

# The effectiveness of nutrition care training program to nurses of Intensive Care Unit on patient's nutritional consequences

*La efectividad del programa de capacitación en atención nutricional para enfermeras de la unidad de cuidados intensivos sobre las consecuencias nutricionales del paciente*

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## Abstract

**Objective:** Malnutrition is a common problem among hospitalized patients. The problem is worse in patients under intensive care units. This study evaluated the effectiveness of nutritional care training in intensive care units and its effects on patients.

**Methods:** In the interventional study with parallel design 60 patients (30 in each group) of ICU were selected by available sampling amongst 104 hospitalized patients according to input/output criteria. The intervention was designed according to the Nutritional Care Guidelines of the American Society for Parenteral and Enteral Nutrition (ASPEN) and the American Association of Critical-care Nurses (AACN) then the nurses of the mentioned wards were trained for one month (4 one-hour sessions). The pre and post-intervention nutritional status of the patients were assessed using a checklist previously has ordered by the Ministry of Health (IR, Iran) to be applied in the patients. Both groups were homogeneous, and the collected data were analyzed applying the Kolmogorov-Smirnov, Mann-Whitney-U, and Friedman test using SPSS software ver19.

**Results:** There were no significant differences between the groups in terms of age, sex, body weight, APACHE score, admission/hospitalization, alcohol consumption, smoking, history of hospitalization, marital status, type of insurance, and surgery ( $p < 0.05$ ). Results showed a significant reduction of nausea ( $p = 0.001$ ), vomiting ( $p = 0.0001$ ), constipation ( $p = 0.002$ ), diarrhea ( $p = 0.004$ ) but no significant in body weight gain and aspiration rate ( $p < 0.05$ ).

**Conclusion:** Regarding the importance of nutrition and its effect on improving patients' condition, it is more highlighted that cohering to standard nutrition principles then continuous training of the nurses can lead to better patient outcomes.

**Keywords:** Malnutrition, Intensive Care Unit (ICU), APACHE, Nutritional Support.

## Resumen

**Introducción:** La desnutrición es un problema común entre los pacientes hospitalizados. El problema se agrava en los pacientes sometidos a unidades de cuidados intensivos. Este estudio evaluó la eficacia de la formación en cuidados nutricionales en las unidades de cuidados intensivos y sus efectos en los pacientes.

**Material y métodos:** En el estudio de intervención con diseño paralelo se seleccionaron 60 pacientes (30 en cada grupo) de la UCI por muestreo disponible entre 104 pacientes hospitalizados según criterios de entrada/salida. La intervención se diseñó de acuerdo con las Guías de Cuidados Nutricionales de la Sociedad Americana de Nutrición Parenteral y Enteral (ASPEN) y de la Asociación Americana de Enfermeras de Cuidados Críticos (AACN) y luego se entrenó a las enfermeras de las salas mencionadas durante un mes (4 sesiones de una hora). Se evaluó el estado nutricional de los pacientes antes y después de la intervención utilizando una lista de comprobación que el Ministerio de Sanidad (IR, Irán) había ordenado previamente que se aplicara a los pacientes. Ambos grupos eran homogéneos, y los datos recogidos se analizaron aplicando las pruebas de Kolmogorov-Smirnov, Mann-Whitney-U y Friedman utilizando el software SPSS 19.0.

**Resultados:** No hubo diferencias significativas entre los grupos en cuanto a edad, sexo, peso corporal, puntuación APACHE, ingreso/hospitalización, consumo de alcohol, tabaquismo, antecedentes de hospitalización, estado civil, tipo de seguro y cirugía ( $p < 0.05$ ). Los resultados mostraron una reducción significativa de las náuseas ( $p = 0.001$ ), los vómitos ( $p = 0.0001$ ), el estreñimiento ( $p = 0.002$ ) y la diarrea ( $p = 0.004$ ), pero no fueron significativos en el aumento de peso corporal ni en la tasa de aspiración ( $p < 0.05$ ).

**Conclusiones:** En cuanto a la importancia de la nutrición y su efecto en la mejora del estado de los pacientes, se destaca que la coherencia con los principios de nutrición estándar y la formación continua de las enfermeras pueden conducir a mejores resultados en los pacientes.

**Palabras clave:** Malnutrición, Unidad de Cuidados Intensivos, APACHE, soporte nutricional

## Introduction

Nutrition is one of the primary and physiological needs of human beings and is essential for the maintenance of life, growth, development, tissue repair, and the function of limbs and organs then cells changed when a person is hospitalized<sup>1,2</sup>. Patients with high stress or severe injury are exposed to breakage of body proteins and energy storage loss, leading to the compromised treatment, infection increase, recovery delay, lasting hospitalization time, increased hospital costs, and mortality rate<sup>3-5</sup>. Malnutrition is more prevalent in ICU patients than in conventional care units<sup>6,7</sup>. The term "malnutrition" implies inappropriate feeding. Though recently published data from developed countries report overfeeding and overestimating patients' nutritional needs, evermore received food volume has bettered patients' outcomes<sup>8-10</sup>, but we encounter some Iran controversies. While a few studies reporting the nutritional status is "better than other countries,"<sup>11</sup> and 62% of critical nurses have good performance in nutrition care<sup>12</sup>, others say malnutrition (less than body requirements) doubled in discharge day in comparison to admission<sup>13</sup>, sometimes prepared nutritional solutions have less energy index but higher in bacterial colony count according to allowed amounts. At least 40% of patients in intensive care units do not have adequate nutritional support<sup>14,15</sup> and finally, the patients' energy intake was lower than his/her requirements<sup>16</sup> even if the various type of feeding was applied in terms of continuous, intermittent and or parenteral nutritional feeding methods<sup>17</sup>.

According to ASPEN and AACN, nurses are considered as the primary member of the nutrition team in intensive care units<sup>18</sup>, but the latest (2020) article in the field from a well-known Namazi Hospital of Shiraz indicating that more than 75% of ICU nurses have not adequate knowledge in enteral feeding<sup>19</sup> warning all medicals to stir in the field.

The study evaluates a nutritional support program's effectiveness based on ASPEN and AACN to ICU nurses on patients' nutritional consequences.

## Materials and methods

The work derived from an MSc thesis carried out in the Nursing Faculty of Baqiyatallah University of Medical Sciences with ethical code of IR.BMSU.Rec.1397.020.

This clinical trial study was done with two parallel-group designs at the intensive care unit of Baqiyatallah Hospital in Tehran, Iran. In the study, the medical intensive care unit (ICU3) and all nurses working in this unit were selected based on research according to input criteria through available sampling. Inclusion

criteria: working in the unit (for nurses), GCS 15 and ability to verbal communication, age over 18 years, and hospitalization stay probably would last at least for one week (for patients). Exclusion criteria: patient's death/transfer or underwent mechanical ventilation within one week of sampling, hospitalization for more than one month, patient's discharge before the end of the first week.

Considering the difference between the mean and standard deviation of the previous studies' variables, the total required sample size was estimated 56 samples using Altman plot with  $\alpha = 0.05$  and  $\beta = 0.10$  and power = 90 %. Based on the calculation, 30 patients were randomly assigned to each group with 10% attrition<sup>20</sup>. The collected data were entered into SPSS statistical software version 19 and analyzed using descriptive and analytic statistics. The Kolmogorov-Smirnov test was used to determine the normality of the data then Mann-Whitney-U and Friedman tests were applied to comparison using SPSS software ver19.

At first, a training program for nurses was designed, and educational material was provided using ASPEN and AACN guidelines, including the following topics:

- Enteral nutrition and problems (nausea and vomiting, diarrhea, constipation, pulmonary aspiration and prohibition of enteral nutrition and precautions
- Parenteral nutrition
- Enteral nutrition in specific diseases
- Short and long term enteral feeding methods
- Determining nutritional needs
- And positioning of the patients.

They were receiving an agreement letter of action from the deputy for IR's research and ethical code.BMSU. Rec.1397.020, the first phase of sampling run for 76 days to obtain 30 patients. Basic relevant data and nutritional consequences of patients, including APACHE score, body weight, nausea, vomiting, constipation, diarrhea, and pulmonary aspiration, were assessed using a checklist (extracted from the specialized evaluation questionnaire of nutrition status of the Ministry of Health, Iran) and patients who did not have the input and output conditions of the study were excluded from the study.

In the second phase, all nurses responsible for caring for patients in the unit participated in a 4 weeks training period containing 4 one-hour sessions. The educational materials taken from ASPEN and AACN, educational pamphlets, and related PowerPoint files have been given to the nurses alongside the sessions.

In the third (post-training) phase, 30 patients were selected again during 74 days according to input criteria and full accordant to the first phase.

## Results

### Dropouts

We primarily included 104 patients in the study based on the inclusion criteria. Twenty-first out of 51 patients in the comparison and 23 out of 53 in the intervention group were excluded due to transfer to other wards or dying.

### Demographics

Comparing the two groups' demographics, there was no significant difference in terms of sex, admission/hospitalization, marital status, type of insurance support, literacy level, employment status, APACHE score, and the patients' bodyweight ( $p < 0.05$ ). The majority of the sample (65%) were in the elementary level of literacy, and 56% were female. Comparison between the two groups is summarized in **tables I** and **II**.

### APACHE score

Since the groups were homogeneous in terms of demographic information, the APACHE score was used to homogenize the patients accurately, which evaluates the level of the patient's physiological status that there was no statistically significant difference (**Table II**) ( $P > 0.05$ ).

### Bodyweight

The study's main target was increased day-to-day in the intervention group in comparison and weight loss was reduced, but it was not significant ( $P > 0.05$ ) as shown in **table III**.

### Nausea, Vomiting, Diarrhea, Constipation and pulmonary aspiration:

The intervention group reported more nausea rate reduction than the comparison group considering 1<sup>st</sup>, 4<sup>th</sup> and 7<sup>th</sup> day of hospitalization in ICU ( $P = 0.001$ ). The group's total nausea was significantly reduced in contrast to the comparison group ( $P = 0.0001$ ). The reduction of vomiting rate comparing the two groups during the 3-time measurement was not significant ( $p > 0.05$ ), but total vomiting rate reduction was significant considering the comparison group on day 7<sup>th</sup> of hospitalization ( $p < 0.0001$ ). The same occurred for diarrhea status in the intervention group ( $p > 0.05$ ), but the group has reported

less diarrhea rate than the comparison group on day 7 of hospitalization ( $p < 0.002$ ). The intervention group on 7<sup>th</sup> day was less constipated than the comparison group ( $p > 0.004$ ), but the rate in the groups did not significantly differ comparing the 3-time measuring ( $p > 0.05$ ). Pulmonary aspiration rate differences were not significant in 3-time measuring and compared to the comparison group on the 7<sup>th</sup> day of hospitalization ( $p > 0.5$ ). Details are summarized in **table IV**.

## Discussion

After training ICU nurses on nutrition in the present study, the intervention group reported lower nausea, vomiting, diarrhea, and constipation but no more pulmonary aspiration rate than the comparison group. Day-by-day improvement in the intervention group was occurred comparing the comparison group, but no significant differences were observed in terms of diarrhea, constipation, and pulmonary aspiration.

Accordingly, Ros et al. (2009) conducted a review and concluded that a multidisciplinary approach should be established to improve patients' nutrition in ICUs then critical care nurses are well placed on the core of such a line<sup>20</sup>. Additionally, Elpern et al. (2004) reported a significant reduction in nausea, vomiting, and aspiration rate during the 3 months of enteral feeding on patients hospitalized in medical ICU. They used the "precautionary interruptions" technique to decreased aspiration rate<sup>21</sup> as we applied in our study.

We summarized ASPEN and AACN guidelines in the forms of pamphlets and PowerPoint files in the ward's bookshelves accessible to the nurses' to promote their knowledge. In an observational study, Mistry (2019) assessed satisfactory level of knowledge, unsatisfactory level of practice, and positive attitude of nasogastric tube feeding of ICU nurses in Egypt, recommending that the nursing procedure book be available ICUs<sup>22</sup>.

Incomplete adherence to the standards repeatedly is frequently reported in indoor studies. Al-Jalali et al.

**Table I:** The distribution of demographics and comparison between the groups.

↓ Variable	Frequency →	Comparison group Number (%)	Intervention group Number (%)	Total Number (%)	The significance Level (P Value)
Literacy level	Elementary	20 (66.7)	19 (63.3)	39 (65)	(P > 0.05)
	Middle	0 (0)	3 (10)	3 (5)	
	Under the diploma	1 (3.3)	1 (3.3)	2 (3.3)	
	Diploma	7 (23.3)	3 (10)	10 (16.65)	
	Academic	2 (6.6)	4 (13.3)	6 (10)	
Gender	Male	12 (40)	14 (46.7)	26 (43.3)	(P > 0.05)
	Female	18 (60)	16 (53.3)	34 (56.7)	
Type of admission	Hospital wards	13 (43.3)	16 (53.3)	29 (48.3)	(P > 0.05)
	Emergency	17 (56.7)	14 (46.7)	31 (51.7)	

**Table II:** The mean and standard deviation of the APACHE score.

Groups and frequency ↓ Variable →	Comparison group	Intervention group	Significance Level (P-Value)
Number of patients	30	30	P< 0.05
The mean APACHE score	18.73	17.36	
Standard deviation	6.8	7.1	

**Table III:** Comparison of weight between the comparison and intervention groups.

Bod Weight →	Mean (SD) (kg)		Significance Level
↓ Time of measuring	Comparison group	Intervention group	
First day in ICU	67.2 (12.8)	68.3(11)	P< 0.05
Fourth day in ICU	66.7 (12.6)	68.1(10.4)	P< 0.05
Seventh day in ICU	66.2 (13.2)	67.9(10.3)	P< 0.05
Difference between the 1st and 7th day	0.9	0.3	P< 0.05
Significance Level	P< 0.05	P< 0.05	

**Table IV:** Comparing the frequency of nausea, vomiting, constipation, diarrhea, and aspiration in two comparison and intervention groups.

Variable		First day in ICU		4th day in ICU		7th day in ICU		Significance Level (P-Value)
		Comparison group % (time)	Intervention group	Comparison group	Intervention group	Comparison group	Intervention group	
Nausea (times)	No	15 (50)	17 (56.7)	12 (40)	26 (86.7)	14 (46.7)	27 (90)	Friedman test† P = 0.001 Mann-Whitney‡ P = 0.0001
	Once	1 (3.3)	1 (3.3)	7 (23.3)	1 (3.3)	10 (33.3)	1 (3.3)	
	Twice	7 (23.3)	8 (26.7)	10 (33.3)	10 (33.3)	5 (16.7)	2 (6.7)	
	Three	5 (16.7)	4 (13.3)	1 (3.3)	0	1 (3.3)	0	
	Four	2 (6.7)	0	0	0	0	0	
Vomiting (times)	No	16 (53.3)	24 (80)	17 (56.7)	28 (93.3)	20 (66.7)	30 (100)	Friedman test P<0.05 Mann-Whitney P = 0.0001
	Once	26.7(8)	3 (10)	10 (33.3)	1 (3.3)	7 (23.3)	0	
	Twice	4 (13.3)	3 (10)	3 (10)	1 (3.3)	3 (10)	0	
	Three	1 (3.3)	0	0	0	0	0	
	Four	1 (3.3)	0	0	0	0	0	
Diarrhea	No	20 (66.7)	25 (83.3)	22 (73.3)	26 (86.7)	20 (66.7)	29 (96.7)	Friedman test P>0.05 Mann-Whitney P = 0.002
	Once	5 (16.7)	4 (13.3)	6 (20)	4 (13.3)	6 (20)	1 (3.3)	
	Twice	4 (13.3)	1 (3.3)	2 (6.7)	0	4 (13.3)	0	
	Three	1 (3.3)	0	0	0	0	0	
	Four	0	0	0	0	0	0	
Constipation	Yes	4 (13.3)	4 (13.3)	3 (10)	4 (13.3)	5 (16.7)	2 (6.7)	Friedman test P>0.05 Mann-Whitney P = 0.004
	No	26 (86.7)	26 (86.7)	27 (90)	26 (86.7)	25 (83.3)	28 (93.3)	
Aspiration	Yes	9 (30)	2 (6.7)	11 (36.7)	2 (6.7)	8 (26.7)	2 (6.7)	Friedman test P> 0.05 Mann-Whitney P> 0.05
	No	21 (70)	28 (93.3)	19 (63.3)	28 (93.3)	22 (73.3)	28 (93.3)	

† Friedman test to compare 3 times of measurement in the two groups; ‡Mann-Whitney-U to compare between the two group

(2019) from North Khorasan province reported merely 86% conformity to standard feeding was observed "during tube feeding" but the conformity rate reduced to 3.8% and 2.3% in pre and post feeding phases respectively highlighting a crucial need to adherence to standards of feeding<sup>23</sup> as previously reported by Ashuri et al. (2012) mentioning the mean score of the measures (during, pre and post phases) in gastrostomy feeding was significantly lower than standards and concluded a comprehensive training program is needed both to train the nurses and the patients<sup>24</sup>.

Although Rubin et al.. (2019) reported a one-day held workshop for community nurses could significantly improve their knowledge about enteral feeding<sup>25</sup>. However, to obtain more effectiveness, our training program was designed to be run for a month (one session per week) to let the nurses review and practice the educational reminder pamphlets. The positioning of the patients was the last topic our training program

based on ASPEN and AACN to attain adequate patient's intake<sup>1,2</sup>, Rezaee et al. (2018) accordantly reported positioning the patients on the right side after enteral feeding resulted in lower Gastric Residual Volume (GRV) improving patient's condition<sup>26</sup>.

According to AACN and ASPEN, we raised the patient's enteral intake to 500 mL of gavage each time if there was no nausea and vomiting, and there was no significant difference considering the comparison group. More studies have rejected any relation between pulmonary aspiration rate and increased GRV<sup>27,28</sup>, but more nurses give enteral feeding if GRV measured is less than 250cc in fear of aspiration pneumonia<sup>29</sup>.

According to the study, it was found that patients' weight loss has been reduced by increasing the level of nurses' awareness AACN and ASPEN guidelines accordant to Nematy et al. (2012) from Ghaem Educational Hospital reporting a slight improvement in patient's weight and

BMI during a hospital stay<sup>30</sup>, but the finding is discordant to more reported studies in the country as Kimiaei et al. (2017) echoed a significant reduction in BMI and body weight in a couple of weeks of ICU stay<sup>31</sup> or Hoseini et al. (2006) that reported a significant reduction in BMI of patients in comparison to admission data at Shariati Educational Hospital of Tehran<sup>32</sup>.

## Conclusion

Educating nutrition support to ICU nurses and adherence to standard principles such as ASPEN and AACN

improved patients' outcomes, decreasing nausea, vomiting, diarrhea, constipation, weight loss, and no a significant increase in aspiration rates. It is recommended that nutritional support education should be a primary concern of stakeholders in the country.

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