

## The effect of Nutrition Support Protocols on Patient Outcomes in Intensive Care Unit: A Systematic Review

Effat Afaghi<sup>1</sup>, Abbas Ebadi<sup>2\*</sup>, Seyyd Davood Tadrissi<sup>2</sup>, Mohammad Reza Naghii<sup>3</sup>, Seyyd jalal Madani<sup>4</sup>

### Abstract

**Introduction:** Nutritional support is an essential component in the intensive care unit. ICU patients than other patients are susceptible to malnutrition, because of the severity and complexity of their care. The aim of this review was to determine the impact of implementing nutrition support on patient outcomes in intensive care unit (ICU).

**Methods:** Articles include conferences, seminars and published articles in international journals by using standard and sensitive keywords such as nutrition support, intensive care unit and patient outcomes were reviewed. The articles published in journals, databases (Science direct, PubMed, cochrane library, oxford, google Scholar, springer, Highwire, Ovid, Wiley, thieme, BMJ clinical evidence, MD consult, up to date) between the years 2003 - 2013 which included the quality control criteria for entry into systematic review. Then the articles which included the Inclusion criteria for entry into the study was selected and after the quality control were entered to a systematic review process.

**Results:** From 1470 retrieved articles, seven articles were analyzed. However, Nutritional support has the positive effect on the delivery of nutrients to critically ill patients; but regarding the studies, different nutrition support algorithms will have a variety of consequences (hospital mortality, length of ventilation, ICU length of stay, and hospital length of stay) in various communities.

**Conclusion:** Using a programmed nutrition protocol based on evidence uses safe methods according to patients' needs and in appropriate time will provide better results while it will be accompanied with exact evaluation of nutrition status and improvement indicators.

**Keywords:** Nutrition Support, Intensive Care Unit, Patient Outcome, Critical Care Unit

1. MSc in Critical Care Nursing, College Of Nursing, AJA University of Medical Sciences, Tehran, Iran
2. Behavioral Sciences Research Center (BSCR), Nursing Faculty, Baqiyatallah University of Medical Sciences, Tehran, Iran
3. Nutrition Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
4. Department of Anesthesiology, Baqiyatallah University of Medical Sciences, Tehran, Iran

#### \* Corresponding Author

Ebadi A.

Behavioral Sciences Research Center and Nursing Faculty, Baqiyatallah University of Medical Sciences, Velayat educational complex, East Second Street, Araj Highway, Shahid Langary Street, Nobonyad Sq, Tehran, Iran

E-mail: ebadi1347@bmsu.ac.ir

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### 1. Introduction

Nutritional support has emerged as a vital component of the management of critically ill patients (1, 2). Nutrition support refers to enteral or parenteral provision of calories, protein, electrolytes, antioxidants, vitamins, minerals, trace elements, and fluids that optimize recovery from illness (3). Nutrition support plays a vital role in the prevention and treatment of nutritional deficiencies in at-risk, critically ill patients. It has three main goals: first, the provide of macronutrients (glucose, protein, fat) and micronutrients (vitamins and trace-elements) to meet the calculated or measured needs (adequation between energy needs and delivery to avoid protein-energy deficit, overfeeding and hyperglycemia, and the onset of their related complications) and remaining blood glucose levels below 180 mg/dL, second, Prevention of malnutrition and related complications, and, finally, the reduce protein

catabolism and negative nitrogen balance (4). Mode, timing, and adequacy of nutritional support affect glycemic control and outcomes in critically ill patients (5).

Typically, ICU patients are unable to nourish themselves orally and rapidly become malnourished, unless they are provided with involuntary feeding either through a tube inserted into the GI tract, called enteral nutrition (EN), or directly into the bloodstream, called parenteral nutrition (PN) (6). Enteral nutrition is preferred to parenteral nutrition unless there is a major gut condition which will delay commencement of enteral nutrition. The first line recommended nutrition support is the early enteral nutrition (begin with 24-48 hours after admission), since it reduces infectious risk and mortality in comparison with late EN and early parenteral nutrition (PN) (5, 7-10).

Malnutrition is a frequent problem associated with detrimental clinical outcomes in critically ill patients. The prevalence of malnutrition among hospitalized patients is



about 15–70% upon admission to hospital (11). In critically ill patients, malnutrition may result in immunodeficiency, hypercatabolism, impaired ventilatory drive, and reduced respiratory muscle mass and etc (12). The consequences associated with malnutrition are considerable and include an increased rate of infection, poor wound healing, prolonged length of mechanical ventilation, increased septic complications, increased length of stay and increased health care costs and finally, increased mortality rates (2, 13, 14).

In critical care, the nutritional status assessment is essential to the daily care of ICU patients, to reduce morbidity and mortality and to decrease hospitalization costs (15, 16). There are different methods for the assessment of nutritional status. A set of methods is necessary to have a careful evaluation of the patient (1). Assessment of nutritional status should include clinical findings, anthropometric measurements (weight, height, ideal body weight, fat-free mass, fat-free mass index, and body mass index), biochemical data (Creatinine, Plasma proteins, albumin, pre-albumin, transferrin, total lymphocyte counts and etc), past medical history and dietary history (patient's dietary habits, food choices, meal patterns, food allergy information, and malabsorption issues) (11, 17, 18).

Although many studies have documented that providing nutritional support can change patient outcomes, the positive or negative changes are controversial. The purpose of this article is to systematically review the literature to determine the effect of nutrition support on patient outcomes in the critically ill patient.

## 2. Methods

### 2.1. Data Sources:

The search strategy aimed to find both published and unpublished studies, limited to English language and restricted to the last decade (2003–2013). Initially a limited search of PubMed and science direct was undertaken to help identify the range and type of studies potentially available for synthesis. This was then followed by an analysis of the text words contained in the title and abstract and of the index terms used to describe the identified articles.

The next step involved searching additional electronic databases using several combinations and permutations of key words (nutrition support, intensive care unit, patient outcome, critical care unit). Using a defined search and retrieval method, the following databases were accessed: 1.Pubmed, 2.Science direct, 3.Cochrane library, 4.MEDLINE, 5.Oxford, 6.Wiely, 7.Journals@Ovid, 8.High wire, 9.up to date, 10.google scholar.

The next step was hand searched to find any additional literature and unpublished studies: conference Proceedings, Seminars and Directory of open access journals.

**Assessment of Methodological Quality:** Two independent reviewers assessed selected studies for methodological validity prior to inclusion in the review. Each retrieved study was critically appraised and the methodological quality assessed using the PRISMA instrument.

### 2.2. Study Selection:

A research question was developed using the PICO (patient or problem, intervention, comparison, outcome) method to assess the effect of nutrition support on patient outcomes in the critically ill patient. The review considered all randomized controlled trials (RCTs) that include adult patient (above 18 years) and use any type of nutritional support without supplemental and immunonutrition. In addition to the review considered any patient outcomes such as hospital mortality, length of ventilation, ICU length of stay and hospital length of stay.

### 2.3. Data Extraction:

Data extracted from the articles included specific details about the purpose, interventions, participants, study methods and outcomes. Data synthesis was not possible because of the different outcomes, control groups and interventions of the selected studies.

## 3. Results

The search strategy identified 1470 articles, and organized into endnote software. The details of the selection process are presented in Table 1.

Finally, 7 articles were selected to enter systematic review. Figure 1 describes form characteristics and methodology of studies. In all interventions, experimental group received nutrition support intervention while control group didn't. Different nutrition support provided in the studies included: algorithm provided by SCCM/ASPEN (Society of Critical Care Medicine and the American Society for Parenteral and Enteral Nutrition), nutrition guideline based on Browman clinical Guideline, nurse-centered nutrition support algorithm, Canadian clinical practice guidelines (CPG)-based nutrition support, and evidence-based nutrition algorithm. In this study, 2346 cases were investigated. From this number, 1193 cases were in experimental group and 1153 people belonged to control group. Three studies were performed as comparative clinical trial and two studies were done as pre- and post-clinical trial.

Kiss et al (2012), reported that implementation of nutrition support algorithm leads to improvement of

nutrition quality in receiving calorie and calorie leading to more improvement if a nutrition support team or nutrition expert evaluates nutrition on a daily basis (19). Singer et al (2011), showed that frequent measurements with indirect calorimetric method in order to determine patients' energy needs compared to typical method, leads to receiving required protein and calorie and decreases mortality; however, it increased independence time to mechanical ventilation and stay in ICU (20). Mo et al (2011), studied the effects of team nutrition support on outcomes of ICU patients and stated that these services could increase sufficient nutrition support, decrease costs, and lead to better outcomes (21). Doig et al (2008), considered implementation of evidence-based nutrition support guideline as a cause of more qualified and early nutrition while it has no significant influence on patients' clinical outcomes (22). Woien et al (2006) considered the nutrition of patients in intensive care and the effects of nutrition support algorithm in ICU of Norway. He indicated that nurse-based nutrition support algorithm in a two-month period would increase calorie intake as enteral nutrition in intervention group compared to control group. He also mentioned lack of responsible people regarding patients' nutrition conditions and lack of team nutrition care among affecting factors on patients insufficient nutrition (23). Jaine et al (2006), showed that although implementation of Canadian clinical guidelines improves nutrition support, it

doesn't improve clinical outcomes (24). The last study in 2004 in Ontario showed that implementation of evidence-based nutrition support algorithm for intensive care patients would lead to better access to nutrition support, less stay in the hospital and may also decrease hospital mortality (25). Now, given these results can it be concluded that nutrition support leads to better patient outcomes in intensive care?

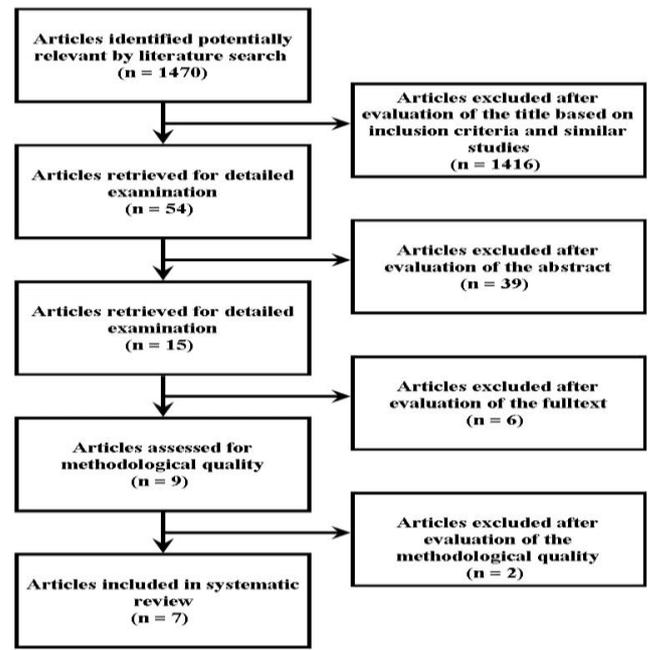


Figure 1. Selection Flow Diagram

Table 1. A summary of included clinical trial studies investigating the nutrition support and Patient outcomes.

Ref	Study	Study Design	Participant Number	Nutrition Support Interventions	Main findings
(19)	Kiss et al (2012)	A Clinical Trial Study	Before (n=56), After (n=56)	Implementation of a nutrition support algorithm based on the SCCM/ASPEN guidelines	Mean delivery of total energy per day (P = .023) Mean delivery of protein per day (P< .001) Duration ventilation (NS*) Length of ICU stay (NS)
(20)	Singer et al (2011)	A Randomized, Pilot Clinical Trial Study	Study group, n= 56 Control group, n= 56	Caloric intake based on : repeated REE measurements (study group) and a weight-based formula (25 kcal/kg/day) (control group)	Length of hospital stay (NS) ICU mortality (p =.001) Length of ICU stay (p =.04) Duration ventilation (p = .03)
(21)	Mo et al (2011)	A Clinical Trial Study	Year1 (2008), n= 629 Year2 (2009), n= 677	To recorded the data of ICU patients getting either parental or enteral nutrition	Length of ICU stay (NS) Length of hospital stay (NS)
(22)	Doig et al (2008)	A Cluster-Randomized Controlled Trial Study	Study group, n= 561 Control group, n= 557	Implementation of evidence-based feeding guidelines	Mortality rate (NS) Length of hospital stay (NS) Length of ICU stay (NS)
(23)	Woien et al (2006)	A Randomized Clinical Trial Study	Study group, n= 21 Control group, n= 21	A nutritional support algorithm by using the enteral route or combining enteral and parenteral nutrition	Mean delivery of nutrients per day (p =.02) Mean delivery of their nutrients in the form of enteral nutrition (p = .03)
(24)	Jain et al (2006)	A Cluster-Randomized Controlled Trial	Active group, n= 325 Passive group,	To provide multifaceted educational interventions including Web-based tools to dietitians	Length of ICU stay (NS) Length of hospital stay (NS) 28-day mortality rate (NS)

	Study	n= 298	(active group) and cpgs to dietitians (passive group)
(25)	<b>Martin et al (2004)</b>	A Cluster-Randomized Controlled Trial Study	study group, n= 248 control group, n= 214
		Implementation of evidence-based algorithms	Length of hospital stay (p=.003) Hospital mortality rate (p =.058) Length of ICU stay (NS)

\* NS: Not Significant

#### 4. Discussion

Regarding the articles entered into systematic review it can be said that although nutrition support can cause improvement of nutrition quality in Patients' calorie intake, the hypothesis that "nutrition support would lead to patients' better clinical outcomes" is challenging. Different protocols can be used in order to provide nutrition support for intensive care patients leading to different outcomes; therefore, there is no single conclusion and all these refer to lack of a specific protocol.

There are a few experimental studies regarding nutrition support based on personal needs and programmed protocols along with daily evaluation of patients' nutrition status in intensive care and most studies have been performed using descriptive and survey methods which can be an experimental obstacle according to the author's personal experience. Some examples include patients' NPO in special days due to diagnostic, laboratory or even surgical measures, a change in diet due to side effects of different medicine such as diarrhea of antibiotics, background problems such as diabetes, chronic obstructive pulmonary, cancer and so on, old age of patients above 70 years, organ failure like kidney and liver (Albumin is produced as a nutrition indicator in liver), unstable homodynamic conditions, lack of nutrition support team (including some experts, pharmacist, nutrition specialist, expert nurses in medical and surgical intensive care), and finally high costs of performing researches. These problems along with many other have made the work of researcher very difficult.

Caroline (2009) states that implementation of nutrition based on a standard protocol is the best effort which can be done by any clinic in order to achieve better results in patients and decrease long-term hospitalization and mortality (15).

Adam webtson (2012) introduces four major areas for a useful nutrition protocol:

1. Patient choice: Ensuring a specific diet for each patient with a special formula for nutrition support.
2. Programming for nutrition treatment: Ensuring onset and continuity of diet at proper time
3. Providing energy and nutrients: Ensuring access to sufficient nutrients based on specific ratio
4. Combination of diets: Ensuring access to nutrients formulation based on each patient's specific needs (1).

In included studies, different limitations such as low sample volume, time, lack of control group, lack of evaluation of nutrition conditions by nutrition experts and lack of team work were considered. Different factors affect patients' outcome hospitalized in ICU but their simulation is not possible in all cases. The major gap of these articles is the investigation of the effects of a nutrition support on patients' outcomes. As nutrition needs are determined individually, there is a need for daily evaluation of nutrition conditions and it would be better to use nutrition indicators such as Albumin, pre-albumin, Maastricht indicators, index of nutrition risks and other biochemical amounts in order to investigate the effects of nutrition support while more attention is paid to patients' outcomes.

#### 5. Conclusion

According to the results of this systematic review, there are no specific and identical statistics on the effects of nutrition support on patients' outcomes in intensive care which can be challenging. Regarding the studies, it is suggested that a broad study with a proper sample size is needed in which nutrition support is applied through a standard protocol and based on patients' needs. In such a study, a safe method is performed at a proper time along with exact evaluation of nutrition status and patient outcomes.

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