Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.4, No.18, 2013

The Effect of two Schedules of Intermittent Enteral Feeding on the Development of Gastric Colonization

Warda Youssef Mohamed[1], Enas abdel Mageed[2], Mogedda Mohamed Mehany [3], Mona Aly Mohammed[3*]
Amal Ismael Abd El-Hafez [4].
1.Professor of Critical Care & Emergency, Cairo University, Egypt.
2.Professor of Microbiology &Immunology, Assiut University, Egypt.
3- Lecturer of Critical Care Nursing, Assiut University, Egypt.
4.Assistant lecture of Critical Care Nursing Assiut University, Egypt
* E-mail of the corresponding author: mona.ali77@yahoo.com

Abstract
Nutritional support is an important aspect of the care of traumatized patients and it can result in improving wound healing, decreasing catabolic response to injury, enhancing immune system function, improving gastrointestinal structure and function, and improving clinical outcomes. However, many complications are associated with enteral feeding including gastric colonization. Routine enteral feeding schedule is not allowing time to acidify stomach with gastric pH. This may predispose the traumatized patients to acquire gastric colonization which may predispose to aspiration pneumonia. **Aim**: this study was carried out to investigate the effect of two schedules of intermittent enteral feeding on the development of gastric colonization **Design**: a quasi-experimental design. **Setting**: trauma ICU at Assiut University Hospitals, Egypt. Patients: A convenience sample of 80 adults' traumatized patients on enteral feeding constituted the study sample. The patients were assigned into two equal groups (group 1 and group 2, 40 patients each). **Methods**: The only manipulation was in the rest period and time interval in which the group 1 patients were rested 8hours at night as compared to 6hours for the group 2 ones, as well group 1 patients were having 4hours time interval between each two consecutive feeding as compared to 2hours for group 2 patients. **Results**: ninety percent of group 2 patients developed gastric colonization as compared to 40% of the group 1 patients with a highly significant statistical difference between both groups in this regard (p= 0.000).**Conclusion**: intermittent 4-hour interval enteral feeding schedule inhibit the development of gastric colonization.
Keywords: intermittent enteral feeding, gastric colonization.

1. Introduction

Although enteral feeding is associated with enhanced utilization of nutrients, decreased infectious complications, ease and safety of delivery, and lower cost, However many complications are associated with enteral feeding. Bacterial colonization of the stomach is the most common complication of enteral feeding in ICU [1, 2].

The stomach is usually not colonized with gram negative bacteria. However, in critically ill patients gastric colonization (GC) frequently occurs and its incidence increases with time. Among mechanically ventilated patients, GC with gram negative bacteria was found in 25% on admission to the ICU, and 40% acquired colonization during the ICU stay. Gastric colonization with gram negative bacteria has been assumed to be an important risk factor for the development of ventilator-associated pneumonia. The nosocomial pneumonia is an important cause of morbidity and mortality which increases hospital stay and costs of caring for critically ill patients. According to the hypothesis of the gastro-pulmonary route of infection, bacteria colonizing the stomach will subsequently colonize the oropharynx and be aspirated into the lower respiratory tract [3].

Enteral feeding, which is the preferred nutritional system in critical patients, can modify gastric pH and increase its colonization. The role of patient's gastric pH has been studied extensively in relation to pathogenesis and epidemiology of GC and nosocomial pneumonia. The stomach is normally sterile and has a pH of 1.5 to 3.5. The colonization with gram-negative bacteria correlates with increase of gastric pH above 4. Gastric colonization was demonstrated in 30% of the patients with median intra-gastric pH < 4 and in 56% when intragastric pH > 4 [4,5].

The gastric microbial growth is pH dependent. Normally the fasting stomach maintains sterility by maintaining an acid pH, and increases in pH may allow the stomach to become colonized. The ICU patients who are receiving enteral feeding, 20% to 40% of them had gastric colonization (GC) when enteral feeding was started, and this proportion increased to 80% after 1 week [6].

Administer of antacids or H2 antagonists for stress ulcer prophylaxis can also increase gastric pH with resultant GC. Gastric colonization was defined as the presence of an identical pathogen in two or more gastric samples. The strategy to lower or maintain an acid gastric pH has been needed. Some authors have attempted to prevent the increase in colonization by acidification of enteral feeding, or by using intermittent feedings schedule that allow breaks in feeding which let the pH of the stomach to decrease and inhibit bacterial overgrowth. The fasting

8 hours at night/24 hours fall the incidence of pneumonia from 54% to 12% [7-9].
Intermittent feedings are administered throughout the day in equal portions of 300 to 400 mL formula over a period of 30 to 60 minutes every 4 to 6 hours, usually by slow gravity drip or infusion pump (10). This type of feedings may be scheduled only during waking hours to give patients time for uninterrupted sleep. The strategy of using intermittent enteral feeding schedule with longer time period between feeding and fasting period at night is recommended [11].
Consequently, nursing care is the key to positive outcome in patients who require enteral nutrition. Critical care nurses are responsible for obtaining initial and weekly weight measurements, vital signs intake, output measurements and laboratory data, and for providing enteral tube care throughout the duration of nutrition support therapy. The nurses are seen as the vital link between the patient and other team members. Critical care nurses must work closely with dietitians and physicians in promoting the best possible nutritional outcomes for the patients [12].

2. Material and methods

2.1. Aim of the Study

This study was conducted to investigate the effect of two schedules of intermittent enteral feeding on the development of gastric colonization

2.2. Research hypothesis:-

Gastric colonization among patients who will receive the intermittent 4-hour interval feeding schedule will be lesser than that among patients who receive the intermittent 2-hour interval feeding schedule.

2.3. Research design

Quasi-experimental design has been utilized in this study.

2.4. Study variables

The independent variable in this study was the intermittent enteral feeding schedule while the dependent variables were patients' gastric colonization and gastric pH level.

2.5. Setting: The study was conducted in the trauma ICU at Assiut University Hospitals, Egypt.

2.6. Patients:

A convenience sample of 80 adults, male and female traumatized patients on enteral feeding constituted the study sample. The patients were assigned into two equal groups considering the following matching criteria; age, sex, diagnosis.

The group 1 patients received the intermittent enteral feeding schedule (feeding formula 5 times/day with 4-hour interval and 8 hours fasting period at night). The group 2 patients received the routine intermittent enteral feeding schedule (feeding formula 10 times/day with 2-hour interval and 6hours fasting period at night)

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

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

2.7. Tools:

Two tools were developed by the researcher based on reviewing the relevant literature [13-20].

2.7.1. Socio-demographic and clinical data tool.

This tool was developed by the researcher and comprises Patient's characteristics. It includes demographic data (patient’s name, age and sex), and patient's diagnosis.

2.7.2. Enteral nutrition assessment tool.

This tool was used to assess the studied patients during the enteral feeding and to assess patients' gastric aspirate for pH and colonization by gastric aspiration culture.

3. **Content validity:** The tools were tested for content related validity by jury of 5 specialists in the field of critical care nursing and critical care medicine from Assiut University, and the necessary modifications were done.

4. Pilot study: A pilot study was conducted on 5 patients to test the feasibility and applicability of the tools. The analysis of the pilot study revealed that minimal modifications are required. These necessary modifications were done and the pilot study patients were excluded from the actual study.

5. Protection of human rights:

An official Permission to conduct the study was obtained from hospital responsible authorities in anesthesiology department, infection control lab, and trauma ICU after explaining the aim and nature of the study. Informed

consent was obtained from each patient or from the responsible person for the unconscious patients. The investigator emphasized that the participation is voluntary and the confidentiality and anonymity of the patients will be assured through coding the data. Patients were assured that can they withdraw from the study at any time without any rational.

6. Procedure:

6.1. Preparatory phase

6.1.1 Pre-enteral feeding assessment for both groups:

The tube placement was confirmed before starting each feeding by the visible marker level, the aspiration of gastric content, and checking sound of instilled air in the stomach. The head of bed was elevated at least 30 degree before each feeding and the cuff of endotracheal or trachestomy tube was inflated to avoid aspiration. The enteral feeding formula was observed for amount, time, color, consistency, odor and temperature.

6.2. Implementation and evaluation phases

6.2.1 Enteral feeding procedure

Group 1 and group 2 were received the routine intermittent enteral feeding in the trauma ICU in relation to the total amount and types of formula per day and same flow rate (14 drop/min).

The only manipulation was in the rest period and time interval in which the group1 patients were rested 8hours at night as compared to 6hours for the group2 ones, as well group1 patients were having 4hours time interval between each two consecutive feeding as compared to 2hours for group2 patients. Feedings were started for group 1 patients from 7am to 11pm. However, feedings for group 2 patients were started from 7am to 1am of next day.

6.2.2 Post-enteral feeding care for the two studied groups: Nasogastric or orogastric tube was irrigated. Feeding bag was rinsed with warm water every shift and changed every 3 day. Patients were given mouth care every 8 hours as a routine care.

6.2.3 Gastric aspirate analysis for pH and cultures: The gastric aspirates were implemented for both groups to assess gastric pH and gastric colonization in the morning shift of the 1st , 3rd , and 7th day before starting of the first feeding at 7am using tool 2. All samples were collected by the researcher. The initial 10 ml of gastric aspirate was discarded and the following 10 ml to 15 ml was taken by another syringe. About 10 ml of gastric aspirate was placed in clean container and sent to hospital lab. for gastric pH test using chemcadet pH/mv meter, code 05986-60,62 (Cole-Parmer instrument company). A 0.5 ml of gastric aspirate was sent to Infection Control Laboratory at Assiut University Hospitals for culture to assess gastric colonization and identification the types of micro-organisms. Data collection phase of the study took approximately one year started from July 2010 till July 2011.

7. Results

7.1 Table 1: Comparison between group 1 and group 2 patients in relation to age and diagnosis.

Items	Group 1 (n= 40)		Group 2 (n= 40)		P-value
	N	%	N	%	
Age: (years)					
16 < 30	13	32.5	13	32.5	0.711
30 - < 40	17	42.5	14	35.0	
≥ 40	10	25.0	13	32.5	
Mean ± SD	31.2 ± 11.4		34.6 ± 10.7		0.175•
Diagnosis:					
Head injury	21	52.5	24	60.0	0.778
Chest injury	10	25.0	9	22.5	
Multiple trauma	9	22.5	7	17.5	
Gender:					
Male	32	80.0	32	80.0	1.000
Female	8	20.0	8	20.0	

Chi-square test •Independent samples t-test

* Statistical significant difference (P < 0.05)

Group 1= study group Group 2= control group

Table 1 shows that, 42.5% of the group 1 and 35% of the group 2 were in the age group of 30 to less than 40 years old, and 52.5% and 60 % of both groups were diagnosed as having head injury respectively. No significant statistical difference was put into evidence between the two studied groups in relation to age and diagnosis.

7.2 Table 2: Comparison between the two studied groups in relation to the gastric pH values during the 1st day, 3rd day, and 7th day.

Day	Gastric pH value		P-value
	Group 1 (n= 40)	Group 2 (n= 40)	
	Mean ± SD	Mean ± SD	
1st day (baseline data)	2.69 ± 0.43	2.94 ± 0.64	0.045*
3rd day	3.45 ± 1.03	4.61 ± 1.29	0.0001*
7th day	3.32 ± 1.02	5.28 ± 1.07	0.0001*

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

Table 2 revealed that, gastric pH value was slightly increased but still within normal range among the group 1 patients through the three assessments **(**1st day, 3rd day, 7th day**)** . However, it was increased above normal range (toward alkaline side) among the group 2 patients with significant statistical differences between the two groups all through the three assessments (p= 0.045, p= 0.000, and p= 0.000) respectively with p-value less than 0.05.

7.3. Figure 1: Comparison between the two studied groups in relation to gastric colonization at 7th day (last assessment).

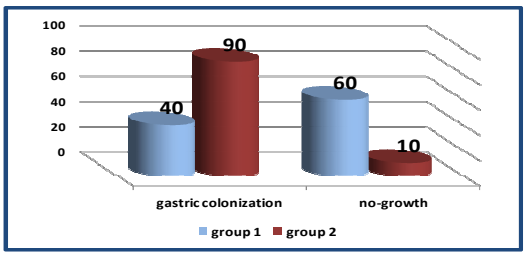

Figure 1 reveals that the majority of group 2 patients (90%) developed gastric colonization as compared to 40% of the group 1 patients at 7th day **(**last assessment**)** with a highly significant statistical difference between both groups in this regard (p= 0.000). Thus, the hypothesis can be supported.

7.4. Table 3: Comparison between the two studied groups in relation to the types of microorganisms developed during the last assessment.

Type of microorganisms	Group 1 (n= 40)		Group 2 (n= 40)		P-value
	N	%	N	%	
Gram positive bacteria:-					
MRSA	9	**22.5**	15	**37.5**	0.143
MRCNS	0	0.0	2	5.0	0.474
VRE	0	0.0	2	5.0	0.474
Gram negative bacteria:-					
Klebsiella spp.	6	**15.0**	16	**40.0**	**0.012***
Escherichia coli	1	**2.5**	8	**20.0**	**0.034***
Proteus	0	0.0	3	7.5	0.239
Pseudomonas	0	0.0	1	2.5	0.314
-Candida albicans:	2	5.0	7	17.5	0.157

Chi-square test * Statistical Significant difference (P < 0.05)
MRSA= Methicillin Resistant Staphylococcus Aureus
MRCNS= Methicillin Resistant Coagulase-Negative Staphylococcus
VRE = Vancomycin Resistant Enterococci

Table 3 shows that, MRSA was developed among 37.5 % of the group 2 patients compared to 22.5% of the group 1 patients with no significant statistical differences between both groups in this respect. Regarding gram negative bacteria, Klebsiella spp. and E-coli were developed in percentages of 40 compared to 15, and 20 compared to 2.5 among the group 2 and group 1 respectively with statistical significant differences between both groups (p= 0.012 and p= 0.034).

7.5. Table 4: Effect of gastric pH on the occurrence of gastric colonization among the two studied groups during the last assessments.

Gastric colonization	Gastric pH value	
	Group 1	Group 2
	Mean ± SD	Mean ± SD
Gram positive bacteria:		
Growth	4.10 ± 1.03	5.65 ± 0.87
No growth	3.10 ± 0.92	5.03 ± 1.18
P-value	**0.008***	0.071
Gram negative bacteria:		
Growth	4.86 ± 0.84	5.50 ± 0.85
No growth	3.00 ± 0.72	4.95 ± 1.39
P-value	**0.0001***	0.127
Candida albicans:		
Growth	3.31 ± 1.14	6.09 ± 0.99
No growth	3.32 ± 1.03	5.15 ± 1.04
P-value	0.980	**0.034***

Independent samples t-test * Statistical significant difference ($P < 0.05$)

Table 4 presented that, significant statistical differences existed between the gastric pH value and the occurrences of gram positive and gram negative bacteria (p= 0.008 and p= 0.0001) among the group 1 patients respectively, indicating no-growth of gram positive and gram negative bacteria with lower gastric pH value (acidic stomach). Regarding the group 2 patients, there were no significant statistical differences found between the gastric pH value and the occurrence of gram positive or gram negative bacteria. On the other hand, there was a significant statistical difference between gastric pH and occurrence of candida spp. (p= 0.034) indicating the growth of candida spp. with higher gastric pH value (alkali stomach).

7.6. Table 5: Relationship between gastric colonization (GC) and selected socio-demographic & clinical variables.

Items	Group 1				P-value	Group 2				P-value
	With GC (n= 16)		Without GC (n=24)			With GC (n= 36)		Without GC (n= 4)		
	N	%	N	%		N	%	N	%	
Age: (yrs)										
< 30	7	30.4	16	69.6	0.341	12	92.3	1	7.7	0.732
30 - < 40	4	57.1	3	42.9		13	92.9	1	7.1	
≥ 40	5	50.0	5	50.0		11	84.6	2	15.4	
Mean ± SD	34.1 ± 13.5		29.2 ± 9.6		0.182	34.4 ± 10.5		35.8 ± 15.0		0.818
Gender:										
Male	12	37.5	20	62.5	0.809	31	96.9	1	3.1	**0.025***
Female	4	50.0	4	50.0		5	62.5	3	37.5	
Diagnosis:										
Head injury	8	38.1	13	61.9	0.508	21	87.5	3	12.5	0.620
Chest injury	3	30.0	7	70.0		8	88.9	1	11.1	
Multiple trauma	5	55.55	4	44.44		7	100.0	0	0.0	

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

Table 5 shows a significant statistical difference between gastric colonization and the gender among the group 2 patients (p=0.025) indicating higher gastric colonization among male patients. No significant relationships were found between gastric colonization and age, and diagnosis.

8. Discussion

The present study presented that the majority of both groups were in age group 30 to less than 40 years and the male to female ratio was 4:1. This can be attributed to the higher exposure of younger male adult to trauma than others due to their work almost outdoors, more active, so they are more exposed to street accidents, or fall from height. This is in line with Ibrahim, 2005 [21] findings in the study of the waiting times before initiating care for patients in emergency department at El-Manial University Hospital, found that more than half of the sample in emergency department were males and their ages were less than 40 years old.

Gastric colonization and pH is an important aspect of monitoring the effect of enteral feeding on the critically ill patients [22-24]. In the present study there was a significant decrease of gastric pH value among the group 1 patients. This may be attributed to the time interval (4-hour vs 2-hour) between feedings and the resting period (8 hours vs 6 hours) at night which allowed the gastric pH to be lower and the stomach to be more acidic by the effect of hydrochloric acid.

The findings of current study revealed that the majority of group 2 patients developed GC as compared to group 1 patients with a highly significant statistical difference between them. This can be attributed to lowering of gastric pH which makes the stomach more acidic and acts as bactericidal. This agrees with Tamowicz et al., 2005 [25] who attributed that the intermittent enteral feeding schedule (16 hours with a 8–hours night break) is proposed in order to provide a temporary increase in gastric acidity preventing in this way bacterial gastric colonization. This finding is supported by the results of Skiest et al., 1996 [23] who proved that a patient fed with intermittent enteral feeding with a period of fasting had lower post fasting gastric pH and lower rates of GC and pathogenic organisms.

In this respect, Heyland et al. 1999 [26] carried out an assessment of the influence of acidification of enteral feeding on gastric colonization in critical patients. The group 2 had received a nutrition formula of standard pH. The incidence of gastric colonization and gastric pH were evaluated. Gastric colonization was observed in 2% of patients who receive acidified nutrition in contrast to 43% in the group 2. This also agrees with Segal et al., 2006 [27] and Collard, Saint, Matthay, 2003 [28] findings who reported a direct correlation between elevated gastric pH and positive gastric colonization. Furthermore, Lee and Jacobs, 2008 [29] found a periodic reduction of gastric pH (below 3.5) in 23 out of 26 patients who receive intermittent enteral feeding in comparison to 11 out of 24 patients who receive continuous enteral feeding, and reported that the intermittent enteral feeding technique has a positive effect on gastric acidity, bacterial gastric GC and colonization of the respiratory tract, as well as the incidence of pneumonia.

In addition, the current study revealed that lowering the gastric pH among the group 1 has a positive effect on the non-occurrence of GC with gram positive and gram negative bacteria. This may be attributed to the fact that the maintaining lowering gastric pH is responsible for inhibiting the growth of bacterial gastric colonization. However, the present study has showed no effect of lowering the gastric pH (acidic stomach) on GC with candida spp. This lack of effect on yeast is consistent with previous observations where yeast colonization was independent of gastric pH. This agrees with Tulamait, 2005 [30] who found that the tube feeding acidified with potassium sorbate had no effect on gastric colonization due to yeast.

In current study the most common isolates of gram positive bacteria from gastric aspirate was MRSA by 37.5% of group 2 compared to 22.5% of the group 1. This agrees with Bonten et al., 2004 [31] and Al-Hadithi, Nassir, and Ahmed, 2002 [32] findings who found out that GC with Staphylococcus aureus was among 5% of studied mechanically ventilated patients. The findings also revealed that GC with gram negative bacteria were less isolated among the group 1 than the group 2, and the most common isolated were klebsiella spp. and E-coli. This can be attributed to the fact that the stomach is normally acidified with gastric hydrochloric acid and this protects us from bacterial GC. The potent bactericidal activity of hydrochloric acid in gastric secretion was first demonstrated by Garrod 1940 [33].

The findings of present study are supported with Tulamait et al, 2005 [30] findings who found out that acidification of tube feedings were particularly effective in reducing gastric colonization by gram negative rods. In this line, Torres et al. 2007 [34] found a positive correlation between gastric pH and concentration of gram negative bacteria. This is similar with Garroute et al. 2008 [35] reported a positive bacterial relationship between colonization of the stomach and nosocomial pneumonia and added that the bacteria responsible for 30 (92%) patients of nosocomial pneumonia were gram negative bacilli.

The critical care nurse carries the responsibility of delivering enteral feeding and monitoring the critically ill patient, so the critical care nurse must be familiar with every aspect of enteral nutrition support, in order to provide safe and effective care. It is important to acquaint with administration schedules, appropriate nursing interventions and possible complications.

9. Conclusion and Recommendations

It can be concluded that the intermittent enteral feeding schedule applied on the group 1 patients (feeding every 4 hours with fasting period 8 hours at night) allowed deceasing the gastric pH value and gastric colonization with statistical significant differences between both groups. Based on the study findings, the study recommended developing strategies aiming at improving the quality of enteral nutrition practices. Also, gastric aspirate culture should be added to the routine investigations.

10. References

1.Mayhall, G. (2004) *Hospital Epidemiology and Infection Control*. Philadelphia: Lippincott Williams & Wilkins; 25-43.
2.Gramlich, L., Kichian, K., Pinilla, J. and Rodych, N. (2004) *Does enteral nutrition compared to parenteral nutrition result in beter outcomes in critically ill adult patients?*. Nutrition; 20: 843- 848.
3.Artinian, V., Krayem, H. and DiGiovine, B. (2006) *Effects of early enteral feeding on the outcome of critically ill mechanical ventilated medical patients.* Chest; 129: 960-967.
4.Urden, L., Stacy, K. and Lough, M. (2010) *Critical Care Nursing; Diagnosis and management.* 6th ed. St. Louis; Mosby, an imprint of Elsevier Inc;123-135.
5.Hudak, C., Gallo, B. and Morton, P. (1998) *Critical Care Nursing: A holistic approach.* 7th ed. Philadelphia: Lippincott-Raven Puplishers;767-773.
6.Spilker, C., Hinthorn, D. and Pingleton, S. (1996) *Intermittent enteral feeding in mechanically ventilated patients: the effect on gastric pH and gastric cultures*. Chest; 110;243-248.
7.Dudek, S. (2010) *Nutrition Essential for Nursing Practice.* 6th ed. Philadelphia; Lippincott Williams &Wilkins;366-375.
8.Hartshorn, J., Lou, M. and Lamborn M. (2000) *Introduction to Critical Care Nursing.* 2nd ed. Philadelphia: W.B. Saunders Company, 3-4.
9.Roberts, S., Kennerly, D., Keane, D. and George C. (2003) *Nutrition Support in the Intensive Care Unit: Adequacy, Timeliness, and Outcomes.* Critical Care Nurse;23(6); 49-57.
10.Morton, P., Fontaine, D., Hudak, C. and Gallo, B. (2005) Critical Care Nursing: a holistic approach. 8th ed. Philadelphia: Lippincott Williams & Wilkins;932-950.
11.Marieb, EN. and Hoehn, K. (2010) *Human anatomy & physiology*. San Francisco: Benjamin Cummings.
12.Morton, P. and Fontaine, D. (2009) *Critical care nursing; a holistic approach.* 9th ed. Philadelphia: Lippincott Williams & Wilkins;1015-1036.
13.Wagner, K., Johnson, K. and Kidd, P. (2006) *High-acuity Nursing.* 4th ed. New Jersey: Pearson Education, Inc.509-512.
14.Moss, G. (2009) *Enteral feeding monitor*. @ www.webmm.ahrq.gov/case.aspx?caseID=184
15.Smeltzer, S., Bare, B., Hinkle, J. and Cheever, K. (2008) *Textbook of Medical- Surgical Nursing.* 11th edition. United States: Lippincott Williams & Wilkins;1175-1188.
16.Woodrow, P. (2012) *Intensive care nursing: A framework for practice.* 3rd ed. London and New York; Routledge Taylor& Francis Group. 87-93.
17.Altman, G., Kerestzes, P. and Wcisel, M. (2010) *Fundamental & Advanced Nursing Skills.* 3rd ed. USA; Delmar;728-740.
18.Creed, F. and Spiers, C. (2010) *Care of acutely ill adult-an essential guide for nurses*. Oxford University Press; 192-197.
19.Tempest, M. (2011) *Enteral nutrition intolerance in critical illness.* Today's Dietition; 13(2):30-31.
20.Parrish, C. and McCray, S. (2003) *Enteral Feeding: Dispelling Myths*. Practical gastroenterology; 11; 33-39.
21.Ibrahim, SG. (2005) *Estimating waiting times before initiating care for patients in emergency department at El Manial University Hospital.* Unpublished master thesis. Faculty of Nursing, Cairo University.
22.El-Baz, N., Reda, N. and El-Soussi, A. (2003) *Bolus versus gravity drip enteral feeding.* Faculty of Nursing, Alexandria University.
23.Skiest, D., Khan, N. and Feld R. (1996) *The role of enteral feeding in gastric colonization; a randomized controlled trail comparing continuous to intermittent enteral feeding in mechanically ventilated patients.* Clinical Intensive Care; 7: 138-143.
24.El-Baz, N. (2002) *The effect of two methods of intermittent enteral feeding on critically ill patients. Unpublished Master thesis*, Faculty of Nursing, Alexandria University.
25.Tamowicz, B., Wolowicka, L., Torlinski, T., Mikstacki, A. and Grzymislawski M. (2005) *Intermittent enteral feeding; the influence on intragastric acidity and the incidence of ventilator-associated pneumonia.* Nowiny Lekarskie;74(3):286-292.
26.Heyland, DK., Cook, DJ., Schoenfeld, PS., Frietag, A., Varon, J. and Wood, G.(1999) *The effect of acidified enteral feeds on gastric colonization in critically ill patients: results of a multicenter randomized trial.* Crit Care Med; 27(11):2399-406.
27.Segal, R., Pogoreliuk, I., Dan, M. and Baumoehl Y. (2006) *Gastric microbiota in elderly patients fed via nasogastric tubes for prolonged periods.* Journal of Hospital Infection; 63: 79-83.
28.Collard, HR, Saint, S. and Matthay, MA. (2003) *Prevention of ventilator-associated pneumonia: an evidence-based systemic review.* Ann Intern Med; 138: 494-501.
29.Lee, B. and Jacobs, S. (2008) *Continuous enteral feeding: A major cause of pneumonia among ventilated intensive care unit patients.* J Parenter Enteral Nutr; 14:353-356.

30.Tulamait, A., Laghi, F., Mikrut, K., and Carey R. (2005) *Potassium sorbate reduces gastric colonization in patients receiving mechanical ventilation.* Journal of critical care; 20(3); 281-287.
31.Bonten, M., Bergmans, CD., Ambergeg, AW., Leeuw, P., Geest, S., Stobberingh, E., Gaillard, C. (2004) *Risk factors for pneumonia and colonization of respiratory tract and stomach in mechanically ventilated ICU patients.* Am J RespCrit Care Med; 154:1339-1346.
32.Al-Hadithi H, Nassir G, Ahmed R. (2002) *Role of tracheo-oropharyngeal & gastric colonization in nosocomial pneumonia in ICU patients.* IJGE; 2(1):39-45.
33.Garrod LP. (1940) *A study of the bacterial power of HCL acid and of gastric juice.* St.Bartholomew's Hospital Reports; 72:145-167.
34.Torres, A., Soler, N., Monton, C. and Fabregas N. (2007) *Stomach as a source of colonization of the respiratory tract during mechanical ventilation: association with ventilator-associated pneumonia.* Eur Respir J:9: 1729-1735.
35.Garroute, M., Chevert, S., Arlet, G. and Marie, O. (2008) *Oropharyngeal or Gastric Colonization and Nosocomial Pneumonia in Adult Intensive Care Unit Patients*. Am J Respir Crit Care Med; 156:1647–1655.