

# The Effect of Various Pre-Cesarean Fasting Times on Maternal and Neonatal Outcomes

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## Abstract

**Background:** Although it is currently recommended that patients avoid solid food for 6–8 h and liquid for 2 h before cesarean section, longer restrictions still apply in many centers. Since studies on the duration of fasting before cesarean section is scarce, we aimed to investigate the effect of different fasting times before cesarean section on maternal and neonatal complications.

**Materials and methods:** This descriptive study was performed on 405 candidates for cesarean section. These women were divided into five groups due to the length of time they did not consume clear liquid and solid food. Then, maternal and neonatal outcomes were compared using Kruskal–Wallis and Chi-square tests.

**Results:** The rate of nausea during surgery was lower in the groups who ate solid food between 2 and 8 h and clear liquid <2 h before surgery ( $P = 0.04$ ). Also, abdominal distension in the first 6 h after surgery in the group that did not eat solid food for <6–8 h and clear liquid for <2 h was more than in the other groups ( $P < 0.05$ ). The prevalence of hypoglycemia was significantly lower in women who ate solid food for <6 h and drank clear liquid for <2 h ( $P < 0.05$ ).

**Conclusion:** Prolonged fasting time before cesarean section not only reduce complications but also may have undesirable consequences. The results of this study showed that it is better to use less strict measures in patients who are candidates for cesarean section and in patients with labor pains who are likely to have a cesarean section.

**Keywords:** Cesarean section, fasting, patient outcome assessment, preoperative care

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**Submitted:** 17-Apr-2022; **Revised:** 07-Jun-2022; **Accepted:** 08-Jun-2022; **Published:** 28-Nov-2022

## INTRODUCTION

Cesarean section means the birth of a fetus through laparotomy followed by hysterotomy.<sup>[1]</sup> According to statistics from 150 countries, about 18.6% of neonates are delivered through cesarean section. The prevalence of cesarean section has increased in most parts of the world, and Iran is not an exception.<sup>[2]</sup> From 1990 to 2014, the average growth rate of cesarean sections in the world and Asia was 4.4 and 19.2% per year, respectively, in 120 countries.<sup>[3]</sup> The results of a meta-analysis of 31 studies

showed the general prevalence of cesarean section in Iran was about 48%.<sup>[4]</sup>

Similar to other surgeries, cesarean section is associated with complications, including aspiration pneumonitis. This complication can occur with all types of anesthesia because anesthesia and sedatives reduce or eliminate the airway protective reflexes that normally prevent regurgitated gastric contents from entering the lungs. To prevent this complication, prophylaxis against acid aspiration and restriction of the consumption of liquids and solid foods is recommended.<sup>[5]</sup>

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10.4103/abr.abr\_118\_22

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**How to cite this article:** Arab S, Yaghmaei M, Mokhtari M. The effect of various pre-cesarean fasting times on maternal and neonatal outcomes. Adv Biomed Res 2022;11:104.

However, it should be noted that prolonged fasting time before and after surgery can cause feelings of thirst and hunger, dehydration, hypoglycemia, ketoacidosis, delayed recovery, anxiety, restlessness, and decreased patient satisfaction.<sup>[6]</sup>

In previous years, patients who were candidates for elective cesarean section were suggested not to take liquids or solid foods, one night before the operation.<sup>[7]</sup> Currently, the American Society of Anesthesiologists 2016 practice guidelines for obstetric anesthesia recommends that patients undergoing cesarean section avoid solid food for 6–8 h and liquids for 2 h before induction of general or local anesthesia.<sup>[8,9]</sup> Enhanced Recovery After Surgery (ERAS) protocols also support drinking liquids, especially those containing hydrocarbons, 2 h before surgery.<sup>[10,11]</sup>

Despite these guidelines, some anesthesiologists and surgeons still apply the “fasting from midnight” method in many countries and hospitals.<sup>[12,13]</sup> Studies have also shown that in some hospitals, the doctor’s orders to stop drinking and eating before cesarean section, and the actual hours when the patient does not consume liquids and solid food is even longer. Crenshaw and Winslow’s study of 51 women undergoing cesarean section showed that they did not consume liquids and solid foods for an average of 11 and 13 h before surgery.<sup>[14]</sup>

Although several studies support the ERAS protocols for different types of procedures, there are few studies that have been performed specifically on cesarean section.<sup>[1,15]</sup> Also, stricter policies are usually adopted for pregnant women regarding the length of time not to consume liquids and solid foods before surgery.<sup>[16]</sup> Therefore, we aimed to investigate the effect of different fasting times before cesarean section on maternal and neonatal complications to collect more documents to use less strict protocols.

## MATERIALS AND METHODS

This descriptive study was performed on 405 female candidates for cesarean section under spinal anesthesia at Taleghani University Hospital in Tehran during 2021–2022. Women with term singleton pregnancies ( $\geq 37$  weeks) who were candidates for cesarean section under spinal anesthesia were included. Exclusion criteria were severe heart, kidney, lung, and liver diseases, hypertensive disease of pregnancy, and history of esophageal reflux or gastrointestinal medications, any additional surgery during cesarean section, complications during or in the first 24 h after cesarean section, and placenta accreta spectrum. Before performing the cesarean section, the purpose of the study and its method was first explained orally to the eligible women and if they agreed to participate, then written consent was obtained. In the pre-surgery information form, name, file number, date of cesarean section, mother’s age, gravidity, parity, gestational age, body mass index, type of cesarean section (elective or emergency), and presence or absence of diabetes in the mother were recorded. Each woman was allocated to one of the following five groups according to the duration and form of fasting:

Group 1: Solid food  $\geq 8$  h/clear liquid  $\geq 6$  h

Group 2: Solid food  $\geq 8$  h/clear liquid  $\geq 2$  and  $< 6$  h

Group 3: Solid food  $\geq 6$  h and  $< 8$  h/clear liquid  $> 2$  h

Group 4: Solid food  $\geq 2$  h and  $< 6$  h/clear liquid  $> 2$  h

Group 5: Solid food  $> 2$  h/clear liquid  $> 2$  h.<sup>[17]</sup>

Spinal anesthesia was performed with 12 mg of 0.5% bupivacaine solution. In patients with anxiety, 1 mg of midazolam was injected intravenously after delivery of the newborn. In patients with nausea and vomiting during surgery, 4 mg of ondansetron was injected intravenously.

After surgery, nausea or vomiting during the operation, operation time, the volume of blood loss during surgery, sex and weight of the baby, Apgar score  $< 7$  at 1 and 5 min, pH of cord blood  $< 7$  and  $< 7.2$  were recorded. Ten minutes after surgery, blood was taken from the mother’s cubital vein to measure glucose level, and the presence of hypoglycemia (glucose level below 70 mg/dL) was recorded. After transfer to the ward, abdominal distension, presence of abdominal bloating (subjective) and larger than usual abdomen (objective), nausea and vomiting in the first and second 6 h after surgery, and patients who have not started the diet after surgery or have not been able to tolerate it were recorded. The data were entered into Statistical Package for the Social Sciences (SPSS) software, version 18, and the variables in groups with different fasting times (groups 1–5) were compared with Kruskal–Wallis and Chi-square tests.  $P < 0.05$  was considered to be statistically significant.

The proposal for this research was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences with the code IR.SBMU.MSP.REC.1399.229.

## RESULTS

Table 1 shows the demographic characteristics of the 405 mothers and infants and variables related to surgery in groups with different fasting times. Data analysis showed that these groups were not significantly different in terms of gravidity, parity, gestational age, body mass index, frequency of diabetic pregnancies, operation time, the volume of blood loss during surgery, and sex and weight of the newborn. There was a significant difference in terms of age ( $P = 0.03$ ), and this was due to a significant difference between groups 1 with 4 and 5 ( $P < 0.05$ ). Also, in terms of frequency of repeat and emergency cesarean sections, group 1 differed significantly from other groups ( $P < 0.0001$ ), because the people in this group had not eaten solid food for  $\geq 8$  h and clear liquid for  $\geq 6$  h and were mostly candidates for elective cesarean section.

Table 2 shows the comparison between some neonatal and maternal outcomes in five groups. Statistical analysis showed that these five groups were significantly different in terms of

**Table 1: Demographic characteristics and surgical indicators in 405 cesarean section women under spinal anesthesia and their neonates in groups with different fasting times**

|                                       | Total (n: 405) | Group 1 (n: 140) | Group 2 (n: 31) | Group 3 (n: 44) | Group 4 (n: 96) | Group 5 (n: 94) | P       |
|---------------------------------------|----------------|------------------|-----------------|-----------------|-----------------|-----------------|---------|
| Age (year)*                           | 31.00±6.39     | 32.58±5.86       | 30.61±5.50      | 31.50±6.50      | 29.94±6.07      | 29.59±7.23      | 0.03    |
| Gravidity (number)*                   | 2.45±1.53      | 2.48±1.59        | 2.23±1.36       | 2.43±1.63       | 2.3±1.35        | 2.66±1.63       | 0.602   |
| Parity (number)*                      | 1.15±1.3       | 1.09±1.32        | 0.97±1.14       | 1±1.14          | 1.13±1.25       | 1.37±1.45       | 0.351   |
| Gestational age (week)*               | 38.19±2.50     | 38.14±2.16       | 38.62±1.02      | 37.81±2.58      | 38.06±3.12      | 38.45±2.58      | 0.10    |
| Body mass index (kg/m <sup>2</sup> )* | 31.00±5.27     | 30.83±4.79       | 30.63±4.58      | 30.35±4.21      | 29.67±4.39      | 30.49±4.73      | 0.47    |
| Previous C/S: n (%)                   | 186 (45.9)     | 94 (67.1)        | 14 (45.2)       | 18 (40.9)       | 31 (32.3)       | 29 (30.9)       | <0.0001 |
| Urgent C/S: n (%)                     | 258 (63.7)     | 5 (3.6)          | 22 (71)         | 44 (100)        | 95 (99)         | 92 (97.9)       | <0.0001 |
| Diabetes: n (%)                       | 64 (15.8)      | 23 (16.4)        | 5 (16.1)        | 7 (15.9)        | 14 (14.5)       | 15 (15.9)       | 0.34    |
| Surgery time (minute)*                | 65.5±19.6      | 65.4±19.6        | 59.3±15.6       | 65.7±21.1       | 66.4±19.1       | 66.5±20.8       | 0.525   |
| Estimated blood loss (mL)*            | 603.82±218.83  | 576.07±209.18    | 606.45±182.45   | 610.22±259.15   | 584.37±165.48   | 661.17±260.70   | 0.07    |
| Girl sex: n (%)                       | 211 (52.1)     | 75 (53.6)        | 14 (45.2)       | 22 (50)         | 56 (58.3)       | 44 (46.8)       | 0.71    |
| Birth weight (g)*                     | 3243±543       | 3205±785         | 3283±532        | 3112±431        | 3371±532        | 3290±512        | 0.83    |

\*Mean and standard deviation, n=number, C/S=cesarean section

**Table 2: Maternal and neonatal outcomes in 405 women undergoing cesarean section under spinal anesthesia in groups with different fasting times**

| Variable  | Total (n: 405) | Group 1 (n: 140) | Group 2 (n: 31) | Group 3 (n: 44) | Group 4 (n: 96) | Group 5 (n: 94) | P      |
|---|----------------|------------------|-----------------|-----------------|-----------------|-----------------|--------|
| Nausea n (%)  |                |                  |                 |                 |                 |                 |        |
| Intraoperation  | 123 (30.4)     | 50 (35.7)        | 11 (35.5)       | 8 (18.2)        | 21 (21.9)       | 33 (35.1)       | 0.04   |
| First 6 h after surgery                                   | 3 (0.7)        | 1 (0.7)          | 1 (3.2)         | 1 (2.3)         | 0 (0)           | 0 (0)           | 0.24   |
| Intraoperative vomiting n (%)                             | 60 (14.8)      | 27 (19.3)        | 5 (16.1)        | 2 (4.5)         | 9 (9.4)         | 17 (18.1)       | 0.06   |
| Abdominal distension in the first 6 h after surgery n (%) | 6 (1.5)        | 0 (0)            | 0 (0)           | 3 (6.8)         | 2 (2.1)         | 1 (1.1)         | <0.05  |
| Maternal hypoglycemia n (%)                               | 36 (8.9)       | 13 (9.3)         | 10 (32.2)       | 5 (11.4)        | 4 (4.2)         | 4 (4.2)         | <0.05  |
| Umbilical artery pH n (%)                                 |                |                  |                 |                 |                 |                 |        |
| <7.2  | 65 (16.8)      | 19 (14.2)        | 5 (16.1)        | 7 (18.4)        | 12 (12.8)       | 22              | P=0.23 |
| <7  | 4 (1)          | 1 (0.7)          | 1 (3.2)         | 0 (0)           | 2 (2.1)         | (24.4)          | P=0.81 |
| Apgar score <7 n (%)                                      |                |                  |                 |                 |                 |                 |        |
| At 1 min  | 13 (3.2)       | 1 (0.7)          | 1 (3.2)         | 0 (0)           | 6 (6.3)         | 5 (5.3)         | 0.07   |
| At 5 min  | 6 (1.5)        | 1 (0.7)          | 0 (0)           | 0 (0)           | 3 (3.1)         | 2 (2.1)         | 0.44   |

n=number

intraoperative nausea ( $P = 0.047$ ), and this difference was between groups 3 and 4 with groups 1, 2, and 5 ( $P = 0.002$ ). Moreover, there was no significant difference between these five groups in terms of nausea in the first 6 h after surgery ( $P = 0.24$ ), and none of the participants experienced nausea in the second 6 h after surgery.

Data analysis showed that although clinically, the prevalence of intraoperative vomiting was lower in groups 3 and 4, the difference was not statistically significant ( $P = 0.06$ ). None of the subjects vomited in the first and second 6 h after surgery.

The prevalence of abdominal distension in the first 6 h after surgery was different between groups ( $P < 0.05$ ), which was related to a significant difference in the prevalence of distension in the third group with the other groups. In the second 6 h after surgery, only three persons (1 in groups 2, 3, and 4) developed abdominal distension. The prevalence of maternal hypoglycemia was significantly different in these

groups ( $P < 0.05$ ) because of the difference between group 2 and the other groups.

There was no significant difference between five groups in terms of umbilical artery's pH  $<7.2$  ( $P = 0.23$ ) and  $<7$  ( $P = 0.81$ ), and Apgar score of  $<7$  at 1 min ( $P = 0.07$ ) and 5 min ( $P = 0.44$ ) prevalence. In terms of not starting a diet or have not been able to tolerate it within 6 h, there was only 1 person in group 5.

## DISCUSSION

This study showed that patients in groups 3 and 4 who had no solid diet for  $\geq 2$  h and  $<8$  h, and clear liquid  $<2$  h had the lowest rate of nausea during the operation. In both groups, the rate of intraoperative vomiting was clinically less than in the other groups. The rate of postoperative hypoglycemia was clinically, but not statistically, lower in groups 4 and 5 and statistically higher in group 2. The rate of abdominal distension in the first 6 h after surgery was higher in group 3. Therefore, it can be said that the results of this study show that women in group 4,

those who received solid food between 2 and 6 h before the operation and fluids less than 2 h before the operation, had the least side effects overall.

Currently, most cesarean sections are performed under local anesthesia and with appropriate techniques, so the incidence of aspiration pneumonitis syndrome is reduced.<sup>[18]</sup> It should be noted that water exits the stomach within 12 min and carbohydrate drinks are not present in the stomach 90 min after drinking.<sup>[5]</sup> Ultrasound examination also showed that gastric emptying was normal during pregnancy and decreased only slightly at the onset of labor. Therefore, current guidelines consider a 6–8 h limit for solid foods and 2 h for diluted liquids to be sufficient before cesarean section<sup>[15]</sup> because prolonged fasting causes complications such as dehydration, insulin resistance, anxiety, headache, hunger and thirst, and delayed recovery.<sup>[6,7,14]</sup>

In a study published by Ghorashi *et al.*,<sup>[16]</sup> 411 women undergoing elective cesarean section fasted from midnight. Then they were randomly divided into two groups. One group did not receive liquid before the operation, and the other group was given 150 cc of clear liquid containing 10% carbohydrates about an hour before the operation. The results showed that regurgitation occurred in only two patients (one patient in each group). No cases of aspiration were reported. The participants in the control group fasted for about 12.5 h. However, the case group fasted for an average of 15 h and 45 min but drank liquid about 45 min before surgery. The results showed that liquid intake 1 h before surgery did not increase regurgitation during surgery.

In a retrospective study, 1599 women undergoing cesarean section with epidural block were studied. The results showed that the group which consumed solid food for 6–8 h and a liquid diet <2 h before surgery had lower rates of vomiting ( $P < 0.05$ ). Our study also showed that the prevalence of nausea was statistically lower, and the prevalence of vomiting was clinically lower in people who did not eat solid food  $\geq 2$  and <8 h, and clear liquid <2 h before surgery. The rate of hypoglycemia was also significantly higher in people who had not eaten solids for > 8 h and clear liquid for >2 h before surgery ( $P < 0.05$ ), which is consistent with our study. Similar to our study, the frequency of Apgar score of <7 at 1 and 5 min in the mentioned study was not significantly different between groups. Unlike our study arterial cord pH <7.2, in this study was more frequent in people who did not eat solid food for >8 h and clear liquid for >2 h ( $P < 0.05$ ).<sup>[17]</sup>

Although in the Li *et al.* study the prevalence of abdominal distension was higher in people who did not eat solid foods for more than 8 h and clear liquid for more than 2 h ( $P < 0.05$ ),<sup>[17]</sup> in our study the highest frequency of abdominal distension was detected in the group who had not consumed solid food between 6 and 8 h and fluids <2 h before the surgery.

Our study was prospective, so it was possible to record data accurately, and this was the strength of this study. The

limitations of our study were the lack of blood sampling from the heel of newborns to compare the frequency of neonatal hypoglycemia in the groups, and the limited number of samples, especially in groups 2 and 3. Also due to the fact that the half-life of ondansetron is about 3 h, it may affect the prevalence of nausea and vomiting in the first 6 h after surgery in people who received ondansetron during surgery. This confounding factor should be considered in future studies.

## CONCLUSION

Prolonged fast time before cesarean section not solely does not scale back complications; however, conjointly could have undesirable consequences. It is better to use less strict measures in patients who are candidates for cesarean section and in patients with labor pains who are likely to have a cesarean section. According to the results of this study, it is sufficient not to consume solid food for about 6 h and liquids for up to 2 h before cesarean section.

## DECLARATIONS

### Acknowledgments

The proposal of this study was approved by the Obstetrics and Gynecology Department and Ethics Committee of Shahid Beheshti University of Medical Sciences (Tehran, Iran), as a residency thesis, for which the authors are very grateful.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given their consent for their clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Ethics approval

The proposal of this research has been approved by the ethics committee of Shahid Beheshti University of Medical Sciences with the code IR.SBMU.MSP.REC.1399.229.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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