

EFFECT OF ABDOMINAL MASSAGE ON GASTROINTESTINAL OUTCOMES AMONG INTERMITTENT ENTERALLY FED CRITICALLY ILL PATIENTS

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Abstract

Background: Prevention and management of gastrointestinal complications in critically ill patients receiving enteral nutrition represent important nursing consideration. These require utilizing techniques and methods for increasing the rate of gastric emptying, and so enhancing tolerance to this nutritional support modality. Among these methods is abdominal massage, which has been proved to improve various digestive functions. **Aim of the study:** This study aimed to evaluate the effect of abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients. **Design:** a quasi-experimental design was utilized. **Setting:** The study was carried out in General Intensive Care Unit at El Fayoum University Hospital. **Subjects:** a purposive sample of 110 critically ill patients who met the inclusion criteria and they were divided to equal study and control group (55 patients in each group). **Data collection tools:** Data were obtained through two main tools; patients' assessment tool and gastrointestinal outcomes assessment tool. **Results:** There were highly statistically significant differences between the study and control group subjects regarding mean scores of gastric residual volume and intra-abdominal pressure, abdominal distension and constipation occurrence at the fifth day post implementation of abdominal massage, while no statistically significant difference between the study and control group subjects regarding frequency of vomiting episodes at the fifth day post implementation of abdominal massage. **Conclusion:** Abdominal massage was an effective intervention on the gastrointestinal outcomes among enterally fed critically ill patients as it leads to reduction in gastric residual volume, abdominal distension, intra-abdominal pressure and constipation. **Recommendations:** On-going and regular in-service educational programs about assessment of gastrointestinal outcomes among enterally fed critically ill patients and how to measure gastric residual volume and intra-abdominal pressure. The study should be replicated on large sample and in different geographical settings in order to generalize the results.

Index Terms: abdominal massage, critically ill patients, enteral nutrition, gastrointestinal outcomes, gastric residual volume, and intra-abdominal pressure

INTRODUCTION

Critically ill patients (CIPs) are patients who have severe illnesses with life threatening conditions that have serious consequences and requiring intense and vigilant medical and nursing care. Critical illness is often associated with a catabolic stress state and systemic inflammatory response. Nutritional support (NS) in critically ill patients prevents further metabolic deterioration and loss of lean body mass. Decrease in length of hospital stay, morbidity rate and improvement in-patient outcomes have attracted and valued the use of nutrition support in the critically ill patients. Nutritional support is the delivery of formulated enteral or parenteral nutrients to appropriate patients for purpose of maintaining/restoring nutritional status " [1], [2] ".

Enteral feeding or enteral nutrition is the preferable route and utilized commonly for nutritional support in critically ill patients. It helps to maintain peristalsis, improve blood supply and strengthen the immune system. So, it may reduce disease severity, diminish complications, decrease intensive care unit length of stay, and favorably impact patients' outcomes [3]. Proper administration of enteral feeding formulas ensures safe delivery of desired nutrients, enhanced patient tolerance and optimal nutrition support. Considering the most appropriate method of administration, the clinician should consider numerous factors such as patient's age, preexisting and current medical condition, nutritional status and requirement, enteral route for feeding, gastrointestinal (GI) tolerance, formula type used, patient mobility, feeding pump availability, and cost. There are four feeding methods of enteral nutrition administration include continuous, cyclic, intermittent, and bolus feedings " [4], [5] ".

Intermittent enteral feeding, involves the controlled delivery of feeds with rest periods of approximately 4–6 hours in between. Intermittent feeding is usually delivered over 20–60 minutes every 4–6 hours with or without a feeding pump. This feeding method is more physiological than continuous/cyclic feeding and permits greater patient mobility between feedings [6]. Despite evidence-based information from different studies regarding several benefits of intermittent enteral nutrition, multiple potential complications can occur if intermittent enteral nutrition is not administered properly, which can be classified into gastrointestinal, mechanical, metabolic, and infectious complications. Gastrointestinal complications are the most common complications of enteral nutrition in critically ill patients. It includes nausea, vomiting, diarrhea, increased gastric residual volume, elevated intra-abdominal pressure, distention of abdomen and constipation [7].

The success of enteral nutrition mainly depends on the role of critical care nurses in carefully assessing and planning feeding requirements, providing feeding safely and efficiently, monitoring patients' response carefully, and preventing enteral feeding related complications. When enteral feeding complications such as high gastric residual volume, constipation, abdominal distention and vomiting occur, nurses may resort to alternative measures as abdominal massage. Abdominal massage is one of the complementary therapies that can be applied independently by nurses for enhancing the digestive system functions " [8], [9] ".

During enteral nutrition, critical care nurses routinely place feeding tube, administering prescribed nutrition, fluid, and medications in a safe and effective way, prevent and detect complications associated with this form of therapy, obtaining weight measurements, vital signs, and laboratory data and providing enteral tube care throughout the duration of nutritional support therapy. The nurse obtains more objective signs of gastrointestinal complications through abdominal examinations. Also, the nurse monitors and records volume and frequency of both urine and stool [10].

Abdominal massage is a gentle, non-invasive therapeutic technique that focuses on the stomach and pelvic area that have relaxing and healing effect, and used for prevention and treatment of wide variety of gastrointestinal complications. Abdominal massage was considered a nursing intervention for minimizing elevated gastric residual, vomiting frequency, constipation and abdominal distension as has been indicated in numerous studies. Abdominal massage shortens the time it takes for food to pass through the digestive tract, stimulates and preserves peristaltic activity, and decreases intra-abdominal pressure. Furthermore, it was a non-pharmacological, noninvasive, and safe approach with no side effects " [11], [12] "

There are various types of abdominal massage (AM) with varied levels of pressure, and strokes. Massage can be applied with the hands, fingers or a massage device. Types of abdominal massage include; Swedish Peristalsis (abdominal) massage, Thai Hara massage, Chinese Chi Nei Tsang Massage and Mayan abdominal massage. Swedish AM is mainly used in western countries; this is the most common type of massage therapy known as a classical or relaxing massage. Swedish massage was invented by a Swedish fencing instructor named Per Henrik Ling who considered the father of Swedish massage in 1830s. There are five basic Swedish abdominal massage techniques; effleurage, petrissage, friction, vibration and tapôtment [13].

Significance of the study:

Critically ill patients are usually in need for careful and continuous observation especially from critical care nurses to avoid and/ or prevent intermittent enteral feeding related complications. In spite of simplicity of administering intermittent enteral nutrition through nasogastric tube, it has serious gastrointestinal complications such as high gastric residual volume, increased frequency of vomiting, abdominal distension, increased intra-abdominal pressure and constipation. These complications can lead to an interruption of enteral feeding and underfeeding which in turn affecting on successful and comprehensive management of critically ill patients. [14].

According to a study conducted in the adult medical intensive care unit of a university hospital in Turkey by **Kahraman et al. (2020) [15]** entitled "Complications Developing in Intensive Care Patients Receiving Enteral Feeding and Nursing Interventions", the incidence rate of abdominal distension was 28.8 %, high gastric residual volumes was 13.4 %, constipation was 17.3 % and vomiting was 1.9 %. These complications usually interfere with the achievement of adequate nutrition support. According to a study carried out by **Morsy et al., (2021) [16]** entitled "Tube Feeding-Associated Patients' Outcomes

at Intensive Care Units" in University hospital in Cairo; 78% of the studied sample developed gastrointestinal complications. Vomiting was occurred in 33% of the studied patients, diarrhea in 34.4%, constipation in 47% of them, and increased high gastric residual volumes in 18% of the studied sample.

Many literatures described abdominal massage as the preferred no pharmacological nursing intervention for managing and preventing enteral feeding related gastrointestinal complications because it has many advantages such as it is easily and independently applied by nurses and free from side effects. So, this study will be conducted to evaluate the effect of abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients.

AIM OF THE STUDY:

This study aimed to evaluate the effect of abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients through the following:

- 1) Assessment of the patients for gastrointestinal outcomes among intermittent enterally fed critically ill patients.
- 2) Implementing abdominal massage on intermittent enterally fed critically ill patients
- 3) Evaluating the effect of the abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients.

Research Hypothesis:

The current study hypothesized that:

The study group who receive abdominal massage will have better gastrointestinal outcomes than the control group.

Operational definitions:

Abdominal massage: It is an intervention that helps to tone and reinforce the muscles located in abdomen and digestive system, in which the abdomen and intestinal areas are massaged with various movements and pressure using five basic techniques; effleurage, petrissage, friction, vibration and tapôtement.

Gastrointestinal outcomes: In this study, it means gastric residual volume (GRV), vomiting, abdominal distension, constipation and intra-abdominal pressure (IAP).

Subjects and Methods:

The study was portrayed under the four main designs as follows:

- I. Technical design.
- II. Operational design.
- III. Administrative design.
- IV. Statistical design.

I. Technical design:

It included research design, setting, subject and tools for data collection.

Research design: Quasi-experimental design (study & control; pre & post implementation) was used to conduct this study to evaluate the effect of abdominal massage (independent variable) on gastrointestinal outcomes (dependent variables) among intermittent enterally fed critically ill patients.

Quasi-experimental research is an empirical interventional study to examine causal relationships or determine the effect of one variable on another. Thus these studies involve implementing a treatment or intervention and examining the effects of this intervention using selected methods of measurement. Quasi-experimental studies differ from experimental studies by the level of control achieved by the researcher. These studies usually lack a certain amount of control over the manipulation of the treatment, management of the setting, and/or selection of the subjects [17].

Research setting: This study was conducted at the General Intensive Care Unit (ICU) at El Fayoum University Hospital, El Fayoum, Egypt. This Intensive Care Unit located at 2nd floor in the hospital with total capacity of 36 beds, 20 ventilators, 36 monitors and 5 emergency carts, it were distributed in 11 rooms, ICU also contains three rooms for medication and supplies storage, number of patients admitted to ICU monthly ranged from 20 to 35 patients with different diagnosis such as respiratory disease, renal disorders, liver diseases, neurological disorders, metabolic disorders and infectious disease.

Research subjects: A Purposive sample of 110 critically ill patients who met the inclusion criteria at previously mentioned setting, and they would be enrolled into two equal groups (study and control group), each group consisted of 55 patients. A Purposive sample of 110 critically ill patients who met the inclusion criteria at previously mentioned setting, and they would be enrolled sequentially into two groups (study and control group); each group consisted of 55 patients. Sample size was calculated statistically by power analysis considering the total number of critically ill patients admitted to El Fayoum university hospital during the year (2019).

Inclusion criteria: The inclusion criteria of the current study included adult patients from both gender >20 years old, patients with newly inserted nasogastric tube for intermittent enteral feeding, patients who have indwelling urinary catheter for measuring intraabdominal pressure, hemodynamically stable, free from intestinal obstruction and didn't have contraindications to abdominal massage such as diarrhea, active bleeding, spinal cord injury or recent abdominal surgery.

Exclusion criteria: The exclusion criteria of the current study included patients receiving prokinetic medications as metoclopramide (reglan) and cisapride (propulsid) to avoid interfering with the massage effects, patients with hepatic impairment and abdominal aortic aneurysm and patients who was receiving radiotherapy or chemotherapy.

Tools for data collection:

Two main tools were used for data collection

Tool (I): Patients' assessment tool: This tool was adapted from (**Abdelhafez & Abd Elnaeem, 2019 [8]; Narmadha & Priyanka, 2019 [18]; Wright & Swearingen, 2019 [19]; El-Feky & Ali, 2020 [3]; Diab et al., 2021 [11]**) and modified by the researcher to suite the study aim. This tool is consisted of **three parts**:

- **Part (I): Demographic data:** It was concerned with patient's demographic data such as age, gender, level of education, residence and occupation.
- **Part (II): Clinical data:** It was concerned with patient's clinical data such as reason for ICU admission, past medical history, surgical history, allergic history, family history, current medications, weight, height, body mass index (BMI) and physiological parameters; vital signs (as heart rate, respiratory rate, blood pressure and temperature), oxygen saturation(Spo2), level of consciousness and fluid intake and output.

Body mass index (BMI): It was calculated by dividing the patient's weight in kilograms by the square of height in meters (kg/m²). Body Mass Index is interpreted using standard weight categories for adults 20 years and older.

Scoring system:

- Underweight: <18.5
- Normal: 18.5-24.9
- Overweight: 25- 29.9
- Obesity class I: 30-34.9
- Obesity class II: 35-39.9
- Obesity class III: ≥40

Glasgow Coma Scale: It was used to assess the level of consciousness. The scale assesses patients' responsiveness through eye-opening, motor, and verbal responses.

The score ranging from 3 (worst) to 15 (best).

- Mild impairment (conscious) : 13-15
 - Moderate impairment (semiconscious) : 9-12
 - Severe impairment (unconscious) : 3-8
- **Part (III): Enteral feeding data:** It was concerned with enteral feeding related data such as type of feeding, amount of feeding (per meal and per day), and number of feeding (per day).

Tool (II) Gastrointestinal outcomes assessment tool: This tool was adapted from (**Abdelhafez & Abd Elnaeem, 2019 [8]; Lynn, 2019 [20]; Cetinkaya et al., 2020 [9]; El-**

Feky & Ali, 2020 [3]; Foschi & Navarra, 2020 [21]; Rajkumar, 2020 [22]; Boling et al., 2021 [23]; Diab et al., 2021 [11]; Rebeiro et al., 2021 [24]; Perry et al., 2022 [25]) and modified by the researcher to suite the study aim. It was used to assess the gastrointestinal outcomes. It was included **five parts** as following;

- **Part (I): Gastric residual volume:** It was used to assess gastric residual volume for the control and study group pre and post implementation of the abdominal massage twice daily for five consecutive days.
- **Part (II): Abdominal distension:** It was used to assess abdominal distension for the control and study group pre and post implementation of the abdominal massage twice daily for five consecutive days. Abdominal distension was assessed by palpation of abdomen in terms of soft, tense and hard, in addition to abdominal circumference measurement.
- **Part (III): Vomiting:** It was used to assess vomiting before and after enteral feeding administration throughout the day for the control and study group through three indicators including; frequency of vomiting episodes (none, once/day, twice/day and more than twice/day), consistency of vomiting in terms of liquid and semi liquid and amount of vomiting which measured by ml. Amount of vomiting was categorized into low, moderate and high.
- **Part (IV): Intra-abdominal pressure:** It was used to assess intra-abdominal pressure for the control and study group pre and post implementation of the abdominal massage twice daily for five consecutive days. Intra-abdominal pressure was measured by using intra-abdominal pressure measurement checklist (manometer technique).

Scoring system:

- 0-12mmHg: Normal intra-abdominal pressure (IAP)
 - 13-15 mmHg: Grade I Intra-Abdominal Hypertension (IAH)
 - 16-20 mmHg: Grade II Intra-Abdominal Hypertension (IAH)
 - 21-25 mmHg: Grade III Intra-Abdominal Hypertension (IAH)
 - >25 mmHg: Grade IV Intra-Abdominal Hypertension (IAH)
- **Part (V): Constipation:** It was used to assess constipation among control and study group subjects pre and post implementation of the abdominal massage for five consecutive days. Criteria for assessment of constipation include; occurrence of constipation, which was described in terms of yes / no, based on frequency of defecation. The patient considered constipated if pass stool once in more than 3 days [26].
 - **Constipation severity** was assessed using modified constipation assessment scale (CAS); it was adapted from (**Abd-Elraheem et al., 2020**) [27] and modified by the researcher to suite the study aim. It was used to delineate the severity of constipation.

It included **five parameters**; abdominal distension or bloating, less frequent bowel movement, oozing liquid stool, smaller stool size, and inability to pass stool.

Scoring system: The score of the scale was graded from 0 to 2 degrees for each parameter; None (0), Some (1), and Severe (2) with total score ranged from 0-10. The total score was obtained by summing the selected grade for each parameter. This score indicated the severity of constipation as following:

- 1-3: mild constipation.
- 4-6: moderate constipation.
- 7 or more: severe constipation.

II- Operational Design:

The operational design was included preparatory phase, content validity and reliability, pilot study, ethical considerations and field work.

Preparatory phase:

It included reviewing of the current and more recent relevant national and international literature reviews and theoretical knowledge of the various related aspects using books, articles, periodicals, magazines and internet in order to develop the data collection tools. The researcher received a training course about abdominal massage technique for one month in Academy of Chinese Medicine in Cairo Training and Human Resources Development to be qualified in applying the correct technique of abdominal massage.

Validity and Reliability:

The tools were revised by a panel of seven experts from medical-surgical and critical care nursing academic staff, Ain shams university. The experts reviewed the tools for clarity, relevance, comprehensiveness, and simplicity and minor modifications were done accordingly. Face and content validity for tool I (patients' assessment tool) was 90% to 100% and for tool II (gastrointestinal outcomes assessment tool) was 71.4 % to 100. Reliability of tools were tested statistically using Cronbach's Alpha coefficient test which revealed that tools of the study were reliable as indicated by the value for tool I (patients' assessment tool) was 0.824 and for tool II (gastrointestinal outcomes assessment tool) was 0.848.

Pilot Study:

A pilot study was carried out on 10% (11 patients) of sample size to test feasibility of the research process, applicability, clarity and efficiency of the tools, as well as to estimate the time needed to conduct the study. The patients who were included in the pilot study were included to the sample because there was minor modifications were done after conducting pilot study.

Ethical Considerations:

The research approval was obtained from scientific research ethical committee in the faculty of nursing, Ain Shams University before initiating the study work. The researcher clarified the objectives and aim of the study to patients or their families included in the study before starting. The researcher assured maintaining anonymity and confidentiality of the subjects' data. Patients or their families were informed that they are allowed to choose to participate or not in the study and that they have the right to withdraw from the study at any time. Ethics, values, culture, and beliefs were respected.

Fieldwork

- The actual work of this study started and completed within seven months from beginning of January to the end of July (2022). Data were collected by the researcher five days per week, at morning and afternoon shifts in the previous mentioned setting.
- Researcher followed the Ministry of Health and Population's protocol to minimize the risk of transmissions of coronavirus which included wearing personal protective equipment especially well fitted masks, hand hygiene, cough etiquette (sneezing or coughing into a tissue or a bent elbow), avoiding touching eyes, nose and mouth with contaminated hands, maintain a distance of at least one meter away from others and getting vaccinated.
- Subjects were divided into two groups; control and study group, each group consisted of 55 patients who having nasogastric tube for intermittent enteral feeding. Study group included patients who received abdominal massage while the control group included patients who received the routine nursing care related to intermittent enteral feeding only.
- **The fieldwork of the current study was conducted through three phases; assessment phase (pre implementation phase), implementation phase, and evaluation phase.**
- **Assessment phase (pre implementation phase):** all newly admitted patients who having nasogastric tube for intermittent enteral feeding were assessed by the researcher for meeting the inclusion criteria to be enrolled in the current study. The aim of the study explained for the patients or their families who agreed to participate in this study prior to data collection after obtaining a written consent. Data was collected first from the control group to prevent contamination of data, then data collection from the intervention group started and completed. The studied patients' demographic data, clinical data and enteral feeding related data were obtained by the researcher from the patients and patient's medical record using Tool (I) patients' assessment tool. It took about 15-20 min to be fulfilled for each patient.
- Pre implementation of abdominal massage; the gastrointestinal outcomes were assessed by the researcher using the second tool which is concerned with

assessment of gastrointestinal outcomes before application of abdominal massage. It was considered as baseline data for assessment of gastric residual volume, abdominal distension, vomiting, intra-abdominal pressure and constipation. It took about 30-35 min to be fulfilled for each patient.

- **Gastric residual volume** was assessed by the researcher before enteral feeding administration and before application of abdominal massage using GRV measurement checklist.
- **Abdominal distension** was assessed by the researcher before enteral feeding administration and before application of abdominal massage by palpation and using abdominal circumference measurement checklist. The light and deep palpations were used to assess abdominal distension. The distension was considered present when the abdomen was tense or hard. Abdominal circumference was measured using a soft flexible measuring tape. Abdominal circumference was used as an indicator for abdominal distension. It was assessed as a baseline at pre implementation phase and the mean scores of abdominal circumference were compared after implementation of abdominal massage.
- **Vomiting** as a gastrointestinal outcome was assessed through its frequency, amount and consistency. Amount of vomiting was measured by ml using collecting bag connected to nasogastric tube. Consistency of vomiting was assessed using observation technique. If there was vomiting, according to the ICU guidelines, the feeding was interrupted and the tube feeding was opened. The patient was re-fed after showed a positive feeding test.
- **Intra-abdominal pressure (IAP)** was measured by the researcher before enteral feeding administration and before application of abdominal massage using intra-abdominal pressure measurement checklist (manometer technique). Each IAP value was obtained by manometer (cmH₂O) and recalculated in millimeter mercury using the conversion factor (1 cmH₂O = 0.74 mmHg).
- **Occurrence of constipation** as a gastrointestinal outcome was assessed through frequency of defecation. The patient considered constipated if pass stool once in more than 3 days and constipation severity was assessed by using modified constipation assessment scale.
- **Implementation phase:** Both study and control group subjects received the routine ICU protocol of the intermittent enteral feeding as the type, frequency and amount of formula. The study group received the abdominal massage twice daily before administrating enteral feeding to avoid aspiration for five consecutive days.
- Gastrointestinal outcomes (gastric residual volume, abdominal distension, vomiting, intra-abdominal pressure and constipation) were assessed twice daily (8am and 8pm) before administrating the enteral feeding for five consecutive days for both groups.

- **Abdominal massage** was applied for the study group only. It took about 20 min to be fulfilled for each patient. Before abdominal massage patient was lying in a supine position with his or her knees flexed and the head-of-bed elevated at 30°–45°. The abdominal region under the chest ribs was exposed, while the rest of the body was covered to maintain privacy of the patient. The researcher stood on the right side of the patient during the massage practice. The Swedish abdominal massage was done to the abdominal wall in the direction of the bowel. It was performed twice daily in a clockwise direction over the intestines on the abdominal wall. The massage was performed before enteral feeding to minimize the risk of aspiration. Lavender oil was used to make the massage easier. The Swedish abdominal massage was done by the researcher using **five** basic techniques; effleurage, petrissage, friction, vibration and tapôtement. The first technique (**effleurage**), started with a gentle relaxing stroke up the abdominal wall, followed by motions likes brushing the skin in the abdominal region. The second technique (**petrissage**), performed through squeezing, lifting, and rolling skin and muscle tissues of the abdomen in a kneading fashion to reach deeper tissues with firm pressure. The third technique (**friction**), this technique was done by rubbing abdominal skin back and forth. The fourth technique (**vibration**), performed through oscillatory actions alternating between slow to rapid movements were exerted to shake and vibrate the abdominal wall. Alternating gentle, quick, and striking, manipulations such as tapping and cupping movements were applied over the abdominal wall during the final technique (**tapôtement**).
- **Evaluation phase:** The effect of the abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients was determined through comparison between the study and control group at pre and post implementation of abdominal massage.

Administrative design:

An official approval with a written letter, clarifying the purpose and setting of the study obtained from the dean of the Faculty of Nursing, Ain Shams University. Another approval obtained from the director of El Fayoum University Hospital. The title and aim of the study explained as well as the main data items and the expected outcomes.

III. Statistical analysis:

The collected data organized, categorized, tabulated and statistically analyzed using the statistical package for social science using SPSS program version 20. Quantitative data were presented as mean and standard deviation (SD). Qualitative data were presented as frequencies and percentages (%). For qualitative data, a comparison between two groups and more was done using Chi-square test (X^2). For a comparison between means of the two groups of parametric data of independent samples, student t-test was used. For a comparison between more than two means of parametric data, F value of ANOVA test was used. Correlation between variables was evaluated using Pearson's correlation coefficient (r). The observed differences and relations were considered as follows:

P.>0.05 insignificance (no difference), P. ≤ 0.05 significant difference and P. ≤ 0.001 highly significant difference.

RESULTS:

Table (1): Frequency and percentage distribution of demographic data for studied patients among the study and control group subjects at pre implementation phase (No=110).

Demographic data	Control group (n=55)		Study group (n=55)		Chi square test	P-Value
	No.	%	No.	%		
Age (years):						
▪ <50-60	7	12.73%	9	16.36%	1.45	0.485 NS
▪ >60 - <70	23	41.82%	17	30.91%		
▪ ≥ 70	25	45.45%	29	52.73%		
▪ Mean ± SD (years)	66.67 ±12.59		67.16 ±12.61		t= 0.20	0.8381 NS
Gender:						
▪ Male	43	78.18%	35	63.64%	2.82	0.09307 NS
▪ Female	12	21.82%	20	36.36%		
Level of education:						
▪ Can't read and write	19	34.55%	16	29.09%	3.91	0.41863 NS
▪ Read & write	13	23.64%	9	16.36%		
▪ Basic primary education	1	1.82%	5	9.09%		
▪ Secondary education	8	14.55%	10	18.18%		
▪ University education	14	25.45%	15	27.27%		
Residence:						
▪ Rural	34	61.82%	28	50.91%	1.33	0.24869 NS
▪ Urban	21	38.18%	27	49.09%		
Occupation:						
▪ No working / retired/ housewife	51	92.73%	47	85.45%	1.50	0.22 NS
▪ Governorate work	3	5.45%	7	12.73%		
▪ Private work	1	1.82%	1	1.82%		

Non-Significant (NS) = P. > 0.05

Table (1) reveals that, 45.45% of the control group and 52.73% of the study group subjects their age were equal or more than 70 years with mean age 66.67 ±12.59 years for the control group and 67.16 ±12.61 years for the study group. In relation to gender, 78.18 % of the control group subjects compared to 63.64 % of the study group subjects was males. Concerning level of education, 34.55 % of the control group and 29.09 % of the study group cannot read and write. As regards residence, 61.82 % of the control group compared to 50.91 % of the study group lived in rural area. Regarding occupation, 92.73 % of the control group subjects compared to 85.45 % of the study group subjects were retired or not working. Moreover, there were no statistically significant differences between the study and control groups regarding their age, gender, level of education, residence and occupation at P.value > 0.05.

Table (2): Comparison between the study and control group subjects regarding effect of abdominal massage on gastrointestinal outcomes (gastric residual volume) (No=110).

Gastric residual volume (GRV) (ml)	Control group (no=55)	Study group (no=55)	T test	P-Value
	(Mean± SD)	(Mean± SD)		
Pre implementation	13.64 ±5.13 ml	12.00 ±4.04 ml	1.86	0.06584 NS
Post implementation (5 th day)	33.82 ±11.71 ml	8.32 ±9.17 ml	12.72	0.00000 HS
Comparison between pre and 5 th day post implementation	t = -14.94 P = 0.00000 HS	t = 2.86 P = 0.00606 HS		

Non-Significant (NS) = P. > 0.05

High significant (HS) = P. < 0.001

Table (2) shows that, the mean scores of gastric residual volume for the control and study group subjects were 13.64±5.13 ml and 12.00±4.04 ml respectively with no statistically significant differences between both groups pre implementation of abdominal massage at P. value > 0.05. Regarding fifth day post implementation of abdominal massage, the mean scores of gastric residual volume in the study group subjects was 8.32±9.17 ml versus the mean score of the control group subjects was 33.82±11.71 ml with highly statistically significant difference regarding mean scores of gastric residual volume between the study and control group subjects at P. value= 0.00000. Moreover, there was highly statistically significant difference between the mean scores of gastric residual volume pre and fifth day post implementation of abdominal massage within the study and control groups at P. value <0.001.

Table (3): Comparison between the study and control group subjects regarding effect of abdominal massage on gastrointestinal outcomes (abdominal distension) (No=110).

Abdominal distension	Control group (n=55)		Study group (n=55)		Chi square test	P-Value
	No.	%	No.	%		
Pre implementation:						
Palpation of abdomen:						
• Hard/ tense(distended)	16	29.09%	11	20.00%	1.23	0.26797 NS
Abdominal circumference (cm) (Mean+ SD)	99.42 ± 16.96		98.35 ± 16.29		t= 0.34	0.73576 NS
Post implementation (5th day):						
Palpation of abdomen:						
• Hard/tense(distended)	38	69.09%	9	16.37%	35.65	0.00000 HS
Abdominal circumference (cm)(Mean+ SD)	102.19 ± 17.03		98.53 ± 16.21		t= 1.16	0.25034 NS
Comparison between pre and 5th day post implementation regarding palpation of abdomen	X²= 31.68 P = 0.00000 HS		X²= 1.52 P = 0.46810 NS			
Comparison between pre and 5th day post implementation regarding abdominal circumference	t= -7.55 P = 0.00000 HS		t= -1.35 P = 0.18388 NS			

Non-Significant (NS) = P. > 0.05

High significant (HS) = P. < 0.001

Table (3) reveals that, 20.00 % of the study group subjects compared to 29.09 % of the control group had hard or tense abdomen. As well as, the mean scores of abdominal circumference for the control and study group subjects were 99.42±16.96 cm and 98.35±16.29 cm respectively with no statistically significant differences between the study and control group subjects in relation to palpation of abdomen and abdominal circumference pre implementation of abdominal massage at P.value > 0.05. Regarding fifth day post implementation of abdominal massage, 16.37 % of the study group subjects compared to 69.09 % of the control group subjects had hard or tense abdomen. As well as, the mean score of abdominal circumference for the study group subjects was 98.53±16.21 cm and the mean score of the control group subjects was 102.19±17.03 cm with highly statistically significant differences regarding palpation of abdomen between the study and control group subjects at P.value= 0.00000. Moreover, there was highly statistically significant difference regarding palpation of abdomen and abdominal circumference pre and fifth day post implementation of abdominal massage within the control group at P.value= 0.00000. As well as, no statistically significant difference regarding palpation of abdomen and abdominal circumference pre and fifth day post implementation of abdominal massage within the study group.

Table (4): Comparison between the study and control group subjects regarding effect of abdominal massage on gastrointestinal outcomes (vomiting) (No=110).

Vomiting	Control group (no=55)		Study group (no=55)		Chi square test	P-Value
	No.	%	No.	%		
Pre implementation:						
Frequency of vomiting episodes						
• None	55	100.00%	55	100.00%	0.000	1.000 NS
• Once/day	0	0.00%	0	0.00%		
• Twice/day	0	0.00%	0	0.00%		
Post implementation (5th day):						
Frequency of vomiting episodes						
• None	46	83.64%	51	92.73%	2.181	0.140 NS
• Once/day	9	16.36%	4	7.27%		
• Twice/day	0	0.00%	0	0.00%		
Comparison between pre and 5th day post implementation	X²= 9.802 P = 0.002 S		X²= 4.151 P = 0.042 S			

Non-Significant (NS) = P. > 0.05

Significant (S) = P. < 0.05

Table (4) reveals that, 100.00 % of the studied subjects hadn't vomiting pre implementation of abdominal massage. Regarding fifth day post implementation of abdominal massage, frequency of vomiting episodes after meal in the study group subjects was 7.27 % and in the control group subjects was 16.36 % with no statistically significant differences between the

study and control group subjects at P.value > 0.05. Moreover, there was statistically significant difference regarding frequency of vomiting episodes pre and fifth day post implementation of abdominal massage within the control and study groups at P.value < 0.05.

Table (5): Comparison between the study and control group subjects regarding effect of abdominal massage on gastrointestinal outcomes (intra-abdominal pressure) (No=110).

Intra-abdominal pressure (IAP)	Control group (n=55)		Study group (n=55)		Chi square test	P-Value
	No.	%	No.	%		
Pre implementation:						
0-12mmHg	29	52.73%	48	87.27%	17.85	0.00013 HS
13-15 mmHg	17	30.91%	7	12.73%		
16-20 mmHg	9	16.36%	0	0.00%		
21-25 mmHg	0	0.00%	0	0.00%		
Mean+ SD	11.46 ± 3.85		7.70 ± 3.00		t=5.62	0.00000 HS
Post implementation (5th day):						
0-12mmHg	17	30.91%	47	85.45%	36.60	0.00000 HS
13-15 mmHg	22	40.00%	8	14.55%		
16-20 mmHg	14	25.45%	0	0.00%		
21-25 mmHg	2	3.64%	0	0.00%		
Mean+ SD	13.21 ± 4.15		7.67 ± 3.00		t=7.94	0.00000 HS
Comparison between pre and 5th day post implementation	t= -6.62 P= 0.00000 HS		t= 0.94 P= 0.350 NS			

Non-Significant (NS) = P. > 0.05

High significant (HS) = P. < 0.001

Table (5) reveals that, 87.27 % of the study group subjects compared to 52.73 % of the control group subjects had normal intra-abdominal pressure. As well as, the mean scores of intra-abdominal pressure for the control and study group subjects were 11.46±3.85 mmHg and 7.70±3.00 mmHg respectively, with highly statistically significant differences between the study and control group subjects in relation to intra-abdominal pressure pre implementation of abdominal massage at P.value <0.001. Regarding fifth day post implementation of abdominal massage, 85.45 % of the study group subjects compared to 30.91 % of the control group subjects had normal intra-abdominal pressure. Meanwhile, the mean scores of intra-abdominal pressure for the study group subjects was 7.67±3.00 mmHg and the mean score for the control group subjects was 13.21±4.15 mmHg with highly statistically significant differences between both groups at P.value=0.00000. Moreover, there was highly statistically significant difference between the mean scores of intra-abdominal pressure pre and fifth day post implementation of abdominal massage within the control group at P.value= 0.00000. As well as, no statistically significant difference between the mean scores of intra-abdominal pressure pre and fifth day post implementation of abdominal massage within the study group at P.value= 0.350.

Table (6): Comparison between the study and control group subjects regarding effect of abdominal massage on gastrointestinal outcomes (constipation) (No=110).

Constipation	Control group (n=55)		Study group (n=55)		Chi square test	P-Value
	No.	%	No.	%		
Pre implementation:						
Constipation occurrence	27	49.09%	34	61.82%	1.80	0.17932 NS
Constipation severity						
• Mild	27	49.09%	34	61.82%	1.34	0.17932 NS
• Moderate	0	0.00%	0	0.00%		
• Severe	0	0.00%	0	0.00%		
Post implementation (5th day):						
Constipation occurrence	32	58.18%	8	14.55%	22.63	0.00000 HS
Constipation severity						
• Mild	0	0.00%	0	0.00%	6.00	0.01431 S
• Moderate	9	16.36%	6	10.91%		
• Severe	23	41.82%	2	3.64%		
Comparison between pre and 5 th day post implementation regarding constipation occurrence	X ² = 0.91 P= 0.33908 NS		X ² = 26.04 P= 0.00000 HS			
Comparison between pre and 5 th day post implementation regarding constipation severity	X ² = 59.00 P= 0.00000 HS		X ² = 42.00 P= 0.00000 HS			

Non-Significant (NS) = P. > 0.05, Significant (S) = P. < 0.05, High significant (HS) = P. < 0.001

Table (6) reveals that, 61.82 % of the study group subjects compared to 49.09 % of the control group subjects had mild constipation, with no statistically significant differences between the study and control group subjects regarding constipation occurrence pre implementation of abdominal massage at P.value=0.17932. Regarding fifth day post implementation of abdominal massage, constipation occurrence in the study group subjects was 14.55 % compared to 58.18 % in the control group subjects with highly statistically significant difference regarding constipation occurrence at P.value= 0.00000. Moreover, there was highly statistically significant difference regarding constipation severity pre and fifth day post implementation of abdominal massage within the study and control group at P.value =0.00000.

DISCUSSION

Critically ill patients are prone to malnutrition because of their hyper metabolic condition. Enteral nutrition had been beneficial over parenteral nutrition as it maintains the intestinal alignment and function, which prevents from bacterial translocation. However, it has been

associated with various gastrointestinal complications/outcomes as, vomiting, abdominal distension, increased gastric residual volume and constipation. These require utilizing techniques and methods for increasing the rate of gastric emptying. Among these techniques is abdominal massage which has been proved to improve various digestive functions " [5], [28] ".

Abdominal massage is low cost, has no side effects, and has been widely used for patients prone to gastrointestinal dysfunction. Abdominal massage improves blood circulation in the gastrointestinal tract and stimulates gastrointestinal peristalsis, which accelerates the passage of food through the gastrointestinal tract. Recent reports suggested that abdominal massage applied to critically ill patients receiving enteral nutrition may reduce the incidence of related gastrointestinal outcomes [29].

The current study is a quasi-experimental study aimed to evaluate the effect of abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients through the following, assessment of gastrointestinal outcomes among intermittent enterally fed critically ill patients, implementing abdominal massage on intermittent enterally fed critically ill patients and evaluating the effect of the abdominal massage on gastrointestinal outcomes among intermittent enterally fed critically ill patients. The current study hypothesized that; the study group subjects who receive abdominal massage will have better gastrointestinal outcomes than the control group subjects will.

Regarding the studied **patients' demographic characteristics**, the current study revealed that, the mean age of the study group was 67.16 ± 12.61 years while the mean age of the control group was 66.67 ± 12.59 years with no statistically significant difference between both groups at pre implementation phase This might be explained due to age is considered a major, well-known and non-modifiable risk factor predisposing to several types of chronic diseases and intensive care unit (ICU) admission. This finding was in agreement with **Momenfar et al., (2018) [30]** who conduct a study entitled "Studying the Effect of Abdominal Massage on the Gastric Residual Volume in Patients Hospitalized in Intensive Care Units", and found that the mean age in the study group was 60.76 ± 17.38 years and the mean age in the control group was 58.66 ± 14.75 years. While, this finding was contradicted with **Diab et al., (2020) [11]**, whose study title was " Effect of Abdominal Massage on Clinical Outcomes of Enterally Fed Mechanically Ventilated Patients " and found that the mean age was 41.53 ± 11.20 years in the study group and 39.20 ± 9.38 years in the control group. Regarding **gender**, the present study showed that, the more than three quarters of the control group and less than two thirds of the study group were males with no statistically significant difference between both groups at pre implementation phase. This finding agreed with **Abdelhafez & Abd Elnaeem, (2019) [8]**, whose study title was " Effect of Abdominal Massage on Gastrointestinal Complications and Intra-Abdominal Pressure of Critical-Enteral-Feed Patients " and found that two thirds of the intervention group and majority of the control group were males. However, this finding **was not in agreement with Cetinkaya et al., (2020) [9]**, whose study title was " The Effect of Abdominal Massage on Enteral Complications in Geriatric Patients" and

found that two thirds of intervention group and more than half of control group were female.

Concerning **level of education**, the present study showed that about one third of the studied subjects cannot read and write with no statistically significant difference between both groups at pre implementation phase. **This result was in agreement with Abd-Elraheem et al, (2020) [27], whose study title was " Effect of Implementing Murdoch Bowel Protocol on the occurrence of Constipation among Critically Ill Patients " and found that one third of study and control group can't read and write.** Although, this finding disagreed with **Mohamed et al., (2021) [14]**, in a study entitled " Effect of Abdominal Massage on Gastrointestinal Function among Enterally Fed Critically Ill Patients" and found that only less than one fifth of the study group and minority of the control group can't read and write.

Regarding **residence**, the current study revealed that less than two **thirds** of the control group compared to more than half of the study group was lived in rural areas with no statistically significant difference between both groups at pre implementation phase. **This was in agreement with Diab et al, (2021) [11] who found that more than half of the study and control group were** lived in rural areas. Meanwhile, these findings disagreed with **Mohamed et al., (2021) [14]** who reported that the majority of the **study and control group were** lived in urban areas.

In relation to **occupation**, the current study revealed that the majority of the study and control group subjects had no work or retired with no statistically significant difference between both groups at pre implementation phase. This finding was in agreement with **Momenfar et al, (2018) [30]** who mentioned that the majority of the **study group and** more than two thirds of the **control group** were unemployed. While this was not in agreement with **Diab et al, (2021) [11] who found that more than two thirds of the control and study group** was working.

Abdominal massage is one of complementary therapy that can be applied to enhance the digestive system functions, improve the intestinal movements and decrease intra-abdominal pressure. Several studies in Egypt, Turkey, Iran, Germany and others have suggested and described using the abdominal massage for patients in ICUs as a nonpharmacological and noninvasive approach for improving gastrointestinal outcomes such as "high gastric residual volume, vomiting, abdominal distension, constipation " **[8], [31] "**.

This part was concerned with discussing the results regarding **effect of abdominal massage on gastrointestinal outcomes** among control and study group subjects pre and post implementation of abdominal massage;

As regards to **gastric residual volume (GRV) as a gastrointestinal outcome**, the current study showed that the mean scores of gastric residual volume (GRV) for the control and study group subjects were 13.64 ± 5.13 ml and 12.00 ± 4.04 ml respectively with no statistically significant differences between both groups at pre implementation phase.

This finding was in the same line with **Momenfar et al, (2018) [30]** who mentioned that the mean of the total GRV before the intervention between the two groups was not statistically significant ($P > 0.05$). Meanwhile, this finding disagreed with **El-Feky and Ali, (2020) [3]** who reported that there was significant statistical difference in the mean gastric residual volume between the two groups in the first assessment day before abdominal massage (at $P < 0.05$).

Moreover, the present study revealed that the mean scores of gastric residual volume in the fifth day post implementation of abdominal massage for the study group was decreased versus the mean score of the control group that increased as compared to the pre implementation phase with highly statistically significant difference between both groups pre and fifth day post implementation of abdominal massage. This might be owing to abdominal massage stimulate the parasympathetic division of the autonomic nervous system leading to increasing muscle activity and relaxing the sphincter in the gut and consequently improving peristalsis and bowel sensation resulting in increasing the gastric emptying and decreasing the residual volume. This explanation was supported by **Aldugiem et al, (2021) [31]** who stated that abdominal massage is efficient in managing and preventing high GRV.

This result was in agreement with **Thomas et al, (2019) [32]** who conduct a study entitled "A study to assess the effectiveness of abdominal massage on gastric residual volume among patients with intermittent nasogastric tube feeding in a selected hospital, Bangalore" and found that there was statistically significant decrease in gastric residual volume after the application of abdominal massage. As well **Mohamed et al., (2021) [14]** reported that the mean scores of gastric residual volume was higher among the control group than the study group from the second day to the fifth day with highly statically significant differences between them regarding gastric residual volume in 3rd, 4th and 5th day. Also, this finding was consistent with **Aldugiem et al, (2021) [31]** who stated that a significant difference was found between the 1st day and 5th day after abdominal massage in the study group regarding to the gastric residual volume. Meanwhile, this finding disagreed with **Cetinkaya et al., (2020) [9]** who found that there was no significant difference between the intervention and control groups in terms of the GRV amount on the fifth day after abdominal massage ($p > 0.05$).

Concerning **abdominal distension as a gastrointestinal outcome**, the present study showed that, one fifth of the study group compared to about one third of the control group had distension. As well as, the mean scores of abdominal circumference for the control and study groups were 99.42 ± 16.96 cm and 98.35 ± 16.29 cm respectively with no statistically significant difference between both groups at pre implementation phase. This result was in agreement with **Aldugiem et al, (2021) [31]** who found that, one third of the study group compared to more than two fifths of the control group had distension with no significant difference regarding abdominal distension between the study and control groups before implementation of abdominal massage.

On the other hand, it was found that the number of control group subjects who had abdominal distension was increased in the fifth day post implementation of abdominal massage as compared to the pre implementation phase with highly statistically significant difference while the number of study group subjects who had abdominal distension was decreased in the fifth day post implementation of abdominal massage as compared to the pre implementation phase with no statistically significant difference. This result was in agreement with a study done by **Wang et al, (2019) [33]** titled " Effects of abdominal massage on gastrointestinal function in ICU patients: a meta-analysis" revealed that the abdominal massage helps to relieve abdominal distension, gastric residual volume and vomiting. Also, These findings coincided with **Dehghan et al, (2018) [34]** who mentioned that the average of abdomen circumference in the control group after the intervention in comparison to the time before the intervention had a significant increase, also a significant difference in this view, and the amount of distention in the intervention group was less than the control group. Furthermore, these findings were in disagreement with **Ali et al, (2022) [35]** who mentioned that more than two third of study group after application of abdominal massage have occasional discomfort of short duration of abdominal distention, while less than half of the control group have frequent and prolonged episodes of abdominal distention. As well, **Abdelhafez & Abd Elnaeem, (2019) [8]** who stated that the abdominal massage was not effective on abdominal circumference over the five days of the study.

In relation to **vomiting as a gastrointestinal outcome**, the current study showed that minority of the study group subjects and less than one third of the control group subjects had vomiting at fifth day post implementation of abdominal massage as compared to pre implementation phase with statistically significant difference within the control and study group subjects.

Despite the number of patients who had vomiting at fifth day post implementation phase in the study group subjects was less than the number of the control group subjects, there was no statistically significant difference between study and control group subjects regarding vomiting. This is might be referring to the abdominal massage was not effective on decreasing frequency of vomiting. This explanation was supported by **Çetinkaya et al, (2020) [9]** who mentioned that abdominal massage did not have a positive effect on vomiting.

This finding was in the same line with a study conducted by **Uysal, (2017) [36]** titled "**The effect of abdominal massage administered by caregivers on gastric complications occurring in patients intermittent enteral feeding—a randomized controlled trial** " and revealed that vomiting occurred in 2.0% of patients in the study group compared to 16.0% of them in the control group after abdominal massage. Moreover, this result was in disagreement with **Fareed and El- Sayad, (2017) [37]** in a study titled "**Effect of Selected Nursing Intervention on Clinical Outcomes among Patients with Nasogastric Tube in Intensive Care Units** " and mentioned that there was a significant reduction of vomiting occurrence among the study group than the control group after abdominal massage. Also, **Diab et al, (2021) [11]** who stated that there was

a statistically significant difference among study group throughout the periods of follow up regarding frequency of vomiting episodes. As well as **Mohamed et al, (2021) [14]** reported that abdominal massage was effective in reducing frequency of vomiting among critically ill patients with nasogastric tube.

Concerning **intra-abdominal pressure as a gastrointestinal outcome**, the present study revealed that majority of the study group subjects compared to more than half of the control group subjects had normal intra-abdominal pressure at pre implementation phase. As well as, the mean scores of intra-abdominal pressure for the control and study group subjects were 11.46 ± 3.85 mmHg and 7.70 ± 3.00 mmHg respectively. This finding was in the same line with **Abdelhafez & Abd Elnaeem, (2019) [8]** who reported the intra-abdominal pressure readings of both groups were within accepted level and not exceeds to be intra-abdominal hypertension in the first day of the study.

Also, the present study revealed that the majority of the study group subjects compared to about one third of the control group subjects had normal intra-abdominal pressure in the fifth day post implementation of abdominal massage with highly statistically significant difference between both groups. As well as the mean scores of intra-abdominal pressure for the control group subjects were increased in the fifth day post implementation of abdominal massage as compared to the pre implementation phase with highly statistically significant difference between both groups and within the control group pre and fifth day post implementation of abdominal massage. This finding might be explained due to effect of abdominal massage on reducing gastric residual volume and abdominal distention which in turn decreasing intra-abdominal pressure. This finding was consistent with **Abdelhafez & Abd Elnaeem, (2019) [8]** who reported that mean of intra-abdominal pressure of intervention group in the five days was the same and in the control group the mean of intra-abdominal pressure was slightly increased in day 5 than first day.

Regarding **constipation as a gastrointestinal outcome**, the present study revealed that, about two thirds of the study group subjects compared to one-half of the control group subjects had constipation, with no statistically significant differences between the study and control groups at pre implementation phase. This result was in agreement with **Cetinkaya et al., (2020) [9] who found** that most of the patients had constipation with no statistically significant differences between both groups before application of abdominal massage.

Moreover, the present study revealed that, minority of the study group subjects compared to more than half of the control group subjects had constipation in the fifth day post implementation of abdominal massage with highly statistically significant differences between both groups. This finding might be due to abdominal massage stimulate peristalsis, decreasing colonic transit time and increasing colonic motility which in turn improve defecation pattern in the study group rather than the control group. This finding was in agreement with **Altun Ugras et al, (2020) [38] whose study title was " Effect of abdominal massage on bowel evacuation in neurosurgical intensive care patients "** who stated that, the patients who underwent abdominal massage had earlier bowel

evacuation than the control group. Also, this in the same line with **Okuyan & Bilgili, (2019) [39]** in a study titled "Effect of abdominal massage on constipation and quality of life in older adults" who stated that when the post intervention constipation status of individuals in the massage and control groups were compared, the constipation status of the massage group decreased with a significant difference between the groups. Similarly, **Cevik et al. (2018) [40]** in a study titled "The effect of abdominal massage on constipation in the elderly residing in rest homes" who found that the mean scores for the number of defecations increased after abdominal massage than before and during it, in a sample of twenty-two elderly patients.

Conclusion

Based on the results of the current study, it can be concluded that:

Abdominal massage was an effective intervention on the gastrointestinal outcomes among intermittent enterally fed critically ill patients as it leads to reduction in gastric residual volume, abdominal distension, intra-abdominal pressure and constipation. Finally, the present study concluded that the study group subjects who received abdominal massage had better gastrointestinal outcomes namely gastric residual volume, abdominal distension, intra-abdominal pressure and constipation.

Recommendations

Based on results of the present study, the following recommendations could be suggested:

➤ Regarding nursing education

- On-going and regular in-service educational programs about assessment of gastrointestinal outcomes among enterally fed critically ill patients and how to measure gastric residual volume and intra-abdominal pressure.
- Developing a simplified and comprehensive manual booklet for nurses including basic information about abdominal massage technique as definition, purposes, types, indications, contraindications and procedure steps.
- Nursing curriculums must include the concept of complementary therapy including abdominal massage as an effective method to improve gastrointestinal outcomes for enterally fed critically ill patients.

➤ Regarding clinical practice:

- Incorporate abdominal massage as a routine nursing care for critically ill patients receiving enteral feeding.
- Gastric residual volume should be checked before enteral feeding for all critically ill patients.

- Nurse supervisors should also verify that abdominal massage technique appropriately followed by all nursing staff to prevent gastrointestinal outcomes or other complications in enterally fed critically ill patients.

➤ **Regarding further researches:**

- Replication of this study on a larger probability sample to ensure generalizability of findings.
- Further researches are needed for assessing critical care nurses performance regarding abdominal massage among enterally fed critically ill patients.

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