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ARTICLE

The Effect of Preoperative Oral Carbohydrate on Breastfeeding After Cesarean Section: A Double-Blind, Randomized Controlled Clinical Trial

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ABSTRACT

Delay in the initiation of breastfeeding is one of the problems of cesarean section. Its causes are insulin resistance, pain, anxiety, stress, thirst, hunger, and so on. Preoperative oral carbohydrate (OCH) reduces postoperative insulin resistance and improves postoperative recovery. The present study was conducted to evaluate the effect of preoperative oral carbohydrate on breastfeeding after cesarean section. In this double-blind randomized clinical trial, 91 pregnant women who underwent elective cesarean section were randomly assigned to preoperative OCH (Nutricia Preop; $n = 45$) or control group (water flavored with lemon; $n = 46$). The patients ingested 800 ml + 400 ml of liquid before the surgery. The time to first breastfeeding after surgery (min), the duration of breastfeeding (min), and breastfeeding frequency were measured using a questionnaire for up to 36 h after the surgery. Time to first breastfeeding after surgery was significantly shorter in the OCH group than in the control group (27.47 $\pm$ 11.51 vs. 51.96 $\pm$ 20.20 min, $p <$ .001). The mean frequency of breastfeeding (6.14 $\pm$ 0.55 vs. 4.82 $\pm$ 0.46, $p <$ .001) was significantly higher and the mean duration of breastfeeding (116.48 $\pm$ 19.68 vs. 82.13 $\pm$ 12.40 min, $p <$ .001) was significantly longer in the OCH group compared with the control group in the first 36 h after the surgery. Preoperative oral carbohydrate improves breastfeeding after surgery (time to first breastfeeding, breastfeeding frequency, and breastfeeding duration). Further clinical trials and precise measurement tools are needed to assess breastfeeding to confirm these effects. The study was registered at http://www.IRCT.ir (IRCT2016072629082N1).

KEYWORDS
breastfeeding; cesarean section; oral carbohydrate; preoperative

Introduction

Cesarean delivery—also known as a C-section—is a surgical procedure used to deliver a baby through incisions in the mother's abdomen and uterus. Cesarean section is a method for childbirth in critical conditions and should not be regarded as an alternative to vaginal delivery. However, the rate of cesarean section is growing increasingly in the world. Despite the known

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benefits of breastfeeding for mothers and infants, the method of delivery is one of the effective factors for the start and continuation of breastfeeding. Infants born by cesarean section experience significant delay in starting breastfeeding, dehydration, hypoglycemia, increased blood bilirubin, and weight loss (Cakmak & Kuguoglu, 2007; Rowe-Murray & Fisher, 2002; Dewey et al., 2003). Mothers who undergo cesarean section, compared with those experiencing vaginal delivery, will be less successful at breastfeeding (Islami et al., 2008). Factors that have negative effects on breastfeeding in cesarean section include anesthetic drugs, weakness, pain, nausea and vomiting, fatigue, stress, anxiety, thirst, and hunger, which can delay or suppress lactogenesis (Boskabadi et al., 2010). Due to these factors, the mother is not capable of appropriate breastfeeding in the early hours after the surgery. Insulin resistance is a phenomenon central to catabolic states, such as burn injury, accidents, sepsis, and elective surgery (cesarean section). Preoperative fasting also induces insulin resistance (Awad et al., 2013). Moreover, pregnancy is a state of insulin resistance. Insulin regulates milk-producing cells and transfers inhibitory intracellular messages, which reduces production of milk when there is insulin resistance (Lemay et al., 2013).

Preoperative oral carbohydrate (one of the protocols of enhanced recovery after surgery [ERAS], multimodal protocols that are becoming popular in an attempt to modify physiological and psychological responses to surgery) has been shown to reduce preoperative thirst, hunger, anxiety, and nausea (Hausel et al., 2001; Bisgaard et al., 2004). It also reduces insulin resistance by 50%, nausea, vomiting, pain, and nitrogen loss after the surgery (Hausel et al., 2005; Yuill et al., 2005; Soop et al., 2004; Nygren et al., 1998).

It is assumed that oral carbohydrate before cesarean section may have a positive effect on breastfeeding by reducing the negative factors of breastfeeding including thirst, hunger, anxiety, nausea, vomiting, pain, and insulin resistance. There are no data from randomized studies on the effect of preoperative oral carbohydrate on breastfeeding after cesarean section. The aim of the present study was to determine and evaluate the efficacy of preoperative oral carbohydrate after cesarean section on breastfeeding (time to first breastfeeding after surgery, the frequency and mean duration of breastfeeding) in the first 36 hours after surgery.

Participants and methods

Participants

This randomized clinical trial was conducted in Shabihkhani Hospital, Kashan, Iran. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.REC.1395.2636) and registered under the code IRCT2016072629082N1 at the Iranian Center of Clinical Trials (http://www.IRCT.ir). Informed consent was obtained from the selected women undergoing elective cesarean section. From May 2016 through August 2016, 150 individuals were assessed for eligibility of whom 120 agreed to participate in the study. The Consolidated Standards of Reporting Trials (CONSORT) diagram is given in Figure 1.

Inclusion criteria were pregnancy scheduled for elective cesarean section with regional anesthesia (spinal), age 20–35 years, gestational age ≥38 weeks, and body mass index (BMI) 25–37 kg/m^2. Exclusion criteria were a history of gastrointestinal disorders; diabetes mellitus; gastrointestinal surgery (stomach and intestine); liver, kidney, and cardiovascular disorders; complications related to the current pregnancy (preeclampsia, high-risk pregnancy, gestational diabetes mellitus); use of general anesthesia; intraoperative blood loss more than

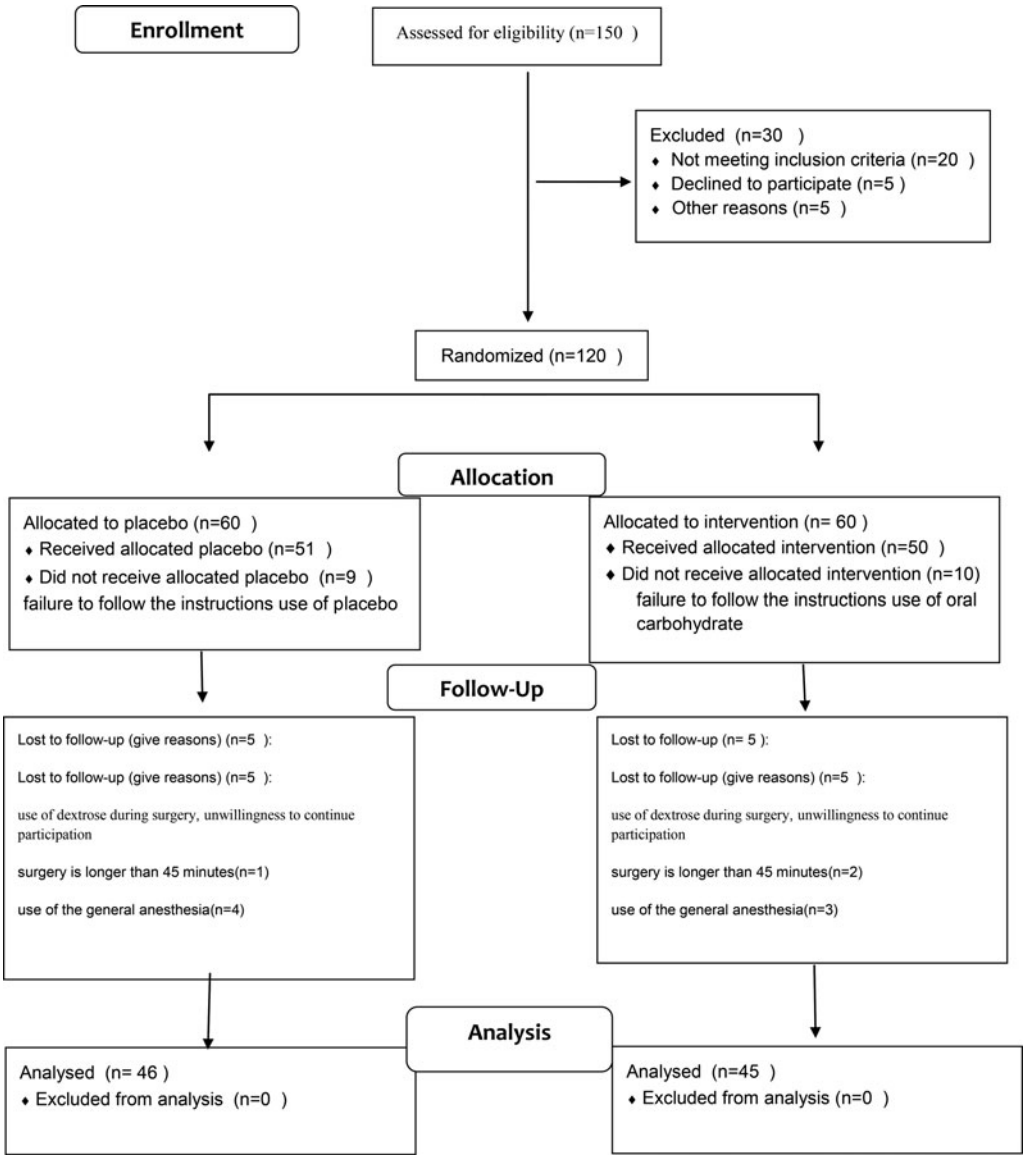

Figure 1. CONSORT diagram for the trial.

1,000 ml; bowel and bladder injury during surgery; use of dextrose during surgery; failure to follow the instructions for the use of oral carbohydrate or placebo; any problem in the baby keeping the mother from breastfeeding; surgery longer than 45 minutes; and unwillingness to continue participation.

Study design

The participants were randomized into two study groups: OCH or flavored water. Randomization was done by applying a table of random numbers. The patients, investigator, nurses, surgeon, and anesthesiologist were all blind to the OCH and placebo. Weight, height, and BMI of the women were measured at the time of admission. Daily intake of energy, carbohydrate, protein, and fat was assessed using a 24-hour recall questionnaire at the time of admission.

OCH and placebo had the same taste and were provided in identical packaging. The OCH group ingested 800 ml of a carbohydrate-rich drink (12.5% carbohydrates, 50 kcal/100 ml, 290 mOsm/kg, pH 5.0, Nutricia Preop; Numico, Zoetermeer, the Netherlands) between 20 and 24 hours before surgery. The control group consumed the same amount of flavored water (0 kcal/100 ml, pH 5.0). There was no food or fluid restriction before midnight. After midnight, the women were allowed no oral intake except another 400 ml of the same drink 2 hours before the initiation of anesthesia in both groups. The participants were similar in terms of the method of anesthesia, drugs used for anesthesia, surgical procedure, and surgeon.

Assessment of breastfeeding

Breastfeeding was assessed by a questionnaire completed by the researcher. The questions included time to first breastfeeding after surgery, breastfeeding frequency up to 36 hours after surgery (divided into 3 sections of 12 hours), and duration of breastfeeding for up to 36 hours after the surgery (divided into 3 sections of 12 hours).

Statistical analysis

Statistical analysis was performed with SPSS version 16 software. The normal distribution of the quantitative variables was assessed using the Kolmogrov-Smirnov test. Quantitative variables are reported as mean and standard deviation (SD) and are compared between the two groups using independent sample *t* test. Qualitative variables are reported as percentage and are compared between the groups using chi-square test.

Results

Of the 120 patients enrolled in the study, 29 patients were lost to follow-up for outcome analysis (Figure 1). Age, weight, height, BMI, gestational age, gravidity, previous cesarean, infant's gender and weight, and daily intake of energy, carbohydrate, protein, and fat are summarized in Tables 1 and 2. There were no statistically significant differences in these variables. There were no complications associated with the intake of OCH or placebo.

Table 1. Demographics and basic information.

Parameter	OCH ($n = 45$)	Placebo ($n = 46$)	*p* value
Age (years)	30.20 (3.37)	29.46 (3.52)	.307
Weight (kg)	81.71 (8.98)	83.33 (8.06)	370
Height (cm)	165.04 (5.75)	167.46 (8.62)	.120
BMI (kg/m^2)	30.09 (3.20)	29.79 (2.45)	.620
Gestational age (weeks)	38.32 (0.42)	38.62 (0.71)	.69
Previous cesarean (*n*)	2.27 (0.86)	1.91 (0.59)	.26
Infant weight (g)	3,306.67 (371.973)	3,397.83 (333.659)	.221
Gravidity (*n*)			
0	9 (20%)	10 (21.7%)	
1	32 (71.1%)	32 (69.6%)	.972
2	4 (8.9%)	4 (8.7%)	
Baby's gender			
Girl	25 (55.6%)	25 (54.3%)	
Boy	20 (44.4%)	21 (45.7%)	.908

Data are presented as mean (standard deviation) or number. OCH = oral carbohydrate; gravidity = the number of times a woman has been pregnant.

Table 2. Daily nutrient intakes.

Parameter	OCH ($n = 45$)	Placebo ($n = 46$)	p value
Energy (kcal)	2,217.46 (463.48)	2,120.82 (458.00)	.320
Carbohydrate (g)	347.74 (107.58)	416.83 (401.51)	.265
Protein (g)	91.10 (25.89)	80.31 (23.15)	.39
Fat (g)	60.77 (21.54)	57.33 (15.51)	.386

Data are presented as mean (standard deviation). OCH = oral carbohydrate.

The comparison of breastfeeding in the OCH group versus the control group is summarized in Table 3. As shown, time to first breastfeeding after surgery was significantly shorter in the OCH group than in the control group (27.47 ± 11.51 vs. 51.96 ± 20.20 min, $p < .001$). The mean frequency of breastfeeding (6.14 ± 0.55 vs. 4.82 ± 0.46, $p < .001$) was significantly higher in the OCH group than in the control group. The mean duration of breastfeeding (116.48 ± 19.68 vs. 82.13 ± 12.40 min, $p < .001$) was longer in the OCH group than in the control group 36 hours after the surgery.

Discussion

The mother's milk is the first protection against various diseases in infants. This shows the importance of breastfeeding in the first hours and days. Significant delays are reported in the start and continuation of breastfeeding in cesarean section (Cakmak & Kuguoglu, 2007). In this randomized clinical trial, we evaluated the effect of preoperative oral carbohydrate on breastfeeding (time to first breastfeeding after surgery, breastfeeding frequency, and duration of breastfeeding up to 36 hours after the surgery) in women who underwent cesarean section with regional (spinal) anesthesia. Our results showed no differences in age, weight, height, BMI, gestational age, gravidity, previous cesarean, infant's gender and weight, and daily intake of energy, carbohydrate, protein, and fat between the two groups. In our study, time to first breastfeeding after surgery was significantly shorter in the OCH group versus the control group. We found no similar clinical trial for comparison. Wang et al. (2010) reported that subjective well-being was significantly better in the OCH group than in the placebo group because of reduced thirst and hunger, and postoperative insulin resistance (PIR) was significantly greater in the placebo group compared with the OCH group (Wang et al., 2010; Viganò et al., 2012). A study by Orosco and Gerozissis (2001) showed enhanced serotonin synthesis in response to carbohydrate ingestion following an increase in the ratio of the concentrations of plasma tryptophan over the sum of other large neutral amino acids ($\mathrm{Trp}/\sum LNAAs$). Therefore, with regard to better well-being and reduced insulin resistance in the early hours after

Table 3. Results of the assessments of breastfeeding after cesarean section.

Parameter	OCH ($n = 45$)	Placebo ($n = 46$)	p value
Time of the first breastfeeding (min)	27.47 (11.51)	51.96 (20.20)	< .001
Breastfeeding frequency (number of times) in the first 12 h	5.60 (0.688)	4.22 (0.554)	< .001
Breastfeeding frequency in the second 12 h	6.20 (0.625)	4.70 (0.553)	< .001
Breastfeeding frequency in the third 12 h	6.22 (0.576)	5.57 (0.501)	< .001
The duration of breastfeeding in the first 12 h (min)	95.00 (19.88)	56.30 (11.75)	< .001
The duration of breastfeeding in the second 12 h (min)	117.56 (11.70)	79.67 (14.19)	< .001
The duration of breastfeeding in the third 12 h (min)	136.89 (23.58)	110.43 (18.06)	< .001
The mean frequency of breastfeeding	6.14 (0.55)	4.82 (0.46)	< .001
The mean duration of breastfeeding (min)	116.48 (19.68)	82.13 (12.40)	< .001

Data are presented as mean (standard deviation). OCH = oral carbohydrate.

surgery in the OCH group and enhanced serotonin synthesis, time to first breastfeeding was significantly shorter in the OCH group. In addition, Gundogdu et al. (2016) reported that a preoperative carbohydrate-rich drink had a beneficial effect on reducing the incidence of postoperative nausea, vomiting, and pain in patients undergoing laparoscopic cholecystectomy. Due to early recovery, reduced nausea, vomiting, and pain, and early initiation of breastfeeding, the frequency of breastfeeding was significantly higher and the duration of breastfeeding was significantly longer in the OCH group.

Because this was the first study, it had many shortcomings and limitations (for example, lack of reference in this regard and small sample size), and further studies are required to confirm the results. It is suggested that a more accurate tool (more use of laboratory tests) be designed to assess breastfeeding.

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Declaration of interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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