Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg
http://www.arabimpactfactor.com
http://olddrji.lbp.world/indexedJournals.aspx
DOI: 10.21608/ASNJ.2022.118651.1311

Effect of Early versus Late Enteral feeding on the outcome of Mechanically Ventilated Patients in intensive care units

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Abstract
Introduction: Enteral nutrition delivery is the preferred optimal method of nutritional supplement in patients in the intensive care unit. **Aim:** This study aimed to compare the effect of early versus late enteral feeding on the outcome of mechanically ventilated patients. **Design:** A quasi-experimental design. **Setting:** General, trauma, coronary, anesthesia and obstetric at intensive care units at Assiut university hospital. **Subjects:** Purposive sample of 80 patients were assigned randomly into two groups**: Group1:** 40 patients who received enteral nutrition within 24-48hr of ICU admission, and **Group2:** 40 patients who received enteral nutrition after 48hr of ICU admission. **Tools:** Patient assessment sheet, Nutritional status assessment tool, Nutritional Intervention Sheet, Acute Physiology and Chronic Health Evaluation (APACHE) II score, and patient outcome assessment tool. **Results:** There were statistical significant decrease in duration of mechanical ventilation, (4.8±1.65 versus 5.48±1.15), intensive care unit length of stay (5.23±1.66 versus 6.10±2.13), and gastrointestinal tract intolerance (30% versus 62.5%) in early versus late enteral nutrition groups (P value<0.05). **Conclusions:** Early enteral nutrition group associated with improved outcomes (decrease in duration of mechanical ventilation, intensive care unit length of stay, and gastrointestinal tract intolerance of critically ill mechanically ventilated patients. **Recommendation:** Provide in-service education and training program for critical care nurses regarding applying early enteral nutrition on critically ill patients.

***Keywords**: Critically ill patient, Enteral feeding, Mechanical ventilation & Outcomes.*

Introduction
Nurses in intensive care are in a key position to maintain patients' nutritional status at an optimal level and closer to the nutritional goals. This calls for nurses' attention to be focused on the provision of alternatives to oral intake. One of these alternatives is the provision of enteral (tube) feeding. Enteral feeding includes delivering a complete feed via nasogastric or orogastric tube into the stomach or percutaneous tubes into the jejunum or duodenum. **(Mula, et al, 2014).**

Enteral feeding (EF) has specific benefits such as reducing nosocomial infection, improving wound healing and decreasing mortality. Enteral nutrition (EN) has been shown to decrease length of time on the ventilator, decrease length of stay and ICU and decrease mortality. **(Emmons, 2014).**

Early enteral nutrition (EEN) has been defined by the European Society for Clinical Nutrition and Metabolism (ESPEN) as feeding initiated within the first 24-48 hours of admission to the ICU, and in meta analyses has been shown to reduce mortality in trauma and the development of multiple organ failure by attenuating the systemic inflammatory response. **(Aben. et al, 2015).** Earlier initiation of nutrition therapy and optimization of protein and energy intake, thus decreasing the rate of hospital malnutrition–associated complications in critically ill adult patients undergoing invasive mechanical ventilation (MV). (**Maria. et al, 2014).** Despite the body of evidence supporting EEN, clinicians may remain hesitant to start EN in an optimal timeframe due to fear of complications, such as intolerance, pneumonia, or diarrhea. **(Hamblin. et al, 2010).**

Late enteral nutrition (LEN) has been defined as feeding initiated after 48 hours of admission to the ICU. Delaying enteral feeding is associated with a reduction in small intestinal glucose absorption, consistent with the reduction in mucosal integrity after nutrient deprivation evident in animal models. The duration of both mechanical ventilation and length of stay in the intensive care unit are prolonged. These observations support recommendations for "early" enteral nutrition in critically ill patients. **(Nam.et al, 2012).**

Significance of the study:
Despite international evidence based nutrition guidelines recommending the early initiation of feeding soon after admission to an ICU, there is widespread variation and inconsistency in the practice of early EN around the world. **(Bagci. et al, 2018)**

It is within the scope of our nursing practice to monitor nutritional intake, advocate for early feeding, and limit feeding interruptions. **(Elkhafafi. et al, 2018).** Early enteral nutrition is safe and effective and benefits the critically ill patient by reducing the hyper catabolic response to trauma, by allowing a faster achievement of a positive nitrogen balance, by performing an effective prophylaxis and by providing improved wound healing**. (Junqueira & Daurea., 2012).**

Mortality rate was 24% for patients who had received enteral nutrition after the third day of admission and 18.1% for patients who had received enteral nutrition within the first48hrs. **(Ghorabi & Shariatpanahi, et al, 2014).**

Operational definitions:

Enteral nutrition:

Enteral Nutrition (EN): Nutrition provided through the gastrointestinal tract via a tube, catheter, or stoma that delivers nutrients distal to the oral cavity. **(Teitelbaum. et al, 2015).**

Early enteral nutrition:

Early enteral nutrition has been defined as feeding initiated within the first 24-48 hours of admission to the ICU. **(Aben. et al, 2015).**

Late enteral nutrition:

Late enteral nutrition (LEN) has been defined as feeding initiated after 48 hours of admission to the ICU. **(Nam. et al, 2012).**

Aim of the study:

The aim of this study was to identify the effect of early versus late enteral feeding on the outcomes of mechanically ventilated patients at Assiut university hospital.

Patients and Method

Research design:

Quasi-experimental research design was used to conduct this study.

Variables:

1. Independent variable: early versus late enteral feeding.
2. Dependent variable: outcome of mechanically ventilated patients (length of ICU stays, duration of connection to mechanical ventilation and GIT complications).

Setting:

This study was conducted in (General, trauma, coronary, anesthesia and obstetric intensive care units, at Assiut university hospital.

Sampling:

Purposive sample of 80 patients were included in this study at the previous setting at Assiut university hospital and these were divided randomly into two groups **group1**: (40 patients received early enteral feeding (enteral nutrition within 24-48hr of ICU admission), and **group2**: (40 patients received late enteral feeding (enteral nutrition after 48hr of ICU admission).

Method of randomization:

Sample was divided randomly by using closed envelop

Calculation of sample size:

$$n = \frac{np(1-p)}{n-1(d^2 \div z^2) + p(1-p)}$$

n=sample size

z=level of confidence according to the standard normal distribution (for a level of confidence of 95% z=1.96)

p=estimated proportion of the population that presents the characteristics (when unknown we use p=0.5)

d=tolerated margin of error (for example we want to know the real proportion within 0.5%=0.05**.**

$$n = \frac{154 \times 5(1-.5)}{153(.05^2 \div 1.96^2) + .5(1-5)} = 68$$

Increase the number of patients above 12 patients for the sample size to avoid any drop in patients.

Research hypothesis:

Early enteral feeding would have better outcome for mechanically ventilated patients than late enteral feeding.

Inclusion criteria

Adult male and female recent mechanically ventilated patients (within 24-48hr).

Exclusion criteria

- Patients who began with enteral feeding then transferred to total parenteral nutrition.
- Patients who received total parenteral nutrition before treatment with mechanical ventilation.
- Patients who candidates for oral intake before mechanical ventilation.
- Patients with gastrointestinal tract disorders such as (bleeding, Peritonitis, Ischemic colitis, and Acute pancreatitis).

Tools:- Five tools were used in this study after reviewing the related literatures.

Tool one: patient's assessment tool

This tool was developed by the researcher after review of literatures **(Khalid. et al, 2010 & Hejazi. et al, 2016)**, to assess the patient conditions to form base line data. This tool included two parts:

Part I: Included socio-demographic patient's profile and clinical data such as: **(**Patient's name, sex, age, weight, height, body mass index, medical diagnosis, length of intensive care unit stay and past medical history).

Part II: Assessment of the patient's conscious level by four score:

The FOUR Score is a 17-point scale (with potential scores ranging from 0 – 16) (from 0-8=unconscious and from 9-16=conscious). The FOUR Score assesses four domains of neurological function: eye responses, motor responses, brainstem reflexes, and breathing pattern**. (Khanal, et al, 2016).**

Tool two: Nutritional status assessment:

This tool was developed by the researcher after review of literatures **(Fontes, et al, 2013, Marcellus & Simadebrata, 2018)**, to assess the nutritional status of patient to form base line data. This tool included three parts:

Part I: - Dietary history information was taken from patient's relevants and patient sheet such as: (usual weight, allergies, Intolerance, Inadequate absorption of nutrients, GIT surgery, GIT medical disease, chronic diseases, and any changes in diet habits of patient.

Part II: Anthropometric measurements were done at (1st and 7^{th} day) of starting of enteral feeding which included:

(Mid-arm circumference, Arm muscle area and Triceps skin fold).

Part III: Biochemical markers measurements were done at (1st and7^{th} day) of starting of enteral feeding which included:

(Total lymphocyte count, S.total protein, Albumin, Phosphate, nitrogen balance, blood sugar and blood urea nitrogen).

Tool three: Nutritional Intervention Sheet:

This tool was developed by the researcher after review of literatures **(Daneshzada. et al, 2015 & Hejazi. et al, 2016)**, to deliver nutritional need of the patient.

This tool included two parts:

Part I: The researcher calculated 24 hrs energy requirements as following:

- **Total energy expenditure** (requirements) = basal metabolic rate (BMR) × (stress factor +activity factor + food thermic effect).
- **-BMR was calculated by Harris -Benedict equation**:
- Male (Kcal-D) =66.5+ (13.75×weight kg) + (5×height cm) -(6.775×age y).
- Female (Kcal-D) = 655.1+ (9.563× weight kg) + (1.85×height cm) -(4.67 ×age y).
- A stress factor and activity factor were estimated based on the patient’s condition and varied up to, according to the published standardized factors.

Part II: GIT function parameters which included:

A- Gastric Residual Volume (GRV).

B-Occurrence of GIT intolerance.

-Medication administered to patients.

Tool four: Acute Physiology and Chronic Health Evaluation (APACHE)II score:

The APACHE-II scoring system was adopted to assess the severity of disease for adult patients admitted to intensive care units. **(Khan. et al, 2011).** The APACHE-II score consists of three components. **The first component** (largest component) of the APACHE-II score is derived from 12 clinical measurements that are obtained within 24 hours after admission to the ICU. The variables are internal temperature, heart rate, mean arterial pressure, respiratory rate, oxygenation, arterial pH, serum sodium, serum potassium, serum creatinine , hematocrit, white blood cells count and Glasgow coma scale. **Second component** is age adjustment: From one to six points are added for patients older than 44 years of age. **Third component** of APACHE-II is chronic health evaluation. An additional adjustment is made for patients with severe and chronic organ failure involving the heart, lungs, kidneys, liver and immune system.

Tool five : patient outcome assessment tool:

This tool was developed by the researcher after review of literatures **(Reintam, et al, 2017)** to assess length of ICU stays, duration of mechanical ventilation, and GIT complications such as: (vomiting, constipation, and diarrhea).

Method:

Data collected through four phases:

Preparatory phase:

- Permission to conduct the study was obtained from the hospital responsible authorities in the general, trauma, coronary, obstetric and anesthesia intensive care unit after explanation of the aim of the study.
- The tools (I) used in this study were developed by the researcher based on reviewing the relevant literature.
- **Content validity:** the tools were tested for content related validity by 5 specialists in the field of critical care nursing and critical care medicine from Assiut University and ascertain that the tools were relevant, understood, and applicable.
- **The Reliability:** was done on the developed tools (I, and II) by Cronbach`s Alpha and reliability level was 0.87 to assess the consistency and stability of the tools.
- **Pilot study:** a pilot study carried out in order to assess the feasibility and applicability of the tools and the necessary modifications were done. The pilot study was done on 8 patients who were excluded from the study.

Ethical consideration:

- Research proposal was approved from Ethical committee in the Faculty of nursing.

- There is no risk for study subject during application of the research.
- The study followed the common ethical principles in clinical research.
- Written consent was obtained from patient's relevants that were willing to participate in the study after explaining the nature and the purpose of the study.
- Confidentiality and anonymity were assured.
- Study subject had the right to refuse to participate and or withdraw from the study without any rational any time.
- Study subject privacy was considered during collection of data.

Assessment phase:-

- During this phase the researcher assessed patient from the first day of admission and record patient demographic and clinical data before any data collection by taking this information from his/her sheet using tool I (part 1).

Implementation phase

- **For (both groups):**

- The researcher assessed nutritional status for the patient by using tool two:
- The researcher took dietary history information from patient's relevants and patient sheet by using tool II-part I.
- The researcher measured anthropometric measurements at (1^{st} and 7^{th} day) of starting of enteral feeding which included:(Mid-arm circumference, Arm muscle area and Triceps skin fold) by using tool 2 part 2.

The researcher calculated arm muscle area by using Hymsfield and coworkers equations:

For males: $\{[MAC-(3.14\times TSF)]^2 /4\times 3.14]-10$.

For females: $\{[MAC-(3.14\times TSF)]^2 /4\times 3.14]-6.5$.

- The researcher recorded biochemical markers measurements at (1st and7^{th} day) of starting of enteral feeding which included:
  (Total lymphocyte count, S.total protein, Albumin, Phosphate, nitrogen balance, blood sugar and blood urea nitrogen) by using tool 2 part 3.
- The researcher took dietary history of patients from relevants

The researcher calculated the following by using tool 3 part 1:

Total body requirements which included:

1. Total energy expenditure (requirements).
2. Basal metabolic rate (BMR).

Assessed time of enteral feeding (early EN feeding within 24-48hrs or late EN feeding after48hrs) by using tool 3 part2:

For early enteral feeding group:

EF was started within 24-48hrs of admission, and Feeding formula was 1mg/kg/day within 24-48hrs of admission.

For late enteral feeding group:

EF was started after 48hrs of admission, and within 24-48hrs of admission the patients were given IV solutions (ringer or saline).

- Monitored fluid intake and output.
- Assessed medication administered to patients.
- The researcher assessed Gastric Residual Volume (GRV).

The researcher measured GRV for patients:

- Hand washing.
- Appropriate placement of feeding tube verified by using stethoscope.
- Enteral Feeding was started within24-48hrs of admission (early enteral nutrition) and after48hrs (late enteral nutrition) started polymeric formula was used and calculated by the critical care team. patients were bolus fed (every 2hrs,10 times per day, infusion is via an open delivery system (the open delivery system utilizes either a large syringe for tube feeding delivery, the feeding tube was flushed with 30ml water after bolus feeding.
- Patient positioned in bed semi fowlers (head of the bed 45-60 degrees) as tolerated.
- Tube was flushed with 30ml water after complete residual volume was obtained.

Evaluation phase:

This phase evaluated patient’s outcome such as: occurrence of GIT intolerance, length of ICU stay, duration of mechanical ventilation by using tool five.

Statistical analysis:

- Data were computerized and analyzed by computer program SPSS (ver.16). Data were presented by using descriptive statistics in the form of frequencies and percentages or means ± standard deviations for qualitative data. Quantitative data were compared using Independent samples t- test for comparisons among two groups. Qualitative variables were compared using chi-square test to determine significance.
- The critical value of the tests “P” was considered statistically significant when P less than 0.05.

Results:

Table (1): Distribution of Patients according to Socio demographic, medical data, and APACHE II score related to both groups:

	Early enteral nutrition (n=40)		Late enteral nutrition (n=40)		P. value
	No	%	No	%	
Age group					
Mean± SD	51.42±16.16		48.02±15.87		0.345
Sex					
Male	28	70.0	32	80.0	0.302
Female	12	30.0	8	20.0	
Diagnosis ≠					
Renal disease	1	2.5	3	7.5	0.305
Respiratory system disorder	9	22.5	10	25.0	0.793
Neurovascular system disorder	5	12.5	12	30.0	0.056
Cardiovascular system disorder	7	17.5	4	10.0	0.330
GIT diseases	6	15.0	8	20.0	0.556
Head and chest trauma	9	22.5	15	37.5	0.222
Other diagnosis	8	20.0	11	27.5	0.431
Past medical history:					0.054
Diabetic ketoacidosis	5	12.5	13	32.5	
HTN	6	15.0	10	25.0	
Cardiovascular disease	15	37.5	10	25.0	
Cancer	0	0.0	1	2.5	
None	14	35.0	6	15.0	
APACHE-II Score: Mean± SD	20.4±5.6		21.25±4.93		0.473

- HTN: Hypertension.
- APACHE: Acute Physiology and Chronic Health Evaluation.
- ≠: more than one diagnosis.
- *Chi square test for qualitative data between the two groups.*
- *Independent T-test quantitative data between the two groups.*

Table (2): Distribution of Patients according to Level of Four Score related to both groups:

	Early enteral nutrition (n=40)	Late enteral nutrition (n=40)	P. value
	Mean ± SD	Mean ± SD	
Four Score			
1st day			
Mean ± SD	7.20 ± 3.32	6.43 ± 1.26	0.067
4th day			
Mean ± SD	8.45 ± 3.5	6.38 ± 1.25	0.001**
7th day			
Mean ± SD	9.06 ± 3.42	5.82 ± 2.27	<0.001**

- *Independent T-test quantitative data between the two groups*
- **Significant level at P value < 0.05*
- ***Significant level at P value < 0.01.*

Table (3): Distribution of Patients according to dietary history related to both groups:

	Early enteral nutrition (n=40)		Late enteral nutrition (n=40)		P. value
	No	%	No	%	
Allergies					
Yes	3	7.5	5	12.5	0.709
No	37	92.5	35	87.5	
Weight loss					
Yes	7	17.5	10	25.0	0.584
No	33	82.5	30	75.0	
Weight gain					
Yes	12	30.0	9	22.5	0.611
No	28	70.0	31	77.5	
Loss of appetite					
Yes	2	5.0	3	7.5	1.000
No	38	95.0	37	92.5	
Increase of appetite					
Yes	1	2.5	2	5.0	1.000
No	39	97.5	38	95.0	
Inadequate absorption of nutrients					
Yes	6	15.0	8	20.0	0.768
No	34	85.0	32	80.0	
Previous GIT surgery					
Yes	0	0.0	0	0.0	-
No	40	100.0	40	100.0	

- *Chi square test for qualitative data between the two groups*

Table (4): Distribution of Patients according to Anthropometric measurements related to both groups:

	Early enteral nutrition (n=40)	Late enteral nutrition (n=40)	P .value
	Mean± SD	Mean ±SD	
1st day			
MAC	22.34±3.70	20.8±3.82	0.095
Skin Fold	7.41±2.25	7.49±2.32	0.872
AMA	435.26±175.26	363.7±153.57	0.056
7th day			
MAC	27.81±4.94	21.8±5.26	0.007**
Skin Fold	8.96±3.07	7.3±1.46	0.125
AMA	665.45±235.9	434.04±254.43	0.027*
1st day			
Height	165.25 ± 6.4	162.88 ± 4.37	0.056
Weight	57.88 ± 8.08	55.33 ± 5.67	0.106
BMI	21.16 ± 2.65	20.82 ± 1.60	0.495

- MAC (Mid Arm Circumference).
- AMA (Arm Muscle Area).
- BMI: Body Mass Index.
- *Independent T-test quantitative data between the two groups*
- **Significant level at P value < 0.05, **Significant level at P value < 0.01*

Table (5): Distribution of Patients according to Biochemical markers measurements related to both groups:

	Early enteral nutrition (n=40)	Late enteral nutrition (n=40)	P. value
	Mean ±SD	Mean ±SD	
Total lymphocytecount103 /mm3			
1st day	1.59 ± 0.97	1.24 ± 0.79	0.080
7th day	1.69 ± 0.98	1.44 ± 0.92	0.243
Serum total protein(g/dl)			
1st day	5.97 ± 0.89	5.5 ± 1.0	0.129
7th day	5.92 ± 1.01	5.29 ± 0.96	0.005**
Albumin(g/dl)			
1st day	3.1 ± 0.83	2.9 ± 0.82	0.281
7th day	2.78 ± 0.90	2.25 ± 0.88	0.009**
Phosphate U/L			
1st day	87.45 ± 19.77	96.13 ± 23.67	0.079
7th day	76.06 ± 8.64	90.1±18.21	0.014*
Blood sugar mg/dl			
1st day	106.25 ± 36.07	107.8 ± 31.74	0.839
7th day	94.63 ± 13.4	116 ± 45.26	0.087
Nitrogen balance(g/day)			
1st day	-16.92 ± 8.77	-19.59 ± 6.21	0.130
7th day	-15.60 ±7.86	-18.91 ± 5.34	0.035*
BUN(mg/dl)			
1st day	27.6 ± 17.8	26.6 ± 13.6	0.778
7th day	32.80 ± 22.8	28.7 ± 14.7	0.342
Serum creatinine(mg/dl)			
1st day	3.25±0.87	3.03±0.7	0.206
7th day	1.37±0.74	2.6±0.7	<0.001**

- BUN (Blood Urea Nitrogen).
- Independent T-test quantitative data between the two groups
- *Significant level at P value < 0.05
- **Significant level at P value < 0.01.

Table (6): Distribution of Patients according to Total Energy Expenditure, Calories Supplement, and BMR related to both groups:

	Early enteral nutrition (n=40)	Late enteral nutrition (n=40)	P. value
	Mean ±SD	Mean ±SD	
TEE (k.cal)	3.1±0.49	2.96±0.39	0.169
Calories Supplement(k.cal)	2.72±0.44	2.87±0.10	0.038*
BMR(k.cal)	1.35±0.19	1.31±0.16	0.367

- TEE:(Total Energy Expenditure).
- BMR: (Basal Metabolic Rate).
- *Independent T-test quantitative data between the two groups.*
- **Significant level at P value < 0.05, **Significant level at P value < 0.01*

Table (7): Distribution of Patients according to Medications related to both groups:

Medications ≠	Early enteral nutrition (n=40)		Late enteral nutrition (n=40)		P. value
	No	%	No	%	
Anabolic hormones. Insulin	2	5.0	10	25.0	0.028*
Antihypertensive: (Concor)	6	15.00	11	27.50	0.274
Anti-Pyretic: (Perflgan)	15	37.50	32	80.00	0.001**
Drugs Causing diarrhea (antibiotic):	33	82.50	38	95.00	0.157
(antiacid) :	30	75.00	37	92.50	0.069
Drugs promote GIT motility(Prokinetic)	17	42.50	38	95.00	<0.001**
Drugs inhibit GIT motility (Sedatives)	11	27.50	8	20.00	0.431
(Antiepileptics) (Epanutin)	5	12.50	6	15.00	0.947

- *Chi square test for qualitative data between the two groups*
- ***Significant level at P value < 0.01.*
- *≠: more than one type was used.*

Table (8): Distribution of Patients according to GIT Complications parameters related to both groups:

	Early enteral nutrition (n=40)		Late enteral nutrition (n=40)		P. value
	No	%	No	%	
Constipation					
Yes	5	12.5	16	40.0	0.011*
No	35	87.5	24	60.0	
Diarrhea					
Yes	4	10.0	10	25.0	
No	36	90.0	30	75.0	0.141
Vomiting					
Yes	12	30.0	25	62.5	0.003**
No	28	70.0	15	37.5	
GRV					
1st day	386.67±35.19		331.82±90.20		0.041*
7th day	207.5±84.85		143.25±98.3		0.003**

- GRV (Gastric Residual Volume).
- *Chi square test for qualitative data between the two groups*
- ***Significant level at P value < 0.01.*

Table (9): Distribution of Patients according to Out Come Criteria related to both groups:

	Early enteral nutrition (n=40)		Late enteral nutrition (n=40)		P. value
Duration of MV (Mean ±SD)	4.8±1.65		5.48±1.15		0.037*
ICU Stay (Mean ±SD)	5.23±1.66		6.10±2.13		0.044*
GIT intolerance:	No	%	No	%	
No %	12	30	25	62.6	0.003**

- MV: Mechanical ventilation.
- ICU stay: Intensive care unit stay.
- GIT intolerance: Gastrointestinal tract intolerance.
- *Independent T-test quantitative data between the two groups.*
- *Chi square test for qualitative data between the two groups*
- **Significant level at P value < 0.05, **Significant level at P value < 0.01.*

Table (1): This table shows: The high percentages of patients are male in early and late enteral nutrition groups (70% and 80%) respectively. As regard to **diagnosis:** more than one third of patients were complained from head and chest trauma (37.5%). Regarding to **Past medical history:** Cardiovascular disease is the most common past medical history (37.5%) with no statistical significant difference between early and late enteral nutrition groups (P value > 0.05). Regarding to **APACHE-II Score:** The mean and standard deviation of APACHE-II Score in early and late enteral nutrition groups is (20.4±5.6 and 21.25±4.93) respectively with no statistically significant difference (P value > 0.05).

Table (2): This table shows. In the **1st day** the mean and standard deviation of four score in early and late enteral feeding groups is (7.20 ± 3.32 and 6.43 ± 1.26) respectively with no statistically significant difference (P value>0.05). **In the 4th day** the mean and standard deviation of four score in early and late enteral feeding groups is (8.45 ± 3.5 and 6.38 ± 1.25) respectively with statistically significant difference (P value =0.001**). **In the 7th day** the mean and standard deviation of four score in early and late enteral feeding groups is (9.06 ± 3.42 and 5.82 ± 2.27) respectively with statistically significant difference (P value < 0.001**).

Table (3): This table shows that weight gain is the most common dietary history (30%) with no statistical significant difference between early and late enteral nutrition groups (P value > 0.05).

Table (4): This table shows the mean and standard deviation of mid-arm circumference is (22.34 ± 3.7 and 20.8 ± 3.82), in early and late enteral nutrition groups in the first day versus (27.81 ± 4.94 and 21.8 ± 5.26), in the seventh day respectively with statistical significant difference (P value < 0.05). Regarding to skin fold, the mean and standard deviation of skin fold is (7.41±2.25 and 7.49±2.32), in early and late enteral nutrition groups in the first day versus (8.96±3.07 and 7.3±1.46), in the seventh day respectively without statistical significant difference (P value > 0.05). Regarding to arm muscle area**,** the mean and standard deviation of arm muscle area is (435.26±175.26 and 363.7±153.57), in early and late enteral nutrition groups in the first day versus (665.45 ± 235.9and 434.04 ± 254.43), in the seventh day respectively with statistical significant difference (P value < 0.05). Regarding to height the mean and standard deviation of height in early and late enteral nutrition groups is (165.25 ± 6.4 and 162.88 ± 4.37) respectively with no statistically significant difference (P value > 0.05).

Regarding to weight the mean and standard deviation of weight in early and late enteral nutrition groups is (57.88 ± 8.08and 55.33 ± 5.67) respectively with no statistically significant difference (P value >0.05). Regarding to BMI the mean and standard deviation of BMI in early and late enteral nutrition groups is (21.16 ± 2.65 and 20.82 ± 1.60) respectively with no statistically significant difference (P value > 0.05).

Table (5): This table shows that the mean and standard deviation of serum total protein is (5.97 ±0.89and5.5±1.0), in early and late enteral nutrition groups in the first day versus (5.92±1.01and5.29±0.96), in the seventh day respectively with statistically significant difference (P value < 0.05). Regarding to **albumin:** the serum albumin decrease from first to seventh day in both group (3.1±0.83 versus 2.78 ± 0.90) in early enteral nutrition groups in the first day versus (2.9±0.82 versus 2.25 ± 0.88) in late enteral nutrition groups in the seventh day respectively with statistical significant difference (P value < 0.05). Regarding to **phosphate:** the mean and standard deviation of phosphate is (87.45±19.77 and 96.13±23.67), in early and late enteral nutrition groups in the first day versus (76.06±8.64 and 90.1±18.21), in the seventh day respectively with statistical significant difference (P value <0.05). Regarding to **nitrogen balance:** the mean and standard deviation of nitrogen balance is (-16.92±8.77 and -19.59±6.21) in early and late enteral nutrition groups in the first day versus (-15.60 ±7.86 and-18.91±5.34), in the seventh day respectively with statistical significant difference (P value <0.05). Regarding to **Serum creatinine**: the mean and standard deviation of Serum creatinine is (3.25±0.87 and 3.03±0.7), in early and late enteral nutrition groups in the first day versus (1.37±0.74and2.6±0.7), in the seventh day respectively with statistical significant difference (P value < 0.05).

Table (6): This table shows that the mean and standard deviation of total energy expenditure in early and late enteral nutrition groups is (3.1±0.49 and 2.96±0.39), respectively without statistical significant difference (P value > 0.05). Regarding to **calories supplement:** the mean and standard deviation of calories supplement in early and late enteral nutrition groups is (2.72 ± 0.44 and 2.87 ± 0.10), respectively with statistical significant difference (P value < 0.05). Regarding to **BMR**: the mean and standard deviation of **BMR** in early and late enteral nutrition groups is (1.35 ±0.19 and1.31±0.16), respectively without statistical significant difference (P value > 0.05). **Table (7):** This table shows that there is statistical significant decrease in anabolic hormone (insulin) in early versus late, (5% versus 25%) respectively (P value<0.01). Regarding to **anti-pyretic**: There is statistical significant decrease in anti-pyretic in early versus late, (37% versus 80%) respectively (P value<0.01). Regarding to **Drugs promote GIT motility (Prokinetic):** There is statistical significant decrease in Prokinetic in early versus late, (42.5% versus 95%) respectively (P value<0.01). Regarding to **Drugs inhibit GIT motility (Sedatives):** There is no statistical significant difference in Sedatives in early versus late, (27.5% versus 20%) respectively (P value>0.01). Regarding to **(antiepileptics):** There is no statistical significant difference in antiepileptics in early versus late, (12.5% versus 15%) respectively (P value>0.01).

Table (8): This table shows that there is statistical significant decrease in constipation in early versus late, (12.5% versus 40%) respectively (P value<0.01). Regarding to **Diarrhea**: There is no statistical significant decrease in diarrhea in early versus late, (10% versus 25%) respectively (P value>0.01). Regarding to **vomiting**: There is statistical significant decrease in vomiting in early versus late, (30% versus 62.5%) respectively (P value<0.01). Regarding to **GRV**: the mean and standard deviation of GRV is (386.67±35.19 and 331.82±90.20), in early and late enteral nutrition groups in the first day versus (207.5±84.85 and 143.25±98.3), in the seventh day respectively with statistical significant difference (P value < 0.01).

Table (9): This table shows that the mean and standard deviation of duration of MV in early and late enteral nutrition groups is (4.8±1.65 and 5.48±1.15) respectively with statistically significant difference (P value < 0.05). Regarding to **ICU stay**: The mean and standard deviation of ICU stay in early and late enteral nutrition groups is (5.23±1.66 and 6.10±2.13) respectively with statistically significant difference (P value < 0.05). Regarding to **GIT intolerance:** The majority of patients in the late enteral nutrition group (62.5%) have GIT intolerance versus (30%) in the early enteral nutrition group with statistical significant difference (P value < 0.05).

Discussion

Despite international evidence based nutrition guidelines recommending the early initiation of feeding soon after admission to an ICU, there is widespread variation and inconsistency in the practice of early EN around the world. **(Bagci. et al, 2018).** It is within the scope of nursing practice to monitor nutritional intake, advocate for early feeding, and limit feeding interruptions **(Elkhafafi. et al, 2018).**

Regarding to **age**, the finding of the current study revealed that the patients age in early and late enteral nutrition groups was more than 40 years without statistical significant difference (p value&>0.05), these findings were supported by **(Hamblin, et al, 2010)** who studied (Early vs Delayed Enteral Nutrition in Critically Ill Medical Patients), and showed no statistical significant difference in age between the two groups P value > 0.05).

Regarding to **sex**, the finding of the current study revealed that the high percentage of patients was male in early and late enteral nutrition groups without statistical significant difference (p value&>0.05). These findings were supported by **(Khalid, et al, 2010)** who studied (Early Enteral Nutrition and Outcomes of Critically Ill Patients treated with Vasopressors and mechanical ventilation), and showed no statistical significant difference in sex between the early and late enteral nutrition groups.

Regarding to **diagnosis** of study sample, the finding of the current study revealed that the most common diagnosis in this study were traumatic head injury, and there was no statistical significant difference between early and late enteral nutrition groups in diagnosis. **This result could be due to** the majority of patients in early and late enteral nutrition in this study were males and they were more prone to hard work and road accidents. These findings agreed with **(Wong, et al, 2011, Hiroyuki, et al, 2019)** study which also showed no statistical significant difference between early and late enteral nutrition groups regarding diagnosis of study sample.

Regarding to **Four Score Scale (FSS)**, the finding of the current study revealed that there was statistical significant difference between the two groups in all days (P value < 0001**), **these result could be due to** early enteral nutrition suppresses the stress s enteral nutrition tate and decrease severity of the disease and improved the conscious level of the patients. These findings supported by **(Mauro. et al, 2016)** who found that the early enteral nutrition group had higher consciousness compared to the late enteral nutrition group. **Furthermore (Othman, & El-Hady, 2015)** found that; the average mean of LOC revealed by FOUR scale for control and early enteral nutrition group at the beginning of study were 7.51 ± 2.06 *vs.* 7.38 ± 1.71 respectively with no significance difference between the two groups.

Assessment of nutritional status based on body composition involves detecting the loss or gain of body components relative to previous measurements. A mean hospital stay of < 5 days is short to show effectiveness of nutritional intervention nutritional outcome measures. It was recognized that repeated measurements too early is unrealistic because the feeding period was too brief to cause significant alterations. There for all anthropometric measurements and biochemical measurements in the present study were taken at the beginning of study and at the end of study period after 7 days. **(Ezz & Mohamed, et al, 2010)**

Regarding to **anthropometric measurements**, the finding of the current study revealed that there was no statistical significant difference between early and late enteral nutrition groups **in the 1^{st} day** in mid-arm circumference(MAC), arm muscle area (AMA), and triceps skin fold (TSF), (P value>0.05). **This may be due to** the hypermetabolic and hypercatabolic state associated with critical illness, and most of patients not received any intervention. These findings were supported by **(Ezz & Mohamed, et al, 2010)** who studied (The effect of early enteral nutrition on the clinical outcome of the mechanically ventilated patients), and showed that the mean baseline anthropometric measurements of both groups were within normal ranges, with no statistical significant differences between early and late enteral nutrition groups. **In the 7th day:** The finding of the current study revealed that there was statistical significant difference between early and late enteral nutrition groups in mid-arm circumference, and AMA (P value<0.05). **This may be due to** the early initiation of enteral nutrition was able to ameliorate the skeletal muscle mass and the total free mass loss as evidenced by changes in mid-arm circumference (MAC), and mid-arm muscle area (MAMA). These findings were supported by **(Alsiagy & Mohamed, et al, 2017)** who studied (The effect of early enteral nutrition on the clinical outcome of the mechanically ventilated patients), and showed that there was a significant decrease (P<0.05) in mid-arm circumference (MAC), and mid-arm muscle area (MAMA) in the 7th day of ICU admission as compared to 1st day anthropometric measurements. **Furthermore,** this result was in line with **(Hejazi, et al, 2016)** who studied (Nutritional assessment in critically ill patients), and showed that the patients' weight, mid-upper-arm circumference, mid-arm muscle circumference, triceps skinfold thickness, and calf circumference decreased significantly in late enteral nutrition group (P<0.001). **Furthermore,** this result was in line with **(Hejazi, et al, 2016)** who studied (Nutritional assessment in critically ill patients), and showed that the patients' weight, mid-upper-arm circumference, mid-arm muscle circumference, triceps skinfold thickness, and calf circumference decreased significantly in late enteral nutrition group (P<0.001).

Regarding to **Biochemical markers**, the finding of the current study revealed that there was no statistical significant difference between early and late enteral nutrition groups in biochemical markers in the 1st day in total lymphocyte count, serum total protein, serum albumin, and blood urea nitrogen (P value >0.05), These findings were supported by **(Ezz & Mohamed, et al, 2010)** who studied (The effect of early enteral nutrition on the clinical outcome of the mechanically ventilated patients), and showed that there was no statistical significant differences between the early and late enteral nutrition groups in biochemical markers. **In the 7th day:** The finding of the current study revealed that the serum albumin decrease from first to seventh day in both groups. **This may be due to:** the measurement of serum albumin levels in critically ill patients may not accurately reflect nutritional status. In critical illness, capillary permeability is increased, causing a loss of proteins from the intravascular compartment, in addition to, the massive fluid hemodilution mechanism. Moreover, hepatic prioritization occurs with the simultaneously reduced synthesis of binding proteins. Albumin lack of specificity and long half –life limits its usefulness in following rapid nutritional changes. Albumin has large extravascular volume distribution and high exchange rate between the intravascular and extravascular fluid compartments, which is more than ten times the rate of either synthesis or degradation. Serum albumin levels often decline rapidly after hospital admission and the rate of fall is too rapid to allow for a nutritional explanation. Altering posture from the upright to the recumbent position produces a decline in serum albumin. Cytokines such as tumor necrosis factor-a, interleukin-2 and -6 inhibit albumin production by inhibiting albumin gene expression and cause a vascular endothelial leak, resulting in an increase plasma clearance rate of albumin. All these make it reflective to inflammatory and hydration rather than nutrition status.

Regarding to **Calories Supplement:** the finding of the current study revealed that there was statistically significant difference in calories supplement in early versus late enteral nutrition groups in calories supplement (P value < 0.05). **This may be due to:** the early initiation of the enteral nutrition improved the overall protein and energy intake. This finding supported by **(Guo, 2015)**, who studied (Gastric residual volume management in critically ill mechanically ventilated patients study in a Singapore General Hospitals), which revealed that a higher GRV threshold allows for a higher delivery of enteral nutrition calories.

Regarding to **medications**, the finding of the current study revealed that there was statistical significant decrease in drugs promote GIT motility (prokinetics) in early versus late enteral nutrition group. **This may be due to:** decrease of GIT complication in early versus late enteral nutrition group. These findings were supported by **(Ezz & Mohamed, et al, 2010)** who studied (The effect of early enteral nutrition on the clinical outcome of the mechanically ventilated patients), and showed that there were statistical significant differences between the early and late enteral nutrition groups in drugs promote GIT motility (Prokinetics).

Regarding to **GIT complications parameters**, the finding of the current study revealed that there was statistical significant increase in Constipation, vomiting, in late enteral nutrition groups, compared to early enteral nutrition groups. Regarding to diarrhea: There was no statistical significant difference in diarrhea in early versus late enteral nutrition groups (P value>0.01). **This may be due to** that early enteral nutrition faster improvement of GIT function and reduce GIT complications. The current results are matching with **(Marzouk, et al, 2021)** who studied (The Effect of Early Versus Delayed Enteral Nutrition in Critically Ill Mechanically Ventilated Medical Patients), and showed that there was no statistical significant difference between early and late enteral nutrition groups in diarrhea. Regarding to GRV: There was significant increase in GRV in early versus late enteral nutrition groups (P value<0.01). The current results are matching with **(Emad, et al, 2015)** who studied (Early Versus Late Enteral Feeding of Mechanically Ventilated Patients: Results of a Clinical Trial**),** and showed that there were statistical significant differences between the early and late enteral nutrition groups.

Regarding to **Out Come Criteria**: Regarding to **length of ICU stay, and Duration of MV**, the finding of the current study revealed that there was statistical significant decrease in the ICU stay, and mechanical ventilation duration in early enteral nutrition group compared to late enteral nutrition group. **This may be due to** EEN enables faster recovery by improving wound healing, maintaining the function of GIT, reducing complications, and length of ICU stays.

Regarding to **Length of ICU stay**: The current results are matching with **(Hamblin, et al, 2010)** who studied (Early vs Delayed Enteral Nutrition in Critically Ill Medical Patients), and showed that**,** the median length of stay in the medical ICU (primary outcome) was significantly shorter in patients who received EEN compared with patients who received delayed EN (4.7 vs 8.5 days, P = .02). These findings may be due to patient's level of conscious affects the duration of MV, as high level of conscious was accompanied with a decreased duration of MV for intervention group than patients of the control group.

Regarding to **Duration of MV:** the finding of the current study revealed that there was a statistical significant decrease in mechanical ventilation duration in early enteral nutrition group compared to late enteral nutrition group. **This may be due to** EEN enables faster recovery by maintaining the function of GIT, improving respiratory function, and reducing complications. These findings may be also due to patient's level of conscious affects the duration of MV, as high level of conscious was accompanied with a decreased duration of MV. These findings supported by **(Gorji, et al, 2014)** who found that the mean duration of mechanical ventilation was significantly shorter in the intervention group than in the control group. And these findings are contrasted by **(Ghorabi & Shariatpanahi, 2014)** who studied (Effect of Early Enteral Nutrition on Clinical Outcomes in an Intensive Care Unit**)**, and showed that there was no significant difference between the two groups of early and late nutrition in the duration of mechanical ventilation.

Conclusions:

Implementing early enteral nutrition had positive effect on critically ill patient outcomes as decreasing duration of mechanical ventilation, decreasing length of hospital stay, and decreasing GIT intolerance**.**

Recommendation:

- Empower registered dietitians or nutrition support teams to initiate and manage enteral nutrition order.
- Provide educational program to nurses about early and late enteral feeding through strong multidisciplinary collaboration.

References:

- **Aben. C, Mabesa. T, & Hard castle. T., (2015):** Complications relating to enteral and parenteral nutrition in trauma patients: a retrospective study at a level one trauma center in south Africa. S Afr J Clin Nutr, Vol 28, No. (2), Pp62-68.
- **Alsiagy. kh, & Mohamed. T., (2017):** Effect of early enteral nutrition on the outcome of mechanically ventilated patients. Alexandria University- faculty of nursing, Vol. (85), No. (3), Pp105.
- **Bagci. S, Keles. E, Girgin. F, Dinçer. R, Ozden. O, Tanyıldız. M, Bayrakçi. B & Kalkan. G., (2018):** Early initiated feeding versus early reached target enteral nutrition in critically ill children: An observational study in pediatric intensive care units in Turkey. Journal of Pediatrics and Child Health Vol. (54), No (3), Pp 480–486.
- **Daneshzada. E, Azadbakhatb. L, Neamanic. F, Abasid. S, Shirania. F, & Peyman Adibie., (2015):** Nutritional assessment in critically ill patients. JNSD; Vol.1, No. (3), Pp157-164.
- **Emad. H, Mehringer. L, Prentice. D, Sherman. G, Schaiff. R, Victoria. F & Marin. H., (2015):** Changing clinical guidelines from delayed to early aperient administration for enterally fed intensive care patients was associated with increased diarrhoea: A before-and-after, intention-to-treat evaluation. Australian Critical Care,Vol.(28),No.(4),Pp208-213.
- **Emmons. M., (2014):** Exploring the Enteral Feeding Practices Used by Critical Care Nurses: A Dissertation. University of Massachusetts Medical School. Graduate School of Nursing Dissertations. Vol. (58), No. (8), Pp914-922.

- **Elkhafafi. H, Khalifa. F, & Kumar. R., (2018):** Factors Affecting Nutritional Adequacy Delivered by Enteral Tube Feeding among ICU Patients. IOSR Journal of Nursing a nd Health Science (IOSR-JNHS), Vol (7), No. (6), Pp 65-72.
- **Ezz. M & Mohamed. N., (2010):** Effect of early enteral nutrition on the outcome of mechanically ventilated patients. Alexandria University- faculty of nursing, Vol. (88), No. (2), Pp109.
- **Fontes. D, Vasconcelos. S, Isabel. M, & Correia. D. (2013):** Subjective global assessment: A reliable nutritional assessment tool to predict outcomes in critically ill patients.
- **Ghorabi. S & Shariatpanahi. Z., (2014):** Effect of Early Enteral Nutrition on Clinical Outcomes in an Intensive Care Unit.Nutr Clin Pract, Vol. (3), No (3), Pp 209.
- **Gorji. MA, Araghiyansc F, & Jafari H., (2014):** Effect of early enteral nutrition in intensive care unit of Medical Sciences University of Mazandarn, Iran.Saudi Journal of Anesthesia ,Vol (30), No(1), Pp72–85.
- **-Guo, B., (2015):** Gastric residual volume management in critically ill mechanically ventilated patients, sage journals, Vol. (24), No. (3), Pp171-180.
- **Hamblin. S, Christopher. K, Joyce. E, Wan. J, Boswell. R, & Hurdle. A., (2010):** Early vs Delayed Enteral Nutrition in Critically Ill Medical Patients. Nutrition in Clinical Practice, Vol (25), No. (2), Pp 270–277.
- **Hejazi, N., Mazloom, Z., Zand, F., Rezaianzadeh, A., & Amini, A., (2016):** Nutritional assessment in critically ill patients. Iran Journal Medical Science, Vol (41), No (2), Pp169-179.
- **Hiroyuki. O, Taisuke. J, Matsui. H, Kiyohide Fushimi, & Yasunaga. H., (2019):** Early Enteral Nutrition in Patients Undergoing Sustained Neuromuscular Blockade: A Propensity- Matched Analysis Using a Nationwide Inpatient Database. The Society of Critical Care Medicine and Wolters Kluwer Health, Vol (47), No. (8), Pp200-212. journal of Critical Care, vol. (20), No. (15), Pp 259.
- **Junqueira. L & Daurea A., (2012):** Enteral nutrition therapy for critically ill adult patients; critical review and algorithm creation**.** Nutr Hosp. Vol (27), No. (4), Pp999-1008.
- **Khanal. K, Bhandari. S, Shrestha. N, Acharya. S & Marhatta. M., (2016):** "Comparison of outcome predictions by the Glasgow coma scale and the Full Outline of UnResponsiveness score in the neurological and neurosurgical patients in the Intensive Care Unit". Indian J Crit Care Med. Vol (20), No. (6), Pp473.
- **Khalid. I, Doshi. P, & DiGiovine. B., (2010):** Early Enteral Nutrition and Outcomes of Critically Ill Patients Treated with Vasopressors and Mechanical Ventilation. Amerian Journal of Critical Care, Vol (19), No. (3), Pp310-322.
- **Khan. F, Naved. S, & Siddiqui. S., (2011):** APACHE-II Score Correlation with Mortality and Length of Stay in an Intensive Care Unit. Journal of the College of Physicians and Surgeons Pakistan, Vol. (21), No. (1), Pp 4-8.
- **Maria. A, Dan. L, & Waitzerg., (2014):** Enteral Nutrition Protocols for Critically Ill Patients: Are They Necessary? journal of Intensive Care Medicine Vol.2, No. 4: 155-163.
- **Marzouk. M, Shams. K, Diaa Eldin. Sh, & Elsedek. A., (2021):** Study of the Effect of Early Versus Delayed Enteral Nutrition in Critically Ill Mechanically Ventilated Medical Patients. Med. J. Cairo Univ., Vol. (89), No. (1), Pp 53-62.
- **Marcellus. S & Simadebrata. M., (2018):** Nutritional Support in Critically Ill Patients. The Indonesian Journal of Gastroenterology, Hepatology and Digestive Endoscopy, Vol (19), No (3), Pp215-220.
- **Mauro. O, Alice. C, Sangeeta. M, David. M & Jean. F, (2016):** Optimizing early enteral nutrition than parenteral nutrition in critically ill patients, journal of critical care, Vol (20), No (5), Pp120-128.
- **Mula. C, Ncama. B. & Maluwa. A. Kama (2014):** Zulu College of Nursing, Nurses Competency Challenges in Enteral feeding in the Intensive Care Units(ICU) and High Dependency Unite(HDU) of a referral hospital Malawi, Malawi Medical Journal,Vol(26),No(3),Pp55-59.
- **-Nam Q. Nguyen, Laura K &Carly Burgstad., (2012):** Delayed enteral feeding impairs intestinal carbohydrate absorption in critically ill patients. Crit Care Med, Vol. (16), No. (6), Pp209- 216. nts, sage journals, Vol. (24), No. (3), Pp171-180.
- **Othman, S., & El-Hady, M., (2015):** Effect of implementing early enteral nutrition on the clinical outcomes of mechanically ventilated patients. Journal of Nursing Education and Practice, Vol. (5), No. (9), Pp 117.
- **Reintam .B., Starkopf, J., Alhazzani, W., Berger, M., Casaer, M., Deane, A., & Oudemans-van Straaten, H. (2017):** Early enteral nutrition in critically ill patients: ESICM clinical practice guidelines. Intensive Care Med, Vol 43, No. (15), Pp380–398.
- **Teitelbaum. D, Guenter. P, Howell. WH, Kochevar. ME, Roth. J & Seidner. DL., (2015):** Definition of terms, style, and conventions used in A.S.P.E.N. guidelines and standards. American Society for Parenteral and Enteral Nutrition Board of Directors and Standards Committee: Nutr Clin Pract.; Vol (20), No. (3), Pp 281-285.

- **Wong. K, Huang. H, Lee. D & Lin. S, (2011):** Impact of disease severity on gastric residual volume in critical patients, World J Gastroenterol,Vol (17), No (15), Pp2007-2012.