi: 10.2522/ptj.20090139. Epub 2010 Jan 7. PMID: 20056720."