

The Effects of Preoperative Sugarless Gum Chewing on Gastric Fluid Volume and pH

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ABSTRAK

Terdapat kekurangan dalam konsensus tentang pengunyahan gula-gula getah semasa tempoh berpuasa sebelum pembedahan disebabkan oleh bukti yang bercanggah. Tujuan penyelidikan ini adalah untuk mengenalpasti kesan-kesan pengunyahan gula-gula getah ke atas isipadu dan pH cecair perut. Kajian prospektif dan secara rawak ini telah dilakukan ke atas pesakit-pesakit yang menjalani pembedahan elektif dengan pembiusan umum. Seramai 60 orang pesakit yang telah berpuasa semalaman dibahagikan antara kumpulan “tanpa gula-gula getah” sebagai kumpulan kawalan dan “kumpulan gula-gula getah” sebagai kumpulan intervensi yang mengunyah satu keping gula-gula getah setelah dipanggil ke dewan bedah. Pesakit-pesakit tersebut kemudiannya ditanya samada pengunyahan gula-gula getah ini dapat mengatasi rasa lapar atau mengurangkan kegelisahan. Isipadu dan pH cecair perut ini diukur sebaik sahaja proses pembiusan diaruhkan. Pengunyahan gula-gula getah tidak menunjukkan kesan yang ketara ke atas isipadu cecair perut [30.4 ± 13.6 ml (kawalan) vs 29.1 ± 11.6 ml (intervensi), $p = 0.693$] dan pH cecair perut [1.4 ± 0.4 (kawalan) vs 1.6 ± 0.4 (intervensi), $p = 0.05$] sebaliknya mengurangkan kegelisahan sebanyak 90.3% di kalangan pesakit yang mengunyah gula-gula getah. Pengunyahan gula-gula getah sebelum pembedahan didapati tidak meningkatkan isipadu cecair perut atau menurunkan lagi keasidan cecair perut serta dapat mengurangkan kegelisahan di kalangan pesakit sebelum pembedahan.

Kata kunci: aspirasi, berpuasa, isipadu cecair perut, pengunyahan gula-gula getah, pH cecair perut

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ABSTRACT

There is a lack of consensus regarding the preoperative fasting period on gum chewing due to conflicting evidence. Our study aimed to determine the effects of preoperative sugarless gum chewing on gastric fluid volume and pH. This prospective randomised study was performed on patients who underwent elective operation under general anaesthesia. Sixty patients who fasted overnight were randomly assigned to either “non-chewing gum” as control or “chewing gum group” as intervention group who chewed one piece of gum upon the call to the operating theatre. They were further enquired whether gum chewing helped cope with hunger and reduced anxiety. Gastric volume and pH were determined immediately after induction of anaesthesia. Gum chewing had no significant effect on gastric fluid volume measured [30.4 ± 13.6 (control) vs 29.1 ± 11.6 ml (intervention), $p = 0.693$] and gastric fluid pH [1.4 ± 0.4 (control) vs 1.6 ± 0.4 (intervention), $p = 0.05$] while managing to reduce anxiety in 90.3% patients who chewed gum. Pre-operative gum-chewing did not increase in gastric fluid volume or a further reduction in gastric fluid acidity and was able to reduce anxiety in patients in the preoperative period.

Keywords: aspiration, fasting, gastric volume, gastric pH, gum chewing

INTRODUCTION

General anaesthesia is generally safe but respiratory complications such as anaesthesia-related aspiration that involves inhalation of material into the airway below the level of the true vocal cords can be fatal. This may result in a wide range of clinical outcomes, being asymptomatic to severe pneumonitis and acute respiratory distress syndrome (ARDS) (King 2010). In 1946, Mendelson (1946) first described the relationship between aspiration of solid and liquid matter and pulmonary sequelae in obstetric patients. The incidence of pulmonary aspiration, morbidity and mortality in an adult population is estimated to be 1 in 7000, 1 in 16,000 and 1 in 100,000,

respectively. Therefore, to reduce the risk of aspiration, preoperative fasting is mandatory before anaesthesia (Sakai et al. 2006). The prescribed 6-8 hours of fasting is sometimes prolonged to more than 8 hours for various reasons that may result in patient irritability, anxiety, hunger and thirst in the perioperative period (Scarlett et al. 2002). Some patients may chew gum during the fasting period despite preoperative orders to avoid oral intake. Until now, there is still no consensus on whether gum chewing is allowed or otherwise during the preoperative fasting period. According to the current edition of American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting, it is recommended that fasting from solid food for 6-8 hours and clear

fluids for 2 hours is essential before elective procedures that require general anaesthesia, regional anaesthesia or procedural sedation with analgesia (American Society of Anesthesiologists Committee 2011). The European Society of Anesthesiology included in their recommendation that “patients should not have their operation cancelled or delayed just because they are chewing a gum, sucking a boiled sweet or smoking immediately before the induction of anaesthesia” (Smith et al. 2011). Some anaesthetists cancelled these cases as they are certain that gum chewing will increase the gastric volume and place the patient at risk for aspiration during induction of anaesthesia. Physiologically, gastric acid secretion is divided into three phases, which include the cephalic, gastric and intestinal phases. The cephalic phase is initiated by sham feedings while both the gastric and intestinal phases are initiated by distension and by certain compounds entering the digestive tract segment. The act of chewing is similar to sham feeding in which not only does it stimulate cephalic phase of gastric acid secretion but also accelerates and enhances stomach and gut motility (Apostolopoulos et al. 2008; Noble et al. 2009).

It could be beneficial if chewing a piece of gum can reduce thirst and lessen patient’s nervousness without harmfully affecting the gastric content. At present, multiple studies have been done to assess the effects of gum chewing on gastric fluid volume with equivocal results (Dubin et al. 1994; Schoenfelder et al. 2006; Soreide et

al. 1995). Dubin et al. (1994) studied American Society of Anesthesiologists (ASA) I and II patients randomised to chewing sugarless gum or no gum. The results revealed that there were no significant differences between groups in terms of gastric volume and acidity. Soreide et al. (1995) randomised patients to sugar-free gum, nicotine gum or no gum. Patients smoking status was also analysed due to the use of nicotine gum. Among non-smokers, chewing of sugar-free gum increased the gastric volume but did not change the gastric pH compared to the negative control. No effect on gastric pH or volume was noted among smokers who chewed nicotine gum. Schoenfelder et al. (2006) randomised children between ages of 5 to 17 into groups of chewing sugar-free or sugared gum for 30 minutes or no gum. Chewing sugared or sugar-free gum resulted in a significant increase of gastric volume with a decrease in gastric pH compared to the no gum controls. In all the aforementioned studies, none of the patients regurgitated or aspirated gastric contents intraoperatively.

Due to the conflicting results and non uniformity in the recommendations regarding gum chewing preoperatively, we therefore embarked on this study to determine further if preoperative chewing of sugarless gum would lead to an increase in gastric fluid volume or a reduction in gastric acidity among the patients who underwent elective operation under general anaesthesia.

MATERIALS AND METHODS

This prospective randomised study was

approved by the Research Committee of Department of Anaesthesiology & Intensive Care, Universiti Kebangsaan Malaysia Medical Centre (UKMMC) and the Medical Research & Ethics Committee, UKMMC (approval code FF-2018-014). Written informed consent was obtained from 60 adult patients between 18-60 years of age, under ASA physical status I and II who were scheduled for an elective surgical procedure requiring general anaesthesia. Obese patients (BMI >30kg/m²) as well as those with increased risk of aspiration including pregnancy, presence of hiatus hernia and others were excluded from this study. All patients were required to fast for at least 6 hours before operation without sedative premedication.

Patients were randomly assigned into two groups i.e. control group (no gum) and intervention group (sugarless gum - Wrigley's® 5 Peppermint Cobalt Sugar-Free Gum) using computer-generated randomisation table via Microsoft Excel software (Redmond, WA, USA). Patients in the sugarless gum group were instructed to chew only one piece of gum when called to the operating theatre and discard it upon arrival to operating theatre air-lock. Duration of gum chewing (referred to as gum time) was recorded. Patients were asked whether gum chewing helped them cope with hunger and reduced their anxiety as "Yes", "No" or "No difference." Standard anaesthesia monitoring with electrocardiography (ECG), non-invasive blood pressure monitoring (NIBP), pulse oximetry and capnography were applied before induction and throughout the surgery.

Patients were induced with IV fentanyl 2 mcg/kg, IV propofol 2 mg/kg and IV rocuronium 0.6 mg/kg. The airway was secured with either an endotracheal tube or LMA ProSeal™ at the discretion of the anaesthesiologist-in charge. Anaesthesia was maintained with sevoflurane in a 50:50 combination of oxygen mixed with air achieving a minimum alveolar concentration of 1.0-1.2. A size 16 or 18 Fr nasogastric tube (NG) was then inserted into the patient's stomach and its placement was confirmed by auscultation of insufflated air. Immediately after the NG tube was passed down, gastric contents were aspirated manually with a 20 ml syringe. The patients were tilted side to side and placed in a 30-degree head down position to facilitate suctioning. The pH of the gastric fluid was immediately determined using Ohaus® Starter 300 Portable pH meter and recorded. Demographic data, fasting time, time of induction, time of gum discard, total gum time, gastric aspirate volume and pH were recorded for each patient. Any intraoperative untoward events including laryngospasm or bronchospasm, regurgitation and aspiration were noted.

The sample size calculation was done using Snedecor and Cochran formula (Snedecor & Cochran 1989). The power of this study was set at 80%, α -value of 0.05. Sample size calculation was derived from the effect of gum chewing on gastric volume with a mean difference of 0.21 and standard deviation of 0.26 (Soreide et al. 1995). A total of 50 patients were required for this study. Anticipating a 15% drop out,

Table 1: Demographic data and pre-operative characteristics in both groups of patients

	Control group (n=30)	Intervention group (n=30)	p-value
Age (years)	38.6 ± 12.2	40.8 ± 10.2	0.453
Sex, N (%)			
Male	20 (66.7)	7 (23.3)	0.001*
Female	10 (33.3)	23 (76.7)	
Body Mass Index (kg/m ²)	25.4 ± 3.8	23.8 ± 3.7	0.098
Duration of fasting (hours)	11.0 ± 3.1	11.0 ± 1.9	0.625
Gum time (min)		27.1 ± 10.7	

Values are expressed in mean ±SD and numbers (percentage).
*p<0.05 is significant.

60 patients were recruited. Data were analysed using IBM SPSS Statistics version 20 (Armonk, NY, USA). After a Shapiro-Wilk test for normality of the data distribution, continuous data were expressed as mean ± SD. Values were compared between two groups using independent t-test, Chi-square test and regression analysis. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 60 patients between the ages of 17-60 years participated in this study with 30 patients in the control group and 30 patients in the intervention group (chewing gum). All the patients were fasted for at least 6 hours before surgery. Table 1 summarises the demographic data and preoperative

characteristics of all patients in both groups. There was no difference in age, body mass index (BMI) and duration of fasting between both groups. There was a significant difference on the gender distribution between the two groups (*p*=0.001). However, this should not be a confounding factor to the study.

Gum chewing had no significant effect on gastric fluid volume measured [30.4±13.6 (control) vs 29.1±11.6 ml (intervention), *p* = 0.693] and gastric fluid pH [1.4±0.4 (control) vs 1.6±0.4 (intervention), *p* = 0.05] as shown in Table 2. A regression analysis further showed that the gastric volume did not significantly correlate to gum time with *F* (1, 28) = 0.031, *p* = 0.86, *R*² =0.001 (Figure 1).

Table 3 summarises the responses of intervention group on the effect of

Table 2: Values of measured gastric fluid volume and pH.

	Control group (n=30)	Intervention group (n=30)	p-value
Gastric fluid volume (ml)	30.4 ± 13.6	29.1 ± 11.6	0.693
pH	1.41 ± 0.40	1.64 ± 0.40	0.050

Values are expressed in mean ±SD
*p<0.05 is significant.

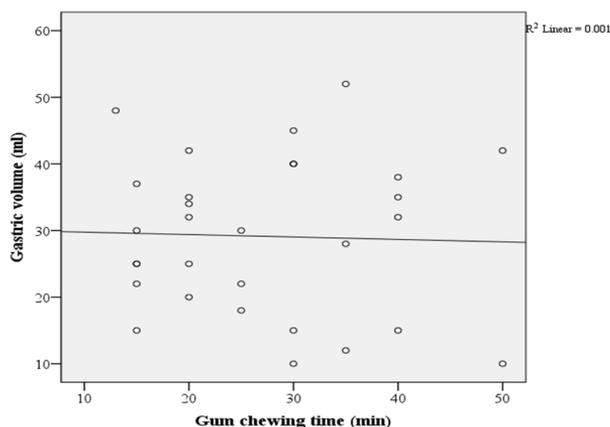


Figure 1: Scatterplot of gum chewing time versus gastric volume. Relationship between gum time and gastric fluid volume aspirated.

gum chewing in coping anxiety and hunger. Majority of the patients in the intervention group (93.4%) felt that chewing a piece of gum managed to help them reduce their anxiety level before operation. However, only 12 out of 30 patients (40%) claimed that gum chewing made them cope with hunger (Table 3).

None of the patients from both groups experienced complications such as laryngospasm, bronchospasm, regurgitation or aspiration of gastric contents intraoperatively.

DISCUSSION

The most feared complication related to general anaesthesia is pulmonary aspiration, where it is highly associated

with significant morbidity and mortality (Cook et al. 2011). Previous studies on rhesus monkeys had suggested that gastric volume >0.4 ml/kg that were directly instilled into the tracheas of these animals was associated with radiological changes. It was later found that in a primate model, the maximum acid aspirated volume that would not cause damage to the lungs was 0.8 ml/kg (approximately 50 ml in 70 kg adult) with pH 3.5 (Raidoo et al. 1990; Rocke et al. 1993). A healthy well-fasted patient has a gastric volume of up to 1.5 ml/kg with no significant risk of aspiration (Agarwal et al. 1989; Harter et al. 1998; Hausel et al. 2001; Phillips et al. 1993; Read & Vaughan 1991). Current fasting guidelines recommend avoiding ingestion of solid food for

Table 3: Aids of gum chewing in coping of hunger and anxiety in Intervention Group (n = 30)

	Response of intervention group		
	Yes	No	No difference
Cope with hunger	12 (40.0)	12 (40.0)	6 (20.0)
Cope with anxiety	28 (93.4)	1 (3.3)	1 (3.3)

Values are expressed in numbers (percentage).

at least 6-8 hours and allowing clear fluids for up to two hours before surgery has been proven to reduce gastric fluid volume, thereby reducing the risks of aspiration. However, there has not been a consensus on the recommendations for gum chewing preoperatively.

From our study, we found that gum chewing did not significantly increase the gastric volume between the two groups (30.4 ± 13.6 vs 29.1 ± 11.6 ml) which was consistent with the recent findings of Valencia et al. (2019), who observed no significant effect of an increase in gastric fluid volume after one hour of gum chewing. Bouvet et al. (2017) found that gum chewing did not change gastric fluid volume two hours after ingestion of 250 ml water in 20 healthy individuals. In a meta-analysis which involved four studies, Ouanes et al. (2015), however concluded that gum chewing in the preoperative period causes small but statistically significant increases in gastric fluid volume although most likely is of no clinical significance in terms of risk of aspiration. In another study, gastric fluid volume and gastric pH were similar among ASA I and II patients who randomly chewed sugar-free gum, chewed bicarbonate chewing gum, took lollipop or drank pure water (Hamid et al. 2012).

In our study, apart from gastric fluid volume, the gum chewing action resulted in no significant difference in gastric pH compared to control group. The mean gastric pH for participants with or without gum chewing was 1.64 ± 0.40 and 1.41 ± 0.40 , respectively. Thus, by chewing a gum, the acidity

of gastric content was not further reduced which was consistent with the findings of a meta-analysis (Ouanes et al. 2015) in that there was no change in the gastric pH. As with the findings of Dubin et al. (1994) and Soreide et al. (1995), our study also demonstrated that there was no significant correlation between gum time and gastric fluid volume.

Due to the unpredictable nature of operating room scheduling, patients always have to fast for more than 8 hours before an elective operation. This may result in anger, frustration and anxiety among patients. Allowing patients to chew a gum preoperatively could help alleviate some of the preoperative anxiety. As shown in our study, majority of the patients in the intervention group (93.4%) admitted that chewing a gum preoperatively was able to reduce their anxiety. The act of gum-chewing itself was previously reported to relieve stress, anger and frustration (Ahmed et al. 2013).

Our study has several limitations. Firstly, this study was performed only among healthy patients who underwent elective operations under general anaesthesia. Therefore, our result might not be applicable to patients requiring urgent surgical intervention or to those with severe systemic comorbidities in whom gastric emptying might be delayed. Secondly, the patients in the gum-chewing group only chewed one piece of sugarless gum for about 30 minutes. Therefore, future studies should be done in a larger cohort of surgical patients with longer gum-chewing time to further confirm these results.

CONCLUSION

In conclusion, chewing gum preoperatively did not increase the gastric fluid volume or caused a further reduction in gastric fluid acidity. At the same time this action was able to reduce anxiety in patients in the preoperative period.

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