

The Effect of Non-Sugared Gum Chewing With Early Ambulation versus Early Ambulation Only on Recovery of Bowel Function after Elective Cesarean Section

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Abstract Background: The rate of CS is surged high in Egypt at 2014. Ileus is the most common CS complication. It may become serious enough to alter women post CS accommodation; delay wound healing and increase hospital stay. **Aim:** to investigate the effect of non-sugared gum chewing with early ambulation versus early ambulation only on recovery of bowel function after elective cesarean section. **Research design:** Randomized controlled clinical trial. **Setting:** Damanhour educational institution affiliated to ministry of health at Elbehira governorate Egypt. **Participants:** A systematic random sample of 100 woman undergoing elective cesarean section. **Tools:** Three tools were used for data collection: Structured Interviewing Schedule, Pre and intra-operative assessment sheet, bowel functions assessment sheet. **Results:** The study results shows statistically significant improvement in all bowel functions among intervention group compared to control. Where, The mean time hours to the first bowel sound (3.90 ± 0.893 compared to 5.34 ± 0.939), onset of gas passage (6.78 ± 0.996 compared to 7.06 ± 1.105), feeling of hunger time (7.98 ± 1.134 compared to 9.40 ± 1.212), begins oral fluids (3.98 ± 0.775 compared to 5.78 ± 0.996), feeding time (10.16 ± 0.817 compared to 11.92 ± 1.712), onset of defecation (12.180 ± 1.240 compared to 14.48 ± 1.403) were significantly shorter in the non-sugared gum chewing with early ambulation group than early ambulation only. Furthermore, abdominal distention and nausea are significantly higher among control group than intervention. **Conclusion:** Non-sugared gum chewing with early ambulation significantly enhance regain of all bowel functions post CS than early ambulation only. In addition, abdominal distention and nausea were significantly higher in non-sugared gum chewing with early ambulation group than early ambulation only. **Recommendations:** Non-sugared gum chewing could be added to post cesarean care protocols.

Keywords: bowel function, cesarean section, non-sugared gums chewing

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1. Introduction

Cesarean section (CS) is an important surgical procedure that is performed when vaginal delivery have pre-identified or emergency risk on both mother and fetus. Cesarean section is not always safe, in numerous cases; it may carry serious complications to both mothers and fetus if not performed under suitable circumstances [1]. Worldwide, CS is one of the most popular operation in the branch of obstetrics and gynecology. According to the world health organization, Brazil ranks first in CS rate (56%) followed by Turkey (53.1%). [2] Egypt come in the third rank in 2014 based on the results of Egypt demographic and health survey. It reported that the rate of CS surged to 52%. [3]

After any abdominal operations, including CS, intestinal functions is seriously affected. Post-surgical autonomic nervous system alteration leads to disturbance

in intestinal functions, especially, motility. Furthermore, manipulation of the internal organs during surgery may have influence on intestinal function. In addition, anesthesia-relaxing effect on gastro-intestinal system contributes to delayed regain of its function. Moreover, the remaining effect of pregnancy hormones have another relaxing effect on gastro-intestinal system. In addition, some analgesics that is used post CS such as metoclopramide, erythromycin, neostigmine and alvimopan can delay intestinal functions regain. [4,5]

All these factors may contribute to slowing or stopping of bowel functions for several hours or days post CS. This problem is usually self-limited within few days but it can lead to some temporal discomforts. These discomforts includes, but not limited to, gases and secretions accumulation in the intestine. This accumulation leads to distention, nausea, vomiting and pain. This may negatively affect parturient physical and psychological postpartum accommodation. [5] If this condition continued to 3-5 days, it is called ileus. Ileus is one of the

most prevalent postoperative problems. It can lead to delayed hospital discharge, increase risk for nosocomial infection and increase hospital cost. Consequently, it increases physical, psychological and economic burden on both mother and family [5,6].

Routine post-operative care for post CS women includes forbidden oral intake until regain of intestinal functions. Indicators for regain of intestinal functions include hearing bowel sound, passage of first flatus, feeling of hunger and passage of stool. [7,8] Early post-operative oral feeding without reassuming bowel functions may lead to serious complications as ileus. Other contributing factors to ileus is postoperative intestinal necrosis, type of anesthetic medication, intraoperative manipulation and duration of the surgery. [9]

Based on the previous data, health care team should search for intervention that stimulates bowel functions without oral feeding. Early ambulation has numerous known benefits. It stimulates the blood circulation and prevents postoperative blood clots. It can enhance respiratory functions and improve wound healing. Furthermore, it improves intestinal functions and improves appetite. However, it seems to be not enough because it does not have a direct effect on the gastro-intestinal system. Another intervention that has a direct effect on the gastro-intestinal system is needed. This intervention is non-sugared gum chewing. It can act as placebo feeding that stimulates cephalic vagal reflex of the gastro-intestinal system. This myoelectric activation can internally stimulate the secretion of gastro-intestinal hormones. These stimulations act to increase salivation, stomach, intestine and pancreatic secretions. In other words, non-sugared gum chewing acts as a virtual diet for the gastro-intestinal system and internally stimulates its functions. [10] If such simple, cheap, affordable, and easy intervention is approved to be effective with early ambulation, it can be an essential post-operative care that enhances bowel functions. It can also enhance postpartum accommodation, improve women's comfort, reduce risk for post-operative ileus, and decrease hospital stay and cost. [11].

1.1. Significance of the Intervention

The rate of CS has surged up to 52% in Egypt in 2014. Ileus is the most common CS complication. It may become serious enough to alter women's post-cesarean accommodation, delay wound healing, increase hospital stay and delay wound healing. Early ambulation is approved to have numerous post-operative benefits including bowel stimulation but it doesn't have a direct effect on bowel functions. Some studies, including Mansour et al., (2016) [12], Bela S, Stephen C (2006) [13] and Abd-El-Maeboud et al. (2010) [14] reported that non-sugared gum chewing has a beneficial effect in the resumption of bowel function. On the other hand, Tandeter H (2009) reported contradictory findings. [15] This contradictory finding necessitates more researches in this topic to reach evidence regarding the effect of gum chewing on intestinal function. Therefore, this study aims to investigate the effect of non-sugared gum chewing with early ambulation versus early ambulation only on recovery of bowel function after elective CS.

2. Methodology

2.1. Aim of the Study

The current study aims to investigate the effect of non-sugared gum chewing with early ambulation versus early ambulation only on recovery of bowel function after elective cesarean section.

2.2. Research Hypothesis

- H0: CS women who chewed non-sugared gum with early ambulation regain their bowel functions at the same time as those who have early ambulation only.
- H1: CS women who chewed non-sugared gum with early ambulation regain their bowel functions earlier than those who have early ambulation only.

2.3. Subjects and Methods

Research design: Randomized controlled clinical trial

Setting: The intervention was conducted at a postnatal ward at obstetrics and gynecology department at Damanhour educational institution affiliated to the ministry of health at Elbehira governorate/Egypt. .

Sample type and criteria:

- **Type:** A systematic random sample.
- **Technique:** CS list was considered sampling frame from which even number were taken until sample size was reached. Inclusion criteria are elective CS with spinal anesthesia, aged 18 years and more, free from gastrointestinal problems, able to chew gum and agreed to participate in the intervention. Women who had experienced any intra or postoperative complication were excluded from the study.
- **Size:** According to Damanhour educational institution statistical center, 2018, the rate of elective CS was 365 cases in the last 6 months. The sample size was calculated using Epi-info program based on the following parameters: target population in the last 6 months= 365, expected frequency= 50%, acceptable error =5%, confidence level= 95%, power analysis= 80%. Sample size was 100 women. The study participants were randomly allocated to group 1 (non-sugared gum chewing with early ambulation) or group 2 (early ambulation only) group.

Tools: Three tools were used for data collection.

Tool 1: Structured Interview Schedule: It consisted of two parts:

Part 1: It included six items to assess women's basic data such as age, residence, qualification, occupation, weight, height.

Part 2: It included obstetrical history such as number of gravidity, parity, the gestational age at time of CS, number of previous CS, and medical history.

Tool 2: Pre and intraoperative assessment sheet: it includes data as fasting time before surgery, duration of surgery, amount of fluid intake, and use of pethidine.

Tool 3: bowel functions assessment sheet: It included ten items for assessing the post-operative bowel function parameters as the onset of nausea, vomiting, bowel sound, gas passage, defecation, feeling of hunger, feeding time and the length of hospital stay by hour after CS.

Tools validity and reliability:

A jury of five expertise in the women and obstetrics health nursing and one from biostatistics filed tested the tools for content validity. Reliability of tools was tested by using Cronbach's Alpha coefficient test, which revealed that tool II consisted of relatively homogenous items as indicated by high reliability ($r=0.76$).

Ethical considerations:

All ethical guidelines followed in clinical trials were applied in this study. Ethical approval to conduct the intervention was obtained from obstetrics and gynecology nursing department at college of nursing Damanhour University. Then another ethical approval was obtained from the head of Damanhour educational institute after explaining the intervention purpose. Another approval was obtained from head of obstetrics and gynecology department at Dmanhour educational institute. Finally, oral consent was obtained from each women after explaining the study purpose. Each woman was insured that all her data will be confidential and will be used for the purpose of research only. All women were assured that they have the right to refuse participation without any consequences.

Pilot study:

A pilot study was conducted on 10.0% of the participants (10 women). The purpose of the pilot study was to test the applicability of the tool as well as estimating the time needed for data collection

Field work:

- Data were collected over a period of six months from the beginning of January until the end of June 2019.

- The study had been conducted on women undergoing elective CS, who fulfilled the inclusion criteria.

- General characteristics, obstetrical history and pre/intra operative data were collected by using tool I and II from the women medical record.

- Group 1 was firstly collected at the first three months of data collection period to avoid contamination of data. For group 2 data was collected in the remaining three months of the data collection period.

- Women in group 1 were instructed to chew non-sugared gum (one pill) for 20 minutes, every 2 hours as soon as they are awake from the operation. The researcher provided each woman with required amount of gum sticks, available sugarless gum (Samarah Foods, Cairo, Egypt). The women continued chewing gums until flatus or stool occurred. No gum chewing during sleep periods. She also was helped to move her legs in the bed as early as she can. In addition, she was helped to ambulate from bed as early as she can after the operation for 10 minutes per hour.

- Women in group 2 followed postoperative hospital routine care which encourage early ambulation. Each women was helped to move her legs in the bed as early as she can. Furthermore, she was helped to ambulate from bed as early as she can after the operation for 10 minutes per hour.

- The women in both groups were not given anything orally until their bowel sounds became audible according to the hospital policy. In addition, they were not given oral or rectal bowel stimulants after surgery.

- Both groups were evaluated every half hour using *tool II* in terms of bowel sounds, feeling of hunger, passage of

gases and defecation. The bowel sounds were evaluated by using a stethoscope. Feeling of hunger, passage of gases and defecation times were recorded according to women's notification. If the woman discharged before having meal or defecation she was followed by phone.

2.4. Statistical Analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 24. Descriptive statistics were done to explore data. It includes frequency, percentage, mean and standard deviation. Differences between the two groups were tested using chi-square and Fisher's Exact tests. Independent (t) test was used to compare between mean differences of the two groups. A statistically significant difference was considered at $p\text{-value} \leq 0.05$. While $p\text{-value} > 0.05$ indicates non-significant results.

3. Results

According to [Table 1](#), no statistically significant differences are found between the two groups' socio-demographic characteristics. Furthermore, almost two-fifths (86% & 92%) of group 1 and group 2 respectively were 21-35 years old. In addition, 36% & 40% of group 1 are illiterate or had primary/preparatory education respectively, compared to 40% & 38% of group 2. Approximately one-half of group 1 (54%) and group 2 (56%) are rural area residents. It is found that 72% of groups 1, 68% of groups 2 had free medical history. In addition, 66% of group 1 have history of previous abdominal surgery compared to 62% of group 2. Finally, 82% of group 1 have no history of bowel problems compared to 92% in group 2.

[Table 2](#) elucidated that there is no statistically significant differences between group 1 and group 2 in relation to their obstetrical history and BMI. The mean was 2.531 ± 1.133 & 2.023 ± 1.03 among group 1 and group 2 respectively for Gravidity: 2.12 ± 1.547 & 1.90 ± 1.389 for parity; 39.04 ± 1.414 & 39.1 ± 1.389 for gestational age; 1.860 ± 1.3250 & 1.740 ± 1.2423 for numbers of previous CS and 29.2548 ± 18.29109 & 26.8768 ± 2.13507 for BMI.

[Table 3](#) presents, no statistically significant difference between group 1 and group 2 in their intra operative data. The mean was 9.02 ± 0.820 & 8.84 ± 1.267 among group 1 and group 2 respectively for fasting time before surgery; 1.790 ± 0.65360 & 1.870 ± 0.50719 for amount of IV fluids and 52.502 ± 7.57614 & 49.602 ± 6.91346 for duration of surgery.

[Table 4](#) shows that 82% of group 1 take pethidine as analgesic compared to 88% of group 2 without statistically significant difference between the two groups. Abdominal distention is statistically higher among group 2 (70%) than group 1 (48%). Meanwhile, nausea is noted among 46% of group 1, compared to 86% of group 2 with statistically significant difference between the two groups. On the other hand, vomiting is found among 60% of group 1, compared to 72% of group 2 without statistically significant difference between the two groups.

Table 1. Percent distribution of the study participants according to their demographic characteristics and medical history

	Group 1 (N=50)		Group 2 (N=50)		Significant test	P value
	N= 50	%	N= 50	%		
Age						
• ≤ 20 year	6	12	3	6		
• 21 - 35 year	43	86	46	92	F=1.308	P=0.742
• ≥36 year	1	2	1	2		
Working status						
• Not working	29	58	31	62	X ² = 0.167	P=0.683
• Working	21	42	19	38		
Education						
• read & write	18	36	20	40	X ² = 0.174	
• prim & prep	20	40	19	38		P=0.934
• Secondary /university	12	24	11	22		
Residence						
• Rural	27	54	28	56	X ² = 0.40	
• Urban	23	46	22	44		P=0.841
Medical history						
• Free	36	72	34	68		
• Diabetes	2	4	3	6	F=1.328	P=0.706
• Hypertension	1	2	3	6		
• Anemia	11	22	10	20		
Previous abdominal surgery						
• Yes	33	66	31	62	X ² = 0.174	P=0.677
• No	17	34	19	38		
Previous history of bowel problems						
• Yes	9	18	4	8	F=2.210	P=0.234
• No	41	82	46	92		

X²= chi-square

F= Fisher exact test

^asignificant at 0.05.

Table 2. Mean and stander division of the study participants according to their obstetrical history and BMI

	Group 1 (N=50)		Group 2 (N=50)		t test	P value
	Mean ± SD		Mean ± SD			
Gravidity:	2.531±1.133		2.023±1.03		0.623	0.543
Parity	2.12±1.547		1.90±1.389		0.748	0.456
Gestational age	39.04±1.414		39.1±1.389		0.214	0.831
Numbers of previous CS	1.860±1.3250		1.740±1.2423		0.467	0.641
BMI	29.2548±18.29109		26.8768± 2.13507		0.913	0.363

t= independent samples t test

^a significant at 0.05.

Table 3. Mean and stander division of the study participants according to their intra operative data

	Group 1(N=50)		Group 2(N=50)		t test	P value
	Mean ± SD		Mean ± SD			
Fasting time before surgery	9.02±0.820		8.84±1.267		0.843	0.401
Amount of IV fluids	1.790±0.65360		1.870±0.50719		0.096	0.934
Duration of surgery	52.502±7.57614		49.602±6.91346		0.99	0.425

t= independent samples t test

^a significant at 0.05.

Table 4. Distribution of the study participants according to their post-operative data

	Group 1		Group 2		t test	P value
	N= 50	%	N= 50	%		
Pethidine administration						
Yes	41	82	44	88	X ² =0.706	0.401
No	9	18	6	12		
Abdominal distention						
Yes	24	48	35	70	X ² =5.002	0.025 ^a
No	26	52	15	30		
Nausea						
Yes	23	46	43	86	X ² =4.937	0.26 ^a
No	27	54	16	32		
Vomiting						
Yes	30	60	36	72	X ² =1.604	0.205
No	20	40	14	28		

X²= chi-square^a significant at 0.05.

Table 5. Mean and stander division of the intervention subjects according to their bowel functions

	Group 1	Group 2	t test	P value
	Mean ± SD	Mean ± SD		
Onset of bowel sound(hour)	3.90±0.893	5.34±0.939	8.085	0.001 ^a
Onset of gas passage(hour)	6.78±0.996	7.06±1.105	5.950	0.013 ^a
Feeling of hunger(hour)	7.98±1.134	9.40±1.212	6.050	0.003 ^a
Start oral fluids	3.98±0.775	5.78±0.996	10.407	0.000 ^a
Feeding time (hours)	10.16±0.817	11.92±1.712	6.559	0.004 ^a
Onset of defecation(hour)	12.180±1.240	14.48±1.403	8.684	0.000 ^a
Period of hospital stay (hours)	30.690±1.839	31.081±2.534	0.360	0.719

t= independent samples t test

^a significant at 0.05.

Table 5 clarifies statistically significant improvement in all bowel functions among group 1 compared to group 2. The meantime to the first bowel sound was 3.90±0.893 in group 1 compared to 5.34±0.939 hours in group 2 (P = 0.001). In addition, the meantime of gas passage onset was 6.78±0.996 in group 1 compared to 7.06±1.105 in group 2. Furthermore, the mean feeling of hunger time was 7.98±1.134 and 9.40±1.212 in group 1 and group 2, respectively. Group 1 begins oral fluids after 3.98±0.775 hours compared to 5.78±0.996 in group 2. Furthermore, the mean feeding time in group 1 is 10.16±0.817 compared to 11.92±1.712 in group 2. Consequently, onset of defecation occurred after 12.180±1.240 hours in group 1 compared to 14.48±1.403 in group 2. The meantime of hospital stay is 30.690±1.839 in group 1 compared to 31.081±2.534 in group 2, without statistically significant difference between groups.

4. Discussion

Abdominal distention, nausea and vomiting are expected complains after CS. Ileus is a serious complication that alter digestive functions after abdominal operations. [16] Several strategies were used to enhance early return of bowel functions after CS such as non-sugared gum chewing during post-operative period. [14] Nurses play an important role in post CS care through assessing gastrointestinal functions. She should auscultate bowel movements until normal peristaltic movement is heard in all abdominal quadrants. Follow the incidence of first flutes, first defecation, time of hunger and reaction after first feeding. [17]

The present study results indicate no significant differences between non-sugared gum chewing with early ambulation and early ambulation only group in relation to their demographic characteristics, obstetrical history, and intra operative data. These results indicate that the two groups are homogenous and any differences in post-operative intestinal functions may be due to non-sugared gum chewing.

The results of the current study indicated that non-sugared gum chewing with early ambulation after CS significantly promote the intestinal function recovery. It can accelerates the first passage of flatus, first defecation, first bowel sound, first bowel movement. It may stimulate intestinal motility by strengthening the cephalic-vagal reflex and increasing the gastrointestinal hormones secretion associated with bowel motility and decrease side effect such as abdominal distension, nausea and vomiting. According to the relevant literatures gum chewing is advocated for stimulating bowel functions as it acts as placebo feeding,

possibly stimulating bowel and gastric motility through repetitive stimulation of the cephalic-vagal complex. [17]

The current study results indicated that abdominal distention and nausea are statistically higher among the early ambulation only than the non-sugared gum chewing with early ambulation group. Although, vomiting is higher among early ambulation only group than group 1, there is no statistically significant difference between the two groups.

The result of the current study is consistent with at least two recent studies. *First*, Darvall J et al., (2019) [18], who compared the effect of gum chewing to ondansetron in management of post-operative nausea. They reported that gum chewing was equal to ondansetron medication in the treatment of post-operative nausea after laparoscopic surgery. The effect of gum chewing is observed in both incidence and recurrence of nausea and vomiting. *Second*, Xu et al., (2018) [19] conducted meta-analysis to investigate effect of gum chewing on gastrointestinal functions after gynecologic surgery. They reported that gum chewing significantly improve bowel function parameters. Furthermore, it significantly decreased the incidence and severity of post-operative abdominal distention, nausea and vomiting.

As regard to early ambulation, Waldhausen and Schirmer (2012) [20] who studied the effect of early ambulation on recovery from post-operative ileus. They electronically recorded their patients' intestinal activities using seromuscular bipolar electrodes. They reported that early ambulation did not enhance intestinal activities. They further elaborated that the effect of early ambulation in managing post-operative ileus and its associated symptoms as abdominal distention, nausea and vomiting is over estimated than real. This result is in line with the current study. In the current study, the early ambulation only group intestinal functions not significantly improved. The improvement of the intestinal functions in the current study results from the combination of gum chewing with early ambulation. Therefore, the woman takes benefits of the two interventions.

These findings are incongruent with other three studies. The first is Ge et al., (2017). [21] They investigated the effect of gum chewing on post-operative bowel functions after laparoscopic surgery. They concluded that gum chewing did not improve nausea and vomiting among post laparoscopic gastrostomy. The second is Tandete (2009) [15], who investigated the effect of gum chewing in reducing post-operative ileus. They reported that artificial sweeteners in gums, such as sorbitol and hexitols, could induce such side effects as bloating, nausea, vomiting and abdominal cramps. The third is Me et al., (2017) [22]

conducted systemic review about the effect of gum chewing on recovery of intestinal functions after colorectal cancer surgery. They concluded that although gum chewing was effective on enhancing the recovery of intestinal functions, it has no significant effect on nausea, vomiting and abdominal distention.

The differences between the latter group studies and current one is justifiable. First, Ge et al., (2017) [21] investigated patient's post-operative bowel functions after laparoscopic surgery while the current study investigated women after CS. Second, Tandete (2009) [15] used sugared gum, where, artificial sweeteners can induce abdominal distention, nausea and vomiting. In the current study, we used non-sugared gum chewing. Third, Me et al., (2017) [22] investigated gum chewing on patients with colorectal cancer surgery. Nausea and vomiting is known to be linked to cancer pathophysiology. Therefore, in case of cancer it is not only post-operative complication, it is a sign of disease. While the current study deals with post CS cases with normal physiological events.

In addition, Conor P et al., (2003) [23] and Jyoti and Kshirsagar (2014) [24] reported contradictory result with the current study regarding early ambulation only group. The former studied the effect of early ambulation associated with early feeding on intestinal functions post-operative. They concluded that accompanying early ambulation with early feeding group have better bowel functions than control group. The later investigated the effect of early ambulation on selected post-operative health parameters. They stated that early ambulation significantly improved all post-operative health parameters including intestinal functions. However, their evaluation was not specific to include all intestinal functions. The differences between the current study results and the latter two might be related to the different intervention. Conor P et al., (2003) [23] accompanied early ambulation with early feeding but the current study accompanied gum chewing with early ambulation. Furthermore, Jyoti and Kshirsagar (2014) [24] evaluated all post-operative health parameters in general. They did not specifically evaluate bowel functions parameters.

The study findings revealed that there was statistically significant difference between both groups regarding time needed to regain their intestinal motility; it was shorter in non sugared gum chewing with early ambulation than early ambulation only group. These study findings are supported the research hypothesis that women who chewed non sugared gum after cesarean section regains intestinal function faster than those who did not. This result is congruent with at least six studies.

First, Kumar et al., (2018) [25], who investigated the efficiency of gum chewing on the recovery of intestinal functions after abdominal surgeries. They concluded that gum chewing significantly shorten the time needed for first bowel sound, first flatus, and early hospital stay in the intervention group compared to control. Second, Bhatiyani et al., (2018) [26] who studied the effect of gum chewing on gastrointestinal recovery after gynecological surgery. They reported that gum-chewing group pass the first flatus 3 hours earlier than control. They also, have regular bowel sounds 5 hours earlier than control without significant difference in the time of first

defecation between the two groups. *Third*, Shang H et al., (2010) [27], who investigated the effect of gum chewing on enhancing postoperative ileus after Cs. They concluded that chewing gum significantly shortens the time of the first bowel movement. *Fourth*, Abd-El-Maeboud et al., (2009) [14], who had conducted their study in Egypt to evaluate the efficacy and safety of gum chewing on the recovery of bowel motility after CS. They reported a statistically significant difference between the study and control groups regarding the mean postoperative time for first hearing bowel sounds. It was 10.9 ± 2.7 hours in the intervention group versus 15.6 ± 3.7 hours for the control. *Fifth*, Kafali et al., (2010) [28] who had studied "the influence of gum chewing on postoperative bowel activity after CS". They stated that bowel sounds and the first passage of flatus postoperatively appeared in a significantly shorter duration of time in the gum-chewing group than the control. *Six*, Dehcheshmeh et al., (2011) [29], who had studied "the effect of chewing sugar free gum after elective CS on return of bowel function in primiparous women", reported that the mean postoperative time interval to first hearing of normal bowel sounds was significantly lower in the gum-chewing group compared with control group.

These findings are also supported by several systematic reviews and meta-analysis studies have documented significant reduction in time to first flatus, bowel movement and the length of hospital stay in the gum-chewing group. These meta-analysis are conducted by Noble et al., (2009) [30]; Fitzgerald and Ahmed, (2009) [31]; Hocevar et al., (2010) [32]; Li et al., (2013) [33].

However, there is a contradiction between the current study results and that of Cavuşoğlu et al., (2009). [34] They had investigated the effect of gum chewing on post-operative ileus after intestinal resection in children". They found that gum chewing after surgery is safe, but does not hasten the return of gastrointestinal function. Similarly, Jakkaew & Charoenkwan, (2013) [35], who evaluated the effect of sugared gum chewing combination with early enteral feeding on recovery of gastrointestinal function after major colorectal surgery. They concluded that sugared gum chewing does not appear to have any benefit to their patient when compared with those managed with early feeding in the postoperative period. In addition, another two 2006 studies performed by Quah et al., (2006) [36] and Niloff PH (2006) [37] reported side effects of gum chewing after surgical operation. They concluded that gum chewing might increase the incidence of bloating, indigestion, and eructation, possibly related to swallowed air during gum chewing.

The differences between the latter group study and that of the current one may be due to two factors. First, the type of surgery where, Cavuşoğlu et al., (2009) [34], Jakkaew & Charoenkwan, (2013) [35] studied patients after major intestinal surgery while the present study studied women after CS. It is logic that after major intestinal surgery, intestinal functions is seriously affected. Second, Quah et al., (2006) [36] and Niloff PH (2006) [37] used sugared gum while, the present study used non-sugared gum. It is known that sweeteners used in gum manufacturing may cause abdominal distention and nausea. In addition, the latter 2006 studies are conducted since long time where different evaluation tools were used.

The results of the present study showed that the time of the first gas passage and the first defecation, took the shorter time for the patients in the gum-chewing with early ambulation group compared to the early ambulation only group.

These findings are consistent with Abd-El-Maeboud et al., (2009) [14] and Huang & He., (2015) [38] The former investigated gum-chewing effect on early recurrence of bowel movement after caesarean section. They stated that gum-chewing group had regained normal bowel sound faster than control group. The latter, Huang & He., (2015) [38] conducted a met-analysis study in china about the effect of gum chewing on restoration of intestinal function after CS. They reported that gum chewing after CS significantly shorten the time of first flatus and the time of first hearing of intestinal sounds. There were also some studies showed that gum chewing stimulated bowel motility and enhance the first flatus/defecation in patients undergoing radical cystectomy with urinary diversion. [39]

On the other hand, the current results did not agree with Lim et al., (2013). [40] They studied the effect of gum chewing on the recovery of gastrointestinal function for patients underwent colorectal resection surgery. They reported that gum chewing was safe but did not improve the gastrointestinal function. Likewise, Zaghiyan et al., (2013) [41] and Forrester et al., (2014) [42] stated that no effect of sugared gum chewing for patient underwent colorectal surgery compared to non- gum chewing group. They conducted their studies about the effect of sugared gum chewing on the return of gastrointestinal function after major surgery. Furthermore, Şenol et al., (2016) [43] did not found significant difference between groups in terms of time to first flatus and bowel movements. They investigated the effect of gum chewing on intestinal functions after gynecologic surgery. This difference in results may be found due to the differences existed between sample, surgery type and time, and type of anesthesia used.

Other variable examined in terms of bowel function was the feeling of hunger, which was 2 hours earlier in the gum-chewing group than the control. The differences between the two groups was statistically significant. This finding is in consensus with the previously discussed Belaet al., (2006) [44] results. They showed that feeling of hunger time post CS was significantly shorter in the intervention group than control. However, in Griffiths et al., (2007) [45] study, the two groups were different on the feeling of hunger time, but not statistically significant. The mean time to the feeling of hunger was 63.5 ± 10.4 hours and 72.8 ± 31.1 hours in the gum chewing and the control group respectively. This insignificant result in Griffiths et al., study could be owing to the small sample size in their study.

In the present study, the mean time to the first eat and the first defecation displayed significant difference between the two groups as it happened 2 hours earlier in the gum chewing with early ambulation than early ambulation only group. This result is similar to the results obtained by Maeboudet al., (2010) [14], Hirayama et al., (2006) [46], Ghafouri et al., (2008), [47] and Abdollahi et al., (2011). [48] Maeboud (2010) [14] studied 200 postpartum woman after elective caesarean

section. According to their results, the mean time of defecation was 21.1 ± 4.7 hours in the gum-chewing group compared to 30.00 ± 8.2 hours in the control group. These results indicate around 9 hour earlier defecation time in the study group compared to control group. Furthermore, the first eating time was 7 hours earlier in the gum-chewing group compared to control. Both Hirayama et al., (2006) [46] and Ghafouriet al., (2008) [47] reported that gum chewing group defecate earlier than control group with 15 hours. In addition, the gum-chewing group have better appetite and eat earlier than control group. The former studied 22 patients after colorectal surgery in Japan while the later studied 50 patients after upper gastro intestinal tract surgery in Tehran. Abdollah et al., (2011) [48] investigated 46 patients following appendectomy surgery in Gorgan/Tehran. They found that the time to the first defecation was 10 hours earlier in the gum chewing than the control group. The differences between the two groups was statistically significant.

However, other 2015 study reported different results. They conducted a research on 38 patients after left colon cancer surgery in England. They concluded that there is no statistical difference was observed in the time to the first defecation between the gum chewing (3.2 ± 1.5 hours) and the control (3.9 ± 1.5 hours) group. [49] The small sample size and type of surgery may justify the difference between the current study and this one.

The current study results showed no statistically significant differences between the two group regarding the period of hospital stay. The current result agrees with Sahinet al., (2015) [49] one. They conducted their study in Turkey about the effect of gum chewing, early hydration and early mobilization on the recovery of intestinal motility after CS. It was reported that the hospital discharge times was not influenced by the interventions as the women chewed gum were discharged in 56.22 ± 2.70 hr. and the women in other groups discharged in 54.99 ± 2.59 .

On the other hand, the current results did not agree with other four studies. The first is Banihosini and Khafri (2013). [50] They reported that gum chewing stimulates early intestinal function and therefore shortens the period of hospital stay. The second is Charoenkwan and Palapinyo (2005). [51] They stated that early start of gum chewing by two hours post CS was associated with early return of bowel function and early hospital discharge than those who start after 6-8 hours postoperatively. The third is Abd-el-Maebud et al., (2009). [14] They stated that the postoperative hospital stay was significantly longer in the control group than study group. The fourth is Safdari et al., (2011). [52] They found that the length of hospital stay was significantly shorter in the gum-chewing group than the control group.

The difference between the current study and the latter group studies is only in the period of hospital stay. However, in relation to intestinal functions, all of them are significantly improved in the current study. The period of hospital stay in Damanhour educational institute is subjected to hospital policy. It is routine for the CS cases to stay under observation on the hospital for 30 to 35 hours at least.

5. Conclusion

Based on the study findings H1 is accepted and H0 is rejected. Non-sugared gum chewing with early ambulation significantly enhance regain of all bowel functions post CS than early ambulation only. In addition, abdominal distention and nausea were significantly higher in early ambulation only group than Non-sugared gum chewing with early ambulation.

6. Recommendations

- Non-sugared gum chewing with early ambulation should be added to post cesarean care protocols.
- Pre-delivery educational classes for pregnant women should include education about the benefits of post-operative non-sugared gum chewing with early ambulation.
- Nursing and midwifery educators should include non-sugared gum chewing with early ambulation in post cesarean nursing care education.
- Further study:
 - Replicate the present study with larger population and different settings.
 - Investigate the effect of non-sugared gum with early ambulation on intestinal functions after gynecologic operations.

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