



Original Article

Evaluation of the Effect of Gummy Candy on Postoperative Ileus and Its Complications

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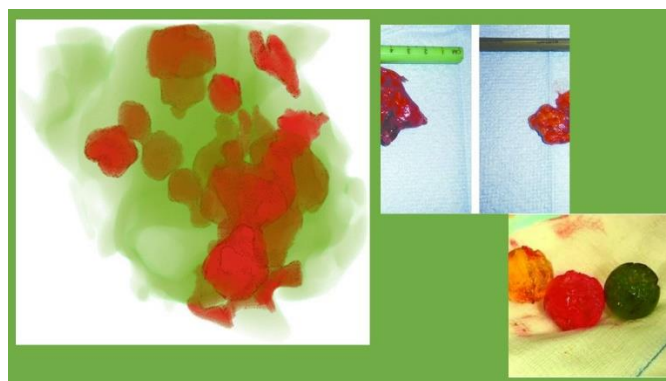
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ABSTRACT

Prolonged postoperative ileus can delay hospital discharge. According to the reports, diet and in particular gummy candy may strengthen bowel movements and hence eliminate ileus. A total of 149 patients within the age range of 7-60 years who underwent laparotomy were randomly divided into the experimental group that were treated with gummy candy and the control group which included 73 patients. The experimental group chewed gummy candy four times a day, 6 hours after operation until the first flatulence. The patients in the both groups were checked for bowel movement and flatulence every two hours and it was recorded precisely. Both groups were also divided into 3 subgroups based on surgical incision. On average, the first recorded bowel sound was 10.78 ± 7.66 hours after the surgery. In addition, the first flatulence was recorded on average 2.51 ± 14.32 hours after the surgery. The mean time of hospitalization in both groups was 104.21 ± 757.85 hours. The mean duration between the surgical end time, the first recorded bowel sound and the time to first flatulence was significantly lower in the experimental group compared with the control group.

GRAPHICAL ABSTRACT



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Introduction

Postoperative ileus (POI) is a recognized complication with a prevalence of up to 15%. Indeed, it is a temporary impairment of gastrointestinal (GI) motility after intra-abdominal or non-abdominal surgery, arising from the surgical stress response [1-3]. It is usually accompanied by vomiting, nausea, abdominal pain and distension, increased morbidity and mortality, delayed postoperative recovery, extended hospitalization and increased healthcare costs. Several therapeutic strategies have been tested to reduce POI. Sham feeding, for example gummy candy has been reported to decrease POI [4-6].

Considering some doubts about the effectiveness of sham feeding approach on reducing POI, we proposed a method in which peristalsis can be induced naturally. Gummy candy could be a proper choice for this purpose owing to following reasons. Firstly, gummy candy could trigger salivation and the neuro digestive processes that lead to normal intestinal function (5) and secondly, swallowing gummy candy could induce Peristalsis [7-9].

Indeed, swallowing leads intestinal wall to be stretched locally, which in turn causes serotonin release and then sensory neurons activation. This process can cause smooth muscles contraction and thereby peristalsis induction. Finally, a small portion of gummy candy could prevent early enteral feeding complications. To examine this hypothesis, we conducted a randomized clinical trial to investigate the impact of gummy candy treatment on patients who underwent laparotomy [10-13].

Material and methods

In this study, we have considered all patients who underwent abdominal surgery for any reasons at Rasool Akram hospital between April 2017 to March 2020. Our excluding criteria were those of age group over 60, having diabetes, inability to chew and being intubated after surgery. The participants were divided into two groups, randomly; the control group (group c) that included 73 patients with an average age of 31.3 years and the intervention group (group I) with 76 patients by average age of 28.2 years.

Then, we assigned the new patients to one of the groups every other day. In the experimental group, 6 hours after surgery, the patients were given gummy candy with coca flavor of Shibaba brand 6 hours after surgery. The procedure repeated every 6 hours until the time of the first flatulence. Patients were asked about flatulence and defecation and checked bowel sounds every 2 hours after surgery. Variables were analyzed by SPSS software (version 19.0) considering descriptive indices. The relationship between variables was examined using Chi-square, independent T, Fisher's exact tests and P-value less than 0.05 was considered statistically significant.

Result and Dissection

This study examined 149 patients, of which 39 (26.2%) were female and 110 (73.7%) were male. The results showed that there was no significant difference in gender ratios of group C and group I; group C included 24% females and 76% males compared with group I, which was comprised of 28.4% female and 71.6% male ($P > 0.05$ with χ^2 test.).

In general, the mean age of patients was 29.81 ± 13.75 . Specifically, the mean age of patients was 31.04 ± 14.08 in group c and 28.57 ± 13.39 in group I, respectively. As observed, there was no considerable difference between the mean age of the two groups ($P > 0.05$ with T-test) [14-16].

On average, the first recorded bowel sound was 10.78 ± 7.66 hours after the surgery. Specifically, the first recorded bowel sound was found 9.43 ± 6.12 hours and 12.11 ± 8.76 hours after the surgery in group C and group I, respectively. We compared the mean time till the first recorded bowel sound appeared in group C with that of group I using T-test. The mean time required to record the first bowel sound in the experimental group was significantly less than that of the control group ($P = 0.033$) [17-19]. In addition, the first flatulence was recorded on average 25.1 ± 14.32 hours after the surgery. Specifically, the first flatulence was found 31.47 ± 16.12 hours in group C and 18.65 ± 8.27 hours after the surgery in group I, respectively. We compared the mean

time of the first flatulence in group C with the experimental group using t-test. The results indicated that the mean time required for the first flatulence in the experimental group was significantly less than that of the control group ($P < 0.001$) [20-22].

The mean time of hospitalization in both groups was 104.21 ± 75.115 hours and 49.66 ± 92.51 hours in the control group and the experimental group,

respectively. The mean time of hospitalization in the control group was compared with that of the experimental group using t-test. It was observed that this range was lower in experimental group, significantly ($P = 0.033$). In this study, we considered three different types of surgical incisions: Midline (39.9%), McBurney's (51%), and subcostal (16.1%). The incision-type ratio was given separately for control and experimental groups (Table 1).

Table 1: The percentage of incision type between group C and group I

Type of incision	Group I	Group C	P > 0.05
Midline	32.4	33.3	
Subcostal	16.2	16	
MCBurney	51.4	50.7	

Table 2 shows the mean duration till the first recorded bowel sound, the time to first flatulence

and the average hospital stay based on incision type [23-25].

Table 2: The mean time of the first recorded bowel sound, the time to first flatulence and hospital stay based on incision type

Type of incision	recorded bowel sound	flatulence	Hospital stay
Midline	16.4 ± 9.5	33.4 ± 18.85	153.57 ± 61
Subcostal	7.92 ± 6.25	23.25 ± 8.96	110.13 ± 43.45
M.C Burney	8.05 ± 3.89	20.29 ± 9.07	70.51 ± 29.72

The analysis conducted using Mann Whitney test demonstrates that:

- There was no significant difference between the mean time till the time to first recorded bowel sound in group C and group I for all incision types ($P > 0.05$);
- there was a significant difference between both groups for all incision types in the first flatulence after surgery ($P < 0.001$); and
- the mean hospital stay of experimental group was significantly less than that of control group considering McBurney's incision. However, the mean hospital stay was the same in both the groups when the other types of incision were considered.

An analysis based on Pearson correlation test led to the following results:

- There was a positive relationship between the age and the mean hospital stay such that the mean hospital stay rose with an increase in the age of

patients (coefficient=0.39 and $P < 0.01$). Specifically, the correlation coefficient was 0.44 with $P < 0.01$ and 0.29 with $P = 0.0011$ in control group and experimental groups, respectively; and b) a positive correlation was also observed between the age and the time to first flatulence (coefficient=0.28 and $P = 0.001$). There were no significant differences in surgical complications between the two groups [26-28].

Postoperative bowel obstruction, which is a medical term to describe functional bowel obstruction, is a common complication in patients undergoing abdominal surgery. This complication is characterized by a lack of bowel movements, which leads to accumulation of bowel contents and delayed release of gas. People with postoperative stable bowel obstruction are immobile, feel discomfort and pain, and are at high risk for other complications. This increases the length of hospital stays and increases medical costs. Daikenchuto is a traditional Japanese

medicine (known as Kampo) that may reduce postoperative bowel obstruction [30-32].

Ileus is common after surgery because people are often prescribed medications that slow bowel movements. This problem is a type of paralytic ileus. In this case, the bowel is not blocked but does not move properly [33-35]. As a result, the digested food has little or no movement along the intestines. Examples of medications that can cause paralytic ileus include: a) Hydromorphone (diladide), b) morphine, c) oxycodone, and d) tricyclic antidepressants such as amitriptyline and imipramine (teframil). However, there are several other causes for ileus, including colon, cancer, Crohn's disease, which causes the intestinal wall to thicken due to autoimmune inflammation, and Diureticitis Parkinson's disease, which affects the muscles and nerves in the gut.

These are the most common causes of ileus in adults. Children can also get ileus. According to the Mayo Clinic, intussusception, i.e., penetration of one part of the intestine into another, is the most common cause of ileus in children. This happens when part of the gut "like a telescope" sinks into another part and folds [36-38]. Ileus is the second most common reason for hospital admission in the first 30 days after surgery. If you have recently had abdominal surgery, you are more likely to develop ileus [39-41]. Abdominal surgeries that the doctor deal with in the intestines usually stop the bowel movement for a period of time. This allows the surgeon to access the bowel. Sometimes natural smoky movements can slowly return to the normal state. Other people are more likely to experience scar tissue later in life, which can lead to ileus [42-45].

The doctor first listens to the patient's symptoms. The patient will probably be asked about any history of medical conditions, prescription drugs, and surgery, especially recent surgeries. The doctor then performs a physical examination, looking for signs of swelling or pressure in the abdomen [46-48]. The doctor also places a headset on the patient's abdomen to check for normal bowel sounds. If your bowel does not move due to ileus, your doctor may not hear anything, or you may hear excessive sounds in your bowel. Imaging studies are usually

prescribed after a thorough physical examination [50]. Your doctor may use these methods to identify areas where the contents of the bowel appear to be concentrated. Imaging studies may show where the ileus is by showing a buildup of gas, an enlarged bowel, or even a blockage [53].

Ileus disease can become a serious and potentially life-threatening condition. Two of the most severe complications are tissue death and peritonitis. Tissue death is also known as ectopic cell death or dead tissue. When obstruction occurs, necrosis or death tissue may occur, so that a blockage prevents blood supply to the intestine [56-58]. Without blood, oxygen cannot reach the tissue, which causes the tissue to die. Dead tissue weakens the intestinal wall. This causes the bowel to rupture easily and the contents of the bowel to leak out. This is known as intestinal perforation [59-61]. And, the perforation of the intestine can lead to peritonitis, meaning serious inflammation in the abdominal cavity caused by bacteria or fungi [5]. The gut contains a large number of bacteria, including *E. coli*. These bacteria must remain in the intestine and must not circulate freely in the abdominal cavity. Bacterial peritonitis can lead to sepsis (a blood infection), a life-threatening condition that can lead to shock and rupture [6].

How is intestinal obstruction treated?

Treatment of ileus depends on its severity. Examples of ileus are minor obstruction, complete obstruction, Paralytic ileus or intestinal paralysis. As far as minor obstruction is concerned, sometimes a condition such as Crohn's disease or diverticulitis means that part of the bowel is not moving. But some intestinal material can move. In this case, if you do not have another problem, your doctor may recommend a low-fiber diet. This can reduce the production of bulky stools, making it easier to pass through the gut. However, if this does not work, surgery may be needed to repair or replace the damaged part of the bowel [4].

Complete obstruction is a medical emergency. Treatment depends on your overall health. For example, some people cannot have major abdominal surgery. The elderly and those with colon cancer are among them. In this case, your doctor may use a metal stent to open the bowel. At

best, food passes through the stent. However, abdominal surgery may still be needed to remove the obstruction or remove the damaged part of the bowel [55].

Considering paralytic ileus or intestinal paralysis, treatment of paralytic ileus begins with identifying the underlying cause. If the drug is the cause of the disease, your doctor may prescribe other drugs to stimulate movement (bowel movement). An example of such a drug is metoclopramide. Also, stopping medications that cause ileus, if possible, can help with recovery. However, you should not stop taking medication, especially antidepressants, without your doctor's approval [7]. It is possible to treat without surgery in the early stages of paralytic ileus. But you may still need to be hospitalized to get the right fluids until the problem is completely resolved. Your doctor may also use a nasal tube with suction in addition to hydration of the venous fluid. This procedure, known as a nasal gastric obstruction, uses a tube to be inserted into the nasal cavity to reach the stomach. It basically pulls out pipes, air and other materials that you might otherwise bring up. Most surgical ileus cases resolve within two to four days after surgery. However, some people need surgery to repair if they do not recover [18].

If left untreated, intestinal obstruction can cause tissue loss in the obstructed area. It can also cause perforation of the intestinal wall, severe infection, and shock. In general, the prognosis of the disease depends on its primary cause. Most cases of intestinal obstruction can be treated. However, other causes, such as cancer, require long-term treatment and monitoring [11].

Conclusion

Postoperative ileus (POI) is defined as gastrointestinal mobility impairment subsequent to an intra-abdominal or nonabdominal surgery. Its etiology may be multifactorial. POI can increase costs, morbidity and the period of hospitalization. The present clinical trial with 149 patients revealed that using gummy candy after surgery may significantly reduce the period required for the first recorded bowel sound, the first flatulence and the period of hospitalization. Further, we investigated the

forementioned parameters within the two experimental and control groups by considering three different types of incisions. We found that the time to first flatulence in the experimental group was significantly shorter for all types of incisions. In addition, the period of hospitalization in the experimental group was significantly shorter only for McBurney's incision.

Despite numerous studies focusing on the effect of gum chewing on POI, no study has evaluated positive and significant relationship between gummy candies consumption and postoperative ileus. Also, none of the studies has related the subject of this article to the type of surgical incisions. Hence, it can be concluded that although the present study shows promising results on the effectiveness of using gummy candy chewing to reduce hospitalization time, the time to first flatulence and bowel sounds, further research is recommended to reinforce findings that support this hypothesis.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

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