Received: 11 March 2022 | Revised: 22 July 2022 | Accepted: 7 August 2022

DOI: 10.1002/nop2.1331

RESEARCH ARTICLE

NursingOpen Open Access WILEY

Does immediate skin-to-skin contact at caesarean sections promote uterine contraction and recovery of the maternal blood haemoglobin levels? A randomized clinical trial

José Miguel Pérez-Jiménez[1] | Manuel Luque-Oliveros[2] | Diego Gonzalez-Perez[3] | Adriana Rivera-Sequeiros[4] | Cleofás Rodriguez-Blanco[2]

[1]Departamento de Enfermería, Faculty of Nursing, Physiotherapy, and Podiatry, Hospital Universitario Virgen Macarena, University of Sevilla, Sevilla, Spain

[2]Universidad de Sevilla, Sevilla, Spain

[3]Universidad Pablo de Olavide, Sevilla, Spain

[4]Hospital Universitario Virgen Macarena, Sevilla, Spain

Correspondence
José Miguel Pérez-Jiménez, Departamento de Enfermería, Faculty of Nursing, Physiotherapy, and Podiatry, Hospital Universitario Virgen Macarena, University of Sevilla, Sevilla, Spain.
Email: jpjimenez@us.es

Abstract

Aim: We analysed whether immediate skin-to-skin contact between the healthy newborn and the mother after a caesarean section has a modulatory role on postpartum haemorrhage and uterine contraction.

Design: Unblinded, randomized clinical trial, simple random sampling, conducted in women undergoing caesarean sections.

Methods: Of the population identified, the caesarean section total ($N = 359$), 23.2% ($N = 83$) met the inclusion criteria: scheduled caesarean section, accepting skin-to-skin contact, good level of consciousness. They were randomly allocated to the intervention group, skin-to-skin contact ($N = 40$), and to the control group, usual procedure ($N = 40$). There were three losses. Clinical variables: plasma haemoglobin, uterine contraction, breastfeeding, postoperative pain, were measured, and subjective variables: maternal satisfaction, comfort, comparison with previous caesarean section and newborn crying.

Results: Women with skin-to-skin contact had greater uterine contraction after caesarean section. The maternal plasma haemoglobin levels at discharge were significantly higher. It was associated with higher breastfeeding rate, satisfaction, comfort levels and with less maternal pain and less crying in the newborn.

KEYWORDS
caesarean section, erythrocyte index, newborn, postpartum haemorrhage, skin-to-skin contact, uterine contraction

1 | INTRODUCTION

The caesarean section practice is increasing exponentially, accounting for 21% of all deliveries (WHO, 2019). In total, 35% of all maternal deaths (MDs) are caused by postpartum haemorrhage (PPH), blood loss >500 ml in vaginal deliveries and >1000 ml in caesarean deliveries (Rivera Fumero et al., 2020). The caesarean group is the highest risk group, due to the type of abdominal surgery and for having a lower amount of circulating oxytocin, a hormone that favours uterine contractility (Mogrovejo, 2021). In 80% of the cases, early postpartum haemorrhage, which occurs in the first 24 h, is related to

Trial registration: RBR-67gq6k https://ensaiosclinicos.gov.br/rg/RBR-67gq6k/ **Trial identification number:** UTN: U1111-1238-8710

uterine atony, generally the most severe (loss of uterine muscle tone due to inadequate contraction of the myometrial cells in response to lack of endogenous oxytocin released after the caesarean section, causing a delay in involution of the uterus). In normal deliveries, a strong uterine contraction occurs to close its blood vessels. Thanks to this contraction, bleeding is minimal in the mother (López-García et al., 2017).

Currently, it is a common practice to separate the mother from her newborn after a caesarean section; therefore, immediate Skin-to-skin (SSC) is not performed (Kollmann et al., 2017). This exerts a negative influence on the recovery of uterine contractility and causes an increased risk of postpartum haemorrhage (PPH) (Fernández-Cañadas, 2018). It is therefore advisable to perform an immediate SSC, as there is an increase in oxytocin and beta-endorphins in the mother, which favours uterine contraction and colostrum ejection (Boyd, 2017). Immediate early skin-to-skin contact consists of placing the naked newborn in prone position on the mother's naked torso as soon as it is born or shortly after that moment (Moore et al., 2016). Epigenetic changes in stress regulation systems have been found in newborns due to separation from the mother after birth (Moore et al., 2016). This fact is related to an increase in the expression of genes that synthesize certain molecules and hormones (cortisol, adrenaline, etc.) from the brain and adrenal gland. This explains why it slows the recovery of the mother and baby, delays recognition of the mother and can create a weak bond between mother and child which, however, can be reversible with a loving and nurturing environment, thanks to SSC (Luby et al., 2020). Currently, considering the weight of the existing evidence and in the context of the caesarean surgical process, there are few data on the relationship between immediate CSS in caesarean sections and postpartum haemorrhage. In this sense, our main objective is to analyse whether immediate skin-to-skin contact between the healthy newborn and the mother after a scheduled caesarean section favours uterine contraction on leaving the postanesthesia room and recovery of the maternal blood haemoglobin levels on the third hospitalization day. We will also study the relationship of this technique with other variables such as breastfeeding, pain, maternal satisfaction and newborn crying.

2 | METHOD

This study has been designed following the CONSORT guideline for clinical trials (Cobos-Carbó & Augustovski, 2011). A randomized, unblinded and randomized clinical trial was conducted with women subjected to caesarean sections in the Gynaecology and Obstetrics service of a tertiary-level public hospital.

Was approved by the hospital's Ethics and Clinical Research Committee and by the Bioethics Committee. The study complied with the principles set forth in the Declaration of Helsinki, with Organic Law 3/2018, of December 5th, on Personal Data Protection and Guarantees of Digital Rights, and with Law 41/2002, of November 14th, Basic Regulatory Law on Patient Autonomy and Rights and Obligations about Clinical Information and Documentation. All patients were informed in writing by means of an informed consent form. The study was conducted in accordance with the requirements of Law 14/2007, of July 3, 2007, on Biomedical Research, and is pertinent. It is aimed at women who are to undergo caesarean sections; therefore, we do not consider sex/gender differences. The authors were committed to sharing the research data in any of the necessary cases to provide openness, transparency and reproducibility of the research. The assay registration number was RBR-67gq6k and the assay identification number: UTN: U1111-1238-8710. The research is developed in patients with caesarean section from January 1, 2019 through November 31, 2019, at the Hospital Universitario Virgen Macarena, a public hospital located in the Spanish city of Seville. It is one of the highest-ranking regional hospitals in the Andalusian Public Health System. It has a health care, research and teaching function and provides health care to a total population of 480,000 people.

Inclusion criteria: Pregnant women aged from 20–40 years old, with fetal presentations not compatible with vaginal delivery (breech), cephalopelvic disproportion that would prevent vaginal delivery, with the previous placenta that prevent vaginal delivery, caesarean sections that must be repeated due to persistence of the previous indication or to the emergence of a new one, different from the one that motivated the previous intervention. - Women whose newborns are immediately assessed by the neonatologist as healthy children and with Apgar test assessment at 5 minutes ≥9. - Caesarean section between 37–41 gestational weeks. - Pregnancy and immediate postpartum without fetal alterations or malformations, of any nature and aetiology, must be recorded in the clinical history.

Exclusion criteria: Women whose caesarean section process has been complicated by a serious pathology (cardiac, metabolic, respiratory disease, etc.). Urgent caesarean sections (umbilical cord prolapse, premature placental detachment, previous placenta with abundant bleeding, suspected fetal distress, suspected uterine rupture).

The main limitation of this study was that we were not able to attend to urgent caesarean deliveries, since we did not have a place that would give us the security to avoid serious complications in this type of caesarean delivery.

HIGHLIGHTS

- Skin-to-skin contact reduces morbidity and mortality at cesarean section
- At cesarean section, skin-to-skin contact accelerates uterine contraction
- Skin-to-skin contact prevents obstetric hemorrhage at cesarean section
- Skin-to-skin contact increases cesarean section satisfaction and comfort levels
- Skin-to-skin contact at cesarean section decreases newborn crying

2.1 | Randomization and blinding methods

The selection of the sample was established through simple random sampling. Patients with a diagnosis of caesarean section were recruited for the clinical trial when they were in the high-risk consultation for pre-evaluation of their process. They were informed of the study by the research team members and were offered to participate in the study. Patients who met the inclusion criteria, who were informed, voluntarily agreed to participate, and gave their signed consent were included in the study. In the Research Unit, they were anonymized by means of a table in which an order number was assigned to their clinical history, which served as identification.

Participants were assigned by permuted randomization of permuted blocks with a block size of 4. Pregnant women were informed of the results of the randomization upon entering the operating room, at which time they were informed of the results of the randomization.

The pregnant women were informed of the results of the randomization upon entering the operating room, at which time it was impossible to continue with the blinding.

3 | INTERVENTION

Study arms: A or Control Group (no SSC), with the conventional intervention according to the hospital's protocols. After the caesarean section, the mother was transferred to the postanesthesia recovery room while the newborn was taken in a crib to the maternity room with the father or companion. B or Intervention Group (SSC), in which skin-to-skin contact with the newborn was performed from the operating room and continued in a room located in the postpartum unit, in the companion's presence.

3.1 | Experimental group

All members of the surgical team were informed and communicated the circuit to perform a safe SSC. When the baby was born, the cord was clamped and cut. The midwife received the newborn directly from the surgeon. She showed the baby to the mother and allowed her to see and kiss him. The paediatrician confirmed the newborn's good health. The assistant weighed the baby and the nurse measured the baby. The midwife prepared the mother for the SSC and placed the baby on her chest, where he remained for at least 1 h. The midwife positioned herself at the top of the bed. The newborn was positioned so that he could start suckling, crossed on the chest, covered with a warm towel or cloth, avoiding any discomfort to the surgeons to close the surgical wound. The placement of the identification bracelets was performed with the baby on the mother's chest, avoiding other routine activities until the newborn started its first feeding. The baby went in bed with the mother to the postanesthesia recovery room, in this case, located in a postpartum room on the fourth floor, next to the father. The newborn was given vitamin K and eye drops in the mother's arms, always leaving these procedures until last. If at any time the mother reported that she felt uncomfortable with the SSC, the father continued with the SSC, with her prior consent. Always controlling that everything was performed safely.

3.2 | Control group

This group followed the normal protocol in relation to caesarean sections. The mother had no contact with the newborn at the time of delivery, being admitted to the recovery room. Once she was stabilized, she was transferred to the maternity ward to be reunited with the child and the father, who were waiting for her.

The following variables were studied:

Skin-to-skin contact (SSC): when the infant spent at least 1 h after the caesarean section on the mother's torso, from the operating room. Dependent variables: Uterine contraction: uterine contraction level prior to the mother's discharge from the awakening room. The anesthesiologist gently pressed on the mother's abdomen to palpate the uterus, check its firmness and assess whether the uterus is very well contracted at the infraumbilical level or if, on the contrary, it remains at the umbilical or supraumbilical levels. Plasma haemoglobin: it is expressed in g/dl. Blood haemoglobin levels were measured before the caesarean section (Hb1), after the caesarean section at recovery room discharge (Hb2) and on the third hospitalization day (Hb3).

We also measured the difference between Hb3 and Hb1 (Hb loss). The first two determinations were performed with venous capillary blood with an HemoCue Hb 201+ System, that met the quality criteria of the hospital where the study was conducted. The analysis prior to hospital discharge, that of the third day was from venous blood sent to the hospital laboratory. The number of gynecologic pads used to absorb bleeding was also measured. Breastfeeding (BF): it expresses whether the breastfeeding act was effective, evaluated at two points in time: during the first hour after birth (at least 1 h in a row) and at 1 month (the only feeding method is breastfeeding).

Postoperative pain: pain manifestation in the operating room (VAS 1), when the mother arrived in the recovery room (VAS 2) and when she left the recovery room for admission to the recovery room (VAS 3). The VAS scale (Visual-Analog Scale) ranges from 0–10, where 0 is no pain and 10 is unbearable pain. The values were grouped to establish three pain levels, namely: from 1–3, mild pain; from 4–6, moderate pain and from 6–10, severe pain.

Mother's satisfaction degree – SSC: satisfaction with the performance of SSC. A five-point Likert scale was used: Very dissatisfied, Dissatisfied, Neither satisfied nor dissatisfied, Satisfied, Very satisfied. Comparison with previous caesarean section: (Yes, No). In the case of having had a previous caesarean section, the patient was asked to rate whether this was a better experience or not. Newborn crying: (Yes, No). If the newborn cried during SSC in the intervention group or when with the father in the room in the control group.

Newborn Apgar test at 1 and 5 min: expressed in whole numbers. Rapid test at birth by which the paediatrician evaluated Appearance, Pulse, Irritability, Activity and Respiration.

Sociodemographic and clinical variables: Age (in years old). Schooling level (no schooling, elementary school, high school, vocational training [VET], university studies). Mother's and NB's weight: (in kilograms). Height: (in cm). Newborn's gender: (Male or Female). Previous caesarean section: (Yes/No).

Other variables: Medical pathology: The presence of chronic diseases. YES-NO. Obstetric pathology: history of obstetric pathology. YES-NO. Reason for caesarean section: previous caesarean section, anomalies at presentation.

3.3 | Statistical analysis and sample size calculation

To calculate the sample size, the researchers relied on a previous quasi-experimental study conducted in another hospital with patients subjected to caesarean sections. In this study, the 'physiologic stability' and 'maternal/neonatal stress' variables were analysed (Crenshaw et al., 2019). A multivariate adjustment model with a logistic regression model was used to determine the number of participants to participate in the study and to identify potential confounders using Epidat 4.2® and SPSS® 25.0. The size was calculated accepting an alpha risk of .05 and a beta risk of .2 in a bilateral contrast. A common standard deviation of .16 and a correlation coefficient between baseline and final measurement of .61 were assumed.

First, a descriptive analysis of all variables was performed. The qualitative variables were presented by absolute and relative frequencies with confidence intervals. The quantitative variables were presented as mean and standard deviation or as median and interquartile range, depending on whether they followed a normal distribution. In the second stage, a bivariate analysis was performed between the variables that could influence the results, with intention-to-treat. Chi-square or Fisher's exact tests were used for the qualitative variables and the Student's t-test and ANOVA or Mann–Whitney's U and Kruskal–Wallis tests were employed for the quantitative variables, depending on whether they presented normal distribution. To explore the relationship between the dependent variables and the patients' sociodemographic and clinical characteristics, the appropriate tests were used in each situation (Student's t-test, ANOVA, Pearson's correlation coefficient or their non-parametric alternatives if necessary [Mann–Whitney's U, Kruskal–Wallis and Spearman's correlation]). Contrast tests for independent and related samples, respectively, were used for the comparative analysis between the two intervention groups. The statistical significance level was set at a *p*-value below .05. The statistical analysis was performed with the IBM SPSS 21 and R Studio statistical software programs. The graphs were generated in GraphPad Prism 8.

4 | RESULTS

Of the total number of patients with indications for caesarean section ($N = 359$) during the research period, 23.2% (83 women) were recruited because they met the inclusion criteria. There were three losses due to difficulty in postanesthesia recovery, two in the control group and one in the experimental group, leaving 40 participants in each group This investigation has led to the development of a protocol in this hospital that also includes emergency caesarean sections. The descriptive analysis of the variables by the group is presented in Table 1 and the characteristics of the patients included in the study are shown in Table 2. The results obtained show significant differences in the uterine contraction level between the groups, being greater in the SSC group (Figure 1). In the SSC group, women mostly presented uterine contraction at the infraumbilical level, while in the control group it was at the umbilical level.

Regarding serum haemoglobin (Figure 2), the control group presented higher Hb1 values prior to the surgery. Even so, the differences in median Hb3 (pre-discharge) between the two groups were statistically significant, being lower in the control group. Both groups present bleeding and Hb decrease after the caesarean section, but it can be observed how the Hb levels are recovered earlier in the SSC group. A new variable called 'Hb decrease' was calculated, which indicates the difference between the mean Hb before the surgery and immediately before hospital discharge. The mean Hb decrease (Hb3-Hb1) was significantly higher in the control group, indicating higher anaemia levels than in the SSC group and, therefore, more bleeding in the postoperative period in the control group, with significance. To assess bleeding, a count of the gynaecological compresses used as a method to absorb bleeding was also performed. In this regard, differences with clinical relevance emerged. To control bleeding, it was found that, in the women who underwent SSC, two compresses at a time were sufficient, while in the control group, it was necessary to use four or more compresses to control bleeding. The level of Hb decrease (Hb3-Hb1) correlated inversely with the uterine contraction level, relating higher levels of uterine contraction to lower levels of Hb decrease during postoperative caesarean section. The women's Hb decrease according to the uterine contraction level presented differences, being greater at the supraumbilical and umbilical levels. When comparing the Hb decrease means between the groups, adjusting for the uterus contraction levels, the differences remained statistically significant, with a lower decrease in the SSC group, as shown in Figure 3.

Below we show the relationship between skin-to-skin contact and other variables such as breastfeeding, postoperative pain, degree of maternal satisfaction, degree of satisfaction compared to previous caesarean sections and newborn crying.

Pain assessment after arrival in the recovery room (VAS 2), is different in each group. The control group reported severe pain (VAS 6–10) in a higher percentage than the CSS group (see graph 4). Minimal pain (VAS 1–3) was identified in 80% of the women undergoing CSS. Upon leaving the awakening room, there were also significant differences in the frequency of no pain or minimal pain between the two groups (Figure 4).

Breastfeeding (BF) was studied at the initiation of the newborn's contact with the mother, from the operating room in the case of the SSC group and at 4–6 h in the case of the control group. Significant differences were found, as a very low number of newborns in the

TABLE 1 Descriptive analysis of variables by groups

Variable		Control	SSC	*p*
Hb (g/dL)	Hb1[a]	12.787 (1.92)	12.087 (0.98)	.274
	Hb2[a]	11.785 (1.26)	11.63 (1.06)	.593
	Hb3[a]	10.522 (1.24)	11.075 (0.99)	.017
	Hb decrease[a,*]	2.265 (1.28)	1.01 (0.49)	.0001
Uterine contraction	Supraumbilical	3 (7.5%)	0%	
	Umbilical	28 (70%)	3 (7.5%)	.0001
	Infraumbilical	9 (22.5%)	37 (92.5%)	
Breastfeeding at birth	Yes	13 (32.5%)	37 (92.5%)	.0001
Breastfeeding at 1 month	Yes	5 (12.5%)	37 (92.5%)	.0001
Pain	VAS 1[a]	0.78 (1.901)	0.58 (1.796)	.890
	VAS 2[a]	6.23 (2.118)	1.48 (2.112)	.0001
	VAS 3[a]	5.23 (1.776)	0.60 (1.172)	.0001
APGAR 1[b,**]		9 [2]	10 [3]	.008
APGAR 5[b,**]		10 [1]	10 [1]	.694
Previous caesarean section	Yes	10 (25%)	9 (22.5%)	.793
Mother's satisfaction[a]		6.5 (2.407)	9.98 (0.158)	.0001
Newborn crying	No	22 (55%)	36 (90%)	.001

[a]Mean and standard deviation M (SD). We consider a homogeneous sample.

[b]Median [range].

*Hb decrease difference between Hb3 and Hb1.

**Newborn crying test after birth (at 1 min, at 5 min). All newborns are healthy to perform SSC.

TABLE 2 Demographic and baseline data by groups

Variable	Control	SSC	*p*
Age (years old)[a]	33.125 (3.57)	33.2 (3.16)	.921
Height (cm)[a]	166.25 (6.77)	163.25 (5.86)	.037
BMI[a]	31.69 (4.59)	32.59 (5.5)	.430
Level of studies			
Basic	23 (57.5%)	9 (22.5%)	
Medium	5 (12.5%)	25 (62.5%)	.0001
High	12 (30%)	6 (15%)	
Mother's weight (kg)[a]	87.23 (11.16)	86.55 (13.27)	.840
Newborn's weight (g)[a]	3512.7 (812.34)	3616.2 (466.95)	.025
Newborn's gender			
Male	31 (77.5%)	20 (50%)	.011
Female	9 (22.5%)	20 (50%)	
Other variables			
Medical pathology[b]	31 (77.5%)	25 (62.5%)	.143
Obstetric pathology[c]	9 (22.5%)	15 (37.5%)	.823

[a]Mean and standard deviation M (SD). We consider a homogeneous sample.

[b]Hypothyroidism, goitre, psoriasis, migraines.

[c]Curettage or abortion, gestational diabetes, poor obstetric history, polycystic ovaries.

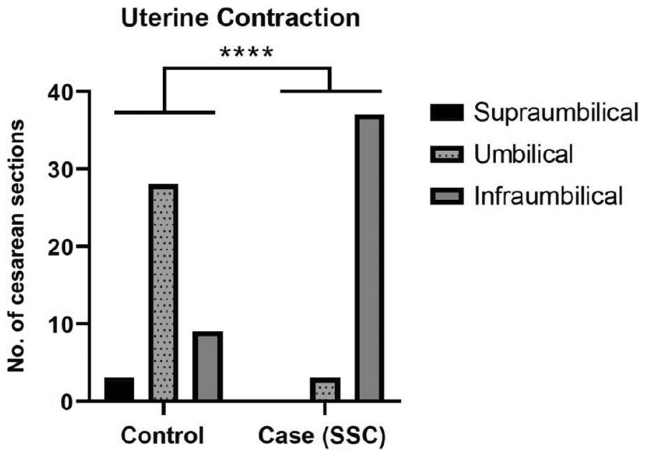

FIGURE 1 Effect of SSC on uterine contraction. Comparison of the uterine contraction level in women subjected to caesarean sections between the case group (SSC) and the controls. Greater uterine contraction is observed in caesarean sections with SSC. The Chi-square statistical test was performed. $N = 40$ in each group. ****$p \leq .0001$

control group initiated breastfeeding at their first contact with the mother, compared to those in the SSC group. The odds ratio shows that the proportion of women who breastfeed in the first hour after delivery is higher in those who undergo SSC compared to those who do not, as can be seen in Figure 5. Analysing BF at 1 month, significant differences also appear ($p < .001$). In the SSC group, 80%

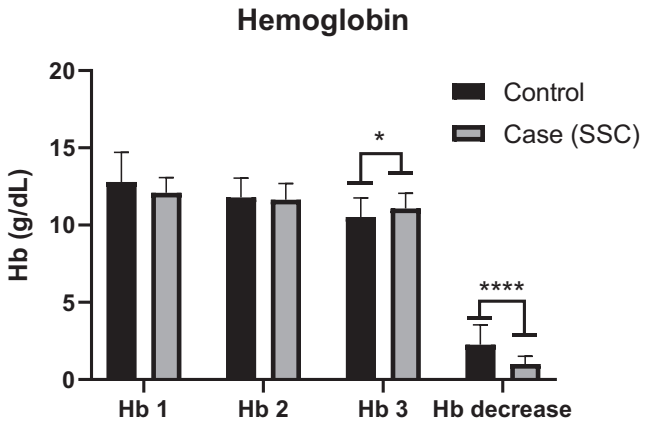

FIGURE 2 Evolution of maternal plasma haemoglobin levels. Evolution of maternal serum haemoglobin during the hospital caesarean section process. Hb1: plasma haemoglobin concentration prior to caesarean section. Hb2: Hb concentration at recovery room discharge. Hb3: Hb concentration at hospital discharge. Hb values decrease throughout the surgical process, being more evident at the end of this process in women who do not undergo SSC. Mann–Whitney's U non-parametric test was performed. Mean and standard deviation are shown. $N = 40$ in each group. $p \leq .0001$

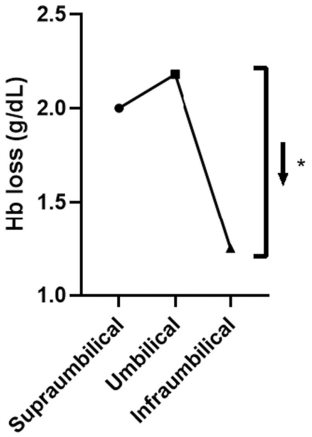

FIGURE 3 Correlation between Hb decrease (Hb3-Hb1) and uterine contraction level. Haemoglobin loss depends on the uterine contraction level, with lower values corresponding to the infraumbilical level. Significant differences ($p < .05$) in the total sample. If we divide the sample between the intervention and control groups, the difference in means is not significant. However, the haemoglobin loss levels in relation to uterine contraction, although not statistically significant, are still lower in the group undergoing SSC. The test used was one-factor ANOVA

of the newborns continued with BF, while in the control group the percentage was only 9%. Likewise, in the control group, there was also a decrease in BF maintenance at 1 month in the newborns that did have effective BF (32.5% BF at initiation vs. 12.5% BF at 1 month). The proportion of women breastfeeding at 1 month from birth was 83.33 (1/.012) times higher among those with SSC than in those not undergoing SSC. The newborn's good health status was assessed through crying, in the presence of the parents performing SSC or alone with the father/companion, in the control group, until the mother arrived from the recovery room. There are significant

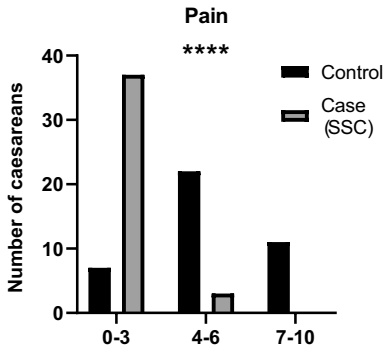

FIGURE 4 Comparison of the pain sensation measured with VAS (visual analog scale) at exit to the recovery room, between the case group (SSC) and the controls. The values are grouped into three numerical intervals: 0–3 (mild pain), 4–6 (moderate pain) and 7–10 (intense pain). The Chi-square statistical test was performed. It can be seen how the pain sensation is moderate in women who do not undergo SSC. $N = 40$ in each group. $^{****}p \leq .0001$

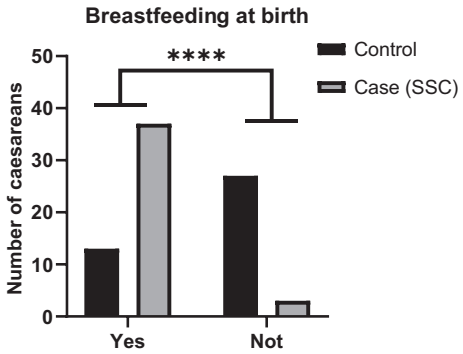

FIGURE 5 Analysis of the effectiveness of breastfeeding in the first hour after birth. The Chi-square statistical test was performed. It can be seen how breastfeeding is more effective in the group of women who undergo SSC. $N = 40$ in each group. $^{****}p \leq .0001$

differences between the two groups ($X^2 = .031$). In total, 90% of the newborns did not cry in the SSC group, when compared to 45.4% in the control group. It is worth mentioning that these newborns in the SSC group also did not cry when receiving intramuscular vitamin K, both during SSC and during BF. The women were asked to rate, using a Likert-type scale, the degree of satisfaction with the comfort felt in the recovery room, where 0 is very dissatisfied and 10 is very satisfied. In total, 90% of the women in the SSC group indicated a grade of 10, very satisfied, when compared to 36.3% in the control group, with a significant difference of $p = .096$. Regarding satisfaction in general, the women in the SSC group equally rated their experience with the highest score (satisfaction = 10, very satisfied). In the case of the women who have had a previous caesarean section (30% SSC group, 27.2% control group), they were asked to rate their current experience when compared to the previous one. All the pregnant women in the SSC group attributed a score of 10, very satisfied, with this SSC technique when compared to the previous caesarean section, without SSC. The women were asked to rate, using a Likert-type scale, the degree of satisfaction, where 0 is very dissatisfied and 10 is very satisfied. The women in the SSC group

indicated that they were very satisfied versus those in the control group, who were less satisfied. Women who had had a previous caesarean section (30% SSC group, 27.2% control group) were asked to rate their current experience compared to their previous experience. All pregnant women in the SSC group attributed a score of 10, very satisfied, to this SSC technique compared to the previous caesarean section, without SSC.

5 | DISCUSSION

The present study shows that all women who underwent skin-to-skin contact achieved faster uterine contraction in the recovery room and had better recovery of plasma haemoglobin levels 3 days after hospitalization. This fact influenced the accelerated recovery of the health status after the caesarean section. To date, most of the published research on SSC has been conducted on normal deliveries or on other variables. A study by Kollmann et al. (2017) whose objective was to investigate the impact of intraoperative bonding (early skin-to-skin contact) after caesarean sections on neonatal adaptation and stress response, points out that there is a cause-effect relationship with SSC; however, no data have been found relating this technique to serum Hb levels and uterine contraction. This study shows that the relationship between SSC and uterine contraction is significant, as Boyd points out in 2017: that skin-to-skin contact increases the levels of maternal oxytocin and beta-endorphins, and that this favours uterine contraction (Boyd, 2017). A team from their institution conducted a quality improvement project to implement a care standard, but they do not demonstrate that it favours the recovery of the mother's health status in terms of the uterine contraction and its consequent effect on the prevention of obstetric haemorrhage by favouring recovery of the Hb values. However, this study does, which is very important, especially for those pregnant women who start with lower-than-normal Hb levels. Another study by Espinoza Quinteros, in 2020, refers to the prevention of obstetric haemorrhage with SSC, but in normal deliveries; moreover, his study is of an exploratory type and qualitative approach, in which interviews were used to learn about satisfaction about the experience (Espinoza et al., 2021). We know that women subjected to caesarean sections presented less circulating oxytocin, a hormone that assists in the bonding and recovery process; therefore, immediate SSC becomes more necessary for this cohort of women. This evidence is supported by Costa Romero, in 2019, although not based on quantitative data; they only point out the importance of this technique and propose a model of action (Costa Romero et al., 2019). In this study, it is also shown that there was a dependence between SSC and breastfeeding in the first hour after delivery and at 1 month and their effect on uterine contraction. In a 2016 Cochrane review, it is also noted that women who undergo SSC after caesarean deliveries are probably more likely to breastfeed successfully, although the analyses were based only on two trials and few women. The evidence was insufficient to determine whether skin-to-skin contact might improve breastfeeding at other times after a caesarean section (Moore et al., 2016). About the perception of maternal postoperative pain, it was lower for women who experience SSC, once they arrive at the recovery room. This fact was studied by Kollmann et al., although only inside the operating room, and the data were inconclusive (Kollmann et al., 2017).

We saw that the level of patient satisfaction, regarding SSC, is highly rewarding. These data were consistent with another paper noting that women who initiated skin-to-skin contact during the surgery were more satisfied with the experience and had lower salivary cortisol levels over time (Crenshaw et al., 2019). There is evidence of a relationship between undergoing a caesarean section and depressive symptomatology (Xie et al., 2011); however, Sword et al. (2011) provide conflicting results on this topic. All the women who underwent SSC in the presence of their companion and who had a previous caesarean section without SSC or companion stated that they had felt a better experience with the most recent caesarean section due to the contact with the infant after birth and that it improved their relationship with their newborn. They stated that they were happy to have the opportunity to immediately bond with their newborns. Brüggemann et al. point out that the presence of a companion during labour, intrapartum and immediate postpartum has been recommended by the WHO, although they do not mention SSC (Brüggemann et al., 2015). This tendency was reinforced by the comments made by the mothers: '…for me it has been the best experience of my life…much better than the previous cesarean section…I came down when I saw that I was alone…nervous and anxious, I only saw it for a second…it is normal that they provide a space…as it's a joy…I would've liked to be with them…it's much better and more relaxing than the first one'. About the crying of the newborns, it was shown that those who underwent SSC in the operating room reached a level of total tranquillity when compared to those who wait for their mother in the room. Infants who remained with their fathers, waiting for the mother to arrive from the recovery room, were restless and cried in most cases. This statement is supported by several authors who detail that, in healthy term newborns, SSC is associated with increased breastfeeding frequency and duration, and it appears to exert a beneficial effect on crying time and cardiorespiratory stability (Rivera Fumero et al., 2020; Sanchez et al., 2009). Our study has quantified and demonstrated this. The basis of our study is a randomized clinical trial, with quantitative data. To date, studies on early SSC of newborns collect little such data (Mörelius et al., 2015; Zwedberg et al., 2015). In a study that is not a clinical trial, conducted with caesarean sections, the author notes: '…it would be interesting to repeat this work with an experimental design (clinical trial) for further research…in hospitals where mother-infant separation routines still exist during cesarean sections (for whatever reason) and to assess whether the results are consistent with those of this study' (Rengel-Días, 2012). Early SSC has not yet been adopted as a healthcare practice standard for healthy term infants in most scheduled caesarean sections, the reason why this occurs is currently unknown (Hanson & Gluckman, 2016). In a 2016 systematic review by Moore, Anderson, Bergman and Dowswell, it is stated that SSC should be initiated immediately after birth in vaginal

deliveries and as soon as the mother is alert and responsive after the caesarean delivery. In the Implications for Research section, they note that '…more research is needed on the effects of early skin-to-skin contact in mothers who deliver by cesarean section', 'Women who deliver by cesarean section may benefit from early SSC, but more studies are needed to confirm this' (Moore et al., 2016). In this context, our study contributes to scientific knowledge with key information to reduce maternal morbidity and mortality rates in mothers who have undergone scheduled caesarean sections. This fact is related to greater stability in the mothers, as they reduce the risk of postpartum haemorrhage. Therefore, it is more advantageous not to separate mother and child in the first hours after this surgery. The authors, Dalbye et al. (2011), noted that providing opportunities for mothers to engage in skin-to-skin contact immediately after a caesarean birth is evidence-based Nursing practice and represents a new expert patient care model for mothers and their newborns (). If maternity hospitals do not provide immediate SSC after caesarean sections, many women and their newborns may miss out on the potential benefits conferred by SSC (Stevens et al., 2014). Techniques such as the caesarean section should not preclude performing SSC from the operating room since, as we have seen while conducting this study, it can be done with no difficulty. However, an important limitation we have had is that the hospital facilities were not 100% prepared to perform this technique. Skin-to-skin contact in women subjected to caesarean sections increases uterine contraction and favours the recovery of maternal plasma haemoglobin levels at the time of hospital discharge. It is possible to perform it from the operating room and facilitates higher success rates in immediate breastfeeding and in breastfeeding maintenance during the first month after the birth of the newborn. It is related to greater feelings of satisfaction for the mother; they feel less pain and their newborns are calmer because they cry less.

6 | LIMITATIONS

The main limitation has been the impossibility of having the hospital's postanesthesia recovery room available and the need to adapt a postpartum room so that the mother, her newborn and the companion could stay together.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICAL APPROVAL

This article was approved by the hospital's Ethics and Clinical Research Committee and by the Bioethics Committee. The study complied with the principles set forth in the Declaration of Helsinki, with Organic Law 3/2018, of December 5th, on Personal Data Protection and Guarantees of Digital Rights, and with Law 41/2002, of November 14th, Basic Regulatory Law on Patient Autonomy and Rights and Obligations regarding Clinical Information and Documentation. All patients were informed in writing by means of an informed consent form. The study was conducted in accordance with the requirements of Law 14/2007, of July 3, 2007, on Biomedical Research, and is pertinent. It is aimed at women who are to undergo cesarean sections; therefore, we do not consider sex/gender differences. The authors were committed to share the research data in any of the necessary cases to provide openness, transparency and reproducibility of the research. The assay registration number was RBR-67gq6k and the assay identification number: UTN: U1111-1238-8710

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

PATIENT OR PUBLIC CONTRIBUTION

This study was designed following the CONSORT guideline for clinical trials. A randomized, unblinded clinical trial was conducted with women subjected to caesarean sections in the Gynaecology and Obstetrics service of a tertiary-level public hospital. The patients were divided into two groups: A or Control Group (no SSC), with the conventional intervention according to the hospital's protocols. After the caesarean section, the mother was transferred to the postanesthesia recovery room while the newborn was taken in a crib to the maternity room with the father or companion. B or Intervention Group (SSC), in which skin-to-skin contact with the newborn was performed from the operating room and continued in a room located in the postpartum unit, in the companion's presence.

ORCID

José Miguel Pérez-Jiménez https://orcid.org/0000-0002-5648-9365
Manuel Luque-Oliveros https://orcid.org/0000-0003-4346-617X
Diego Gonzalez-Perez https://orcid.org/0000-0002-5029-2289
Adriana Rivera-Sequeiros https://orcid.org/0000-0001-5950-5183
Cleofás Rodriguez-Blanco https://orcid.org/0000-0002-8674-9180

REFERENCES

Boyd, M. M. (2017). Implementing skin-to-skin contact for cesarean birth. *AORN Journal*, *105*, 579–592.

Brüggemann, O. M., Ebele, R. R., Ebsen, E. S., & Batista, B. D. (2015). In vaginal and cesarean deliveries, a companion is not allowed in the room: Discourses of nurses and technical directors. *Revista Gaúcha de Enfermagem*, *36*, 152–158.

Cobos-Carbó, A., & Augustovski, F. (2011). Declaración CONSORT 2010: actualización de la lista de comprobación para informar ensayos clínicos aleatorizados de grupos paralelos. *Medicina Clínica*, *137*(5), 213–215. https://doi.org/10.1016/j.medcli.2010.09.034

Costa Romero, M., Lalaguna Mallada, P., & Díaz Gómez, N. M. (2019). Contacto piel con piel tras un parto por cesárea. Puesta al día y propuesta de actuación [Skin to skin contact after cesarean delivery. Theme update and actuation proposal]. *Revista Española de Salud Pública*, *93*, e201902006.

Crenshaw, J. T., Adams, E. D., Gilder, R. E., DeButy, K., & Scheffer, K. L. (2019). Effects of skin-to- skin care during cesareans: A Quasiexperimental feasibility/pilot study. *Breastfeeding Medicine*, *14*(10), 731–743. https://doi.org/10.1089/bfm.2019.0202

Dalbye, R., Calais, E., & Berg, M. (2011). Mothers' experiences of skin-to-skin care of healthy full-term newborns–a phenomenology study. *Sexual & Reproductive Healthcare*, *2*(3), 107–111.

Espinoza, J.A., Asanza, S., & Malo, M.J. (2021). Contacto piel con piel en épocas del COVID – 19: experiencias maternas en el Hospital Universitario del Río, Cuenca Ecuador, Repositorio institucional de la Universidad del Azuay.

Fernández-Cañadas, A. (2018). Administración de oxitocina y vía del parto: asociación con el cese de la lactancia materna. Tesis Doctoral. Universidad Autónoma De Madrid, Facultad De Medicina, Departamento de Cirugía.

Hanson, M., & Gluckman, P. (2016). Commentary: Developing the future: Life course epidemiology, DOHaD and evolutionary medicine. *International Journal of Epidemiology*, *45*, 993–996.

Kollmann, M., Aldrian, L., Scheuchenegger, A., Mautner, E., Herzog, S. A., Urlesberger, B., Raggam, R. B., Lang, U., Obermayer-Pietsch, B., & Klaritsch, P. (2017). Early skin-to-skin contact after cesarean section: A randomized clinical pilot study. *PLoS One*, *12*(2), e0168783. https://doi.org/10.1371/journal.pone.0168783

López-García, L. F., Ruiz-Fernández, D. P., Zambrano-Cerón, C. G., & Rubio-Romero, J. A. (2017). Incidencia de hemorragia posparto con base en el uso terapéutico de uterotónicos. Resultados maternos en un hospital de mediana complejidad de Bogotá, Colombia. *Revista Colombiana de Obstetricia y Ginecología*, *68*(3), 218–227.

Luby, J. L., Baram, T. Z., Rogers, C. E., & Barch, D. M. (2020). Neurodevelopmental optimization after early-life adversity: Cross-species studies to elucidate sensitive periods and brain mechanisms to inform early intervention. *Trends in Neurosciences*, *43*(10), 744–751. https://doi.org/10.1016/j.tins.2020.08.001

Mogrovejo, C. A. (2021). Proceso de atención de enfermería según la teoría de Marjory Gordon en paciente con hemorragia posparto inmediato (examen complexivo). UTMACH, Facultad De ciencias Químicas Y De La Salud, Machala, Ecuador.

Moore, E. R., Bergman, N., Anderson, G. C., & Medley, N. (2016). Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database of Systematic Reviews*, *11*(11), CD003519. https://doi.org/10.1002/14651858.CD003519.pub4

Mörelius, E., Örtenstrand, A., Theodorsson, E., & Frostell, A. (2015). A randomised trial of continuous skin-to-skin contact after preterm birth and the effects on salivary cortisol, parental stress, depression, and breastfeeding. *Early Human Development*, *91*(1), 63–70. https://doi.org/10.1016/j.earlhumdev.2014.12.005

Organización Mundial de la Salud (2019). Nota descriptiva N°348. Mortalidad materna. [cited February 20, 2021]. https://www.who.int/es/news-room/fact-sheets/detail/maternal-mortality

Rengel-Días, C. (2012). Efecto del contacto piel con piel con padres de recién nacidos por cesárea sobre la lactancia materna. Tesis Doctoral. Universidad de Málaga. Repositorio Institucional de la Universidad de Málaga, RIUMA.

Rivera Fumero, S., Chacón, G. C., & González, C. A. (2020). Hemorragia posparto primaria: diagnóstico y manejo oportuno. *Revista Médica Sinergia*, *5*(6), 2–10. https://doi.org/10.31434/rms.v5i6.512

Sanchez, M., Alonso, C. P., Mussons, F. B., Urcelay, I. E., Conde, J. C., Narbona, E., & Comisión de Estándares de la Sociedad Española de Neonatología. (2009). Recomendaciones para el cuidado y atención del recién nacido sano en el parto y en las primeras horas después del nacimiento. *Anales de pediatría*, *71*(4), 349–361.

Stevens, J., Schmied, V., Burns, E., & Dahlen, H. (2014). Immediate or early skin-to- skin contact after a caesarean section: A review of the literature. *Maternal & Child Nutrition*, *10*(4), 456–473. https://doi.org/10.1111/mcn.12128

Sword, W., Kurtz Landy, C., Thabane, L., Watt, S., Krueger, P., Farine, D., & Foster, G. (2011). Is mode of delivery associated with postpartum depression at 6 weeks: A prospective cohort study. *BJOG*, *118*, 966–977.

Xie, R.-H., Lei, J., Wang, S., Xie, H., Walker, M., & Wen, S. W. (2011). Cesarean section and postpartum depression in a cohort of Chinese women with a high cesarean delivery rate. *Journal of Women's Health*, *20*, 1881–1886. https://doi.org/10.1089/jwh.2011.2842

Zwedberg, S., Blomquist, J., & Sigerstad, E. (2015). Midwives' experiences with mother-infant skin-to-skin contact after a caesarean section: "Fighting an uphill battle". *Midwifery*, *31*(1), 215–220. https://doi.org/10.1016/j.midw.2014.08.014

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Pérez-Jiménez, J. M., Luque-Oliveros, M., Gonzalez-Perez, D., Rivera-Sequeiros, A., & Rodriguez-Blanco, C. (2023). Does immediate skin-to-skin contact at caesarean sections promote uterine contraction and recovery of the maternal blood haemoglobin levels? A randomized clinical trial. *Nursing Open*, *10*, 649–657. https://doi.org/10.1002/nop2.1331