TITLE: Gastric emptying time in full-term pregnancy after drinking a 200 ml oral nutritional supplement: a pilot study among the Indonesian population

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ABSTRACT

BACKGROUND: The American Society of Anesthesiologists (ASA) and the Canadian Anesthetists’ Society (CAS) preoperative fasting guidelines allow patients to get solid foods six hours and clear liquids two hours prior to surgery. Oral nutritional supplements (ONS) may become another option in preoperative nutrition management for the future. The benefits are to fulfill the nutrition need of the patients and make the patients more satisfied. To minimize the risk of aspiration, there must be a proper management.

OBJECTIVE: The objective of this study was to assess the gastric emptying rate of full-term pregnant women after drinking 200 mL ONS in Indonesian population.

METHODOLOGY: Nine pregnant subjects with gestational ages >37 weeks consented to complete the study. Consent was obtained from the participants. They underwent ultrasound of the stomach at baseline and then were given 200 mL of ONS. Gastric emptying time was assessed every 30 minutes by ultrasound until the stomach volume was less than 80 ml.

RESULTS: Ultrasound assessment showed that the gastric emptying rate after drinking 200 ml of ONS with a specific formula (62% carbohydrate, 18% protein and 20% fat) was less than two hours.

CONCLUSION: This study suggests that giving a 200 ml oral nutrition supplement could be an option for providing continued nutrition to patients for caesarean section two hours prior to the procedure. Further study with larger sample size need is needed to validate the findings of this small study.
INTRODUCTION

Several studies have suggested that prolonged preoperative fasting can lead to increases in postoperative complications. Surgery itself can cause hypermetabolism and prolonged fasting could make this even worse. Prolonged fasting depletes liver glycogen before surgery, leading to mobilization of muscle glycogen after surgery, which in turn may lead to reduced muscle strength.[1] Other potential consequences of prolonged fasting are hunger, thirst, tiredness, weakness, inability to concentrate,[2] nausea and vomiting,[3] metabolic consequences[4] and lack of patient satisfaction.[5]

Three hours after a meal, the body will start using glycogen, endogenous protein and fat stores as sources of energy.[6] Without protein intake, the level of plasma amino acids decreases,[7] and there is muscle degradation to maintain circulating amino acids (e.g., alanine, glutamine and branched chain amino acids/BCAA).[8] Thus, consuming protein prior to surgery could be beneficial for reserving protein stores. Oral nutritional supplements (ONS) are an option that provides complete nutrients and has the possibility of being given shortly before surgery to avoid aspiration.

Pulmonary aspiration of gastric contents can be a serious condition for patients undergoing general or regional anesthesia. To reduce the risk of aspiration, it is recommended to have a stomach empty prior to surgical procedures; however, the stomach is never completely empty due to gastric secretions. [9-12] Since 1999, the American Society of Anesthesiologists (ASA) and the Canadian Anesthetists’ Society (CAS) proposed preoperative fasting guidelines (Table 1).[13] The guidelines allow patients to have any nutrients six hours prior to surgery and clear liquids two hours prior to surgery.

<table>
<thead>
<tr>
<th>Ingested material</th>
<th>Minimum fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear liquids</td>
<td>2 hours</td>
</tr>
<tr>
<td>Non-human milk</td>
<td>6 hours</td>
</tr>
<tr>
<td>Light meal</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

*a Examples: Water, fruit juice without pulp, carbonated beverages, clear tea, and black coffee.*

*b Example: Dry toast and clear liquid. Fried or fatty foods may prolong gastric emptying time. Both amount and type of food must be considered.*

The guidelines recommend no routine use of gastrointestinal stimulants, gastric acid secretion blockers or oral antacids.
A study by Simpson et al. [14] reported delayed gastric emptying in those who were 12-14 weeks pregnant compared to non-pregnant controls, whereas gastric emptying in the 8-11 weeks pregnant group was between the other two groups. Levy et al. [15] also indicated a delay in gastric emptying at 8-12 weeks of gestation. However, Macfie et al. [16] showed no difference in gastric emptying in any of the three trimesters of pregnancy, and there was also no significant difference when compared to non-pregnant women. Theoretically, three hours after the meal, the body starts using glycogen, endogenous protein and fat stores as a source of energy [17]. Studies have shown that without protein intake, the level of plasma amino acid decreases as reflected in luminal and plasma amino acid concentration after meals and there is muscle degradation to maintain circulating amino acids (e.g., alanine, glutamine and branched chain amino acids/BCAA). [7] 20% fat has been described as the lowest balance diet composition of fat, [18] whereas 18% protein will support the protein need in trauma/critical care patients/surgical patients, however still in the range of balance diet. [19] Our preliminary unpublished study on assessment of stress with the measurement of blood glucose, insulin, CRP, IL-6 showed that person taking the nutrition which has the combination of carbohydrate, fat and protein had less post surgical stress.

In this study, we focus on gastric emptying during full-term pregnancy in a pre-caesarean surgery setting, especially among the pregnant patients in developing countries. We are unaware of any study in which pregnant women were given nutrition containing protein for up to two hours prior to the surgery in this population. The objective of this study was to assess the gastric emptying rate of full-term pregnant women after drinking 200 ml ONS.

**METHODOLOGY**

Each patient received ONS (1 kcal/1 ml) with standard complete nutrients (macronutrient and micronutrient), with fats (20%), protein (18%) and carbohydrates (62%). The ONS is a formula, which was made by a local pharmaceutical company based on our prescription. The characteristics of ONS are: 57 gm in 200 ml, liquid viscosity and osmolarity 870 mOsm. This study was performed after receiving approval from The Committee of Medical Research Ethics of The Faculty of Medicine at Indonesia University.

**Setting**: The study was performed at the Radiology Department, Cipto Mangunkusumo General Hospital (RSCM), Jakarta, Indonesia.

**Inclusion Criteria**: Pregnant patients aged 20-35 years old with gestational ages >37 weeks who presented for antenatal care at the Obstetrician Department at RSCM were included.

**Exclusion Criteria**: Patients with nausea and vomiting or those on antiemetic and/or promotility drugs were excluded. Patients with high blood pressure and/or diabetes were also excluded.

**Study procedures**: The study was conducted from July to November 2009. The meal schedule of the patients before assessment followed the ASA, 1999, guidelines for emptying the stomach;
patients were allowed to have any nutrients six hours prior to surgery and clear liquids two hours prior to surgery. Patients were not allowed to have any nutrients for six hours prior and clear liquid for two hours prior to the assessment. They did not have any overnight fasting pattern. Patients underwent a baseline gastric ultrasound at time zero to assess the gastric volume. The patients were then given 200 mL ONS with the specific formula indicated above. Theoretically, three hours after the meal, body starts using glycogen, endogenous protein and fat stores as the sequential assessments were done using 2D- ultrasound every 30 minutes until the stomach was considered to be empty again. In our study, we used a 2D-ultrasound for assessment of gastric emptying because it is non-invasive, safe and can be performed repeatedly. This technique has also been validated and recommended for gastric emptying assessment.[20, 21] Based on the sonographic method for gastric accommodation assessment developed by Gilja [21] utilized a method that shifted the scanner to a lateral position to follow the change in stomach position. Gastric volume was determined using the formula \( \pi r^2L \) [22] where is a mathematical constant, \( r \) and \( L \) are the radius and the length of gastric, illustrated in Figure 1. The selection of 2D ultrasonography also was used, as it is the more readily available technology in the developing country. 3D ultrasonographies in recent studies though have shown some superiority to the 2D ultrasonography. [23]

RESULTS

Descriptive analysis was used. Nine healthy pregnant patients with a gestational age of greater than 37 weeks completed the study. The age of the subjects was between 22–34 years old (27.6 ± 3.7 years of age). The last meal before scanning and the volume of the empty stomach are shown in Table 2. The baseline gastric volume of the subjects was between 19– 62.6 ml (41.8 ± 18.7 ml).

<table>
<thead>
<tr>
<th>No</th>
<th>Last meal time (hours)</th>
<th>Last consumed meal</th>
<th>Empty stomach volume ( t_0 ) (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>Solid food (rice + chicken + cucumber)</td>
<td>43.1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Clear fluid (200 mL tea + 20 g sugar)</td>
<td>48.3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Clear fluid (200 mL tea + 20 g sugar)</td>
<td>32.1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Clear fluid (200 mL tea + 20 g sugar)</td>
<td>62.6</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Solid food (3 table sp rice + tempeth + spinach + milk)</td>
<td>26.4</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>Clear fluid (300 mL plain water)</td>
<td>26.7</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>Solid food (traditional vegetables salad)</td>
<td>39.3</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Clear fluid (200 mL tea + 15 g sugar)</td>
<td>19</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>Clear fluid (200 mL tea + 15 g sugar)</td>
<td>77</td>
</tr>
</tbody>
</table>

The gastric volumes of the subjects following consumption of 200 ml of ONS are shown in Table 2. Subjects underwent 2D-ultrasound every 30 minutes for two hours to evaluate their gastric
contents (figure 1). The images were obtained within few minutes. Eight patients reached a gastric volume of less than 80 ml by the 90th minute, whereas one subject reached a gastric volume of less than 80 ml by the 120th minute, as illustrated in Table 3.

Figure 1. Sequential images of the stomach before and after drinking 200 mL ONS

a. Empty stomach

b. 30 minutes after drinking ONS

c. 60 minutes after drinking ONS

d. 90 minutes after drinking ONS
DISCUSSION

In this study, we assessed nine pregnant women with gestational ages > 37 weeks. They all received 200 ml ONS with a specific formula. No one complained of nausea or vomiting. All subjects had a gastric volume of less than 80 ml, which was consistent with an empty stomach using the ASA and CAS (1999) guidelines as shown in Table 1. The gastric volume was calculated using the formula $\pi r^2L$.

The baseline gastric volume in our patients was 41.8 ± 18.7 ml, which is consistent with a previous study by Johnson [12]. One of our subjects had eaten solid food three hours prior to the baseline ultrasound assessment. She was included in the study as her baseline gastric volume was calculated to be 26.4 ml. Burton et al.[24] showed that even after a patient ingested two scrambled eggs served on one slice of bran bread along with a 240-mL glass of skim milk (total meal weight: 368 g, total calories: 302 kcal, 32% protein, 35% fat, 33% carbohydrate), their gastric volume was considered empty after four hours. Lewis and Crawford [25] studied 40 patients who were scheduled for elective caesarean section under general anesthesia. The control group was treated conservatively, whereas the study group received a light breakfast of toast and tea four hours prior to surgery. The gastric content was aspirated using tubes; the
volume was significantly greater and the pH of the aspirate was significantly lower in the study group compared to the control group.

In our study, all patients had a gastric volume of less than 80 mL in less than 2 hours after consuming the 200 ml ONS. This result was consistent with a previous study by Maltby and coworkers.[26] In one of our patients, the gastric volume increased by more than 200 ml from baseline at the 30th minute. One possible hypothesis for this increase in gastric volume by more than 200 ml may be due to an increase in gastric juice and enzyme secretion as well as osmolarity. Our findings are consistent with the study by Vist & Maughan.[27]

This study has several limitations. Besides being a pilot study with a small sample size, we have not taken into account any potential or different co-morbidities like the patient’s history of reflux or gastroparesis or the normal composition of the regional diet. Although the use of magnetic resonance imaging (MRI) has been considered as the gold standard as shown in several studies, we opted to use ultrasound since it is the most available test with favorable cost, great flexibility and user friendly compared to MRI. [20,21,28-30] Using 2D-ultrasonography with mathematical calculations rather than 3D-ultrasonography, also made it a limitation, but it is the most available method for many hospitals in developing countries.

CONCLUSION

This study suggests that giving a 200 ml oral nutrition supplement could be an option for providing continued nutrition to patients for caesarean section two hours prior to the procedure. Further study with larger sample size need is needed to validate the findings of this small study.

REFERENCES


