

**FEEDING TOLERANCE IN ENTERAL NUTRITION VIA
BOLUS AND CONTINUOUS FEEDING MODE IN
CRITICALLY ILL VENTILATED PATIENT**

by

NUR ZHAFIRAH BINTI BASRI



**Dissertation submitted in partial fulfillment
of the requirements for the degree
of Bachelor of Health Science (Honours) (Dietetics)**

June 2018

CERTIFICATE

This is to certify that the dissertation entitled “Feeding Tolerance In Enteral Nutrition Via Bolus And Continuous Feeding Mode In Critically Ill Ventilated Patient” is the bona fide record of research work done by Miss Nur Zhafirah bt Basri during the period from September 2017 to May 2018 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfillment for the degree of Bachelor of Health Science (Honours) (Dietetics).

Main supervisor,

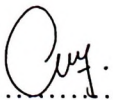


.....
Dr. Soo Kah Leng
Lecturer
School of Health Sciences
Universiti Sains Malaysia
Health Campus
16150 Kubang Kerian
Kelantan, Malaysia

Date: 10 . 6 . 2018 .
.....

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.



Nur Zhafirah bt. Basri

Date: 11/06/2018

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LIST OF ABBREVIATIONS

ASPEN	American Society for Parenteral and Enteral Nutrition
EN	Enteral Nutrition
ESPEN	European Society for Clinical Nutrition and Metabolism
GCS	Glasgow Coma Scale
GI	Gastrointestinal
GIT	Gastrointestinal Tract
GRV	Gastric Residual Volume
HGRV	High Gastric Residual Volume
HUSM	Hospital Universiti Sains Malaysia
ICU	Intensive Care Unit
LOS	Length of Stay
NG	Nasogastric
ONS	Oral Nutritional Supplement
TPN	Total Parenteral Nutrition

ABSTRAK

Toleransi Penerimaan Enteral Nutrisi Melalui Bolus dan Berterusan dalam kalangan Pesakit di Unit Rawatan Rapi yang Menggunakan Alat Bantuan Pernafasan

Istilah pesakit yang dalam keadaan kritikal dimaksudkan mempunyai unsur 'hypercatabolism' yang disebabkan oleh tekanan dari segi psikologi dan psikososial yang berkaitan dengan penyakit kritikal. Enteral nutrisi adalah alternatif untuk membekalkan sumber tenaga yang diperlukan oleh pesakit yang dalam keadaan kritikal secara mencukupi kerana enteral nutrisi mempunyai sumber makronutrisi dan mikronutrisi yang seimbang. Tujuan kajian ini dijalankan adalah untuk melihat tahap toleransi pesakit dalam penerimaan enteral nutrisi melalui bolus atau berterusan. Tahap toleransi tersebut diukur dengan membandingkan jumlah penyedutan, dan masalah berkaitan sistem penghadaman. Seramai 48 orang responden telah terlibat dalam kajian ini. Responden dipilih melalui melengkapinya kriteria yang telah ditetapkan. Data sosial demografi dan keadaan pesakit telah diambil melalui fail perawatan. Semua data yang diambil di dalam kajian ini adalah melalui fail perawatan pesakit yang disediakan di dalam wad yang dipilih. Kajian ini menunjukkan tiada hubungkait antara jenis penyampaian yang diberikan dengan kadar sedutan gaster ($p=0.563$). Selain itu, tiada hubungkait antara jenis penyampaian yang diberikan dengan kadar cirit-birit ($p=0.838$). Hubungkait antara jenis penyampaian dan sembelit juga tidak dapat dibuktikan ($p=0.663$).

ABSTRACT

Feeding Tolerance in Enteral Nutrition Via Bolus and Continuous Feeding Mode in Critically Ill Ventilated Patient

The term critically ill patients are characterized with the presence of hyper catabolism that cause by physiological and psychosocial stressors that associated with critical illness. Enteral nutrition is the alternative to provide sufficient energy required by critically ill patient as it contains complete balanced nutrients which include macronutrients and micronutrients in form that easy to digest. The aim for this study is to measure the feeding tolerance compared between bolus versus continuous feeding modes. The rate of feeding tolerance was measured by comparing the aspiration rate, and gastrointestinal (GI) complication. A total of 48 respondent was involved in this study. Study respondents who fulfilled the inclusion criteria were selected through convenience sampling technique. A social demographic data and health condition was collected from medical folder. All the data in this study was collected from medical folders that available in ward selected. This study found that there is no association between feeding mode and aspiration rate ($p= 0.563$). There is also no association between feeding modes and diarrhea incidence ($p=0.838$). The association between mode of feeding and vomiting is not found ($p=0.663$).

CHAPTER 1: INTRODUCTION

1.1 Background of Study

The term critically ill patients are characterized when there is presence of hyper-catabolism cause by physiological and psychosocial stressors that associated with critical illness (Kadamani et al, 2014). Critically ill patient will have problem on their feeding and consequence of this condition if not nutritional support adequately to meet human body requirement will result in malnutrition (Chan et al, 2010). Nutrition support is the common intervention given to critically ill patient in hospital who unable to feed orally. Nutrition support is the delivery of formulated enteral or parenteral product nutrients for the purpose to maintain or restore nutritional status among patient that having problem to obtain adequate nutrition normally (Krause's 2015).

Enteral nutrition provided through few paths that involved gastrointestinal function (GIT) via catheter, tube, and stoma. The principal indication for enteral nutrition (EN) is based on the functional of patient's GI tract with sufficient length, absorptive ability, and the capacity of it to take nutrients through the oral route totally or in part (ASPEN, 2009). Selection of enteral formulated product is based on patient's condition and diagnosis to meet their daily requirement on energy, macronutrients, and micronutrients. There are two types of enteral formulated product which is ready to drink and in powder form that need to be made based on feeding regime. EN for the critically ill and mechanically ventilated patients in short-term can be fed via two routes known as the continuous and bolus infusion but still

there is not enough evidence that support which routes is preferred and able to lower the risk of aspiration and gastrointestinal complications (Kadamani et al, 2014).

1.2 Problem Statement

EN has advantage where it can provide trophic effects to patients in maintaining the intestinal, increase stimulation of intestinal perfusion, preserves gut immunity, and reduced hospital length of stay. However, there are question on the ability to provide adequate EN in critically ill patients in short-term fed by bolus and continuous route based on mechanical complication and patient's tolerance. Common issues related by this route of feeding are aspiration and GI complication. There are many causes that can lead to aspiration such as patient's advance age, low level of consciousness, cough reflex, sedation, the presence of a tracheal tube, patient in supine position, misplacing of EN tube and vomiting (Kadamani et al, 2014). Aspiration can be life threatening as it can cause gastric content entry the lung and cause other complication.

Moreover, EN also related to GI complications and the most common issues involved are nausea and vomiting (20%), high gastric residual volume HGRV (20–70%), diarrhea (63%), and constipation (5–83%) and these complications will interfere with the ability to achieve adequate amount of EN (Whelan et al, 2009). Feeding tolerance of EN was defined when the delivery of 90% of predicted daily energy requirements achieve over 48 hours without HGRV, vomiting, diarrhea, or abdominal distention (Chan et al, 2010). The options are either to used continuous pump-assisted feeding throughout the day, or bolus

feeding of larger quantities over short periods of time which is typically 200–400 ml over 10–20 min (Bowling et al, 2008). Based on the issues, this study is performed to determine the rate of incidence of aspiration and GI complications by using continuous versus bolus infusion of EN in critically ill patients at Hospital University Sciences Malaysia (HUSM).

1.3 Research Question

1.3.1 Is there any significance different in bolus versus continuous feeding of enteral nutrition in critically ill patients?

1.4 Objective

1.4.1 Main Objective

To compare between bolus and continuous route of enteral nutrition in critically ill patients

1.4.2 Specific Objective

1. To compare the rate of aspiration in enteral nutrition via bolus and continuous route in critically ill patients.
2. To compare the GI complication in feeding routine via bolus and continuous route.

1.5 Research Hypothesis

1.5.1 H_a: There is significance different in rate of aspiration between bolus and continuous nutrition infusion in critically ill ventilated patients.

1.5.2 H₀: There is no significance different in rate of aspiration between bolus and continuous nutrition infusion in critically ill ventilated patients

1.6 Significance of study

This study aimed to see the feeding tolerance of EN received by critically ill ventilated patient via bolus and continuous feeding. Thus, researchers hope that it can help to improve the feeding tolerance received by patient and able to choose the most appropriate feeding route based on patient condition. Moreover, this study also tries to increase patient tolerance and reduce GI complication among critically ill ventilated patient. This study may help researchers and healthcare practitioner, in improving nutrients received by patient so that it can improve their health status.

1.7 Conceptual Framework

Delivery of EN through orogastric or nasogastric route can be decided by few types mode of feeding. In this study, the feeding tolerance among critically ill patients was measured by evaluate the rate of aspiration, and GI complication in both feeding mode. GI complication that include are the incidence vomit, and abnormal bowel open which measured as presences of diarrhea or constipation.

CONCEPTUAL FRAMEWORK

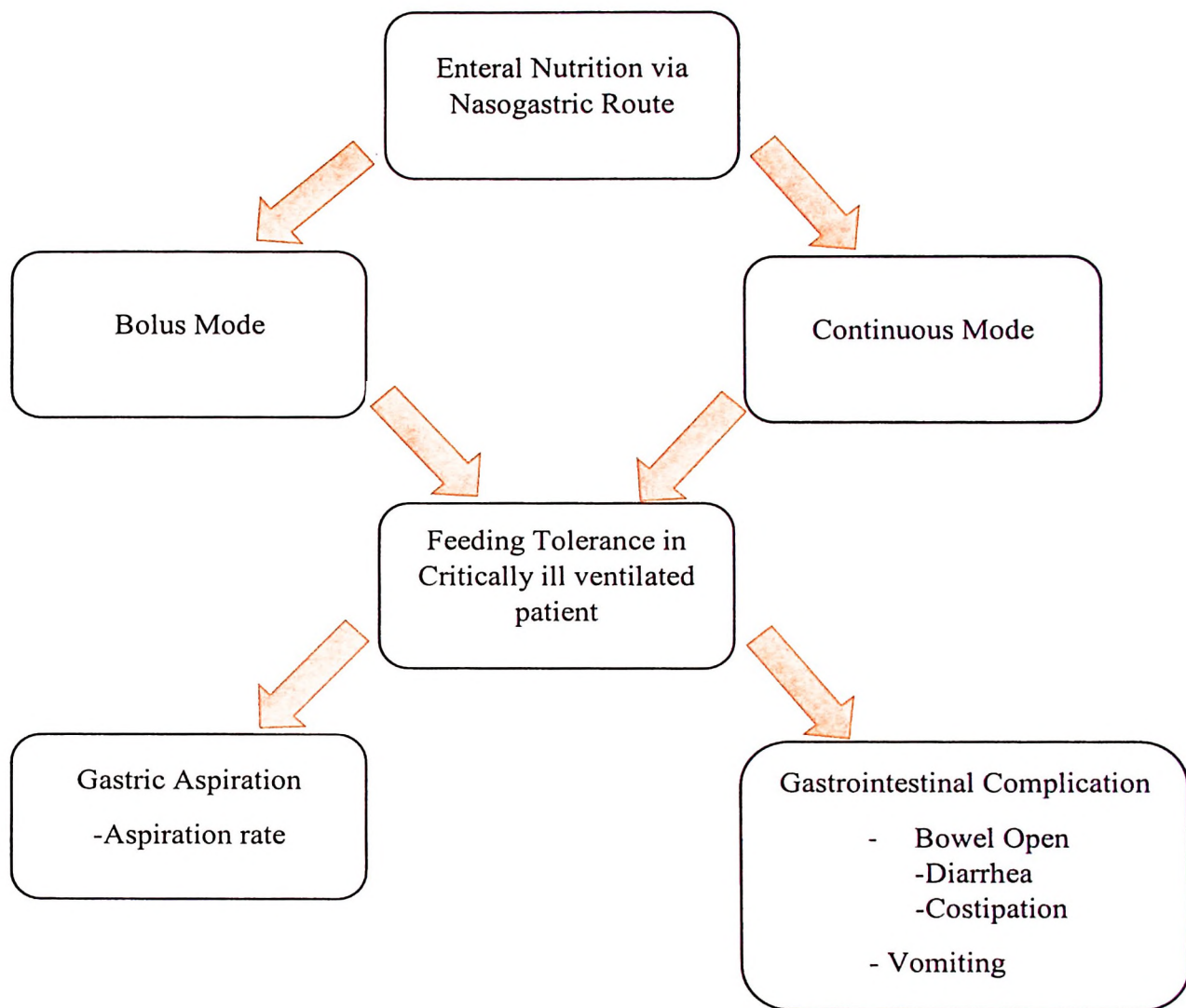


Figure 1.1: Conceptual framework of feeding tolerance in feeding mode bolus versus Continuous

CHAPTER 2: LITERATURE REVIEW

2.1 Enteral Nutrition

Enteral nutrition is one of the alternative to provide sufficient energy required by critically ill patient. It contains complete balanced nutrients which include carbohydrate, protein, fat, and macronutrients in form that easy to digest. EN usually will be chosen rather than PN because EN help to maintain GI function and increase patient tolerance. In choosing EN formula it is based on patient condition, biochemical blood result and diagnosis. For critically ill patient who undergoes medical or surgical treatments in hospital, the provision of nutrients near 100% of the target is via the gut as it may reduce mortality rate, particularly in malnourished patients (Alberda et al, 2009).

Even though EN able to supply sufficient nutrient to patient, there are always issues on rate of delivery that patient received based on the route used. Underfeeding is common in critically ill patients and usually it mainly because of gastrointestinal dysmotility or hemodynamic conditions (Ridley and Davies, 2011). EN in critically ill trauma patients able to preserve the physical gut barrier function, maintain gut associated lymphoid tissue mass and function (Manzanares et al, 2011). To support this, there are recent analysis based on the results of three randomized trials that included 126 trauma patients being admitted to critical care and this study showed that early provision of EN was associated with reduced rate of mortality (Osland et al, 2011).

2.2 Bolus feeding

Bolus feeding is one of the choice in delivery of EN in short-term by nasogastric or orogastric in critically ill patient. It is more physiological compared to continuous feeding but there are some authorities claim it may causes more complications such as pulmonary aspiration, abdominal bloating, discomfort, diarrhea and one of these complications, the pulmonary aspiration has the greatest potential for clinically significant sequelae (Bowling et al, 2008). It is usually administered for 20-60 minutes per feeding and it is more convenient and less expensive compared to pump feeding and patients with normal gastric function able to tolerate up to 500ml per feeding (Krause, 2015). There will be 4 to 6 feeding per day to fulfill the requirement needs by patient. The first feeding should be start from 50-100ml and add 50-100 ml for the next 8-12 hours to increase feeding regime. Full feeding regime usually able to achieve in 5-7 days based on patient tolerance and GI ability. Gravity bolus feeding did not need a machine to push the formula into tubes like continuous feeding. Bolus feeding also is easy to be used by physician and caregiver whether in ward or practice at home after discharge.

2.4 Continuous Feeding

Continuous feeding infusion in EN required pump and this method is appropriate for patients who do not tolerate the volume of infusion used bolus, cyclical or intermittent (Krause, 2015). The use of enteral feeding pumps will allow clinicians and home caregivers to set the delivery amount of enteral formula given to patient in a consistent manner (ASPEN, 2009). Usually, the starting amount in continuous feeding will be 10-30ml and increase another 10-30ml for

the next 8-12 hours to increase feeding regime and achieve energy requirement. Continuous feeding using pump machine that will be set the duration of feeding and amount and usually the feeding will keep continue for 24 hours or 3 hours with 1 hour gap between the next 3 hours feeding. This method able to increase patient tolerance as the delivery of EN will be in small amount in every hour but there is still not enough evidence about this too. Moreover, feeding pumps should always be calibrated periodically as it may assure the accuracy and for patients that requiring EN at home it should have a feature that can promote safety and able to minimize sleep disturbances (ASPEN, 2009).

2.5 Gastric Aspiration

Gastric aspiration is one of the way to measure patient tolerance on feeding given. Evaluate the tolerance of the patient based on the appearance and volume of liquid that eliminate from the gastric drainage tube in the daily nursing record help to prevent bronchial aspiration (Araújo-Junqueira and De-Souza, 2012). Moreover, there are some researchers have suggested that values from 50-150 ml to 250-500 ml of gastric residual volume for every four hours represent the same risk bronchial aspiration and/or pneumonia in critically ill patients (Montejo et al, 2010). Periodically check on feeding tube placement should be done as various daily procedures that performed in the ICU may lead to displacement such as surgical procedure and examination on patient, aspiration of airway secretions, and changes of position (Araújo-Junqueira and De-Souza, 2012). However, there are more risk that can cause aspiration such as patient positioning on bed, sedation, the presence of a nasogastric tube, misplaced of the feeding tube, mechanical ventilation, vomiting, high risk of injury, and patient at advance age that can increase risk of aspiration. Risk of aspiration can be

reduced by simple step such as maintain head-of-bed by elevate at an angle of 30° to 45° and assess feeding tube placement at 4-hour intervals to make sure the tube remained on the desired location.

2.6 Gastrointestinal Complication

Gastrointestinal complication or intolerance is one of the way to evaluate delivery of EN feeding in patient. GI intolerance also defined by rate of vomiting, presence of abdominal distention, complaints of discomfort, high GRV, diarrhea, stool, or abnormal abdominal radiographs (ASPEN, 2012). However, the presence of this GI complication is not only caused by EN but it is also influenced by medicine, injury, treatment, surgery, and patient condition itself. Diarrhea during enteral feeding may involves various mechanisms and primary alterations in absorptive physiology of GI function (Whelan et al, 2009). The most common GI complication are nausea and vomiting which is about 20%, HGRV 20-70%, diarrhea 63% and constipation 5-83% (Whelan et al, 2009). Main concern of HGRV and vomiting are the risk of aspiration and gastric content might occur based on certain research available but still the risk is not reported until now (Kadamani et al, 2014). Constipation is a common event in critically ill patients and early beginning of enteral EN was associated with earlier return of normal bowel function (Nassar et al, 2009).

CHAPTER 3: METHODOLOGY

3.1 Research Design

A cross sectional study was carried out to investigate rate of feeding tolerance in enteral nutrition via bolus and continuous feeding route among critically ill ventilated patient in Hospital University Science Malaysia (HUSM). This study helped to evaluate the difference rate of feeding tolerance between the two modes if feeding.

3.2 Research Setting and population

Target population of this research was critically ill patients who were on mechanically ventilated in HUSM ward.

3.3 Research Location

This study was conducted at HUSM Intensive Care Unit in ward 1 Mutiara, Trauma ICU, 2 Delima and 1 Kristal where the data were collected from patient's medical record.

3.4 Sample size calculation

This study applied convenience sampling. Sample size not calculated due to unavailability of information required in calculation. However, according to study done by Kadamani et al, (2013) the required sample size was 60 respondents and 30 respondents for each feeding mode.

3.5 Sampling method

This study was conducted among 48 respondents from HUSM who were critically ill received EN by bolus or continuous and on mechanical ventilated. Convenience sampling had been used in this study therefore, each patients of the population that met the inclusion criteria had an equal opportunity being selected as the subjects of the study. Moreover, 48 critically ill patients on mechanical ventilated that received EN via bolus or continuous feeding route was selected randomly the met of inclusive and exclusive criteria. The data was collected within 2 months and the estimated number of respondent was 60 respondents.

3.6 Inclusion Criteria

Table 3.1: Inclusion criteria and exclusion criteria

Inclusion Criteria	Exclusion Criteria
• 18 years old and above • Patient on mechanical ventilated machine • Patient fully feeds by EN • Patient feeding via bolus or continuous route • Patient who have normal conserved GI function • On ENT at least 72 hours	• Patient on TPN • Severe hemodynamic instability • Bowel obstruction • Severe protracted ileus • Major upper gastrointestinal bleeding

3.8 Data collection instrument

3.8.1 Medical Folder

Subject demographic information was obtained from medical folder in HUSM ward involved. This instrument was the main source of data since all the information taken from the notes noted by physicians.

3.8.2 ICU chart

Data also obtain from ICU chart. It had the main information about respondent's treatment such as aspiration volume, diarrhea, constipation, vomiting, and types of feeding route are found. Nurses and physician report this information daily.

3.8.3 Nursing notes

Information on types of Enteral Formula given to respondent and the total energy consumption were also collected from nurse's notes which was recorded daily.

3.9 Data collection

Data collection was conducted in wards selected which were 2 Delima, 1 Kristal, 1 Mutiara and Trauma ICU in HUSM. The whole process of data collection spent about 10 weeks from February, 2018 until April, 2018.

3.10 Measurement of variable

3.10.1 Dependent Variable

Dependent variable in this study was feeding tolerance. It was measured based on symptom noted down which are vomiting, diarrhea, constipation and aspiration rate

3.10.2 Independent Variable

Independent variable in this study was types of feeding mode used which were bolus and continuous feeding route.

3.11 Data analysis

The data obtained from this study were analyzed by using the Statistical Package for the Social Sciences (SPSS) version 22.0. Numerical data was analyzed and expressed in the form of range, mean, and standard deviation, while categorical data were analyzed and expressed in frequency and percent. Mann–Whitney U test was used to compare non-normally distributed numerical data such as age, height, and weight while Fisher’s Exact Test was used to test association between two categorical variables.

3.11 Ethical Issues

Informed consent is a voluntary agreement to participate in research study and in this study, it was given to caregiver as respondent was unable to decide. Informed consent is important before enrolling a participant and ongoing once enrolled. It must be obtained for research that involved all types of human subject research such as interventional, diagnostic, social, and behavioral studies and by obtaining consent the respondent understand about their rights, the purpose of the study, the procedures, and the potential benefits

3.10 Flow Chart of Study

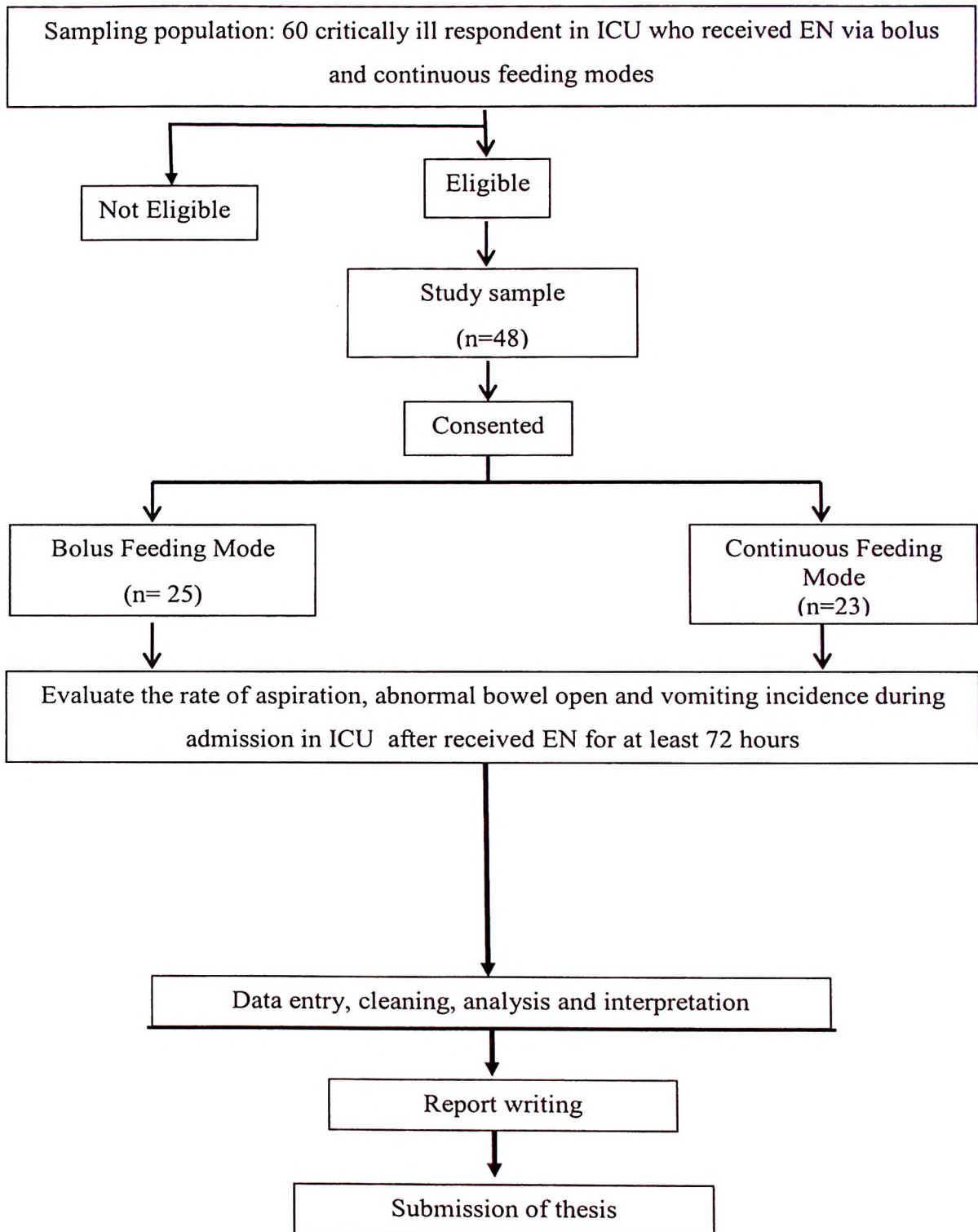


Figure 3.1: Flowchart of the study

CHAPTER 4: RESULTS

A total of 48 critically ill ventilated respondent were successfully recruited in this study. The actual patients needed in this study were 60 respondents. However due to several limitations, the number of respondents recruited only reach 80% from total participants needed.

4.1 Socio-Demographic Characteristics and Health Condition

Socio-demographic characteristics were shown in the table 4.1. A total of 48 critically ill on mechanical ventilated received EN via bolus and continuous were recruited. The mean for age in bolus mode was 50.64. While the mean for age in continuous mode was 56.04. Male respondent in this study were 62.5%, (30/48) from total respondent recruited and follow by female 37.5%, which (18/48) from total recruited. Meanwhile for the races, Malay was dominant race in this study with a participation of 89.6% (43/48) followed by Chinese 10.4% (5/48). Respondent were diagnosed with one or more diagnosis during admission therefore, it was categorized into few categories. In total, the highest number of respondent in diagnosis category is neurology 17(35.4%) followed by metabolic & cardiac 8(16.7%), respiratory & metabolic 7(14.6%), neurology & respiratory 6(12.5%). For respiratory, metabolic, and neurology & metabolic scored the same 3(6.3%) and lastly respiratory & cardiac 1(2.1%). Based on mode of feeding in bolus, the highest number of respondent in diagnosis category is neurology 13(52%) followed by neurology & respiratory 4(16%), respiratory & metabolic 3(12%). Respiratory, and neurology & metabolic scored the same 2(8%). Metabolic & cardiac only have 1 respondent. In continuous group, metabolic & cardiac have the highest

respondent 7(30.4%), followed by neurology & cardiac and respiratory & metabolic had the same number of respondent 4(17.4%), metabolic 3(13.0%), then neurology & respiratory had 2(8.7%). Lastly for respiratory, neurology & metabolic, and respiratory & cardiac have the same number of respondent 1(4.3%). For Glasgow Coma Scale (GCS), the mean for total respondent GCS is 5.27(2.664). Bolus feeding mode produced mean GCS of 5.16(2.641) while for continuous mode is 5.39(2.743). The minimum and maximum scored for GCS is 2-10T for total and the 2 feeding modes. Moreover, types of formula used in this study were divided into three groups which are polymeric, specialized, and semi-elemental. Number of respondent that used polymeric formula is 15(31.3%). Specialized formula was used by total respondent is 29(60.4%) and semi elemental 4(8.3%).

Table 4.1: Socio-demographic characteristics and Health Condition of respondent

Characteristics	Total (n= 48)	Bolus (n=25)	Continuous (n=23)
Age (year) ⁺	53.23(17.738)	50.64(18.225)	56.04(17.145)
Gender ⁺	1.10(0.309)	1.16(0.374)	1.09(0.209)
Men	30(62.5%)	16(64.0%)	14(60.9%)
Women	18(37.5%)	9(36.0%)	9(39.1%)
Races ⁺	1.10(0.309)	1.16(0.374)	1.04(0.209)
Malay	43(89.6%)	21(84.0%)	22(95.7%)
Chinese	5(10.4.0%)	4(16.0%)	1(4.3%)
Diagnosis			
Neurology	17(35.4%)	13(52%)	4(17.4%)

Respiratory	3(6.3%)	2(8%)	1(4.3%)
Metabolic	3(6.3%)	0(0%)	3(13.0%)
Neurology& Respiratory	6(12.5%)	4(16%)	2(8.7%)
Neurology& Metabolic	3(6.3%)	2(8%)	1(4.3%)
Respiratory& Metabolic	7(14.6%)	3(12%)	4(17.4%)
Respiratory& Cardiac	1(2.1%)	0	1(4.3%)
Metabolic& Cardiac	8(16.7)	1(4%)	7(30.4%)
GCS ⁺	5.27(2.664)	5.16(2.641)	5.39(2.743)
Polymeric	15(31.3)	5(20%)	10(43.5%)
Specialized	29(60.4)	18(72%)	11(47.8%)
Semi-Elemental	4(8.3)	2(8%)	2(8.7%)

⁺ Mean (SD), n (%)

n: total number of subjects, SD: standard deviation

4.2 Mode of Feeding and Aspiration

Statistical test was carried out to determine association between mode of feeding and aspiration rate by using Fisher's Exact test ($\chi^2 = 1.447$ $p=0.563$) and there was no association found. Rate of aspiration in this study were divided into three categories which are no aspiration incidence, less than 500ml and more than 500ml. Based on the result, 21(43.8%) respondent noted with no incident of aspiration while 26(54.2%) respondent reported incident of aspiration less than 500ml per episode and only 1(2.1%) of respondent reported aspiration incident with more than 500ml. When comparing between bolus and continuous feeding modes, the number of respondent have no incident of aspiration is higher in bolus which is 12 respondents versus 9 respondents in continuous mode. Anyways, number of respondent have incident of aspiration <500ml is higher in continuous with a difference of 2 respondents only. Incident of high aspiration ≥ 500 ml was only noted in bolus mode. The aspiration rate was the total amount for each 3 consecutive days.

Table 4.2: Mode of Feeding and Aspiration

Characteristics	Total (n= 48)	Bolus (n= 25)	Continuous (n= 23)	p-value
Aspiration				(0.563) ^a
No Aspiration	21(43.8%)	12(48%)	9(39.1%)	
<500ml	26(54.2%)	12(48%)	14(60.9%)	
≥ 500 ml	1(2.1%)	1(4%)	0(0%)	

n (%), n: total number of respondent

^aFisher's Exact test

4.3 Mode of Feeding and Diarrhea

Another statistically test was done to determine association between modes of feeding and diarrhea by using Pearson Chi Square ($\chi^2 = 0.042$; $p = 0.838$). Again, there was no association found. Incidence of diarrhea was 16(33.3%) which is lower than no incident of diarrhea 32(66.7%). By comparing the diarrhea incidence according to feeding modes, there is no significant found between these two variables as both group have the same number of respondent with diarrhea, 8(32%).

Table 4.3: Mode of Feeding and Diarrhea

Characteristics	Total (n= 48)	Bolus (n= 25)	Continuous (n= 23)	<i>p</i> -value
Diarrhea				(0.838) ^b
Yes	16(33.3%)	8(32%)	8(34.8%)	
No	32(66.7%)	17(68%)	15(65.2%)	

n (%), n: total number of respondent

^b Pearson Chi Square test

4.4 Mode of Feeding and Vomiting

Incidence of vomiting is rarely occurred in this study. A statistical test was done to test this data by using Fisher's Exact test ($p=1.00$) and there was no statistically association found between feeding mode and rate of aspiration as $p>0.05$. Based on table 4.3 below, incidence

of vomiting in total was 4(8.3%). There is no significant association found as the incidence of vomiting in these two groups was the same, only two times.

Table 4.4: Mode of Feeding and Vomiting

Characteristics	Total (n= 48)	Bolus (n= 25)	Continuous (n= 23)	<i>p</i>-value
Vomiting				(0.663) ^a
Yes	4(8.3%)	2(8%)	2(8.7%)	
No	44(91.7%)	23(92%)	21(8.7)	

n (%), n: total number of respondent

^a Fisher's Exact test

4.5 Mode of Feeding and constipation

Comparison between mode of feeding receiving EN via bolus and continues, the incidence of constipation was only once. Therefore, statistically analysis was unable to be done and the data is presented in the bar chart as below. Only one constipation is only noted once was among 23 respondents in continuous feeding mode. There was no constipation problem in bolus mode of feeding. A bar chart in figure 4.1 shows the result of this comparison in constipation.

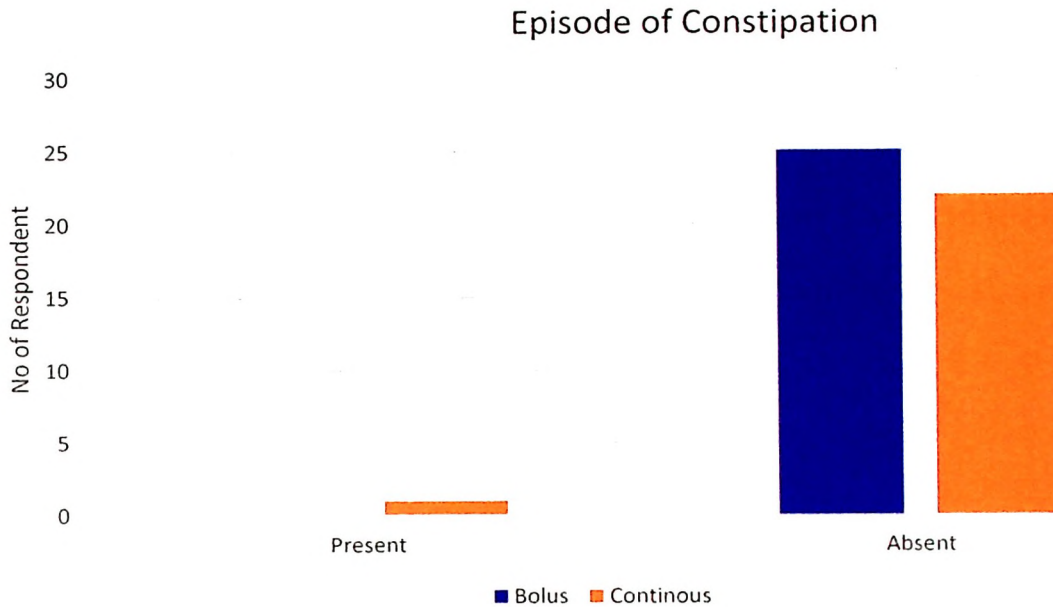


Figure 4.1: Bar chart in mode of feeding and constipation

4.6 The frequency of aspiration, diarrhea, constipation and vomiting in EN

In terms of frequency, the total frequency of aspiration that divided into three group is as in table 4.2. The mean and SD of aspiration is 0.0625(1.9026) and there is no statistically found. Furthermore, the mean and SD for diarrhea is 0.542(0.8903), no statistically found. Next, comparison between modes of feeding with constipation have mean and SD 0.0139(0.09623). Lastly, the comparison between modes of feeding and vomiting is divided with yes and no. The mean and standard deviation is 0.0278(0.9310) and there are 4 respondents noted with vomiting (8.3%) while others is not noted with any vomiting incident 44(91.7%).

CHAPTER 5: DISCUSSION

5.1 Socio-demographic Characteristics of Study Respondent

Majority of the study respondents in this study were Malay. There was no Indian respondent in this study because the largest population in Kelantan is Malay (92.7%), Chinese is only (3.35%) and the smallest population in Kelantan is Indian around (0.23%) (Department of Statistics, 2010). In term of age, there are no significant different when comparing between bolus and continuous and the mean difference in age between these two groups is only 6 years. Moreover, there is also no significance different in gender received EN via bolus and continuous as the number of respondent recruited in this study is small. In distribution of diagnosis based on group, mostly respondents were in the neurology group. This is due to the ward selected in this study were Trauma ICU and general ICU.

One of the common diagnosis in the two selected wards was involving motor vehicle accident and it was one of the factor that neurology group had contributed to the highest number of respondents. Then it followed by metabolic & cardiac which also influenced by the ward involved where patients with worsening condition will be transferred from general ward to general ICU. The Glasgow Coma Scale (GCS) was used to determine level of consciousness by evaluating eye opening, motor response, and verbal response and possible scores ranged from 3 (poor) to 15 (good) (Metheny et al, 2008). The minimum and maximum of GCS scored in this study for both group is the same which is 2-10T. Semi-elemental formulae have been evaluated in 2 randomized trials with contradictory results when Meredith et al (1990) described a reduction in the incidence of diarrhea using a semi-

elemental formula, and study by Heimburger et al (1997) found a higher frequency of diarrhea with this type of formula. The most frequent used was specialized formula and this was influenced by disease diagnosed in each respondent such as acute kidney injury, end-stage kidney failure, diabetes, and others.

5.2 Mode of Feeding and Aspiration

The results from this study showed no association between incidence of aspiration between feeding modes in EN. Similar result was also has been reported in other study by Serpa et al (2003), Steevens et al (2002) and Kadamani et al (2014). Moreover, factor that causing elevated incidence of high aspiration in the other studies may be related to the definition high gastric residual volume (HGRV) itself of 150 ml in Serpa et al (2003), and 200ml by Pisani (2009). Current study shows aspiration between 150-400ml is a poor marker of high aspiration or HGRV (McClave et al, 2005). Randomized control trial proved that by raising the cut-off value for high aspiration to 250ml-500ml still could not increase the incident of aspiration, vomiting or either pneumonia. Therefore, in this study the cut off point for high aspiration as a marker for HGRV is 500ml and above based on current finding by McClave et al (2016) and Montejo et al (2010). There is no significant association between aspiration volume and modes of feeding. However, there was one incident of high aspiration in bolus modes versus none in continuous feeding mode.

5.3 Mode of Feeding and Diarrhea

When comparing of modes of feeding in relation to the incidence of diarrhea, both bolus and continuous showed the same incidence of diarrhea therefore there was no statistically significant association between feeding modes and diarrhea. Other studies by Macleod et al (2007) and Steevens et al (2002) have shown the same result with this study but have higher incidence of diarrhea in bolus compared to continuous group. Definition of diarrhea is based on daily fecal score above 15 by using the King's Stool Chart. But due to some limitations, this study the defined diarrhea is three times or more incident of loose stool in moderate amount per day is considered as diarrhea.

5.4 Mode of Feeding and Vomiting

No statistically significant association found between modes of feeding and vomiting. This indicate that vomiting was not affected by the mode of feeding in EN delivery method itself. This finding could be related to low aspiration rate and application of standard protocols during the EN administration in critically ill patient (Quigley et al, 2001). The use of medication such as prokinetic agents also would improve gastric emptying and EN tolerance (McClave et al, 2016).

5.5 Mode of Feeding and Constipation.

There was only one constipation case noted in this study under continuous mode of feeding. Previous study had showed that slow delivery of EN volume via continuous modes may not produce gastric and colonic distention and leading to reduce antro-pyloric pressure waves