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## A prospective randomized controlled study of effect of gum chewing on return of gut motility after elective and emergency laparotomy surgeries

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### Abstract

**Objective:** To investigate the effect of gum chewing on recovery from post-operative ileus after elective and emergency laparotomy surgeries.

**Methodology:** A prospective randomized study, consisting of 101 patients fulfilling the inclusion criteria was undertaken at Bangalore Baptist Hospital, Bengaluru, from January 2014 to December 2015. Commercially available chewing gum was used. The outcome of interest was time to flatus, time to bowel movement, and length of hospital stay.

**Results:** There were significant reductions in the time to flatus and time to feces between the study group and the control group. The patients in the group got discharged a day earlier as compared to the patients in the control group (Study group (7.87 +/- 1.8 days). Control group (9.085 +/- 1.26days)).

**Conclusion:** In this study, the efficacy of chewing gum on post-operative ileus was well appreciated. The study group had early recovery as compared to the control group.

**Keywords:** Chewing gum, gum chewing, post-operative ileus, emergency, elective, laparotomy, flatus

### Introduction

Postoperative ileus is defined as delayed return of bowel movements following gastrointestinal surgeries, sometimes lasting for 3 to 5 days. It has been noticed in day to day surgical practice that this ileus has caused lot of distress and discomfort to the patient both physically and mentally. Prolonged ileus leads to lengthened stay in the hospital thereby increasing the risks for infections especially the hospital acquired infections, and complications like deep venous thrombosis, respiratory compromise and sky soaring hospital costs<sup>[1]</sup>.

Post-operative ileus is a common consequence after a prolonged abdominal surgery, especially where there has been lot of bowel handling and peritoneal contamination.

Hence reducing this latent period between the surgery and the initiation of diet was necessary. By making the patients participate in gum chewing in the post-operative period is one of the methods used to fasten the recovery of bowel and get it ready for the diet initiation.

### Methodology

#### Study design

Hundred and one cases were enrolled in the study. All patients undergoing elective and emergency laparotomy surgeries from January 2014 to December 2015 were enrolled. The cases were studied purely on prospective randomized controlled trial basis. No retrospective cases were added in the study.

**Study setting:** This study was conducted in General Surgery Department of Bangalore Baptist Hospital which is a tertiary care center.

### Inclusion criteria

- Adult patients undergoing elective and emergency laparotomy surgeries.
- Fully conscious oriented and able to follow instructions.
- Patients who have signed the consent form.

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**Exclusion criteria**

- Unconscious patients who cannot follow instructions and who are not fully oriented.
- Inability to chew gum.
- Uncorrected hypothyroidism.
- Muscular and neurological disorders.
- Patients on abdominal radiation treatment.
- Documented history of irritable bowel syndrome.
- Patients in sepsis and shock at the time of admission.
- Patients on ventilator support.

**Results, Analysis and Discussion****Table 1:** Demographic distribution and surgical characteristics

Characteristics	Study group N = 54	Control group N = 47
Mean age (yrs.)	44.63 +/- 17.806	47.45 +/- 20.662
Male/female ratio	40/14	39/8
Co morbid illness	50(92.6%)	41(87.2%)
Electrolyte imbalance	44(81.48%)	39(82.97%)
Mean duration of surgery (minutes)	202.13 +/- 60.66	217.87 +/- 60.55
Abdominal drain	48(88.9%)	43(91.5%)

**Table 2:** Asa Grading

Asa Grade	Study Group	Control Group	Chi square	p-value
1	6(11.11%)	12(25.5%)	7.272	0.064
2	3(5.6%)	6(12.8%)		
3	2(3.7%)	0(0.0%)		
4	38(70.37%)	26(55.32%)		
5	5(9.26%)	3(6.38%)		
6	0	0		

Most of the patients in the study population belonged to the ASA grade 4.

**Table 3:** Associated comorbidities

Comorbidities	Study group	Control group	Chi square	p-value
Yes	50(92.6%)	41(87.2%)	0.809	0.368
No	4(7.4%)	6(12.8%)		

In the study group of 101 patients 91 (91.9%) had one or more comorbidities. There were 50 (92.6%) patients who had comorbidities in the chewing gum group (n=54) and 41(87.2%) of

the patients in the non-chewing gum group (n=47) had comorbidities.

**Table 4:** Elective and emergency surgeries

Type of surgery	Study group	Control group	Chi square	p-value
Emergency	38(70.4%)	32(68.1%)	0.062	0.804
Elective	16(29.6%)	15(31.9%)		

Study included 101 patients who underwent laparotomies and among them 70(69.31%) were emergency surgeries and 31(30.69%) were elective surgeries.

Chewing group included 38(70.4%) emergency surgeries and

16(29.6%) were elective. The non-chewing gum group included 32(68.1%) emergency surgeries and 15(31.9%) elective surgeries. p-value is 0.804 and insignificant and the groups are comparable.

**Table 5:** Mean duration of surgeries

Duration of surgery	Study Group (minutes)	Control Group (minutes)	t-value	p-value
Mean duration (minutes) [Mean and S.D]	202.13 +/- 60.66	217.87 +/- 60.55	1.302	0.196

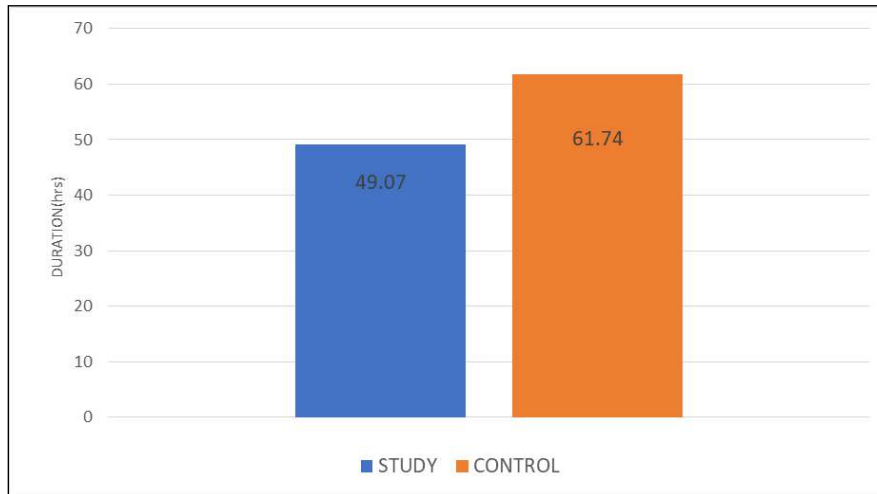
Mean duration of surgeries in study group: 202.13 +/- 60.66 minutes

Mean duration of surgeries in control group: 217.87 +/- 60.55 minutes

p-value is 0.196 and is not significant.

**Table 6:** Time to flatus

Flatus	Study group (in hours)	Control Group (in hours)	t-value	p-value
Mean duration for passage of flatus [Mean and S.D]	49.07 +/- 13.88	61.74 +/- 8.54	5.423	0.000



**Fig 1:** Comparison of time to first passage of flatus between study and control group

The average time to the first passage of flatus was 49.07 +/- 13.88 hours in the experimental group and 61.74 +/- 8.54 hours in the control group; the difference in these values was statistically significant (t = 5.423, p < 0.001).

**Table 7:** Time to flatus in elective surgeries

Flatus Groups	Elective surgery		t-value	p-value
	Study group (in hours)	Control group (in hours)		
Mean duration for passage of flatus [Mean and S.D]	51 +/- 14.96	60 +/- 8.48	2.04	0.051

Among the elective surgeries the patients who chewed gum passed flatus by mean 51+/-14.96 hours, and those who did not chew gum had a mean duration of 60+/- 8.48 hours.

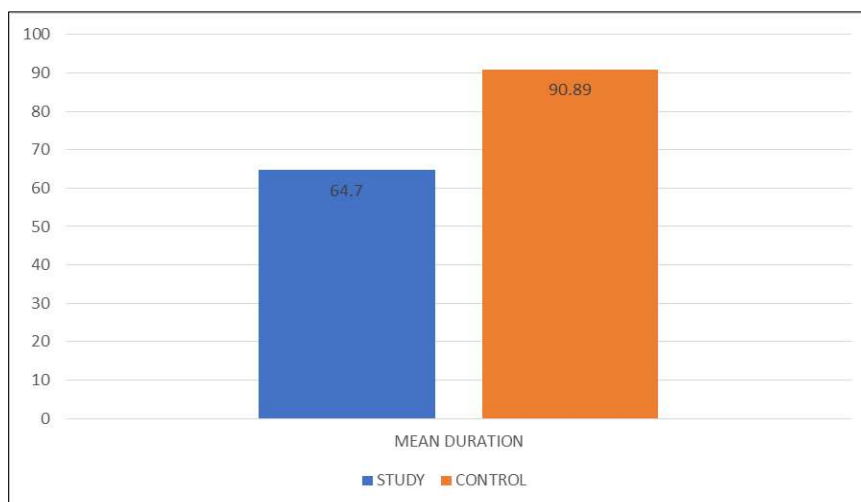
**Table 8:** Time to flatus emergency surgeries

Flatus	Emergency Surgery		t-value	p-value
	Study group (hours)	Control group (hours)		
Mean duration for passage of flatus(hours) [Mean and S.D]	48.26 +/- 13.53	62.56 +/- 8.57	5.163	0.000

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 48.26 +/- 13.53 hours, and those who did not chew gum had a mean duration to flatus as 62.56+/-8.57 hours. p-value is 0.000 and is significant.

**Table 9:** Time to feces

Feces	Study Group (hours)	Control Group (hours)	t-value	p-value
Mean duration for passage of feces (hours) [Mean and S.D]	64.7 +/- 12.88	90.89 +/- 13.84	9.844	0.000



**Fig 2:** Time comparison in passage of feces between study and control group

In the study group mean time for passage of feces from the time of surgery was 64.7+/-12.88hours. In the control group the mean time was 90.89+/-13.84hours. p-value is 0.000 and is significant.

**Table 10:** Time to feces in elective surgeries

Feces Groups	Elective		t-value	p-value
	Study Group (in hours)	Control Group (in hours)		
Mean duration for passage of flatus [Mean and S.D]	67.87 +/- 16.78	85.73 +/- 8.1	3.72	0.001

Among the elective surgeries the patients who chewed gum passed feces by mean 67.87 +/-16.78 hours., and those who did not chew gum had a mean duration of 85.73 +/- 8.1 hours.

p-value is 0.001 and is significant.

**Table 11:** Time to feces in emergency surgeries

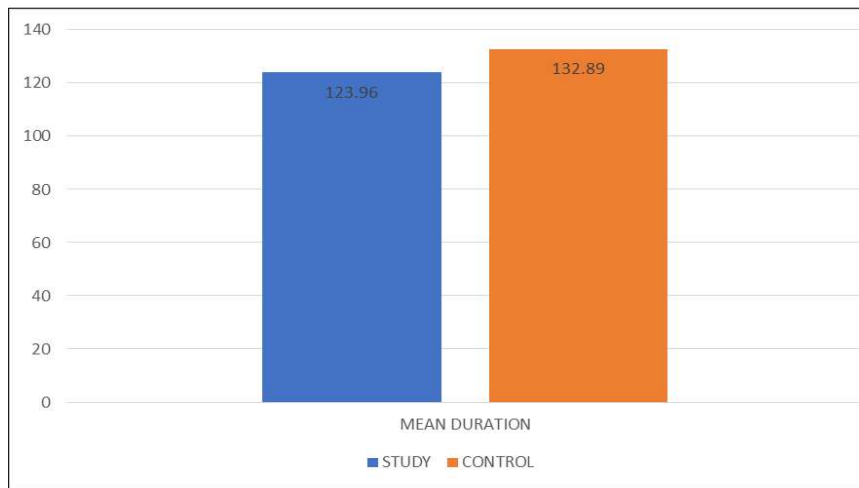
Feces Groups	Emergency		t-value	p-value
	Study Group (hours)	Control Group (hours)		
Mean duration for passage of flatus [Mean and S.D]	63.36 +/- 10.82	93.31 +/- 15.33	9.54	0.000

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 63.36 +/- 10.82 hours, and those who did not chew gum had a mean duration to feces as 93.31 +/-15.33 hours.

p-value is 0.000 and is significant.

**Table 12:** Mean duration for initiation of diet

Diet	Study group	Control group	t-value	p-value
Mean duration for initiation of diet(hours) [Mean and S.D]	123.96 +/- 33.75	132.89 +/- 29.49	1.407	0.163



**Fig 3:** Time comparison for initiation of diet between the study and control group

In the study group mean time to diet from the time of surgery was 123.96 +/-33.75 hours. In the control group the mean time was 132.89 +/- 29.49 hours. p-value is 0.163 and is not significant.

**Table 13:** Mean duration for initiation of diet – elective group

Diet Groups	Elective		t-value	p-value
	Study group	Control group		
Mean duration for initiation of diet(hours) [Mean and S.D]	130.75 +/-35.56	128.93 +/- 30.41	0.152	0.880

Among the elective surgeries the patients who chewed gum were started on diet by mean 130.75 +/- 35.56 hours, and those who did not chew gum had a mean duration of 128.93 +/- 30.41hours.

p-value is 0.880 and is not significant

**Table 14:** Mean duration of for initiation of diet – emergency group

Diet Groups	Emergency		t-value	p-value
	Study group	Control group		
Mean duration for initiation of diet(hours) [Mean and S.D]	121.11 +/- 33.02	134.75 +/- 29.25	1.813	0.07

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 121.11 +/- 33.02 hours., and those who did not chew gum had a mean duration to initiation of diet as 134.75 +/- 29.25 hours.

p-value is 0.07 and is not significant.

**Table 15:** Post – operative hospital stay

Hospital stay	Study group	Control group	t-value	p-value
Mean duration of stay in hospital (in days) [Mean and S.D]	7.87 +/- 1.8	9.085 +/- 1.26	3.865	0.000



**Fig 4:** Comparison of mean days for discharge between the study and control group

Mean days to discharge in study group was 7.87+/-1.8 days p-value is 0.000 and is significant.  
 Mean days for discharge in control group was 9.085+/- 1.26 days.

**Table 16:** Post – operative hospital stay- emergency surgeries

Hospital stay Groups	Emergency		t-value	p-value
	Study group	Control group		
Mean duration of hospital stay(in days) [Mean and S.D]	7.42 +/- 1.81	8.72 +/- 1.37	3.327	0.001

In case of emergency surgeries – study group patients got discharged by mean days of 7.42+/-1.68 from the day of surgery. Control group got discharged by mean days of 8.72+/-1.69.

Hence in case of emergency surgeries, post-operative stay in the study group (7.42+/-1.68) was shorter as compared to the control group (8.72+/-1.69).

**Table 17:** Post – operative hospital stay- elective surgeries

Hospital stay Groups	Elective		t-value	p-value
	Study group	Control group		
Mean duration of hospital stay(in days) [Mean and S.D]	8.93 +/- 1.28	9.86 +/- 0.35	2.69	0.01

In case of elective surgeries – study group (chewing gum group) patients got discharged by mean days of 8.94+/-1.59 from the day of surgery. Control group (non-chewing gum group) got discharged by mean days of 9.87+/-1.71. Hence in case of elective surgeries, post-operative stay in the study group (8.94+/-1.59) was shorter as compared to the control group (9.87+/-1.71).

other studies which have shown the contrast to be true<sup>[3, 4]</sup>. These studies refute the effects of gum-chewing on peristaltic movements and digestive system stimulation. In addition, most previous studies were after colorectal or gynecology surgery, whereas few reports focused on the effect of gum-chewing after gastrectomy<sup>[5, 6]</sup>.

**Discussion**

Post-operative ileus is very common after abdominal surgeries. There is always a debate regarding starting diet in patients post operatively. Hence this study was conducted to know the various factors associated with post-operative ileus and the effect of chewing gum in the recovery of ileus.

This study was conducted to relook at the effectiveness of the gum chewing in all abdominal surgeries (including both emergency and elective surgeries) in Bangalore Baptist hospital from January 2014 to December 2015 in the department of general surgery. 101 patients were included in the study (54 in the study group and 47 in the control group).

In the recent few years, there has been lot of importance given for promoting fast recovery in the post-operative period. It has been noted that the patients undergoing abdominal surgery experience reduced gastrointestinal peristalsis owing to extensive dissection, postoperative exhaust, and long duration of anesthesia.

We analyzed the following factors in our study.

The conventional, pharmacological interventions to reduced or to say prevent postoperative ileus and restore bowel functions after surgery has been widely used many of which includes use of Nasogastric tube to decompress the stomach, adequate pain control<sup>1</sup> early mobilization of the patient to stimulate bowel function, epidural anesthesia<sup>[2]</sup> and pro kinetic drugs such as metoclopramide, erythromycin, neostigmine, among others.

The mean age group in the study group was 44.63+/-17.8 years and in the control group was 47.45+/-20.662 years. Compared to the study conducted by Schuster *et al.*<sup>[7]</sup> in 2006 on patients undergoing open sigmoid resections the mean age was 60years and 63years in the study and control group respectively. Similarly, another study conducted by Anderson *et al.*<sup>[3]</sup> in 2015 on patients undergoing pancreaticoduodenectomy, the mean age was 65.9 and 63.2 years in the study and control group respectively.

As it can be seen, most of the recent studies show effectiveness of chewing in reducing postoperative ileus however there are few

Chewing gum group (study) group had 74.1% males and 25.9% females. The non-chewing gum group had 83% males and 17% females. p-value was 0.280 and is not significant and comparable in both the groups. (Table 1).

Majority of the patients in the study and in the control group belonged to the ASA grade 4 i.e.70.37% in the study group and

55.32% in the control group. (Table 2)

In the study group, 92.6% of the patients had co-morbidities and 87.2% in the control group. p-value was 0.368 and was not significant and hence both the groups were comparable. (Table 3) The number of emergency and elective surgeries in the study group were 69.31% and 30.69% respectively. In the control group, 68.1% and 31.9% were in the emergency and in the elective group respectively. (Table 4)

Majority of the surgeries in both the groups were between 2 to 4 hours. (Table 5).

Overall the mean duration of surgeries was 209.46+/-60.82 minutes. Mean duration of surgery in the study group and the control group was 202.13+/-60.66 and 217.87+/-60.55minutes. Similarly, the mean duration of surgeries in the elective and emergency group were 255.48+/-57.85minutes and 189.07+/-60.83 minutes. The study conducted by Schuster *et al.* [7] in 2006 in patients with open sigmoid resections the mean duration of surgery was 108 and 115minutes. Hence the surgeries in our study lasted for a longer time compared to this above study. (Table 5). But the surgeries lasted for a shorter time when compared with the mean duration on surgeries conducted by Anderson *et al.* [3]. The time to the first passage of flatus was 49.07 +/- 13.88 hours in the experimental group and 61.74 +/- 8.54 hours in the control group; the difference in these values was statistically significant ( $t = 5.423, p < 0.001$ ).

Among the elective surgeries the patients who chewed gum passed flatus by mean 51+/-14.96hours, and those who did not chew gum had a mean duration of 60+/- 8.48 hours. (p-value-0.051).

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 48.26+/-13.53 hours and those who did not chew gum had a mean duration to flatus as 62.56+/-8.57 hours. (p-value 0.000) (Tables 6, 7 & 8).

In contrast to our study, the study conducted by Quah *et al.* [8] after open colectomy the mean duration of passage of flatus was 57.6+/-24 hours and 61.8+/-24 hours respectively in which there wasn't much difference in the passage of flatus in the chewing and the non-chewing gum group.

However Zhang *et al.* [5] found out that the first passage of flatus in the gum-chewing group was seen on average of 69 hours after operation, which was significantly earlier than the average of 77 hours in the control group ( $p < 0.05$ ) which was comparable to our study with a significant improvement in the study group compared to the control group.

In the study group mean time for passage of feces from the time of surgery was 64.7+/-12. 88 hours. In the control group the mean time was 90.89+/-13.84 hours (p-value 0.000).

Among the elective surgeries the patients who chewed gum passed feces by mean 67.87 +/-16.78 hours, and those who did not chew gum had a mean duration of 85.73 +/- 8.1 hours.

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 63.36 +/- 10.82 hours, and those who did not chew gum had a mean duration to feces as 93.31+/-15.33 hours. Hence in the study group the mean duration of passage of feces was earlier compared to the control group. (Tables 9, Figure 2, table 10 and 11).

This was similar to the study conducted by Anderson *et al.* [3] in which the mean duration of passage of feces was 182.4+/-64.8 hours and 218.4+/-148.8 hours in the study and control group. But it was contradictory to the study conducted by Quah *et al.* [8] in which the mean duration of passage of feces was 76.8+/-36hours and 93.6+/-36hours in the study and control group. The difference was not significant since the p-value was 0.38.

In the study group mean time to diet from the time of surgery

was 123.96+/-33. 75 hours. In the control group the mean time was 132.89 +/- 29.49 hours. (p-value : 0.163)

Among the elective surgeries the patients who chewed gum were started on diet by mean 130.75 +/- 35.56 hours., and those who did not chew gum had a mean duration of 128.93 +/- 30.41 hours. (p-value: 0.880).

Among the patients who underwent emergency laparotomies in the study group had a mean duration of 121.11 +/- 33.02 hours., and those who did not chew gum had a mean duration to initiation of diet as 134.75+/- 29.25 hours. (p-value: 0.07) (Tables 12, figure 3, Table 13 and 14).

This was similar to the study conducted by Anderson *et al.* [3] in which the time of initiation of diet was early in the chewing gum group i.e. at 122.4+/-64.8 hours compared to the non-chewing gum group which was 184.8+/-84 hours.

In our study the average length of hospital stay was 8.43 +/- 1.682days.

The average length of hospital stay in the study group was 7.87+/- 1.8 days and in the control group was 9.085+/- 1.26 days.

Hence post-operative stay in the study group was shorter as compared to the control group.

In case of elective surgeries – study group (chewing gum group) patients got discharged by mean days of 8.93 +/- 1.28 days from the day of surgery. Control group (non-chewing gum group) got discharged by mean days of 9.86 +/- 0.35 days.

Hence in case of elective surgeries, post-operative stay in the study group was shorter as compared to the control group.

In case of emergency surgeries – study group patients got discharged by mean days of 7.42+/-1.81 from the day of surgery. Control group got discharged by mean days of 8.72+/-1.37. (Tables 15, 16 and 17; Figure 4).

Hence in case of emergency surgeries, post-operative stay in the study group was shorter as compared to the control group.

This was similar to the study conducted by Anderson *et al.* [3] where the average length of hospital stay was 18.0+/-4.9 days in the study group and 21.8+/-6.5 days in the control group. Hence there was significant difference in the length of hospital stay in the study and in the control group.

In Ngowe study [9] in 2010, also showed the same results in regard to length of hospital stay. Hospital stay was shorter in the chewing gum group (4.9 days.) than in the control group (6.7 days), ( $P < 0.0001$ ). The study concluded that chewing gum ameliorates recovery after open appendectomy by reducing postoperative ileus and that it is a cheap and helpful treatment to be recommended in developing countries in Africa.

In contrast to this study the length of hospital stay did not show significant difference in the study and control group in study conducted by Quah *et al.* [8] i.e. the length of hospital stay in the study and control group were 11.1+/-7.3 days and 9.4+/-2.5 days respectively.

Hence as per our study the chewing gum group had early recovery from the post-operative ileus when compared to the control group.

## Conclusions

Gum chewing has a positive effect on the early recovery of bowel motility and reduction of hospital stay. It is an effective and side-effect-free method. Most importantly it is cost effective and can be recommended in developing countries.

In our study as well chew gum as method to reduce the post-operative ileus was very effective and can be safely made as a part of the post-operative care.

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### Conflict of interest

The author declares that, they have no conflict of interest.

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