Uncorrected Proof

J Crit Care Excell. 2026 March; 3(1): e171446 https://doi.org/10.5812/jcce-171446

Published Online: 2026 March 31 **Research Article**

Comparison of the Effects of Abdominal Massage with and Without Peppermint Extract on Gastric Residual Volume and Abdominal Distension in Patients Receiving Enteral Feeding in the Intensive Care Unit: A Clinical Trial

Marzie Safari [1], Hossein Shahdadi [2,*], Mozhgan Rahnama [2], Abdolghani Abdollahimohammad [2], Mahdieh Poodineh Moghadam [2]

[1] Student Research Committee, Zabol University of Medical Sciences, Zabol, Iran
[2] Nursing Department, Zabol University of Medical Sciences, Zabol, Iran

[*] ***Corresponding Author:*** Department of Nursing, Birjand University of Medical Sciences, Birjand, Iran. Email: zb5950@gmail.com

Received: 23 February, 2026; **Revised:** 9 March, 2026; **Accepted:** 19 March, 2026

Abstract

Background: Enteral feeding intolerance is common among intensive care unit (ICU) patients and often manifests as elevated gastric residual volume (GRV) and abdominal distension. Nonpharmacological interventions may offer safe alternatives to drug therapy.

Objectives: This study aimed to compare the effects of abdominal massage with and without peppermint extract on GRV and abdominal distension in patients in the intensive care unit (ICU) who were receiving enteral nutrition.

Methods: A single-blind randomized clinical trial was conducted in which participants were blinded to group allocation. A total of 50 patients who met the inclusion criteria were randomly assigned by lottery using numbered, sealed envelopes to receive abdominal massage with peppermint extract (n = 25) or without peppermint extract (n = 25). The intervention lasted 3 consecutive days and consisted of 20-minute abdominal massage sessions twice daily. According to the intensive care unit (ICU) protocol, patients received gavage feeding every 3 hours, resulting in 2 feeding sessions during the 6-hour interval between massage sessions. Gastric residual volume was assessed twice daily: immediately before the first massage session and 1 hour after the second session. Abdominal circumference was also measured twice daily, before the first massage session and after the second session. Data were analyzed using IBM SPSS Statistics version 23.

Results: The independent t-test revealed a statistically significant between-group difference in mean GRV before and after massage during the 3-day intervention period ($P < 0.001$). Analysis of covariance, adjusted for baseline values, also confirmed a significant between-group difference ($P < 0.001$). However, no statistically significant between-group difference was found in mean abdominal circumference ($P \geq 0.05$).

Conclusions: Abdominal massage with peppermint extract was more effective than massage alone in reducing GRV among enterally fed neurological intensive care unit (ICU) patients. Given the low cost and ease of use of peppermint extract, this intervention may be considered a useful adjunctive nursing measure to reduce GRV. Although no significant reduction in abdominal distension was observed, this finding does not necessarily indicate a lack of efficacy; rather, it suggests the need for a larger sample size with adequate power to detect this outcome.

Keywords: Abdominal Massage, Peppermint Extract, Gastric Residual Volume, Abdominal Distension, Enteral Feeding, Patients

1. Background

Nutritional support is essential in the intensive care unit (ICU), where malnutrition is highly prevalent and debilitating, affecting 35 - 78% of critically ill patients (1, 2). Malnutrition is associated with adverse outcomes, including poor wound healing, prolonged hospitalization, increased disease risk, and higher mortality (1). This problem is compounded by the rapid loss of 5 - 10% of skeletal muscle mass per week among critically ill patients (2). For patients unable to eat orally, enteral nutrition, often delivered through a nasogastric tube, is the physiologically preferred method of maintaining intestinal integrity (3, 4).

Enteral nutrition is frequently complicated by gastric intolerance, which manifests as increased gastric residual volume (GRV), vomiting, and abdominal distension (5). Abdominal distension can impede diaphragmatic

Copyright © 2026, Shahid Beheshti University of Medical Sciences. This open-access article is available under the Creative Commons Attribution 4.0 (CC BY 4.0) International License (https://creativecommons.org/licenses/by/4.0/), which allows for the copying and redistribution of the material only for noncommercial purposes, provided that the original work is properly cited.

How to Cite: Safari M, Shahdadi H, Rahnama M, Abdollahimohammad A, Poodineh Moghadam M. Comparison of the Effects of Abdominal Massage with and Without Peppermint Extract on Gastric Residual Volume and Abdominal Distension in Patients Receiving Enteral Feeding in the Intensive Care Unit: A Clinical Trial. J Crit Care Excell. 2026;3(1):e171446. doi: https://doi.org/10.5812/jcce-171446

movement and reduce lung capacity (2), whereas elevated GRV, a key indicator of intolerance, often leads to feeding interruption and failure to meet target caloric intake (4). Nurses in the ICU play a vital role in monitoring these complications by assessing bowel sounds, palpating for distension (6), and measuring GRV (4).

Standard interventions to improve gastric emptying, such as prokinetic drugs, can cause adverse effects, including bronchospasm and abdominal cramps, whereas reducing feeding rates increases the risk of malnutrition (2, 4). Abdominal massage is a low-cost, low-risk, nonpharmacological intervention hypothesized to enhance gastrointestinal blood flow, stimulate peristalsis, and activate parasympathetic responses (5). Evidence of its efficacy is mixed: some studies have reported reductions in GRV and distension (2, 6), whereas others have reported conflicting results, highlighting the need for further research, particularly on nurse-performed massage (5).

Combining massage with therapeutic oils, such as olive oil, has shown promise (7). Medicinal plants such as peppermint have a long history of use and contain known bioactive compounds. These plants offer therapeutic potential for gastrointestinal symptoms, and their compounds can be effectively absorbed through the skin (8, 9).

Given the critical need to manage enteral feeding complications, the limitations of pharmacological options, the potential of abdominal massage, and the gastrointestinal benefits of peppermint, this study aimed to compare the effects of abdominal massage with and without peppermint extract on GRV and abdominal distension in enterally fed ICU patients.

2. Objectives

This study aimed to compare the effects of abdominal massage with and without peppermint extract on GRV and abdominal distension in intensive care unit (ICU) patients receiving enteral nutrition.

3. Methods

3.1. Study Design and Setting

A single-blind randomized clinical trial was conducted to evaluate and compare the effects of abdominal massage with and without peppermint extract on GRV and abdominal distension in patients receiving enteral nutrition. Participants were effectively blinded to group allocation because their level of consciousness was low (Glasgow Coma Scale score ≤ 7). However, the assessor measuring GRV and abdominal circumference was not blinded to group allocation. Thus, the study had a single-blind design. The study was conducted in 2025 in the neurosurgical intensive care units (ICUs) of selected hospitals affiliated with Iran University of Medical Sciences. The trial was designed and reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Figure 1).

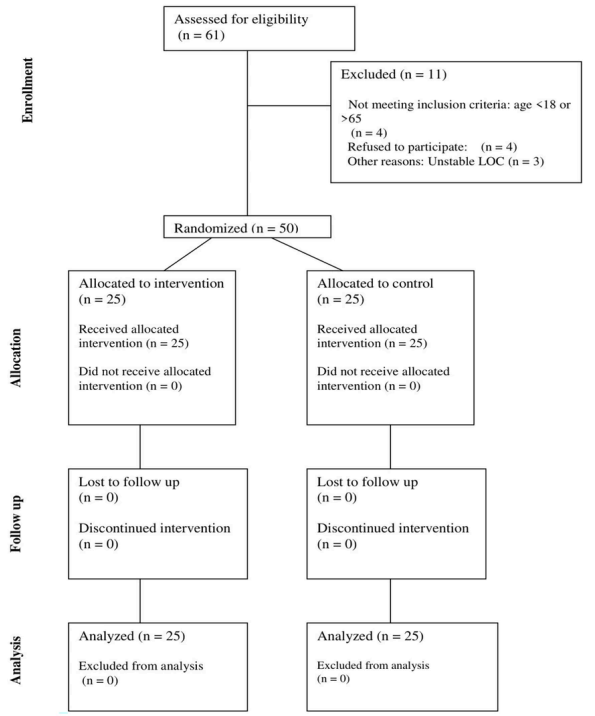


Figure 1. CONSORT diagram

3.2. Participants and Sampling

The study population comprised all patients receiving enteral feeding in the neurological ICUs. Inclusion criteria were age 18 - 65 years; hospitalization in the ICU requiring enteral nutrition through a nasogastric tube, with feeding recently initiated; no use of prokinetic medications to avoid interaction with the intervention; a Glasgow Coma Scale score ≤ 7; no history of abdominal surgery or radiotherapy within the preceding 6 weeks; no contraindications to abdominal massage, such as abdominal hernia, irritable bowel syndrome, intestinal cancer, active abdominal wounds, or pregnancy; absence of bowel obstruction or diarrhea; and a normal diet before hospitalization. Exclusion criteria were failure to complete the intervention because of discharge, death, or cessation

of enteral feeding, and development of diarrhea during the study period.

The sample size was calculated based on the study by Momenfar et al. (10), using a formula for comparing 2 means, with a 99% confidence level, 80% power, and an assumed 10% attrition rate for GRV (11).

$$n = C \times \left(\frac{\sqrt{\mathrm{SD}\,1^2 - \mathrm{SD}\,2^2}}{\mathrm{Mean}\,1 - \mathrm{Mean}\,2} \right)^2 \times 1.1$$

$$n = 10.5 \times \left(\frac{\sqrt{54.9^2 - \mathrm{SD}\,39.30^2}}{143.46 - 97.30} \right)^2 \times 1.1 = 25$$

A minimum of 25 participants per group was required. Ultimately, 50 eligible patients were randomly assigned by lottery to receive abdominal massage with peppermint extract (n = 25) or without peppermint extract (n = 25). All patients completed the study after randomization, and no participants were excluded.

Randomization was performed using 50 sealed, numbered envelopes. All envelopes were identical in appearance and numbered from 1 to 50 to maintain the sequence. Half contained the phrase "massage with peppermint extract," and the remaining envelopes contained "massage without peppermint extract." The envelopes were then sealed with tape. After informed consent was obtained, a ward nurse who was not a member of the research team selected and opened an envelope for each patient in order of admission. Patients were allocated to the corresponding study group according to the contents of the selected envelope.

3.3. Data Collection Tools and Measurements

Data were collected using (a) a demographic questionnaire covering age, sex, place of residence, and reason for hospitalization; (b) a nutritional status monitoring checklist covering the date and time of assessment, enteral feeding volume, GRV before and after massage, number of vomiting episodes, feeding interruptions, and aspiration events; (c) a 60-mL SUPA-brand enteral syringe for GRV aspiration; and (d) a flexible measuring tape (cm) for measuring abdominal circumference.

The validity of the monitoring checklist had previously been confirmed by Momenfar et al. (10), and its reliability had been established using equivalence reliability. The syringe and measuring tape were regarded as standard, valid instruments for their respective measurements. In the present study, all measurements were performed by a trained researcher whose measurement reliability had been evaluated before data collection.

3.4. Ethical Considerations and Procedure

The study was approved by the Research Deputy and the Ethics Committee of Zabol University of Medical Sciences (approval code: IR.ZBMU.REC.1403.133) and registered in the Iranian Registry of Clinical Trials (registration code: IRCT20250514065728N1). After administrative permissions were obtained from the participating hospitals, the study objectives and procedures were explained to the patients' families or legal guardians, who provided written informed consent. Given the patients' reduced level of consciousness, consent was obtained from their surrogate decision-makers. Confidentiality and the right to withdraw from the study at any time were assured.

3.5. Intervention Protocol

Two liters of 1% peppermint extract from Barij Co., derived from peppermint essential oil, were prepared at the required concentration. Paraffin—an odorless, inert massage oil from Barouj Pharmaceutical Co.—was used for the control group at the same concentration as the peppermint extract. Paraffin oil has no known pharmacological effects on the skin or gastrointestinal tract and served as a neutral vehicle. The containers for both oils were identical in color and size.

Because of their low level of consciousness, patients could not detect the peppermint odor and were unaware of which substance was used for abdominal massage.

Abdominal massage was performed for female patients by the primary researcher, a master's student in nursing certified by the Chista Massage Training Institute, and for male patients by a trained male research assistant with a nursing degree, in accordance with ethical, legal, and cultural norms.

The intervention lasted 3 consecutive days for each participant. Patients received a standardized 20-minute abdominal massage twice daily. In both groups, 10 - 15 mL of extract or oil was used per session, depending on the size of the abdominal area being massaged. The volume was measured using a syringe. No adverse events were recorded during the study.

According to the ICU protocol, enteral feeding was administered every 3 hours; consequently, 2 feedings occurred during the 6-hour interval between the first and second daily massage sessions.

3.6. Massage Technique and Monitoring

During each session, the patient was positioned supine, with the head elevated 30 - 45 degrees and the knees flexed and supported by a small pillow to relax the abdominal muscles. The researcher stood on the patient's right side. The massage protocol consisted of stroking, gentle touch, kneading, and vibration based on standard Swedish massage techniques. A trained researcher performed the massage using a standard checklist (2, 6). Throughout each session, the patient's facial expressions, signs of discomfort, and vital signs, including respiratory rate, heart rate, and pulse oximetry, were monitored. Massage was discontinued immediately if any sign of an adverse reaction occurred.

3.7. Outcome Measurement Procedures

Correct placement of the nasogastric tube was confirmed in both groups using air insufflation with epigastric auscultation before data collection. Gastric residual volume was assessed twice daily, before the first massage session and 1 hour after the second session, using a 60-mL syringe. The aspirate was obtained by slow suction, its volume was recorded, and the gastric contents were reinfused. If GRV exceeded 250 mL, the attending physician was notified for further evaluation (10). When minimal or no aspirate was obtained, the measurement was repeated to verify whether the stomach was empty (4).

Abdominal circumference was also measured twice daily, before the first massage session and after the second session, using a flexible measuring tape. The tape was consistently positioned at the level of the umbilicus, and the measurement site was marked to ensure reproducibility. Readings were taken at end-expiration (4). During the intervention, privacy was maintained by exposing only the abdominal region from the anterior superior iliac spine to the subcostal margin, while the rest of the body was covered with a sheet.

4. Results

A total of 50 patients receiving enteral feeding in the neurological intensive care unit (ICU) were enrolled. All randomized participants completed the 3-day intervention and were included in the final analysis. The mean age was 43.24 ± 11.12 years in the intervention group (abdominal massage with peppermint extract) and 45.12 ± 10.82 years in the control group (abdominal massage without peppermint extract). An independent-samples t-test showed no statistically significant difference in age between the groups ($P = 0.548$), indicating baseline homogeneity.

Chi-square analysis also showed no statistically significant between-group differences in sex, educational level, place of residence, or reason for hospitalization (all $P > 0.05$), as presented in Table 1.

The Shapiro-Wilk test confirmed that age, GRV, and abdominal circumference data assessed before and after massage on 3 consecutive days were normally distributed in both groups ($P \geq 0.05$).

As shown in Table 2, the independent-samples t test indicated a statistically significant between-group difference in mean GRV at all time points ($P < 0.001$). Table 3 shows that analysis of covariance, adjusted for baseline GRV, confirmed a significant between-group difference on all 3 days ($P < 0.001$), with partial eta squared values of 0.24, 0.27, and 0.43 on days 1, 2, and 3, respectively. In contrast, Table 4 shows no statistically significant between-group difference in mean abdominal circumference at any time point (all $P \geq 0.05$). Although vomiting episodes, feeding interruptions, and aspiration events were initially considered, none occurred during the study period.

5. Discussion

This study investigated the effects of abdominal massage with and without peppermint extract on GRV and abdominal distension in enterally fed patients admitted to a neurological intensive care unit (ICU). The main finding was that abdominal massage combined with peppermint extract resulted in a significantly greater reduction in GRV than massage alone. Abdominal massage may facilitate bowel motility through changes in intra-abdominal pressure and mechanical stimulation of intestinal activity. However, the observed effect may also be reflexive, resulting from massage-induced vagal stimulation rather than being attributable solely to the topical application of peppermint extract. Evidence of transdermal absorption of peppermint oil in critically ill patients remains limited, and further studies are needed to clarify the mechanism.

Evidence from the literature supports the antispasmodic properties of peppermint, including its topical efficacy in reducing tension-type headaches and migraines, improving peripheral blood flow, and producing a cooling effect on the skin during physical activity (9, 12). The underlying mechanism is primarily attributed to calcium-channel antagonism and smooth muscle relaxation within the gastrointestinal tract (13). In addition, Kiani et al. demonstrated in 2014 that peppermint extract reduced pyloric spasm during endoscopy, further supporting its gastrointestinal relaxant effect (14).

To our knowledge, no previous study has evaluated the effect of topical peppermint extract combined with abdominal massage on GRV in ICU patients. Nevertheless, Ebrahimian et al. reported that enteral administration of

Table 1. Demographic Characteristics of Patients Receiving Enteral Nutrition in the Experimental and Control Groups [a]

Variables	Control Group	Experimental Group	Test Statistic	P value [b]
Gender			0.199	0.656
Female	14 (56)	13 (52)		
Male	11 (44)	12 (48)		
Education level			2.35	0.309
Primary	4 (16)	8 (32)		
Diploma	16 (64)	11 (44)		
Higher education	5 (20)	6 (24)		
Place of residence			0.32	0.571
City	13 (52)	11 (44)		
Village	12 (48)	14 (56)		
Reason for hospitalization			0.251	1.000
Head trauma	12 (48)	12 (48)		
Stroke	4 (16)	5 (20)		
Brain tumor	9 (36)	8 (32)		

[a] Values are expressed as No. (%).

[b] Chi-square test.

Table 2. Mean and Standard Deviation of Gastric Residual Volume at Baseline and After Intervention in the Experimental and Control Groups [a]

Day	Time Point	Experimental Group, mL	Control Group, mL	t-Score	95% CI of the Difference (mL)	P value
Day 1	Baseline	250.48 (7.52)	275.4 (4.73)	-14.01	-28.49, -21.34	< 0.001
Day 1	After intervention	232.92 (6.47)	263.40 (4.58)	-17.96	-31.66, -25.29	< 0.001
Day 2	Baseline	248.32 (7.36)	273.32 (4.80)	-14.22	-28.53, -21.46	< 0.001
Day 2	After intervention	230.12 (6.11)	257.12 (3.83)	-18.71	-29.90, -24.09	< 0.001
Day 3	Baseline	246.04 (7.29)	271.08 (4.67)	-14.46	-28.54, -21.55	< 0.001
Day 3	After intervention	227.56 (4.69)	252.92 (2.81)	-19.96	-27.91, -22.80	< 0.001

[a] Values are expressed as mean (SD) unless otherwise indicated. Abbreviations: mL, milliliter; df, degree of freedom; CI, confidence interval; SD, standard deviation.

Table 3. Adjusted Mean and 95% Confidence Interval of Gastric Residual Volume in the Experimental and Control Groups [a]

Day	Experimental Group, mL	Control Group, mL	F-Score	df	Difference (mL)	P value	Partial Eta Squared
Day 1	191.32 (177.23, 205.40)	231.07 (216.99, 245.16)	15.14	1, 47	-60.31, -19.20	< 0.001	0.24
Day 2	172.00 (158.94, 187.02)	217.83 (202.81, 232.85)	18.10	1, 47	-67.49, -24.14	< 0.001	0.27
Day 3	151.89 (139.83, 163.95)	202.50 (190.44, 214.57)	35.45	1, 47	-67.71, -33.51	< 0.001	0.43

[a] Values are expressed as adjusted mean (95% CI) or 95% CI. Abbreviations: mL, milliliter; df, degree of freedom; CI, confidence interval.

peppermint extract significantly reduced GRV in mechanically ventilated trauma patients (15). Although the route of administration differed, their findings are consistent with those of the present study, demonstrating a beneficial effect on GRV.

Abdominal distension did not differ significantly between the groups, despite 20-minute abdominal massage sessions with peppermint extract twice daily for 3 consecutive days. This result was unexpected, given the established carminative properties of peppermint (12). Previous studies have generally reported beneficial effects of massage alone in reducing distension. For example, Uysal et al. recommended routine nurse-led abdominal massage to prevent abdominal distension in patients

Table 4. Mean and Standard Deviation of Abdominal Circumference Before and After Measurements in the Experimental and Control Groups [a]

Day	Time Point	Experimental Group, cm	Control Group, cm	t-Score	95% CI of the Difference (cm)	P value	Cohen's d
Day 1	Baseline	80.88 (10.15)	76.56 (12.76)	1.32	-2.23, 10.87	0.191	-0.42
Day 1	After measurement	80.80 (10.08)	76.40 (12.68)	1.35	-2.12, 10.92	0.181	-0.45
Day 2	Baseline	80.64 (9.92)	76.16 (12.76)	1.38	-2.02, 10.98	0.172	-0.31
Day 2	After measurement	80.40 (9.87)	76.04 (12.60)	1.36	-2.08, 10.79	0.180	-0.32
Day 3	Baseline	80.24 (9.97)	75.92 (12.71)	1.33	-2.18, 10.82	0.188	-0.31
Day 3	After measurement	80.12 (9.84)	75.92 (12.65)	1.31	-2.45, 10.65	0.196	-0.32

[a] Values are expressed as mean (SD) unless otherwise indicated. Abbreviations: cm, centimeter; SD, standard deviation; CI, confidence interval.

receiving enteral nutrition (4). Other studies have also reported that abdominal massage reduces abdominal distension in critically ill patients receiving enteral feeding (2, 5, 16).

The discrepancy between the present findings and earlier evidence (2, 4) may be explained by methodological differences, including variations in massage technique, session duration, daily frequency, and total intervention length. For example, Aldugiem et al. (2) implemented a 5-day intervention, whereas the present study was limited to 3 days. Uysal et al. (4) used 15-minute sessions 3 times daily, compared with 20-minute sessions twice daily in the present study. Differences in massage technique may also have contributed to the inconsistent findings. Although no significant reduction in abdominal distension was observed, this finding does not necessarily indicate a lack of efficacy; rather, it suggests the need for a larger sample adequately powered to detect this outcome.

5.1. Limitations

The study was limited by the inability to implement full blinding because outcome assessors were not blinded to group allocation, and by the relatively short intervention period, which may have influenced outcome sensitivity. In addition, abdominal circumference is an indirect measure and may not reflect true abdominal distension in the presence of ascites, obesity, or edema.

5.2. Conclusions

Abdominal massage combined with peppermint extract appears more effective than massage alone in reducing GRV in enterally fed neurological ICU patients. Given that elevated GRV may lead to clinical complications and considering the low cost and ease of application, peppermint-enhanced massage may be considered an adjunctive nursing intervention for managing GRV. However, no significant effect was observed on abdominal distension, which may be related to variations in technique, duration, frequency, or overall intervention length. Future research should examine these variables using larger samples and more rigorous blinding designs.

Acknowledgements

This article was derived from a master's thesis in Medical-Surgical Nursing at the Faculty of Nursing and Midwifery, Zabol University of Medical Sciences (ethics code: IR.ZBMU.REC.1403.133). The authors thank Zabol University of Medical Sciences, the participating patients, hospital administrators and staff, and all individuals who contributed to the study.

Footnotes

AI Use Disclosure: Deepseek was used for translation in the abstract section at a Moderate level.

Authors' Contribution: Study Concept and Design: H. S. and M. R.; Analysis and Interpretation of Data: A. A. and M. R.; Manuscript Drafting: M. S.; Critical Revision for Important Intellectual Content: M. P. and H. S.; Statistical Analysis: A. A.

Clinical Trial Registration Code: IRCT20250514065728N1 .

Conflict of Interests Statement: The authors do not declare any conflicts of interest for this study.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication. The data are not publicly available due to university policies.

Ethical Approval: IR.ZBMU.REC.1403.133 .

Funding/Support: This study did not receive any funding from any institutions.

Informed Consent: After administrative permissions were obtained from the participating hospitals, the study

objectives and procedures were explained to the patients' families or legal guardians, who provided written informed consent. Given the patients' reduced level of consciousness, consent was obtained from their surrogate decision-makers. Confidentiality and the right to withdraw from the study at any time were assured.

References

1. Rezaeian M, Monfared-Parizi S, Mousavi Shirazifard Z, Sayadi A, Khodadadi H, Ghaseminasab-Parizi M. Evaluation of nutritional intake and malnutrition in critically ill patients and its relationship with 28-day death. *Sci Rep*. 2025;**15**(15677). 15677. [PubMed ID: 40325094]. [PubMed Central ID: PMC12053633]. https://doi.org/10.1038/s41598-025-00780-2.
2. Aldugiem M, Abdelkader A, El-Soussi A, Zeitoun T, Abdelkader FA, Abdelrahem ASA, et al. Effect of abdominal massage on gastrointestinal outcomes of critically ill patients with enteral feeding. *J Med Chem Sci*. 2021;**4**(5):497-507. https://doi.org/10.26655/JMCHEMSCI.2021.5.11.
3. Doley J. Enteral nutrition overview. *Nutrients*. 2022;**14**(2180):2180. [PubMed ID: 35683980]. [PubMed Central ID: PMC9183034]. https://doi.org/10.3390/nu14112180.
4. Uysal N, Eşer İ, Akpinar H. The effect of abdominal massage on gastric residual volume: A randomized controlled trial. *Gastroenterol Nurs*. 2012;**35**(2):117-123. [PubMed ID: 22472671]. https://doi.org/10.1097/SGA.0b013e31824c235a.
5. Wang X, Sun J, Li Z, Luo H, Zhao M, Li Z, et al. Impact of abdominal massage on enteral nutrition complications in adult critically ill patients: A systematic review and meta-analysis. *Complement Ther Med*. 2022;**64**(102796). 102796. [PubMed ID: 34902566]. https://doi.org/10.1016/j.ctim.2021.102796.
6. Altun Ugras G, Yüksel S, Isik MT, Tasdelen B, Dogan H, Mutluay O. Effect of abdominal massage on bowel evacuation in neurosurgical intensive care patients. *Nurs Crit Care*. 2020;**27**(4):558-566. [PubMed ID: 33179847]. https://doi.org/10.1111/nicc.12575.
7. Faghihi A, Najafi SS, Hashempur MH, Najafi Kalyani M. The effect of abdominal massage with extra-virgin olive oil on constipation among elderly individuals: A randomized controlled clinical trial. *Int J Community Based Nurs Midwifery*. 2021;**9**(4):268-277. [PubMed ID: 34604396]. [PubMed Central ID: PMC8479287]. https://doi.org/10.30476/ijcbnm.2021.88206.1495.
8. Naureen I, Saleem A, Sagheer F, Liaqat S, Gull S, Fatima M, et al. Chemical composition and therapeutic effect of Mentha species on human physiology. *Sch Bull*. 2022;**8**(1):25-32. https://doi.org/10.36348/sb.2022.v08i01.004.
9. Carlson RE, Buch RM, von Fraunhofer JA. Peppermint (Mentha piperita L.) essential oil in systemic and oral health. *EC Dent Sci*. 2021;**20**(7):43-55.
10. Momenfar F, Abdi A, Salari N, Soroush A, Hemmatpour B. Studying the effect of abdominal massage on the gastric residual volume in patients hospitalized in intensive care units. *J Intensive Care*. 2018;**6**(47). 47. [PubMed ID: 30116533]. [PubMed Central ID: PMC6086016]. https://doi.org/10.1186/s40560-018-0317-5.
11. Abdollahimohammad A, Firouzkouhi M. [Sample size estimation in randomized clinical trials (RCTs)]. *J Diabetes Nurs*. 2019;**7**(1):737-739.
12. Balakrishnan A. Therapeutic uses of peppermint: a review. *J Pharm Sci Res*. 2015;**7**(7):474-476.
13. Shams R, Oldfield EC, Copare J, Johnson DA. Peppermint oil: clinical uses in the treatment of gastrointestinal diseases. *JSM Gastroenterol Hepatol*. 2015;**3**(1):1036. https://doi.org/10.47739/2373-9487/1036.
14. Kiani MA, Partovi S, Poursoltani E, Khakshour A, Kianifar HR, Jafari SA. [Evaluate peppermint impact in pyloric spasm in children undergo endoscopy]. *J North Khorasan Med Sci*. 2014;**6**(1):141-149. https://doi.org/10.29252/jnkums.6.1.141.
15. Ebrahimian A, Rahbar S, Homami S, Paknazar F, Fakhr-Movahedi A. Comparison of the effect of mint extract and chamomile drops on the gastric residual volume of traumatic patients under mechanical ventilation and nasogastric tube feeding in the intensive care unit: A triple-blind randomized crossover trial. *Avicenna J Phytomed*. 2023;**13**(5):488-499. [PubMed ID: 38089419]. [PubMed Central ID: PMC10711581]. https://doi.org/10.22038/AJP.2023.21889.
16. Ilgin VE, Yayla A. The effect of abdominal massage on distension and pain in intubated patients receiving enteral nutrition in neurosurgical intensive care units in the postoperative period. *Int J Caring Sci*. 2023;**16**(3):1694-1705.