Effect of intermittent enteral feeding schedule on the occurrence of gastrointestinal complications and hospital stay among critically ill patients

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Abstract:

Nutrition support can result in improved wound healing, a decreased catabolic response to injury, enhanced immune system function, improved gastrointestinal structure and function, and improved clinical outcomes). The appropriately and timely nutritional intervention can improve patient recovery and survival, decrease complication rates, and decrease costs. Gastrointestinal complications (vomiting, diarrhea, constipation, and abdominal distension) are most commonly associated with complications derived from enteral feeding. **Aim**: this study was carried out to investigate the effect of the intermittent enteral feeding schedule on the occurrence of gastrointestinal complications and the length of the hospital stay among critically ill patients at Assiut University Hospitals. **Design**: a quasi-experimental design. **Setting**: trauma ICU at Assiut University Hospitals and the study took approximately one year started from July 2010 till July 2011. **Patients**: A convenience sample of 80 adults' critically ill patients on enteral feeding constituted the study sample. The patients were assigned randomly into two equal groups (control group and study group, 40 patients each).. **Methods**: The only manipulation was in the rest period and time interval in which the study group subjects were rested 8hours at night as compared to 6hours for the control ones, as well study group subjects were having 4hours time interval between each two consecutive feeding as compared to 2hours for control group subjects. **Results**: There was a significant statistical difference between both groups (p=0.000)indicating lesser hospital stay among study group subjects (52.5 % of the study group subjects were hospitalized less than one month as compared to 35 % of the control group subjects were stayed between 30 to less than 45 days). It was also found that, 57.5% of control group patients developed gastrointestinal complications as compared to 45% of the study group patients (n.s). **Conclusion**: intermittent 4-hour enteral feeding schedule had lowered the incidence of gastrointestinal complication and length of the hospital stay.

Key words: Enteral Feeding , Gastrointestinal Complications ,Critically Ill Patients.

Introduction:

Malnutrition has been associated with poor outcomes among critically ill patients, as evidenced by increased morbidity, mortality, and a length of hospital and ICU stay (**Artinian, Krayem and DiGiovine, 2006**). The appropriately and timely nutritional intervention can improve patient recovery and survival, decrease complication rates, and decrease costs (**Kaplow and Hardin, 2007**). Enteral feeding is more
advantageous than total parenteral nutrition. Enteral feeding is used in 33% to 92% and parenteral nutrition is used in 12% to 71% of critically ill patients (**Morton, 2005**).

Although enteral nutrition is often cited as a safer nutritional therapy than parenteral nutrition, complications still may occur. These complications can be categorized as gastrointestinal, mechanical, and metabolic. The reported frequency of these complications has been reported to occur in 0% to 20% of patients. Many of these complications can be prevented or treated by closely observing residuals and watching for signs and symptoms of gastric intolerance. Nursing care of patients receiving enteral nutrition under supervision of nutrition support team will result in fewer complications (**Juan, 2006**).

Gastrointestinal complications reported in 8% to 65% of patients. Signs and symptoms of gastrointestinal intolerance to enteral feeding include diarrhea, nausea, vomiting, abdominal discomfort, distension, and high residual returns (**Gibney, Eliar and Ljungqvist, 2005**).

Diarrhea is frequent reported complication of patients receiving enteral nutrition, with an incidence of 2% to 70%, and between 15% to 52% of critically ill patients. Statistical reports from Ministry of Health reported that at Assiut University Hospital 2410 patients were admitted in periods from April 2004 to October 2006 and 69% of these

admitted patients had diarrhea during their stay in the ICU **(Ministry of Health, 2007)**. *Critical care nurses* must provide adequate fluid and electrolyte replacement, maintain skin integrity, and administer antidiarrheal agents. The stool must be checked for infection to prevent complications **(Gibney Eliar and Ljungqvist, 2005)**.

Vomiting is commonly associated with enteral feedings. Approximately 20% of critically ill patients experience nausea and vomiting. Vomiting increases the risk of pulmonary aspiration. *Critical care nurses* should elevated head of bed and check gastric residual before the next feeding or every four hours for continuous feeding, deceased rate of formula administration, or discontinue feeding. If delayed gastric emptying is suspected, consider reducing narcotic medications, switching to a low-fat formula, administering the feeding solution at room temperature, and administering a motility agent. A careful assessment of medications that may contribute to vomit should be undertaken **(Rolfes, Pinna and Whitney, 2006)**.

Pulmonary aspiration of enteral formulas is a serious complication of enteral feeding in critically ill patients. The prevalence of aspiration pneumonia varies from 2% to 95%. Pulmonary aspiration caused by regurgitation of the formula or feeding tube positioned in esophagus or respiratory tract **(Wagner, Johnson and Kidd, 2006)**. Critical care nurse eliminates the regurgitation of formula through the following procedure. keeping the head of bed elevated to 45 degrees during feedings unless contraindicated; temporarily stopping feeding when the patient is supine for prolonged periods, positioning the patient in the right lateral position when possible to encourage gastric emptying, keeping the cuff of endotracheal tube inflated as much as possible during enteral feeding, and being alert to any increase in abdominal distention **(Urden, Stacy and Lough, 2010)**.

Constipation is an increasingly recognized common complication during tube feeding. A combination of reduced mobility and inadequate fluid replacement is most commonly responsible for constipation. *Critical care nurses* should assess patients' bowel movement daily, ensure adequate amount of fluid intake, switching to a fiber formula. Critical care nurses should encourage early ambulation to promote optimal intestinal motility, promoting activity and exercises, and administer laxatives and stool softener as necessary **(Payne-James and Grimble, 2007)**.

Intermittent enteral feeding schedule (IEFS) was almost resembles the normal meal regimen, and lesser development of gastrointestinal complications. Intermittent feedings are administered of 300 ml to 400 ml feeding by slow gravity drip or infusion four to six times a day over a period of 30 to 60 minutes. An intermittent feeding schedule has been reported to decrease gastrointestinal complications **(Morton et al, 2005)**.

Consequently, nursing care is the key to positive outcome in patients who require enteral nutrition. Critical care nurses are responsible for obtaining initial and weekly weight measurements, vital signs intake, output measurements and laboratory data, and for providing enteral tube care throughout the duration of nutrition support therapy. The nurses are seen as the vital link between the patient and other team members include a physician, a nurse, a pharmacist, and a dietitian **(Morton and Fontaine, 2009)**.

Aim of the Study

This study was conducted to investigate the effect of intermittent enteral feeding schedule on the occurrence of gastrointestinal complications and the length of hospital stay among critically ill patients at Assiut University Hospitals.

To fulfill the aim of this study the following research hypotheses and question were formulated:

Research hypotheses:-

1. Gastrointestinal complications among patients who will receive the intermittent 4-hour interval feeding schedule (study group) will be lesser than that among patients who are receiving the intermittent 2-hour interval feeding schedule (control group).

2. The length of hospital stay among patients who will receive the intermittent 4-hour interval feeding schedule (study group) will be lesser than that among patients who receive the intermittent 2 hours interval feeding schedule (control group).

Subjects, Materials and Methods

Research design

Quasi-experimental design has been utilized in this study.

Study variables

The independent variable in this study was the intermittent enteral feeding schedule while the dependent variables were patients' gastrointestinal complications, and hospital stay.

Setting:

The study was conducted in the trauma ICU (which contains 12 beds) at Assiut University Hospital. The study took approximately one year started from July 2010 till July 2011.

Patients:

A convenience sample of 80 adults, male and female critically ill patients on enteral feeding constituted the study sample. The subjects were assigned into two equal groups (control group and

study group, 40 patients each) considering the following matching criteria; age group of 5 years, sex, diagnosis, medications, and type and preparation of formula.

Inclusion criteria: having nasogastric or orogastric tube feeding, can tolerate enteral feeding, hemodynamically stable, and will be on enteral nutrition for seven days.

Exclusion criteria: excluded from the current study the patients with a history of peptic ulcer, gastrointestinal bleeding, prior gastric surgery, chronic illness (diabetes mellitus, hypertension, and renal failure), and abdominal trauma.

Study tools:

Two tools were developed by the researcher and used in this study. The tools were revised by a panel of 5 nursing and medical experts, and tested then piloted by the investigator.

Tool 1: Socio-demographic and clinical data tool

This tool was developed by the researcher based on reviewing the relevant literature and used to assess the studied patients regarding socio-demographic and medical data to form base line data to be compared with. This tool comprises two main parts.

Part one: Patient's characteristics

It includes demographic data (patient's name, age and sex), patient's diagnosis, past medical history, the date of ICU admission, the date of ICU discharge, and the period of his hospital stay.

Part two: Medications administered

Tool 2: Gastrointestinal complications assessment tool.

This tool was used to assess the frequency, aggravating and relieving factors of gastrointestinal complications. It includes vomiting, diarrhea, constipation, abdominal distension.

Methods:

- An official Permission to conduct the study was obtained from the hospital responsible authorities in the anesthesiology department, and trauma ICU after explaining the aim and nature of the study.
- An approval was obtained from the local ethical committee and the study was followed the common ethical principles in clinical research.
- The tools used in this study were developed by the researcher based on reviewing the relevant literature **(Moss, 2009; Smeltzer et al, 2008; Woodrow, 2012; and Altman, Kerestzes and Wcisel, 2010)**.
- Content validity: The tools were tested for content related validity by jury of 5 specialists in the field of critical care nursing and critical

care medicine from Assiut University Hospital, and the necessary modifications were done.
- Pilot study: A pilot study was conducted on 5 patients to test the feasibility and applicability of the tools. The analysis of the pilot study revealed that minimal modifications are required. These necessary modifications were done and the pilot study subjects were excluded from the actual study.
- Protection of human rights (ethical considerations): Informed consent was obtained from each patient or from the responsible person for the unconscious patients. The investigator emphasized that the participation is voluntary and the confidentiality and anonymity of the subjects will be assured through coding the data. Subjects were assured that can they withdraw from the study at any time without any rational.
- The control group subjects received the routine intermittent enteral feeding schedule. (feeding formula 10 times/day with 2-hour interval and 6hours fasting period at night)
- This study was implemented throughout three phases; the preparatory, the implementation and the evaluation phases.
- The two group patients were assessed at 1st day (baseline data), 3rd day, and 7th day (last assessment)

The preparatory phase
Pre-enteral feeding assessment for both groups:
- Both groups were assessed on individual bases utilizing the patients' records, and the health team members.
- Tube placement was confirmed before starting each feeding by the visible marker level, the aspiration of gastric content, and checking sound of instilled air in the stomach by injecting air through a 60 cc syringe and listening to the sound of air using stethoscope over epigastric region.
- The head of bed was elevated at least 30 degree before each feeding and the cuff of endotracheal tube or trachestomy was inflated to avoid aspiration of formula during feeding.
- The enteral feeding formula was observed for amount, time, color, consistency, odor and temperature.

The implementation and the evaluation phases
Enteral feeding procedure
- Both study and control patients were received the routine intermittent enteral feeding in the trauma ICU in relation to the total amount and types of formula per day and same flow rate (14 drop/min).
- The only manipulation was in the rest period and time interval in which the study group

subjects were rested 8hours at night as compared to 6hours for the control ones, as well study group subjects were having 4hours time interval between each two consecutive feeding as compared to 2hours for control group subjects.

- Feedings were started for study group subjects from 7am to 11pm. However, feedings for control group subjects were started from 7am to 1am of next day.

Post-enteral feeding care for the two studied groups
- Nasogastric or orogastric tube was irrigated with 30-50 ml of tepid water following the administration of every feeding in both groups.
- Feeding bag was rinsed with warm clean tap water every shift and changed every 3 day.
- Patients in both groups were given mouth care every 8 hours as a routine care in trauma ICU.

Gastrointestinal complications assessment
- Gastrointestinal complications were assessed and evaluated for frequency, aggravating and relieving factors for both groups on daily bases allover the 7days of the study period using tool 3.
- For vomiting; patients were observed for vomiting and assessed for abnormal content. The feeding was stopped and the feeding tube was opened. The feeding was re-started after positive feeding test was confirmed.
- For diarrhea; patients were considered to have diarrhea when passing three largely watery stools per day **(Dudek, 2010)**.
- For constipation; patients were considered to be constipated if they didn't pass stool for three days **(Payne-James and Grimble, 2007)**.
- For abdominal distension; it was confirmed through palpitation and percussion of the stomach **(Wagner, Johnson and Kidd, 2006)**.

Statistical analysis of the data:
        The collected data were coded and entered in a data based file using the excel program for windows. Frequency analysis and manual revision were used to detect any errors. Statistical analysis was performed using the software program package SPSS, version 13 (SPSS Inc., Chicago, USA). Values are expressed as means $\pm$ standard deviation (continuous variables) or as percentages of the group from which they were derived (categorical variables). Chi square test was used to compare the frequencies or proportions between the study and the control groups. Independent samples t-test was used to compare the values of the mean score between the study and the control groups. The critical value of

the tests "P" was considered statistically significant when P less than 0.05 .

Limitation of the study
- The study findings are limited in generalizability due to the fact that the sample was collected from one geographical area in Assiut.
- The gastric residual volume before every feeding cannot measure to decrease the risk of acquired infection.

Results:

Table 1: Comparison between the study and the control group subjects` in relation to age, diagnosis, and gender.

Items	Study group (n= 40)		Control group (n= 40)		P-value
	N	**%**	**N**	**%**	
Age: (years)					
16 < 30	13	32.5	13	32.5	0.711
30 - < 40	17	42.5	14	35.0	
≥ 40	10	25.0	13	32.5	
Mean ± SD	31.2 ± 11.4		34.6 ± 10.7		0.175•
Diagnosis:					
Head injury	21	52.5	24	60.0	0.778
Chest injury	10	25.0	9	22.5	
Multiple trauma	9	22.5	7	17.5	
Gender:					
Male	32	80.0	32	80.0	1.000
Female	8	20.0	8	20.0	

Chi-square test •Independent samples t-test   * Statistical significant difference (P < 0.05)

Table 2: Comparison between the two studied groups in relation to the types of medications received.

Type of medications	Study group (n= 40)		Control group (n= 40)		P-value
	N	**%**	**N**	**%**	
Antibiotics	40	**100.0**	40	**100.0**	--
H2 receptor blocker	11	27.5	15	37.5	0.340
PPI	20	**50.0**	20	**50.0**	1.000
Sedative	16	**40.0**	16	**40.0**	1.000
Anti-emetic	6	15.0	8	20.0	0.556
Anti-diarrheal	8	20.0	13	32.5	0.204
Laxatives	5	12.5	4	10.0	0.723

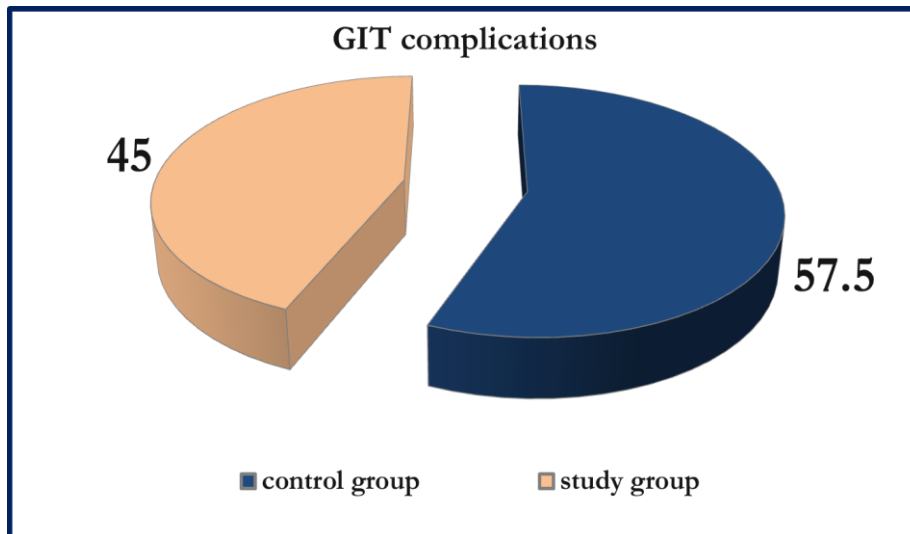Chi-square test   * Statistical Significant difference (P < 0.05)   PPI = Proton pump inhibitor

Figure 1: Comparison between the two studied groups in relation to the development of gastrointestinal complications throughout the assessment periods
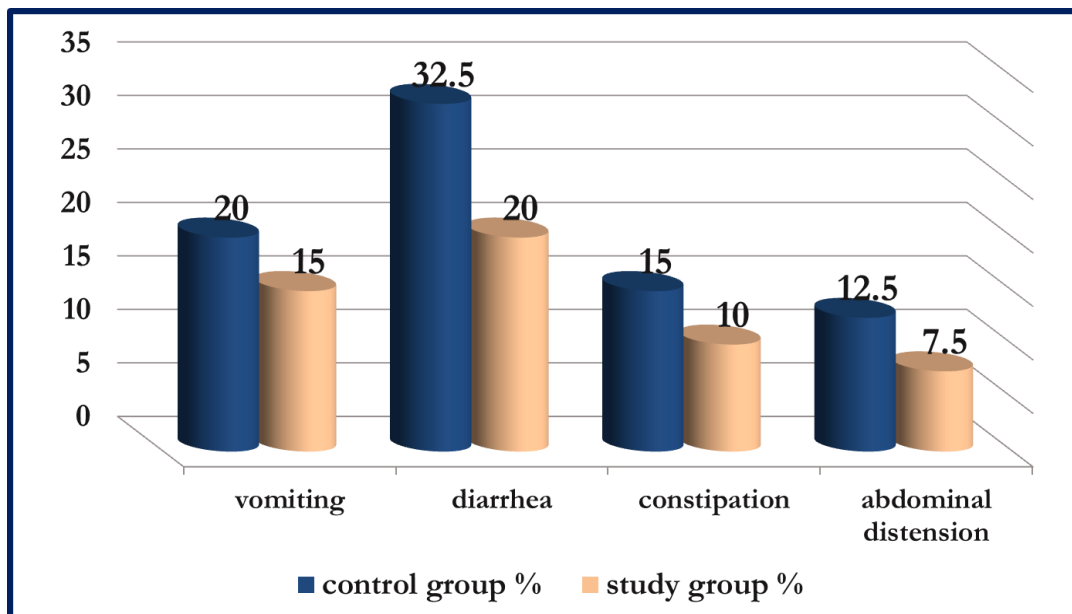

Figure 2: Comparison between the two studied groups in relation to the types of gastrointestinal complications developed

Table 3: Comparison between the two studied groups in relation to aggravating factors of gastrointestinal complications.

Aggravating factors of GIT complications	Study group		Control group	
	N	%	N	%
Vomiting:				
Rapid infusion rate	2(6)	33.3	4(8)	50.0
Improper patient position	2(6)	33.3	1(8)	12.5
Delay gastric empty	2(6)	33.3	3(8)	37.5
Diarrhea:				
Rapid infusion rate	3(8)	37.5	4(13)	30.8
Side effects of antibiotic therapy	4(8)	50.0	2(13)	15.4
Bacterial contamination	1(8)	12.5	7(13)	53.8
Constipation:				
Inactivity	3(4)	75.0	3(6)	50.0
Dehydration	1(4)	25.0	2(6)	33.3
Low fiber formula	0	0.0	1(6)	16.7
Abdominal distension:				
Decrease GIT function	3(3)	100.0	5(5)	100.0

Table 4: Comparison between the two studied groups in relation to relieving factors of gastrointestinal complications.

Relieving factors of GIT complications	Study group		Control group	
	N	%	N	%
Vomiting:				
Decrease rate of feeding	3(6)	50.0	6(8)	75.0
Elevate head of bed	3(6)	50.0	2(8)	25.0
Diarrhea:				
Slow rate of feeding	3(8)	37.5	4(13)	30.8
Evaluate medications profile to determine their potential for causing diarrhea	5(8)	62.5	9(13)	69.2
Constipation:				
Exercise and ambulation	2(4)	50.0	2(6)	33.3
Water and fluid replacement	1(4)	25.0	2(6)	33.3
Fiber supplemented	1(4)	25.0	2(6)	33.3
Abdominal distension				
Exercise	3(3)	100.0	5(5)	100.0

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Table 5: Comparison between the two groups in relation to the length of hospital stay.

Items	Study group (n= 40)		Control group (n= 40)		P-value
	N	%	N	%	
Hospital stay: (days)					
< 15	0	0.0	2	5.0	
15 - < 30	21	**52.5**	11	27.5	0.019*
30 - < 45	15	37.5	14	**35.0**	
≥ 45	4	10.0	13	32.5	
Mean ± SD (Range)	31.8 ± 7.7 (16-48)		38.9 ± 15.4 (11-73)		
Mortality	2	5.0	4	10.0	0.671

Chi-square test   * Statistical significant difference (P < 0.05)

Table 1 shows that, 42.5% and 35% of the study and control groups were in the age group of 30 to less than 40 years old, and 52.5% and 60 % of both groups were diagnosed as having head injury respectively. Concerning gender, this table shows that 80% of the two studied groups were males. No significant statistical difference was put into evidence between the two studied groups in relation to age, diagnosis, and gender.

Table 2 shows that all patients (100%) received antibiotics therapy, half of them (50%) in both groups received proton pump inhibitor, and more than one third of them (40%) received sedative medications. No significant statistical difference existed between the two studied groups regarding the types of medications.

Research hypothesis (1) stated that the gastrointestinal complications among patients who will receive the intermittent 4-hour interval feeding schedule (study group) will be lesser than that among subjects who are receiving the intermittent 2-hour interval feeding schedule (control group).

Figure 1 presents that, more than half (57.5%) of the control group subjects developed gastrointestinal complications as compared to 45% of the study group subjects with no significant statistical difference between the two groups. Thus, the first hypothesis cannot be supported.

Regarding the different types of gastrointestinal complications developed,

Figure 2 shows that, diarrhea was prominent among 32.5% of the control group compared to 20% of the study group subjects. The least gastrointestinal complications among both groups were the abdominal distension in percentages of 12.5 as compared to 7.5 of the two groups respectively. No significant statistical difference was put into evidence between the two groups in this respect.

Table 3: Regarding vomiting, the aggravating factors were rapid infusion rate, improper patient position, and delay gastric empty by 33.3 % of the study group subjects respectively, compared to 50 %, 12.5%, and 37.5% of the control group subjects respectively. The factors aggravated diarrhea was the side effect of the antibiotics therapy among 50% of the study group subjects compared to 15.4% of the control group. Then, bacterial contamination of formula was resulted in 53.8% of the control group subjects compared to 12.5% of the study group subjects. Regarding constipation, the most aggravating factor was the inactivity by 75% and 50% of the study and the control groups respectively.

Table 4 shows that, 50% and 75% of the study and control groups subjects were relieved their vomiting by decreasing rate of feeding respectively. Regarding diarrhea, 62.5% and 69.2% of both

groups were relieved their diarrhea by evaluating the medications profile to determine their potential for causing diarrhea respectively. Furthermore, 50% and 33.3% of both groups were relieved their constipation by applying exercise and ambulation. The table also shows that the relieving factor of abdominal distension was by applying exercise for all patients

Hypothesis (2) stated that the length of hospital stay among patients who will receive the intermittent 4-hour interval feeding schedule (study group) will be lesser than that among patients who receive the intermittent 2 hours interval feeding schedule (control group).

Table 5 shows that, 52.5 % of the study group subjects were hospitalized less than one month as compared to 35 % of the control group subjects who were stayed between 30 to less than 45 days. A significant statistical difference was put into evidence between the two groups in this respect with p-value of 0.019. Thus, the second hypothesis can be supported

Discussion

Intolerance to enteral feeding has been reported in up to 60% of the ICU patients. The signs and symptoms of intolerance to enteral feeding include vomiting, abdominal distension and/or pain, constipation, and diarrhea. Research has shown that gastrointestinal complications often result in decreased provision of EN and prolonged the ICU or the hospital stay **(Tempest, 2011)**.

The rate at which EN is initiated and the schedule for advancement vary greatly from institution to institution. Although many guidelines exist, there is no evidence to support any schedule for EN initiation or advancement **(Parrish and McCray, 2003)**. **Hence**, the present study aims at investigating the effect of intermittent enteral feeding schedule on the occurrence of gastrointestinal complications and the length of hospital stay among critically ill patients at Assiut University Hospitals.

Regarding the length of hospital stay, this study revealed that there was a significant decrease in length of hospital stay among the study group subjects. This can be attributed to the intermittent enteral feeding schedule (IEFS) which applied on the study group subjects was almost resembles the

normal meal regimen, and lesser development of gastrointestinal complications than the control group ones. This is in agreement with various studies reported that the length of hospital stay as a conditioning factor for the occurrence of nosocomial diarrhea **(Parrish and McCray, 2003; Guenter, 2010; Marik and Zaloga, 2001)**. These findings also agrees with **El-Gamal, 2007** findings in the

study of the impact of triage management protocol on complications and the hospital stay among patients with blunt abdominal trauma at El-Kaser El-Aini Hospital, documented relative longer a hospital stay period among control group subjects compared to study group ones, and attributed that to the relative increase in the number and duration of complications.

In this respect, **Heys, Walker, and Smith, 2000** found that the enteral nutritional support supplemented with key nutrients, reduced the infectious complications and the length of the hospital stay. Moreover, **Dudek 2010** described the delay in the hospital stay to cause a nutritional problem. Hence, it predisposes to weight loss. On the other hand, **El- Feky, 2001** in the study of the relationship between nutritional status, wound healing, and the hospital stay among general surgical patients at El-Manial University Hospital, reported that the longer hospital stay was found among the studied patients and mentioned that the diagnosis is not a factor affecting the hospital stay.

Gastrointestinal symptoms

are most commonly associated with complications derived from enteral feeding. Gastrointestinal complications (GICs) include vomiting, diarrhea, constipation and abdominal distension (**Rosdahl and Kowalski 2012**). The present study indicated that the increasing feeding time interval and resting period at night did not increase the incidence of GICs as there was no significant statistical difference found between both groups in relation to number of patient with GICs. The largest number of patients in both groups had **diarrhea**. This agrees with **Taha, 2006**, who reported that diarrhea occurs in 22% of patients receiving tube feeding. In this context, **Okuma et al., 2009** and **Williams and Leslie, 2005** stated that the incidence of diarrhea associated to enteral feeding ranges from 2% to 63%. Two main factors seem to be the cause of this wide range of reported incidences; the lake of standard definition of diarrhea for patients receiving enteral tube feeding, and the disease state and the critical illness. Moreover, **Galindo et al, 2006** mentioned that diarrhea was more frequent in the intermittent enteral feeding than the continuously fed patients.

The factors aggravated diarrheas were the side effect of the antibiotics therapy among half of study group and the bacterial contamination of formula among more than half of control group. Antibiotic-associated diarrhea (AAD) is a common complication of antibiotics and develops in 5% of patients. The pathogenesis of AAD may be mediated through the disruption of the normal colonic microflora and overgrowth of pathogens, by increasing peristalsis, or by acting as colonic irritants

(**Boyce and Havill, 2005).** Bacterial contamination of formula can be attributed to the majority of the two studied patients had received hospital prepared formula, which might have been contaminated during the process of preparation, packing, or transfer to trauma ICU. Bacterial contamination may also occur due to the frequent preparing, and handling of the formula every 2 hours as a result of applying the routine feeding schedule. Moreover, it was found out that even when commercially prepared products are used, contamination could occur when diluting formulas, reconstituting powdered formulas, or when mixing in additive.

This is similar to **Trabal et al., 2008** findings in their research about factors associated with nosocomial diarrhea in patients with enteral tube feeding. They found out that the nosocomial diarrhea is a troublesome and costly condition, its reported complications include increased length of stay and higher costs and it is associated with considerable morbidity and mortality. This also agrees with **Riley, Codde and Rouse, 1995** finding. The relieving measures of diarrhea were evaluated the medications profile to determine their potential effect for causing diarrhea, and slow rate of feedings. This agrees with **Reda and Ibrahim, 2000** and **Forchielli and Bines, 2008** findings who recommended that nursing interventions that can be taken to prevent or reduce the EN induced diarrhea include: reviewing the medications that the patient is receiving, observing things that can cause diarrhea as a side effect, hypertonic oral suspensions should be diluted before giving as a bolus through a feeding tube, reviewing the formula and gastrointestinal absorptive function, considering the change rate of delivery or formula as indicated (reduced osmolality, fiber enriched, lactose free).

Vomiting and abdominal distension are important parameters in the assessment of feeding tolerance and gastric empty. The present findings indicated that higher frequency of vomiting and abdominal distension among the control group subjects than the study group ones. The aggravating factors of vomiting were rapid infusion rate, improper patient position, and delay gastric empty. This is in line with **El-Baz, 2002** findings, who attributed vomiting to the patient's position after feeding and delay gastric empty, and added that the effect of medications and specific nutrient intolerance as lactose can cause vomiting and distension. **Reda and Ibrahim, 2000** found out that the rapid infusion rate, improper patient position, and cold formulas were the most common causes of vomiting in their study.

The relieving factors of vomiting were the slow rate of delivery, and elevating the head of the bed. In this respect, **El-Baz, Reda and El-Soussi,**

2003 stated that vomiting can be prevented by placing the patient on his right side to facilitate the passage of gastric content through pylorus, and to decrease the rate and volume of feeding delivered, frequent checking of residuals, administering prokinetic agents to stimulate gastric motility. The aggravating factor of abdominal distension found in the present study was decreased GIT function. This can be attributed to the use of sedation and analgesic which may lead to decrease the gastric motility and decrease absorptive ability of the small intestine. This is in line with **Salem, 2001** findings.

Constipation is another GI complication associated with enteral feeding. In the present study, the aggravating factors of constipation were inactivity, dehydration, and low fiber formula. In this respect, **Taha, 2006** found that the most frequent GIC was constipation (43%), and he attributed that to many factors as low fiber intake, low fat intake, fluid and feeding intake less than the requirements and lastly the impaired physical mobility. **Guenter, 2010** demonstrated that constipation which is associated with enteral nutrition could be caused by lack of adequate hydration, long term fiber free feedings, bed rest, fecal impaction, and narcotics administration. This agrees with **Pirlich, 2006** findings who stated that the decreased fluid intake, the use of high energy dense formula and the lack of dietary fiber are possible reasons for constipation associated with EN. Furthermore, immobilization and decreased bowel motility as a result of sedatives or opioids may contribute to constipation.

Constipation can be relieved or prevented by ensuring that the patient receives adequate amount of water and fluid, using a fiber-containing formula, and encourage early ambulation and exercises to stimulate intestinal motility. This agrees with **Pirlich, 2006** findings who stated that relieving the conditions of constipation include; reviewing patients EN prescription, increasing fluid intake, reducing density of formula or switching to fiber containing formula, excluding bowel obstruction by auscultation and x-ray abdomen, and if these steps fail consider stool softener or bowel stimulants. These measures agree with those of **Reda and Ibrahim, 2000** and **Salem, 2001** and they added that restricting narcotics and antimotility agents, and using stool softeners and laxatives as needed could help such critically ill patients to control constipations.

Conclusion and Recommendations

Based on the findings of the present study, it can be concluded that the intermittent enteral feeding schedule applied on the study group subjects (feeding every 4 hours with fasting period 8 hours at night) had lower development of gastrointestinal complications (diarrhea, vomiting, constipation, and abdominal distention) than the control group ones. This can be explained by the fact that IEFS applied on the study group subjects almost resembles the normal meal regimen. Moreover, a statistical significant difference was found between both groups regarding the length of hospital stay indicating higher length of hospital stay among the control group subjects.

Based on the study findings, the following

Recommendations are suggested:

- Developing an educational program for nurses about the aggravating and relieving factors of gastrointestinal complications; vomiting, diarrhea, constipations and abdominal distention and its nursing care.
- Training nurses on enteral feeding procedure need to be pursued to minimize tube-fed associated complications.
- More studies are necessary to evaluate effectively the value of IEFS in the development of nosocomial pneumonia.
- Applying this study on a large sample size and in different ICUs as post-operative ICU to produce better results.
- Reapplying this research on a larger probability sample acquired from different geographical areas in Egypt for generalization.

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