

The effect of aromatherapy and Su Jok interventions on post-cesarean pain

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ABSTRACT

Objective: The aim of this study was to determine the effect of aromatherapy and Su Jok interventions as non-pharmacological methods of relieving pain after cesarean section.

Materials and methods: This randomized controlled trial was conducted with 120 women who had cesarean delivery in the gynecology and obstetrics department of a training and research hospital between February 9 and October 2, 2019. The participants were allocated to the aromatherapy group, Su Jok group, Su Jok and aromatherapy group, or control group using block randomization based on parity. Su Jok was performed using buckwheat seed; aromatherapy was applied using lavender, eucalyptus, or rose oil. Data were collected using a participant information form and pain was assessed using the Visual Analog Scale.

Results: There was no significant difference between the groups in mean pain levels before or after the intervention, although the control group had less initial pain compared to the intervention groups. However, all three intervention groups showed significant decreases in pain levels immediately and 30 min after the intervention compared to pre-intervention levels ($p < 0.05$). The intervention in all three groups reduced the level of pain. In particular, the pain level of the Su Jok group reached from moderate to mild. There was no significant change in the control group.

Conclusions: Aromatherapy and Su Jok interventions performed separately and simultaneously in addition to routine hospital care were more effective in reducing post-cesarean pain than routine care alone.

What is already known about the topic

Post-cesarean pain has adverse physical and psychological effects on mothers in the early postpartum period. At the same time, pharmacological agents to be used by the mother may cause negative effects on the baby. For this reason, complementary methods can be applied to minimize the negative effects that may occur in the baby. Previous studies have shown that aromatherapy is effective for post-cesarean pain, and Su Jok is also reported to be effective for different types of pain in different regions.

What this study adds

Our study demonstrates the effectiveness of two complementary therapies, Su Jok and aromatherapy, in reducing post-cesarean pain. These methods may enable mothers to have a more comfortable postpartum period using fewer pharmacological agents. And mothers may have various choices in complementary therapy based on their

convenience.

1. Introduction

Pregnancy is a physiological condition and having a healthy conclusion to pregnancy is as important as maintaining a healthy pregnancy. Although natural birth is the preferred delivery method for the health of mother and baby, cesarean section is unavoidable when natural birth is dangerous [1].

Cesarean delivery is similar to other major surgical procedures. Therefore, there can be many adverse effects associated with both the procedure and the anesthesia given. In addition, the mother may also experience physical and psychosocial problems in the postpartum period [2]. Pain is a common problem after cesarean delivery. Post-cesarean pain increases sympathetic nervous system activity, resulting in increased epinephrine, aldosterone, and cortisol levels, and causes changes in metabolic activity [3]. Studies have indicated that most mothers experience pain of varying intensity after cesarean section and

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have lower comfort levels than those who delivery naturally [4–7]. Along with postoperative and postpartum difficulties, the mother also experiences more problems with self-care and newborn care. Therefore, pain management is essential to prevent pain-related complications, ensure the mother's comfort, and enable the mother to care for the infant as soon as possible after cesarean delivery [4,7–9].

The aim of post-cesarean analgesia should be to prevent or minimize postoperative pain. The selection of analgesics for post-cesarean pain differs from other surgical procedures. In other surgeries performed with similar incisions in the lower abdominal region, opioid analgesics are preferred. However, when administering analgesic therapy after cesarean section, mother and baby should be protected from adverse drug effects, and the mother-infant relationship and drug passage into breast milk must be taken into consideration [10,11]. Therefore, non-pharmacological methods can also be used to support pharmacological therapy. Nonpharmacological methods such as aromatherapy, acupuncture point stimulation, music therapy, hand and foot massage, pulsed electromagnetic field application, Reiki, auricular plaster therapy, and progressive relaxation exercises have been reported to reduce post-cesarean pain [7,12–20].

Aromatherapy is a nonpharmacological method in which essential oils are applied to maintain and improve physical and mental health. Aromatherapy has been shown to have positive effects on stress, anxiety, fatigue, blood pressure, heart rate, acute and chronic pain, and post-cesarean pain [14,21–28].

Su Jok acupuncture is another nonpharmacological treatment method. Su Jok means *hands* and *feet* in the South Korean language and is applied to the hands and feet. The philosophy behind this practice is that every part of the human body is interconnected by different bonds, and these bonds provide harmony to form a whole body and interact to maintain its vitality. Like applying acupuncture to the ear as a representation of the human fetus, Su Jok is applied to areas of the hands and feet corresponding to parts of the human body. Different techniques are used to stimulate the correspondence points where the body is reflected on the limbs [29,30]. The results of some pain studies have suggested that Su Jok therapy is effective in different regions and different types of pain [31–47]. As a result of the study of Nurjannah and Hariyadi (2021), it was determined that Su Jok is effective in reducing pain in various parts of the body [40].

The aim of this study was to determine the effect of aromatherapy and Su Jok interventions as nonpharmacological methods of relieving pain after cesarean section.

2. Materials and methods

This randomized controlled trial was conducted in the gynecology and obstetrics department of a training and research hospital between February 9 and October 2, 2019.

The study hypotheses were as follows:

H₀: Su Jok and aromatherapy do not reduce the severity of postoperative pain.

H₁: Su Jok therapy reduces the severity of postoperative pain.

H₂: Aromatherapy therapy reduces the severity of postoperative pain.

H₃: Simultaneous application of Su Jok and aromatherapy reduces the severity of postoperative pain.

2.1. Participants

A total of 120 women who delivered by cesarean section under regional anesthesia and had pain, were within the first postoperative 48 h, and who volunteered to participate in the study were included. If analgesic was administered, patients at least 3 h after administration were included in order for the analgesic effect to decrease or disappear.

Women with epilepsy, asthma, allergies, communication problems, and those with any condition affecting the hands (e.g., numbness, injury) that would interfere with the intervention were not included in the study. The women were divided into four groups: aromatherapy, Su Jok therapy, Su Jok and aromatherapy, and the control group.

2.2. Sample size

A priori power analysis was performed to determine the sample size using Cohen's standard effect sizes as a reference [48]. In power analysis based on the mean VAS scores in the reference study, we determined that for 95% confidence, 95.1% test power, and effect size (d) of 1.54, each group should include at least 12 patients [49]. A total of 156 women were evaluated for eligibility; 24 did not meet the inclusion criteria and 12 did not want to participate. Therefore, a total of 120 patients (30 in each group) were included in the study. Post hoc power analysis indicated the study had 100% power.

2.3. Randomization

The participants were allocated to the intervention and control groups using block randomization based on parity (primiparous/multiparous). 30 blocks were created in groups of four and each block was randomized within itself [50].

2.4. Interventions

Routine pain management in the hospital consists of oral paracetamol 500 mg 3 times daily and intravenous diclofenac sodium 75 mg as needed. We determined that all of the women participating in the study received only oral paracetamol. Other than pharmacological treatment, no other interventions are provided to reduce pain.

Su Jok procedure: In this study, we applied the seed therapy technique using viable buckwheat seeds. The hands were selected for treatment because we considered this more appropriate after cesarean section. Standard system was used for corresponding area. The acupuncture point, which is the reflection of the painful area, was

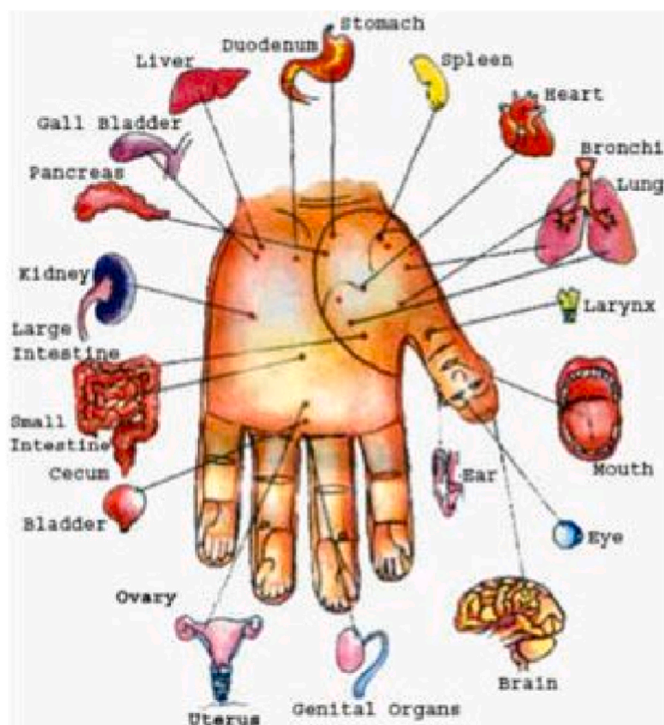


Fig. 1. Reflection points on hand.

identified on the patient's hand (Fig. 1). This point was massaged for a few minutes by researcher and then the buckwheat seed was fixed to this point with a bandage. The patient was shown how to do massage (Fig. 2). Since a total of 30 min will be massaged, the patient applied the massage herself in the remaining time.

Aromatherapy procedure: Lavender, rose, and eucalyptus oils were used. Each participant was presented the three oils and asked to select one for them to choose the scent they like (26 people preferred lavender oil, 17 people preferred rose oil and 17 people preferred eucalyptus oil). Three drops of the participant's preferred oil were applied to sterile gauze and fixed to their collar with a bandage. The participant inhaled the essential oil for 30 min.

2.5. Data collection

Data were collected using a participant information form and the Visual Analog Scale (VAS).

Participant information form: We prepared this form to gather information about the participants' age, education level, employment status/occupation, social insurance coverage, number of children, place of residence, pain control methods and analgesic use, operative history, reason for delivering by caesarean section, and presence of post-operative pain.

Visual Analog Scale: The VAS is a self-assessment tool in which the individual rates their pain on a 10-cm or 100-mm horizontal or vertical line labeled on one end with "no pain" (0 points) and on the other end with "unbearable pain" (10/100 points).

Women who met the inclusion criteria first completed the participant information form and then the VAS was used for the first pain assessment. Participants in the Su Jok group received only Su Jok therapy, those in the aromatherapy group received only aromatherapy with the essential oil they selected, and those in the Su Jok and aromatherapy group received both Su Jok and aromatherapy simultaneously. All interventions lasted 30 min. The second pain assessment was done immediately after the intervention and the third pain assessment was done 30 min later. The control group received no additional intervention other than routine hospital care (follow-up of vital signs) and the second and third pain assessments were done at 30-min intervals after the first assessment (Fig. 3).

2.6. Statistical analysis

The data were statistically analyzed using computer software. Mean, standard deviation, number, and percentage values were used as descriptive statistics. Differences in categorical values between groups were analyzed using chi-square tests. For numerical variables, between-

group comparisons were performed using independent samples *t*-test, Mann-Whitney *U* test, Kruskal-Wallis test, one-way analysis of variance (ANOVA), repeated measures ANOVA, Bonferroni correction, and Friedman test. Cohen's *d* was used to determine the effect size. Statistical significance was interpreted using an alpha value of 0.05 and 95% confidence intervals.

2.7. Ethics

Ethical approval to perform this study was obtained from the clinical research ethics committee (protocol no: 09.2018.364) of a university medical school. Written permission was also obtained from the hospital and informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki. The researcher performing the aromatherapy and Su Jok procedures attended training and received a certificate of participation.

3. Results

The women in the study had a mean age of 29.55 ± 4.85 years, 67.5% had primary education, and 83.3% were not employed. Most of the women (83.3%) were multiparous, with 45% having three or more children. The mean time elapsed after the patients participating in the study received analgesics was determined as 5.53 ± 3.6 h.

Considering the essential oils used for aromatherapy, it was seen that most of the patients (43.4%) preferred lavender oil. There was no statistically significant difference between the groups in terms of the oils used (Table 1).

VAS pain scores of interventions groups in all three assessments showed no significant differences in statistical comparisons of primiparous and multiparous women ($p > 0.05$). However, both primiparous and multiparous women demonstrated a significant decrease in mean pain scores in repeated measures analysis ($p < 0.05$). Comparison of women with different pain-related factors showed that those with postoperative gas had higher mean pain scores at all time points compared to women with other factors ($p < 0.05$). Comparison based on pain character showed that all VAS scores were higher among women with continuous pain compared to those with intermittent pain ($p < 0.05$) (Table 2, Table 3, Table 4).

VAS pain scores of control group in all three assessments showed no significant differences in statistical comparisons of primiparous and multiparous women ($p > 0.05$). Of the factors that may be associated with pain, there is not significant differences in pain scores. Comparison of women with different pain-related factors showed that those with postoperative gas had higher mean pain scores at all time points compared to women with other factors. Comparison based on pain

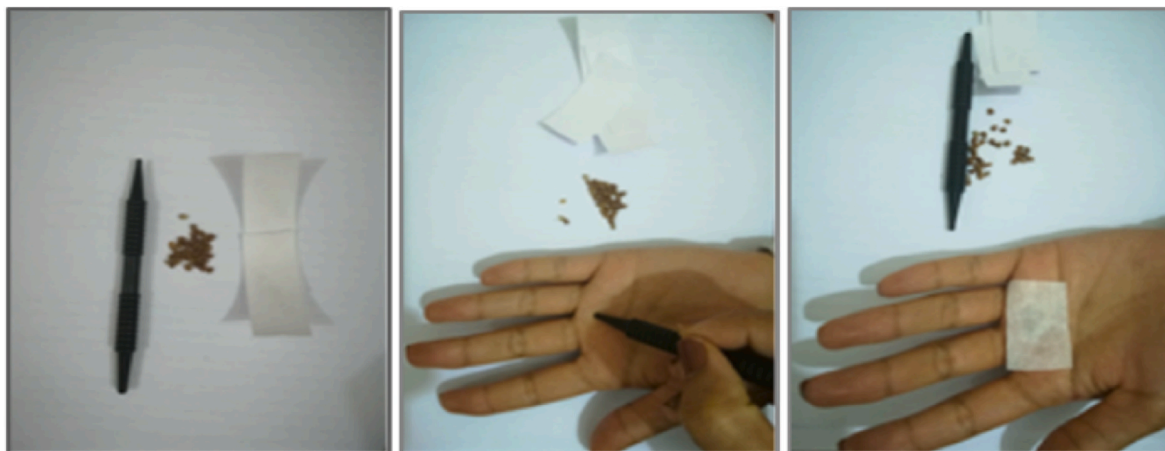


Fig. 2. An example of applying the Su Jok.

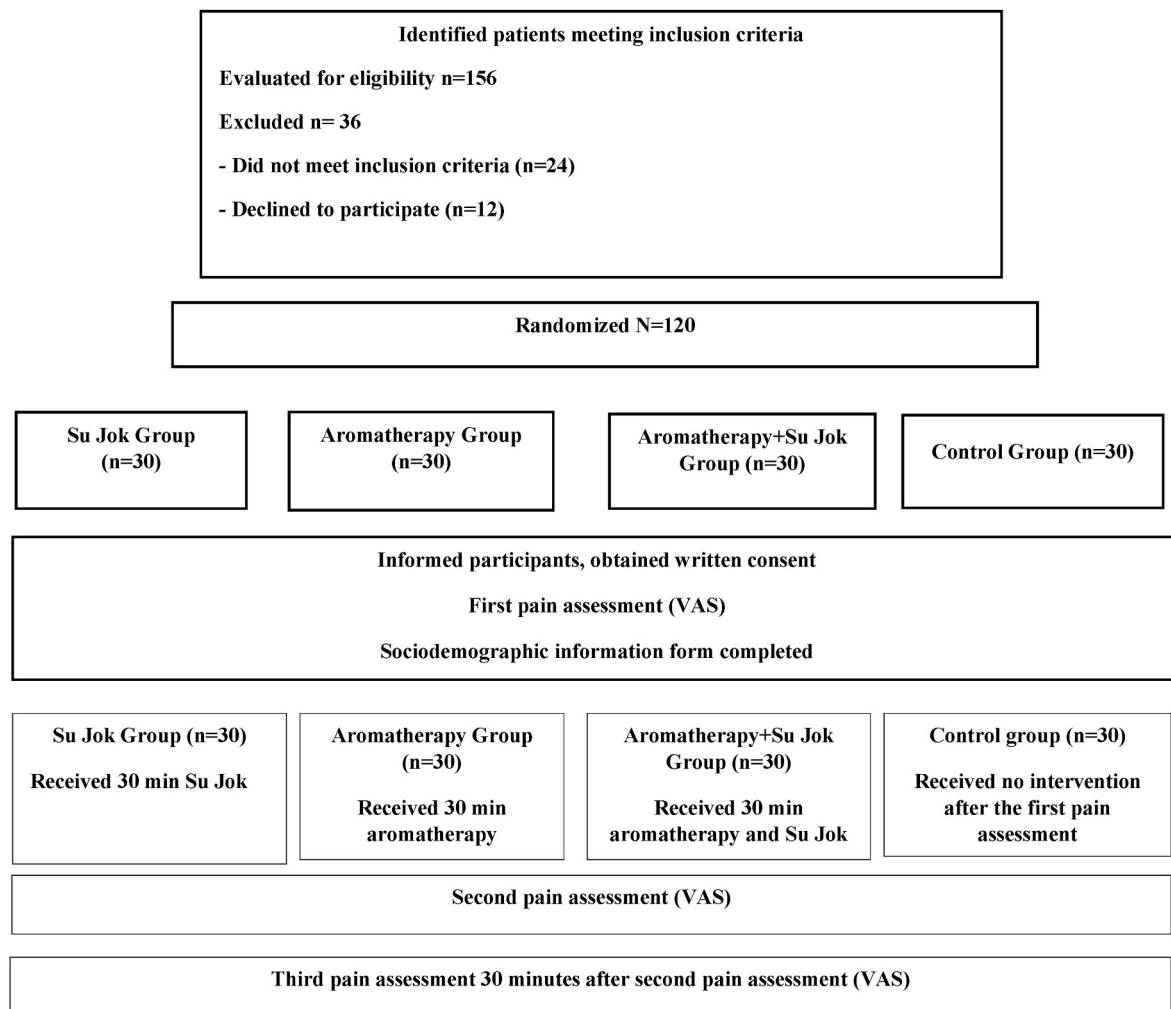


Fig. 3. Study procedure.

Table 1
Essential oils used for aromatherapy application.

Essential oil	Total (N = 120)		Aromatherapy (n = 30)		Su Jok + Aromatherapy (n = 30)		Test Values
	n	%	n	%	n	%	
Lavender	26	43,4	14	46,8	12	40,0	$\chi^2 = 0,271$ $p = 0,873$
Eucalyptus	17	28,3	8	26,6	9	30,0	
Rose	17	28,3	8	26,6	9	30,0	

Pearson Chi-square test (χ^2).

character showed that all VAS scores were higher among women with continuous pain compared to those with intermittent pain ($p < 0.05$) (Table 5).

Analysis of VAS pain scores in the intervention and control groups showed that pain levels were moderate, with no significant difference in pain intensity between the groups ($p > 0.005$) [51,52]. Although the difference was not statistically significant, it is noteworthy that the control group had lower mean VAS scores in the first assessment compared to the intervention groups. When the VAS scores were examined within the groups, the control group showed a slight increase in pain intensity in the third assessment, but there was no significant difference in mean VAS scores ($p > 0.005$). While the pain level of the Su Jok group was moderate before the intervention, it decreased to mild after the intervention [51,52]. The Su Jok group showed a significant

reduction in mean pain scores ($p < 0.05$), with significant decreases between the first and second, second and third, and first and third assessments ($p < 0.05$).

There was also a significant reduction in pain in the aromatherapy group ($p < 0.05$). Mean VAS scores were significantly lower in the second and third assessments when compared with the first assessment ($p < 0.05$).

Similarly, mean VAS scores in the aromatherapy and Su Jok group showed significant decreases between the first and second and between the first and third assessments ($p < 0.05$) (Table 6).

The calculated effect sizes based on measurements that changed significantly showed that aromatherapy and Su Jok + aromatherapy interventions had small effect; Su Jok intervention had a medium effect (Table 7) [53,54].

4. Discussion

Pain signals a threat to the organism and causes a stress response in the body that can lead to various physiological and psychological consequences. Post-caesarean pain and its associated effects are not only experienced by the mother but can also affect the newborn, and safe pain relief methods are essential because analgesics can be passed from mother to baby via breast milk. This study was conducted to determine the effectiveness of the nonpharmaceutical methods of aromatherapy and Su Jok in reducing or eliminating post-caesarean pain.

Most of the patients in our study were multiparous. This was also

Table 2
Comparison of VAS pain scores of Su Jok group according to selected clinical variable.

	VAS_1	VAS_2	VAS_3	Test Values	Difference
Number of births					
Primiparous (n = 5)	4,80 ± 1,09	3,20 ± 1,30	2,60 ± 1,14	x ² F = 8316 p = 0,016	1 > 2,3
Multiparous (n = 25)	4,54 ± 2,36	4,06 ± 2,43	3,64 ± 2,61	x ² F = 43,054 p = 0,001	3 < 1,2
Test Values	U = 47,5 p = 0,395	U = 50,5 p = 0,497	U = 47,5 p = 0,397		
Factors possibly associated with pain					
Presence of intestinal gas ^g (n = 7)	5,28 ± 3,14	5,85 ± 2,26	5,85 ± 2,26	x ² F = 0,000 p = 1,00	1,2,3
Position and movement ^p (n = 11)	4,31 ± 1,55	3,45 ± 1,25	2,13 ± 1,22	x ² F = 17,762 p = 0,00	1 > 2>3
^a Other ^o (n = 12)	4,41 ± 2,15	3,20 ± 2,55	3,29 ± 2,49	x ² F = 13,455 p = 0,001	1 > 2,3
Test Values and Difference	KW = 0,264 p = 0,876 g,p,o	KW = 8767 p = 0,012 g > p,o	KW = 13,017 p = 0,001 g > p,o		
Pain Character					
Continuous (n = 8)	6,25 ± 2,36	5,25 ± 2,71	4,81 ± 2,75	x ² F = 9238 p = 0,005	1 > 2,3
Intermittent (n = 22)	3,97 ± 1,82	3,43 ± 1,96	2,97 ± 2,19	x ² F = 13,855 p = 0,001	3 < 1,2
Test Values	U = 35,5 p = 0,012	U = 43,5 p = 0,034	U = 52,0 p = 0,087		

Between-group comparisons with *t*-test (t); Mann-Whitney *U* test (U), and Kruskal-Wallis test (KW). Within-group comparisons performed using repeated measures ANOVA (F) with post-hoc Bonferroni correction and Friedman test (x²F).

^a Coughing, noise, eating, breastfeeding.^o.

reported by Schoenwold [55] and Çırpanlı [56] in their studies of women undergoing cesarean section. When we analyzed pain scores in primiparous and multiparous women in our study, we determined that pain scores decreased in both groups but did not differ significantly between the groups. This indicates that post-cesarean pain severity is not associated with parity. When we evaluated other potential pain-related factors, there was no significant change in pain levels in women with complaints of intestinal gas, whereas pain scores decreased significantly with position and movement and with other factors. Ayaz [57] reported that movement greatly increased post-cesarean pain. When the pain character is evaluated according to the duration of the pain, it is seen that the pain scores decrease, but the pain scores of the patients with continuous pain are higher than those with intermittent pain. Higher pain scores in women with persistent pain are expected and may be a result of postoperative gas.

In our analysis of mean pain scores in the three assessments, there were no significant differences among the intervention and control groups. This indicates that participants in the control and intervention groups had similar, moderate pain levels. After the pain-reducing

Table 3
Comparison of VAS pain scores of aromatherapy group according to selected clinical variable.

	VAS_1	VAS_2	VAS_3	Test Values	Difference
Number of births					
Primiparous (n = 5)	3,90 ± 0,22	3,50 ± 0,50	3,30 ± 0,44	x ² F = 6500 p = 0,075	1,2,3
Multiparous (n = 25)	5,28 ± 2,38	4,34 ± 2,57	4,22 ± 2,64	x ² F = 18,429 p = 0,00	1 > 2,3
Test Values	U = 42,0 p = 0,243	U = 51,0 p = 0,519	U = 52,0 p = 0,555		
Factors possibly associated with pain					
Presence of intestinal gas ^g (n = 7)	5,85 ± 2,85	5,64 ± 2,82	5,64 ± 2,82	x ² F = 3500 p = 0,174	1,2,3
Position and movement ^p (n = 13)	4,73 ± 2,29	3,80 ± 2,37	3,65 ± 2,32	x ² F = 11,290 p = 0,004	1 > 2,3
^a Other ^o (n = 10)	4,90 ± 1,72	3,70 ± 1,76	3,50 ± 1,95	x ² F = 10,381 p = 0,006	1 > 2,3
Test Values and Difference	KW = 0,954 p = 0,621 g,p,o	KW = 2367 p = 0,306 g,p,o	KW = 2845 p = 0,241 g,p,o		
Pain Character					
Continuous (n = 6)	7,00 ± 2,60	5,75 ± 1,89	5,66 ± 2,31	x ² F = 7412 p = 0,025	1 > 3
Intermittent (n = 24)	4,56 ± 1,89	3,81 ± 2,34	3,66 ± 2,33	x ² F = 17,294 p = 0,00	1 > 2,3
Test Values	U = 29,0 p = 0,022	U = 32,5 p = 0,039	U = 36,0 p = 0,059		

Between-group comparisons with *t*-test (t); Mann-Whitney *U* test (U), and Kruskal-Wallis test (KW). Within-group comparisons performed using repeated measures ANOVA (F) with post-hoc Bonferroni correction and Friedman test (x²F).

^a Coughing, noise, eating, breastfeeding.^o.

interventions, mean pain scores in all three intervention groups decreased significantly in the second and third assessments, while the mean pain score increased in the control group, resulting in a smaller difference in pain levels between groups. This explains the lack of a significant difference in the intervention groups compared to the control group in the second and third pain assessments. However, analysis of the three pain assessments within each group showed that Su Jok and aromatherapy significantly reduced pain when performed alone and together. Some reports in the literature suggest that post-cesarean pain can be alleviated with nonpharmacological methods such as aromatherapy, music therapy, hand and foot massage, pulsed electromagnetic field application, Reiki, auricular plaster therapy, and progressive relaxation exercises [7,12–14,16–19,58]. In previous studies, these nonpharmacological methods were used alone for pain relief after cesarean section, whereas both methods used in this study were found to be effective in reducing pain when performed alone and in combination. There is no other study in the literature in which both aromatherapy and acupuncture or Su Jok were performed together.

In the Su Jok group, mean pain scores decreased progressively with

Table 4
Comparison of VAS pain scores of Su Jok + aromatherapy group according to selected clinical variable.

	VAS_1	VAS_2	VAS_3	Test Values	Difference
Number of births					
Primiparous (n = 5)	6,00 ± 1,41	5,00 ± 2,09	4,90 ± 1,94	x ² F = 7538 p = 0,023	1 > 2,3
Multiparous (n = 25)	5,32 ± 2,58	4,50 ± 2,85	4,46 ± 2,65	x ² F = 25,213 p = 0,000	1 > 2,3
Test Values	U = 923 p = 0,584	U = 973 p = 0,851	U = 992 p = 0,958		
Factors possibly associated with pain					
Presence of intestinal gas ^a (n = 12)	6,66 ± 2,04	6,45 ± 2,09	6,20 ± 1,93	x ² F = 3263 p = 0,196	1,2,3
Position and movement ^p (n = 8)	5,25 ± 2,12	4,12 ± 2,01	4,31 ± 1,62	x ² F = 12,080 p = 0,002	1 > 2,3
^a Other ^o (n = 10)	4,10 ± 2,51	2,70 ± 2,54	2,70 ± 2,54	x ² F = 20,00 p = 0,00	1 > 2,3
Test Values and Difference	KW = 5943 p = 0,051 g,p,o	KW = 10,951 p = 0,004 g > p,o	KW = 10,462 p = 0,005 g > p,o		
Pain Character					
Continuous (n = 12)	6,54 ± 2,46	5,62 ± 2,77	5,75 ± 2,52	F = 10,182 p = 0,006	1 > 2,3
Intermittent (n = 18)	4,69 ± 2,16	3,88 ± 2,51	3,72 ± 2,24	F = 22,769 p = 0,00	1 > 2,3
Test Values	U = 64,00 p = 0,060	U = 66,5 p = 0,076	U = 58,00 p = 0,033		

Between-group comparisons with *t*-test (t); Mann-Whitney *U* test (U), and Kruskal-Wallis test (KW). Within-group comparisons performed using repeated measures ANOVA (F) with post-hoc Bonferroni correction and Friedman test (x²F).

^a Coughing, noise, eating, breastfeeding.^o

each assessment, and the intervention was found to have a moderate effect on reducing pain intensity. The effect of Su Jok is explained as the removal of blockages in the flow of energy by stimulating certain points, thereby promoting energy flow [29,30]. At the same time, buckwheat seeds were used in this study. It is argued that since seeds give life to plants, there is a great energy inside them and this energy is a life-giving source that is in constant exchange with the external environment [30]. Su Jok may have been effective both because of the energy of the seed and because it cleared the energy blockage.

As a result of Nurjannah and Hariyadi's (2021) retrospective study with 101 people, Su Jok was found to be an effective method in reducing pain in the abdomen, arm, back, extremity, head, hip, neck, scapula and shoulder. Rajput (2019) applied Su Jok to reduce pain during vaccination in infants and determined that the application was effective in reducing pain. In the study of Kamavosyan (2020), it was determined that Su Jok reduced chronic migraine pain, and in the study of Nazilla et al. (2021), headache.

Tores et al. [36] reported that Su Jok reduced pain severity in their study of patients with periarthritis, while Cruz and Munoz [31]

Table 5
Comparison of VAS pain scores of control group according to selected clinical variable.

	VAS_1	VAS_2	VAS_3	Test Values	Difference
Number of births					
Primiparous (n = 5)	4,60 ± 1,67	4,20 ± 2,16	4,60 ± 1,94	x ² F = 1077 p = 0,584	1,2,3
Multiparous (n = 25)	4,48 ± 2,23	4,56 ± 2,39	4,62 ± 2,46	x ² F = 0,839 p = 0,657	1,2,3
Test Values	U = 56,50 p = 0,733	U = 55,50 p = 0,693	U = 60,50 p = 0,911		
Factors possibly associated with pain					
Presence of intestinal gas ^a (n = 13)	5,46 ± 2,47	5,38 ± 2,66	5,50 ± 2,61	x ² F = 1200 p = 0,549	1,2,3
Position and movement ^p (n = 7)	3,00 ± 1,41	3,14 ± 1,95	3,28 ± 2,28	x ² F = 0,154 p = 0,926	1,2,3
^a Other ^o (n = 10)	4,30 ± 1,41	4,30 ± 1,70	4,40 ± 1,64	x ² F = 0,500 p = 0,779	1,2,3
Test Values and Difference	KW = 6427 p = 0,040 p < g,o	KW = 4539 p = 0,103 g,p,o	KW = 4722 p = 0,094 g,p,o		
Pain Character					
Continuous (n = 8)	6,25 ± 2,37	6,25 ± 2,37	6,25 ± 2,37	F = -- p = --	1,2,3
Intermittent (n = 22)	3,86 ± 1,67	3,86 ± 2,00	4,02 ± 2,09	F = 1273 p = 0,529	1,2,3
Test Values	U = 36,00 p = 0,013	U = 40,50 p = 0,024	U = 45,00 p = 0,042		

Between-group comparisons with *t*-test (t); Mann-Whitney *U* test (U), and Kruskal-Wallis test (KW). Within-group comparisons performed using repeated measures ANOVA (F) with post-hoc Bonferroni correction and Friedman test (x²F).

Analysis of VAS pain scores in the intervention and control groups showed that pain levels were moderate, with no significant difference in pain intensity between the groups (p > 0.005) [51,52]. Although the difference was not statistically significant, it is noteworthy that the control group had lower mean VAS scores in the first assessment compared to the intervention groups. When the VAS scores were examined within the groups, the control group showed a slight increase in pain intensity in the third assessment, but there was no significant difference in mean VAS scores (p > 0.005).

^a Coughing, noise, eating, breastfeeding.^o

performed Su Jok on patients with tension headache and observed reduced pain severity and frequency in 80% of the patients. In a quasi-experimental study conducted by Perez et al. [33], severe pain was reduced after Su Jok therapy in 148 patients with severe knee pain due to various deformations. Other studies suggested that Su Jok reduces pain in various conditions such as heel spur pain, pelvic pain caused by hydrosalpinx, cervicalgia, dysmenorrhea pain, acute alveolar abscess pain, chest pain and neck pain [34,35,37,39,43–45,47]. Our findings support the literature.

Similar to the Su Jok group, the mean pain scores of participants in the aromatherapy group decreased in the second and third assessments,

Table 6

Within-group and between-group comparisons of mean VAS pain scores.

	Control ^a (n = 30)	Su Jok ^b (n = 30)	Aromatherapy ^c (n = 30)	Su Jok + Aromatherapy ^d (n = 30)	Test Values	Difference
VAS 1	4.50 ± 2.12	4.80 ± 2.06	5.30 ± 2.32	5.61 ± 2.23	F = 1.135 p = 0.338	a,b,c,d
VAS 2	4.50 ± 2.33	3.95 ± 2.25	4.53 ± 2.48	4.90 ± 2.61	F = 0.451 p = 0.717	a,b,c,d
VAS 3	4.61 ± 2.35	3.50 ± 2.39	4.36 ± 2.54	4.71 ± 2.34	F = 1.387 p = 0.250	a,b,c,d
Test Values and Difference	F = 0.458 p = 0.534 1,2,3	F = 15.21 p = 0.000 1 > 2>3	F = 10.69 p = 0.001 1 > 2,3	F = 15.78 p = 0.000 1 > 2,3		

Between-group comparisons performed using one-way ANOVA (F). Within-group comparisons performed using repeated measures ANOVA (F) with post-hoc Bonferroni correction.

Table 7

Effects of Su Jok and aromatherapy on post-cesarean pain intensity.

	Su Jok (n = 30) d	Aromatherapy (n = 30) d	Su Jok + Aromatherapy (n = 30) d
VAS 1 vs. 2	0.39	0.32	0.29
VAS 1 vs. 3	0.67	0.38	0.40
VAS 2 vs. 3	0.28	–	–

*Cohen's d effect size: Small 0.2; Medium 0.5; Large 0.8; Very large 1.3.

and the intervention had a moderate effect. Lavender essential oil was mostly preferred by the patients. Aromatherapy applied by inhalation is the fastest route for essential oils to act due to the anatomic proximity and relationship between the nasal cavity and brain. Various volatile compounds in essential oils are transmitted to the limbic system through the nose. Essential oils that affect the limbic system can act as peripheral modulators through autonomous pathways, and may elicit responses such as relaxing, sedative, or stimulatory effects. The citronellol found in rose and eucalyptus essential oils and the linalool in lavender oil are sedative components [58,59]. The pain-reducing effect of aromatherapy interventions is believed to occur via this mechanism. The findings reported in the literature are similar to those in this study. In their systematic review of randomized controlled trials of postoperative pain management techniques, Dimitriou et al. [24] reported that lavender oil significantly reduced postoperative pain intensity after cesarean section. As a result of the aromatherapy application of Aparyanti (2017) using lavender oil to reduce the severity of pain after cesarean section, the pain severity of the experimental group was significantly lower than the control group; beta endorphin levels were also found to be significantly higher in favor of the experimental group [14]. Studies on post-cesarean pain relief indicated that aromatherapy was effective in reducing pain [12,13,58].

As in the Su Jok and aromatherapy groups, mean pain scores also decreased in the group that received Su Jok and aromatherapy simultaneously. The effect size was also moderate, suggesting that aromatherapy and Su Jok performed in combination also decreased pain severity but not to a greater extent than the interventions performed separately.

5. Conclusion

The results of this study suggest that Su Jok and aromatherapy performed separately or together in addition to routine medical treatment are moderately effective in reducing pain after cesarean section. These methods can easily be applied by caregivers to reduce post-cesarean pain and we recommend their use.

Study limitations

A limitation of this study is that the complementary interventions could be performed only once, and we were not able to evaluate their long-term effects. In addition, the results are limited to our sample of women who underwent cesarean section with regional anesthesia and cannot be generalized to the general population.

Implications for nursing practice

Nurses can independently apply these methods as a complementary therapy for patients with pain.

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CRediT author contribution statement

Hülya Elmalı Şimşek: Conceptualization, Data curation, Formal analysis, Methodology, Investigation, Writing - original draft, Writing - review & editing.

Şule Ecevit Alpar: Conceptualization, Methodology, Investigation, Supervision, review & editing.

Declaration of competing interest

There are no conflicts of interest to disclose with respect to the research, authorship, and/or publication of this article.

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