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**Comparison of early and on-demand maternal feeding after  
Caesarean delivery: a prospective randomised trial**

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**ABSTRACT**

**Introduction:** This study aimed to compare early and on-demand maternal feeding after Caesarean delivery in terms of gastrointestinal complaints and patient satisfaction.

**Methods:** A total of 262 women with uncomplicated singleton term pregnancies who underwent a Caesarean section under regional anaesthesia were randomised to a soft food diet served at Postoperative Hour 2 (early feeding group) or eating whenever they wanted to upon return to the ward (on-demand group). Patient satisfaction scores at the time of discharge and gastrointestinal complaints were compared.

**Results:** 133 (50.8%) women were in the fed-early group and 129 (49.2%) in the on-demand group. Major characteristics and surgical procedures were comparable between the two groups. No significant between-group differences in demographic criteria or surgical procedures were evident ( $p > 0.05$ ). The mean time to the first feeding was  $120.00 \pm 00.00$  minutes for the early feeding group as compared to  $236.59 \pm 107.74$  minutes for the on-demand feeding group ( $p = 0.001$ ). Satisfaction levels did not differ significantly between the two groups ( $p = 0.366$ ). Duration to first breastfeeding, analgesia on the ward, passage of flatus, defecation, mobilisation and urination after catheter removal did not differ significantly between the two groups ( $p > 0.05$ ).

**Conclusion:** Early initiation of solid food in low-risk women after Caesarean delivery under regional anaesthesia was associated with high satisfaction and did not increase gastrointestinal complaints. We suggest having flexibility in terms of postoperative feeding time. This may shorten hospitalisation time and decrease hospitalisation costs.

*Keywords:* Caesarean delivery, gastrointestinal complaints, patient satisfaction, postoperative feeding, prospective randomised trial

## INTRODUCTION

Caesarean delivery rates are increasing worldwide.<sup>(1)</sup> As a result, postoperative care is gaining momentum in terms of shortening hospitalisation time, decreasing the rate of hospital infection and financial costs, and increasing patient satisfaction. Postoperative pain and gastrointestinal complaints are the most common complaints after a Caesarean.<sup>(2)</sup> Optimisation of postoperative feeding time may increase patient satisfaction and decrease postoperative complaints.<sup>(3,4)</sup> However, no standard postoperative feeding time is available; the timing varies among clinics,<sup>(5,6)</sup> ranging from the second postoperative hour to the first passage of flatus or a bowel movement. Gastrointestinal complications, such as vomiting and ileus, and the need for emergency re-interventions are of concern when determining feeding time.

In this study, we compared early and on-demand maternal feeding after Caesarean delivery in terms of gastrointestinal complaints and patient satisfaction.

## METHODS

We recruited a total of 262 women with uncomplicated singleton term pregnancies who underwent Caesarean section under regional anaesthesia between November 2017 and March 2018. This study was registered at ClinicalTrials.gov (no. NCT03349151, <https://clinicaltrials.gov/ct2/show/NCT03349151>) and was approved by the Medical Ethics Committee of Acibadem MAA University, Istanbul, Turkey (ATADEK ID no. 2017-4/13).

Women with uncomplicated singleton term pregnancies who underwent an uncomplicated elective Caesarean performed under regional anaesthesia were included in our study. Exclusion criteria were general anaesthesia, history of bowel surgery, diagnosis of a fetal anomaly, history of maternal disease (cardiovascular disease, chronic hypertension, thromboembolic disorders, gastrointestinal and hepatic disorders, or diabetes mellitus), and

intraoperative or immediate postoperative complications. All patients provided written informed consent. Using a computer-generated sequence concealed from the obstetrician and patients, the patients were randomised to a soft food diet (honey, skimmed cheese, soup, mashed potatoes, pudding and grissini) served during Postoperative Hour 2 or whenever they wanted to eat after returning to the ward. Opaque, sealed envelopes with the selected regimen were attached to the files of the patients included in the study. The nurse opened the envelopes at the end of the surgery. The nurse who questioned the patients and filled in the forms was blinded to the study.

All enrolled women received 10.0–12.5 mg of bupivacaine hydrochloride and 50 µg of fentanyl or 10–12.5 mg of bupivacaine hydrochloride, 50 µg of morphine and 10 µg of fentanyl in the operating room. All patients had a Pfannenstiel incision for a laparotomy and a transverse incision at the lower uterine segment for a hysterotomy. Cefazolin sodium (2 g) was given to all patients for prophylaxis just before the skin incision. A uterine incision with a continuous single-layer closure was performed in all patients with Number 1 polyglactin 910 sutures. The rectouterine pouch and paracolic gutters were cleaned before closing the parietal peritoneum. Peritoneal closure was performed with 2/0 poly(glycolide-co-lactide).

The primary outcome was patient satisfaction measured using a visual analogue scale (VAS) on the second day after surgery, before they were discharged. The VAS is a 100-mm long scale with descriptions at both ends, where 0 = lack of satisfaction about the timing of the meal after surgery and 100 = full satisfaction about the timing of the meal after surgery. A statement was provided to explain the intended measure. Secondary outcomes were: (a) time to first postoperative passage of flatus and defecation; (b) the existence of postoperative gastrointestinal complaints such as nausea, vomiting or abdominal distention; (c) and the use of postoperative pain medication. The VAS score, time to start first and second meals, amount of food consumed at the first meal, nausea, vomiting 30 minutes after first feeding,

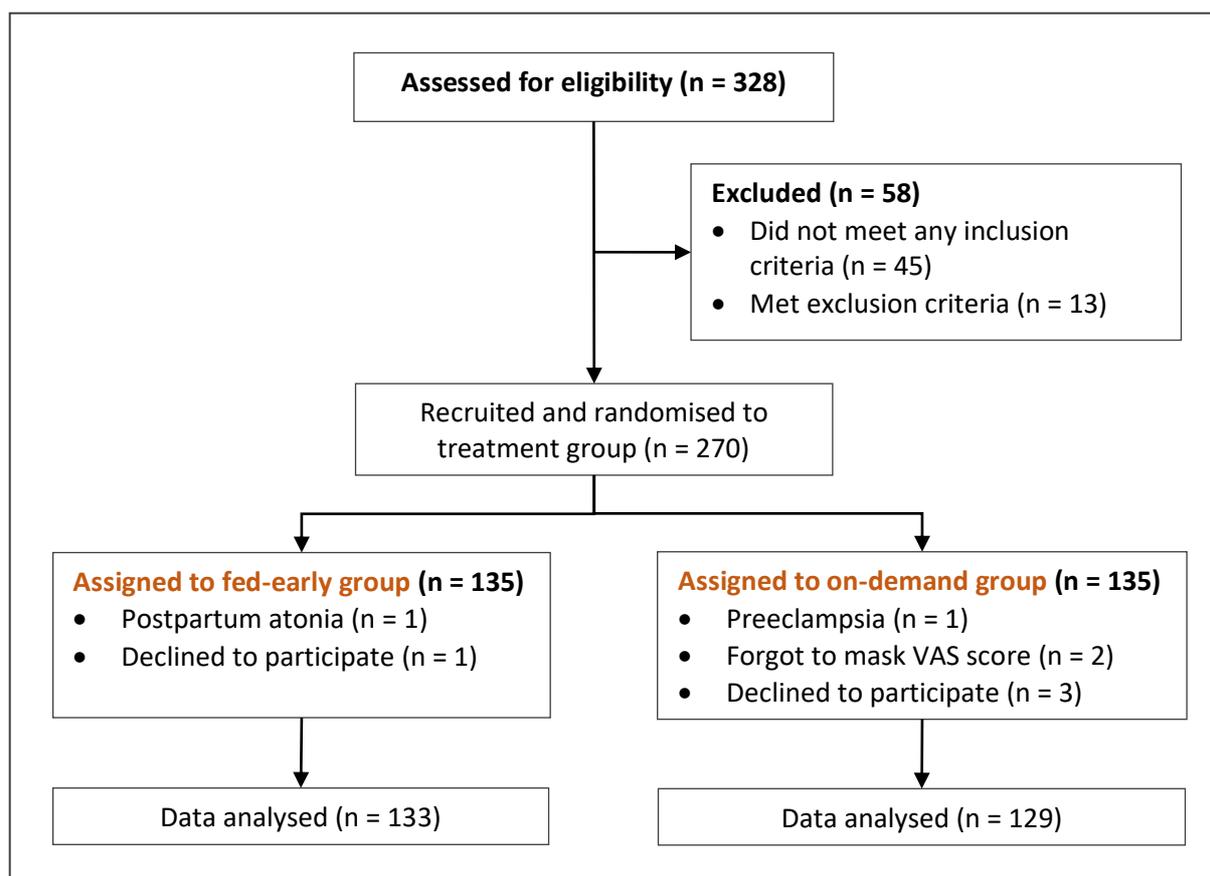
need for opiate analgesics, need for nonsteroidal anti-inflammatory drugs, first analgesia on the ward, time to first passage of flatus, time to first defaecation, time to first mobilisation, and first urination after catheter removal were recorded postoperatively.

Sample size calculation was performed with the aid of G\*Power 3 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). Based on a previous study, the required sample size was 86 patients in each group to achieve 80% power for detecting a 0.43 effect size at a 0.05 significance level.

The R-3.4.3 programme (R Core Team, R Foundation for Statistical Computing, Vienna, Austria) was used for the statistical analysis. Normality assessment of the variables was made employing the Shapiro-Wilk test. Descriptive statistical methods (mean, standard deviation and frequency) were used to evaluate the data. Student's *t*-test was used to compare normally distributed quantitative data, and the Mann-Whitney *U*-test was used for non-normally distributed quantitative variables. The chi-square test with continuity (Yates) correction was used to evaluate qualitative variables. A *p*-value < 0.05 was considered to be significant.

## RESULTS

A total of 328 women underwent Caesarean sections between November 2017 and March 2018. Of these, 58 women were excluded from the study. A total of 270 women were recruited and randomised to treatment: 135 women were allocated to the early intervention group, of whom 133 completed the study; another 135 women were allocated to the on-demand group, of whom 129 completed the study. The 262 remaining women were analysed, with 133 (50.8%) in the fed-early group and 129 (49.2%) in the on-demand group (Fig. 1). The major characteristics and surgical procedures of the women and the study groups are shown in Table I.



**Fig. 1** Patient flowchart shows the process from recruitment to study completion.

**Table I. Demographic features and surgical procedures of the two groups.**

Characteristic	No. (%)			p-value
	Early feeding (n = 133)	On-demand feeding (n = 129)	Total (n = 262)	
Age* (yr)	33.20 ± 3.91	32.78 ± 4.28	33.00 ± 4.10	0.408‡
Body mass index* (kg/m <sup>2</sup> )	27.95 ± 3.80	28.48 ± 4.33	28.21 ± 4.07	0.296‡
Nulliparity	92 (69.2)	82 (63.6)	174 (66.4)	0.337§
Gestational age at delivery† (wk)	39 (28.2–39.4)	39 (38.4–39.2)	39 (38.3–39.3)	0.273¶
<b>Indication for Caesarean section</b>				0.333§
Repeat Caesarean section	37 (27.8)	44 (34.1)	81 (30.9)	
Malpresentation	11 (8.3)	8 (6.2)	19 (7.3)	
Macrosomia	5 (3.8)	5 (3.9)	10 (3.8)	
Failure to progress	20 (15.0)	8 (6.2)	28 (10.7)	
Presumed fetal compromise	4 (3.0)	3 (2.3)	7 (2.7)	
Performed on request	5 (3.8)	9 (7.0)	14 (5.3)	
Cephalopelvic disproportion	33 (24.8)	30 (23.3)	63 (24.0)	
Others	18 (13.5)	22 (17.1)	40 (15.3)	
<b>RA technique</b>				0.168§
Combined spinal-epidural	99 (74.4)	86 (66.7)	185 (70.6)	
Epidural	34 (35.6)	43 (33.3)	77 (29.4)	

<b>Morphine usage during RA</b>	53 (39.8)	59 (45.7)	112 (42.7)	0.336§
<b>Surgery duration† (min)</b>	60 (55–70)	60 (57.5–75)	60 (55–70)	0.063¶

\*Data presented as mean  $\pm$  standard deviation, †median (25th–75th percentile). Calculated using ‡Student's *t*-test, §chi-square test, ¶Mann-Whitney U test. RA: regional analgesia

The mean age of the participants was in the range of 21.00–44.00 years (mean 33.00  $\pm$  4.10 years). The body mass index of the participants was 17.30–46.30 kg/m<sup>2</sup> (mean 28.21  $\pm$  4.07 kg/m<sup>2</sup>). A total of 174 (66.4%) participants had nulliparity. Gestational age at delivery was in the range of 37.0–41.2 weeks (median 39.0 weeks). 81 (30.9%) participants had a repeat Caesarean indication. Combined spinal-epidural analgesia was used for 185 (70.6%) participants. Morphine was used as regional analgesia in 112 (42.7%) participants. Surgery duration was in the range of 30–120 minutes (median 60 minutes). No significant between-group differences in characteristics or surgical procedure variables were evident (Table I).

Results for the early and on-demand feeding groups are shown in Table II. The mean time to first feeding was 120.00  $\pm$  00.00 minutes for the early feeding group compared to 236.59  $\pm$  107.74 minutes for the on-demand feeding group ( $p = 0.001$ ). The mean time to the second meal was 409.64  $\pm$  154.96 minutes for the early feeding group compared to 553.60  $\pm$  194.94 minutes for the on-demand feeding group ( $p = 0.001$ ). Satisfaction tended to be higher in the early feeding group than in the on-demand group ( $p = 0.366$ ). Duration to first breastfeeding, analgesia on the ward, passage of flatus, defecation, mobilisation, and urination after catheter removal did not differ significantly between the study groups ( $p \geq 0.05$ ).

**Table II. Results for the early and on-demand feeding groups.**

Parameter	Mean $\pm$ SD (median)		p-value
	Early feeding (n = 133)	On-demand feeding (n = 129)	
<b>Satisfaction level (mm)</b>	92.30 $\pm$ 10.66 (97.00)	89.65 $\pm$ 15.79 (96.00)	0.366†
<b>Time to first feeding (min)</b>	120.00 $\pm$ 0.00 (120.00)	236.59 $\pm$ 107.74 (210.00)	0.001†,‡

<b>Food amount consumed at first feeding*</b>			0.204§
Small amount	10 (7.5)	4 (3.1)	
Moderate	28 (21.1)	34 (26.4)	
All/almost all	95 (71.4)	91 (70.5)	
<b>Time to second meal (min)</b>	409.64 ± 154.96 (383.50)	553.60 ± 194.94 (530.00)	0.001†,‡
<b>Outcomes 30 min after first feeding*</b>			
Nausea	7 (5.3)	11 (8.5)	0.424§
Vomiting	6 (4.5)	5 (3.9)	1.000§
<b>Need for opiate analgesics*</b>	15 (11.3)	18 (14.0)	0.641§
<b>Need for NSAID*</b>	102 (76.7)	91 (70.5)	0.259§
<b>First breastfeeding (min)</b>	65.69 ± 44.15 (60.00)	67.87 ± 33.73 (60.00)	0.378†
<b>Need for analgesia*</b>	53 (39.8)	59 (45.7)	0.336§
<b>First analgesia on the ward (min)</b>	173.86 ± 143.8 (135.00)	180.23 ± 141.5 (150.00)	0.581†
<b>Time to first passage of flatus (hr)</b>	17.32 ± 8.19 (16.92)	18.73 ± 9.51 (17.50)	0.288†
<b>Time to first defecation (hr)</b>	32.26 ± 9.55 (31.50)	33.57 ± 11.73 (33.96)	0.436†
<b>Time to discharge from hospital (hr)</b>	48.5 ± 3.5 (48.00)	49.4 ± 5.8 (48.00)	0.11†
<b>Time to first mobilisation (hr)</b>	5.69 ± 1.20 (5.83)	5.95 ± 1.45 (6.00)	0.200†
<b>Time to first urination after catheter removal (hr)</b>	3.14 ± 1.61 (3.00)	3.44 ± 2.25 (3.00)	0.561†

\*Data presented as no. (%). †Calculated using Mann-Whitney U test. ‡ $p < 0.05$  is considered statistically significant. §Calculated using chi-square test and continuity correction. NSAID: nonsteroidal anti-inflammatory drug; SD: standard deviation

## DISCUSSION

Our results showed that early feeding is well tolerated in women undergoing uncomplicated Caesarean delivery under regional anaesthesia, which is consistent with most studies in the literature.<sup>(3,4,7,8)</sup> Our primary outcome, patient satisfaction, had scores that were similar between the early feeding and on-demand feeding groups. This finding is compatible with those of previous studies.<sup>(3,4)</sup> Our secondary outcome measures were the times to first passage of flatus and defecation, nausea and vomiting 30 minutes after first feeding, and the need for pain medication.

In meta-analyses reported in 2013 and 2015, early regular feeding was started 6–8 hours after surgery.<sup>(9,10)</sup> In our study, a regular diet was started two hours after surgery in the early feeding group. A 2016 study in which a solid food regimen was started as early as 106 minutes, as compared to 165 minutes, had timing and outcomes that were compatible with those of our study.<sup>(4)</sup>

Early passage of flatus has a significant role in postoperative pain control. The times to first passage of flatus and defecation were similar for both groups in our study. In a meta-analysis by Guo et al, it was found that early feeding was associated with early first flatus and early defecation. However, early feeding groups had their first meal within the first 12 hours postoperatively. In our study, all patients in both groups had their first feeding within six hours after their Caesarean section; thus, our results do not contradict the literature.<sup>(10)</sup> The need for opiate analgesics was also comparable between our study groups. However, there was a trend of a decreased need for opiate analgesics in the early feeding group. As administering opiate analgesics depresses gastrointestinal motility,<sup>(11)</sup> we think that having comparable gastrointestinal outcomes among our study groups may depend on the need for similar opiate analgesics administration.

Early mobilisation and early catheter removal are important components of enhanced recovery after surgery.<sup>(12)</sup> In our study, although time to first mobilisation tended to be earlier in the early feeding group, this did not reach statistical significance. Many studies<sup>(3,4,7)</sup> have investigated the subject of postoperative urinary catheter removal and time to hospital discharge. We did not include time to postoperative urinary catheter removal in our study, as our hospital routinely removes the catheter 24 hours after surgery. Time to hospital discharge was similar between the early and on-demand feeding groups in the present study. One of the reasons for similar discharge time might be the routine discharge protocol of our hospital. In our clinic, Caesarean patients are discharged on the second postoperative day unless there is a

complication or the patient prefers to stay longer. In addition, no significant difference in the time to first mobilisation was observed due to our department's protocol of mobilisation at six hours postoperatively. In Guo et al's meta-analysis, the times to first mobilisation, removal of the urinary catheter and hospital discharge were shorter in the early feeding group.<sup>(10)</sup>

One of the main concerns associated with Caesarean deliveries is the timing of first breastfeeding after the surgery. The first breastfeeding time was not different between the early feeding and on-demand feeding groups in our study. However, in a randomised controlled trial by Teoh et al, the early feeding group started first breastfeeding earlier than the control group.<sup>(13)</sup> This difference may be attributed to varying definitions for early feeding time in the studies. Additionally, time to first urination after removal of the catheter in our study groups was similar to the results in Tan et al's randomised trial.<sup>(4)</sup>

Our primary and secondary outcome measures tended to be better in the early feeding group, but there was no significant difference between the groups. This similarity might be due to the fact that the first feeding interval between the trial arms was much shorter than the intervals of the previous studies. Nausea was more frequent 30 minutes after first feeding in the on-demand feeding group (8.5%) compared to the early feeding group (5.3%). However, the difference was not significantly different. This finding is compatible with that of a 2013 meta-analysis.<sup>(9)</sup> The incidence of vomiting was similar between our study groups, which is similar to the randomised trial in the study by Tan et al.<sup>(4)</sup> Ileus or abdominal distention is a concern in starting an early solid food regimen after a surgery, but neither was observed in either group in our study.

The present study showed that early feeding and on-demand feeding after Caesarean section have similar outcomes in terms of postoperative patient satisfaction, nausea, vomiting, need for analgesics (opiate or non-opiate), time to first breastfeeding, mobilisation,

flatus, defecation and hospital discharge. On-demand feeding protocols may be difficult to be implement, as one of the serving staff has to be instantly ready for a demand. However, patients probably prefer on-demand feeding when compared to eating according to hospital protocols.

In conclusion, early feeding and on-demand feeding are tolerable approaches after a Caesarean section, and these approaches have similar patient satisfaction levels. Thus, both approaches can be implemented in clinical practice according to physicians' preferences. Nevertheless, on-demand feeding may be superior, as it allows patients to make their own choice during the postoperative period.

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