Acta Medica Alanya

RESEARCH ARTICLE

ARAŞTIRMA

Acta Medica Alanya

2020;4(1): 43-47.

DOI:10.30565/medalanya.639335

Is diabetes mellitus associated with malnutrition in patients in intensive care unit? Diabetes and malnutrition

Yoğun bakım hastalarında diyabetes mellitus malnütrisyonla ilişkili midir? Diyabet ve malnütrisyon

Avşar Zerman[1], Şakir Özgür Keşkek[2]*

[1] *Department of Internal Medicine, Division of Intensive Care Unit, City Training and Research Hospital, Adana, Turkey.*

[2] *Alaaddin Keykubat University, School of Medicine, Department of Internal Medicine,Alanya,Antalya,Turkey.*

ABSTRACT

Aim: Types of diseases and treatment modalities can also lead to the exacerbation of malnutrition. The aim of this study was to investigate nutritional status of patients with diabetes mellitus in the intensive care unit of a tertiary hospital.
Materials and methods: One hundred and ninety-two patients were enrolled and divided into two groups. The study group comprised of 77 patients with type 2 diabetes and the control group comprised of 115 patients without diabetes. The nutritional risk assessment was tested with NRS (Nutritional Risk Screening) 2002, Nutric score, MNA (Mini-Nutritional Assessment) and MUST (Malnutrition Universal Screening Tool).
Results: The groups were comparable according to the NRS 2002 (3.37 ± 1.84 vs. 3.93 ± 1.72, p = 0.075), Nutric score (4.61 ± 1.85 vs. 4.56 ± 1.85, p = 0.869), MNA (8.0 ± 3.1 vs. 7.1 ± 3.2, p = 0.068) and MUST score (1.62 ± 1.46 vs. 1.81 ± 1.59, p = 0.456).
Conclusion: In this study, the risk of malnutrition is comparable in both groups. This result may suggest that malnutrition is also related to co-morbidities in addition to diabetes.

Keywords: Diabetes mellitus, malnutrition, intensive care unit

ÖZ

Amaç: Hastalık türleri ve tedavi yöntemleri yetersiz beslenmenin alevlenmesine yol açabilir. Bu çalışmada, üçüncü basamak bir hastanenin yoğun bakım ünitesinde (YBÜ) diyabetes mellituslu hastaların beslenme durumunun araştırılması amaçlandı.
Yöntem: Yüz doksan iki hasta çalışmaya dahil edildi ve iki gruba ayrıldı. Çalışma grubuna tip 2 diyabetli 77 hasta, kontrol grubuna ise diyabeti olmayan 115 hasta alındı. Beslenme durumu ve riski NRS (Nutritional Risk Screening) 2002, Nutric skoru, MNA (Mini-Nutritional Assessment) ve MUST (Malnutrition Universal Screening Tool) testleri ile değerlendirildi.
Bulgular: Gruplar NRS 2002 (3.37 ± 1.84 vs. 3.93 ± 1.72, p = 0.075), Nutric skoru (4.61 ± 1.85 vs. 4.56 ± 1.85, p = 0.869), MNA (8.0 ± 3.1 vs. 7.1 ± 3.2, p = 0.068) ve MUST skoruna (1.62 ± 1.46 vs. 1.81 ± 1.59, p = 0.456) göre benzer bulundu.
Sonuç: Bu çalışmada, malnütrisyon riski her iki grupta benzer bulundu. Bu sonuç malnütrisyonun diyabete ek olarak eşlik eden diğer hastalıklarla da ilişkili olduğunu düşündürmektedir.

Anahtar kelimeler: Diyabetes mellitus, malnütrisyon, yoğun bakım ünitesi

Received 28.10.2019 Accepted 19.12.2019 Published (Online):02.03.2020

***Corresponding author:** Şakir Özgür Keşkek, Alaaddin Keykubat University, School of Medicine, Department of Internal Medicine, Alanya/Antalya, Turkey, Phone: +905052996942 E-mail: drkeskek@yahoo.com

ORCID:0000-0001-5888-3123

To cited: Zerman A, Keskek SO. Is diabetes mellitus associated with malnutrition in patients in intensive care unit? Diabetes and malnutrition. Acta Med Alanya 2020;4(1):43-47. doi:10.30565/medalanya.639335

INTRODUCTION

Nutrition support in the Intensive Care Unit (ICU) is very important since it has a significant impact on recovery from illness and overall outcome. Patients in the ICU have a higher risk of malnutrition than patients undergoing general admission to hospitals [1]. Malnutrition is associated with poorer clinical outcomes, including postoperative problems, morbidity and mortality [2,3].

Nutritional risks to a patient should be assessed at the time of admission to the ICU, and the enteral nutrition should be started preferably within 24 h [4]. Due to the impaired intake of nutrient and the hypercatabolic-hypermetabolic response to injury or severe illness, severe protein calorie malnutrition is common in patients in the intensive care unit [5]. Types of diseases and treatment modalities can also lead to the exacerbation of malnutrition [6].

Malnutrition is a common public health problem but is generally under-recognized as a health concern in patients [7]. It is also a common problem in elderly patients: depending on the screening and assessment methods used, malnutrition is present in 5%–30% of older adults [7].

Diabetes mellitus (DM) is a common chronic metabolic disease associated with serious complications, demand for multimodal treatment, and significant economic burden [8]. With the development of complications and hospital lengths of stay, life expectancy is worsened with diabetes, and nutritional status is generally correlated with these total outcomes.

The aim of this study was to investigate the nutritional status of patients with diabetes in the ICU of a tertiary hospital.

MATERIAL and METHODS

This retrospective study was conducted in the internal medicine intensive care unit of a tertiary hospital in Turkey from 20 December 2017 to 20 February 2018. The Institutional Review Board approved this study and all procedures were followed in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration. Patients treated in the ICU between September 2015 and February 2018 were scanned. One hundred and ninety-two patients were enrolled and divided into two groups. The study group comprised of 77 patients with type 2 diabetes and the control group comprised of 115 patients without diabetes. All patients had co-morbidities such as sepsis, renal failure, respiratory insufficiency, cardiovascular diseases, cerebrovascular diseases, gastrointestinal system diseases, malignancies, etc.

The nutritional risk assessment was tested with NRS (Nutritional Risk Screening) 2002, Nutric score, MNA (Mini-Nutritional Assessment) and MUST (Malnutrition Universal Screening Tool). The NRS-2002 consists of a nutritional score and severity of disease score and an age adjustment for patients aged >70 years. Nutritional score was calculated as follows: weight loss >5% in 3 months or food intake below 50% to 75% in preceding week=1; weight loss >5% in 2 months or BMI 18.5 to 20.5kg/m2 and impaired general condition or food intake 25% to 60% in preceding week=2; and weight loss >5% in 1 month or >15% in 3 months or BMI <18.5kg/m2 and impaired general condition or food intake 0% to 25% in preceding week=3. Severity of disease score: hip fracture, chronic patients with acute complications=1, major abdominal surgery, stroke, severe pneumonia, hematological malignancies=2, and head injury, bone marrow transplantation, intensive care patients with Acute Physiology and Chronic Health Evaluation (APACHE) score >10=3. NRS-2002 score is the total of the nutritional score, and severity of disease score and age adjustment. Patients are classified as no risk=0, low risk=0 to 1, medium risk=3 to 4, and high risk ≥4 [9].

The Mini Nutritional Assessment Screening Form is a nutritional screening tool especially designed for the older population. It consists of 6 questions, scored from 0 to 2 or 3. These questions deal with weight loss, appetite, mobility, psychological stress, neuropsychological problems, and BMI [10].

The NUTRIC score was calculated using age, number of co-morbidities, number of days between admittance to hospital, APACHE II at admittance and the sequential organ failure assessment

(SOFA) score [9].

Age, gender, body mass index (BMI), ICU length of stay, Glasgow coma score, APACHE II, SOFA, invasive mechanical ventilator (IMV) frequency, duration of IMV, NRS 2002, Nutric score, MNA and MUST score, and co-morbidities were recorded.

The MedCalc 18.2.1 software program (MedCalc Belgium) was used for statistical analysis. Data was reported as the mean ± standard deviation. The Kolmogorov-Smirnov test was used to show the normal distribution of quantitative measurements. Chi-square was used to test the statistical significance of differences in gender distribution and malnutrition risk. T test or Mann Whitney U tests were used for comparison of quantitative measurements (age, BMI, Glasgow coma score, APACHE II, SOFA, duration of IMV, NRS 2002, Nutric score, MNA and MUST score) between the two groups. An odds ratio was used to analyze the degree of association between the malnutrition score and diabetes. The probability of making a Type I error (alpha, significance) is 0.05 in all tests.

RESULTS

Table 1 shows the baseline characteristics and comparisons of the study and control groups. The groups were matched in terms of age and gender (p = 0.091, 0.426, respectively). The mean ages of the study and control groups were 68.6 ± 13.4 and 71.6 ± 14.6 years old, respectively. There were 38 women and 39 men in the study group, and 46 women and 69 men in the control group. Patients with diabetes had higher BMIs compared to patients without diabetes (28.7 ± 7.5 vs. 24.4 ± 4.4, p<0.001). Intensive care unit length of stay was comparable in diabetic and non-diabetic patients (10.6 ± 10.3 vs. 8.9 ± 7.6 days, p = 0.422, respectively, table 1). There was no statistically significant difference between the groups according to the invasive mechanical ventilator (IMV) frequency and duration of IMV (p=0.243, p=0.06, respectively, table 1).

The percentages of co-morbidities for each group are shown on table 2. The Glasgow coma score, APACHE II and SOFA of the both groups were comparable (p > 0.05, for each, table 2).

Frequencies of malnutrition risk in patients with diabetes according to the NRS 2002, Nutric score, MNA and MUST score were 77.9%, 53.2%, 41.6%, 66.2%, respectively while they were 87.8%, 55.7%, 55.7%, 67.8% in patients without diabetes. There were no difference between the groups according to the malnutrition risk frequencies (p=0.586, 0.810, 0.264, 0.918, respectively, table 2).

Table 1. Demographical characteristics of the groups.

	DM (+) N=77	DM (-) N=115	p
Age (years)	68.6 ± 13.4	71.6 ± 14.6	0.091
Female N (%)	38 (49.4%)	46 (40.0%)	0.426
BMI kg/m^2	28.7 ± 7.5	24.4 ± 4.4	<0.001
IMV frequency	31 (40.3%)	33 (28.7%)	0.243
Duration of IMV	10.8 ± 13.5	6.2 ± 4.2	0.06
Intensive care unit length of stay (days)	10.6 ± 10.3	8.9 ± 7.6	0.422

DM: Diabetes Mellitus, BMI: Body Mass Index, IMV: Invasive mechanical ventilator

Table 2 Comparison of the groups according to the co-morbidities, disease severity and nutrition status

	DM (+) N=77	DM (-) N=115	p
Co-morbidities			
Sepsis	39 (50.6%)	61 (53.0%)	0.855
Respiratory insufficiency	48 (62.3%)	59 (51.3%)	0.424
Renal failure	27 (35.1%)	34 (29.6%)	0.566
Cardiovascular disease	22 (28.6%)	27 (23.5%)	0.543
Cerebrovasculardisease	18 (23.4%)	33 (28.7%)	0.532
Gastrointestinal system disease	6 (7.8%)	14 (12.2%)	0.379
Malignancies	9 (11.7%)	20 (17.4%)	0.351
Disease severity			
Glasgow	12.7 ± 2.5	12.7 ± 2.3	0.760
APACHEII	21.1 ± 6.6	20.5 ±6.3	0.539
SOFA	4.4 ± 2.4	5.0 ± 3.2	0.136
Malnutrition risks			
NRS 2002	60 (77.9%)	101 (87.8%)	0.586
Nutric score	41 (53.2%)	64 (55.7%)	0.810
MNA	32 (41.6%)	64 (55.7%)	0.264
MUST score	51 (66.2%)	78 (67.8%)	0.918
Malnutrition scores			
NRS 2002	3.37 ± 1.84	3.93 ± 1.72	0.075
Nutric score	4.61 ± 1.85	4.56 ± 1.85	0.869
MNA	8.0 ± 3.1	7.1 ± 3.2	0.068
MUST score	1.62 ± 1.46	1.81 ± 1.59	0.456

The groups were comparable according to the NRS 2002 (3.37 ± 1.84 vs. 3.93 ± 1.72, p = 0.075), Nutric score (4.61 ± 1.85 vs. 4.56 ± 1.85, p =

0.869), MNA (8.0 ± 3.1 vs. 7.1± 3.2, p = 0.068) and MUST score (1.62 ± 1.46 vs. 1.81 ± 1.59, p = 0.456, table 2). According to the odds ratio, there was no association between any of malnutrition score and diabetes (p=0.07, 0.742, 0.056, 0.817, respectively, table 3).

DISCUSSION

In this study, we investigated the nutritional status of patients with diabetes in an internal medicine intensive care unit. We tried to show the effect of diabetes on nutritional status in ICU patients. We used nutritional risk assessment tests and we compared both groups according to NRS 2002, Nutric score, MNA and MUST score. A variety of methods were used to evaluate the nutritional situation of patients admitted to hospital. As there is no gold standard of nutritional evaluation, and as most of the methods are inconvenient and time-consuming, they were not routinely used [11]. In most of the previous studies NRS 2002 and MNA are commonly used. Nutric score was not studied for patients with diabetes in the ICU but it was found to be superior to NRS 2002 for assessing malnutrition risk in the patients [12]. It has also better performance than the commonly used MUST score in critically ill patients [13]. According to the current study results, we found comparable nutritional scores in both of the groups with all nutritional risk assessment tests.

Diabetes mellitus is a risk for malnutrition [14] and diabetic patients with malnutrition are at an increased risk of morbidity and mortality. This condition also lowers quality of life and increases the medical costs [15-17]. In this study we found that 77.9%, 53.2%, 41.6%, 66.2% of patients with diabetes were malnourished, according to the NRS-2002, Nutric score, MNA and MUST score, respectively. A few previous studies have investigated malnutrition in patients with diabetes: in Spain, in a prospective observational study, Sanz et al. reported that 21.2% of patients with diabetes were malnourished and accounting for half of the in-hospital deaths. The nutritional evaluation was carried out only with the MNA, within the first 24-72 hours of hospital admission, in their study [16]. In the current study, we have found 41.6% according to the MNA test, though the frequency of malnourished patients was higher in our study since we enrolled only internal medicine ICU patients and these patients had severe diseases. On the other hand, the majorities of the patients were elderly and all had co-morbidities. Frequency of malnutrition in elderly patients in hospital was studied before and the estimated frequency was found to be 29%–61% in an elderly hospital population [15-17].

In this study, the BMI of patients with diabetes was higher than the patients without diabetes. Overweight condition is an indicating factor for the pathogenesis of type 2 diabetes mellitus. Adipose tissue increases insulin resistance and proinflammatory cytokine production (leptin, tumor necrosis factor and interleukin-6), leading to increased fasting blood glucose levels in patients and ultimately inducing type 2 diabetes [18]. In accordance with this link, 15.5% of the malnourished patients with diabetes were reported as obese in the literature [19]. In a multicenter study in Belgium, Vanderwee et al. analyzed 2 329 elderly hospitalized patients for malnutrition. Of these patients 455 (11.9%) were diabetes mellitus. They reported the risk of malnutrition as 43% according to the MNA [20] and this result is similar to ours. Vischer et al. conducted a single center study on 164 (37.2% with diabetes mellitus) in patients in Switzerland. They defined the risk of malnutrition prevalence as 50.5% according to the MNA [21].

Our study had some limitations. Firstly, the retrospective study design may be considered a limitation. Secondly, it would have been beneficial if the groups had been designed homogeneously. Thirdly, the correlation analyses between HbA1c and nutritional scores were not performed and fourthly, a multicenter study with a larger sample size could have given clearer results. On the other hand, according to our scan of the literature, this is the first study that investigated the nutritional status of patients with diabetes in an ICU. Additionally, we checked the patients for malnutrition with four different nutritional assessment tests and finally, the severity of illnesses were comparable in both groups.

In conclusion, the risk of malnutrition was comparable in both groups in our ICU and this result may indicate that traditional screening and

assessment tools could not uniformly identify diabetic patients as malnourished or at nutrition risk, in the context of an ICU. Additionally, our results suggest that the malnutrition may not only be associated with diabetes, but also related to co-morbidities. There may be other considerations for older and inpatient subjects, such as reduced energy requirements, decreased taste and smell sensitivities, decreased appetite, polypharmacy, chronic illness, functional status, social factors, etc. [22].

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Nothing to declare.

Funding sources: The authors received no financial support.

Conflict of Interest: The authors have no relevant conflicts of interest and received no financial advantage for this article.

REFERENCES

1. Sioson MS, Martindale R, Abayadeera A, Abouchaleh N, Aditianingsih D, Bhurayanontachai R et al. Nutrition therapy for critically ill patients across the Asia Pacific and Middle East regions: A consensus statement. Clin Nutr ESPEN. 2018;24:156-64. doi: 10.1016/j.clnesp.2017.11.008.
2. McClave SA, Martindale RG, Vanek VW, McCarthy M, Roberts P, Taylor B et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2016;40:159-221. doi: 10.1177/0148607115621863.
3. Ghorabi S, Shariatpanahi ZV. Effect of early enteral nutrition on clinical outcomes in an intensive care unit. Thrita. 2014;3(3):e20905. doi: 10.5812/thrita.20905.
4. Lew CCH, Yandell R, Fraser RJL, Chua AP, Chong MFF, Miller M. Association between malnutrition and clinical outcomes in the intensive care unit: a systematic review. JPEN J Parenter Enteral Nutr.2017;41:744-58. doi: 10.1177/0148607115625638.
5. Nompleggi D. The basic principles of nutrition support in the intensive care unit. In: Irwin R, Rippe J, editors. Manual of Intensive Care Medicine. Philadelphia: Lippincott Williams & Wilkins; 2006. p. 516–18.
6. Freijer K, Nuijten MJ, Schols JM. The budget impact of oral nutritional supplements for disease related malnutrition in elderly in the community setting. Front Pharmacol. 2012;3:78. doi: 10.3389/fphar.2012.00078.
7. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: a narrative review. Maturitas. 2013;76:296–302. doi: 10.1016/j.maturitas.2013.07.013.
8. Rosenzweig JL. Diabetes and the health care system: economic and social costs. In: Kahn CR, Weir GC, King GL, editors. Joslin's diabetes mellitus. Philadelphia: Lippincott Williams & Wilkins; 2005. p. 777–92.
9. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M. Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). Clin Nutr. 2003;22(4):415-21. PMID:12880610
10. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form Mini-Nutritional Assessment (MNA-SF). J Gerontol A Biol Sci Med Sci. 2001;56(6): M366-72. DOI:10.1093/gerona/56.6.m366
11. Klein S, Kinney J, Jeejeebhoy K, Alpers D, Hellerstein M, Murray M et al. Nutrition support in clinical practice: review of published data and recommendations for future research directions. Summary of a conference sponsored by the National Institutes of Health, American Society for Parenteral and Enteral Nutrition, and American Society for Clinical Nutrition. Am J Clin Nutr. 1997;66:683–706. DOI:10.1093/ajcn/66.3.683
12. Canales C, Elsayes A, Yeh DD, Belcher D, Nakayama A, McCarthy CM et al. Nutrition Risk in Critically Ill Versus the Nutritional Risk Screening 2002: Are They Comparable for Assessing Risk of Malnutrition in Critically Ill Patients? JPEN J Parenter Enteral Nutr. 2019;43(1):81-7. doi: 10.1002/jpen.1181.
13. de Vries MC, Koekkoek WK, Opdam MH, van Blokland D, van Zanten AR. Nutritional assessment of critically ill patients: validation of the modified NUTRIC score. Eur J Clin Nutr. 2018;72(3):428-435. doi: 10.1038/s41430-017-0008-7.
14. Ahmed N, Choe Y, Mustad VA, Chakraborty S, Goates S, Luo M. Impact of malnutrition on survival and healthcare utilization in Medicare beneficiaries with diabetes: a retrospective cohort analysis. BMJ Open Diab Res Care. 2018;6:e000471. doi:10.1136/ bmjdrc-2017-000471
15. Rasheed S, Woods RT. An investigation into the association between nutritional status and quality of life in older people admitted to hospital. J Hum Nutr Diet. 2014;27:142–51. doi: 10.1111/jhn.12072.
16. Sanz-Paris A, Boj-Carceller D, Lardies-Sanchez B, Perez-Fernandez L, Cruz-Jentoft AJ. Health-Care Costs, Glycemic Control and Nutritional Status in Malnourished Older Diabetics Treated with a Hypercaloric Diabetes-Specific Enteral Nutritional Formula. Nutrients. 2016;8(3):153. doi: 10.3390/nu8030153.
17. Söderström L, Rosenblad A, Thors Adolfsson E, Bergkvist L. Malnutrition is associated with increased mortality in older adults regardless of the cause of death. Br J Nutr. 2017;117(4):532-540. doi: 10.1017/S0007114517000435.
18. Dandona P, Aljada A, Bandyopadhyay A. Inflammation: The link between insulin resistance, obesity and diabetes. Trends Immunol. 2004;25:4–7. doi: 10.1016/j.it.2003.10.013.
19. Ahmed N, Choe Y, Mustad VA, Chakraborty S, Goates S, Luo M, et al. Impact of malnutrition on survival and healthcare utilization in Medicare beneficiaries with diabetes: a retrospective cohort analysis. BMJ Open Diabetes Res Care. 2018;6(1):e000471. doi: 10.1136/bmjdrc-2017-000471
20. Vanderwee K, Clays E, Bocquaert I, Gobert M, Folens B, Defloor T. Malnutrition and associated factors in elderly hospital patients: a Belgian cross-sectional, multi-center study. Clin Nutr. 2010;29(4):469-76. doi: 10.1016/j.clnu.2009.12.013.
21. Vischer UM, Frangos E, Graf C, Gold G, Weiss L, Herrmann FR, Zekry D. The prognostic significance of malnutrition as assessed by the Mini Nutritional Assessment (MNA) in older hospitalized patients with a heavy disease burden. Clin Nutr. 2012;31(1):113-7. doi: 10.1016/j.clnu.2011.09.010.
22. Leslie W, Hankey C. Aging, Nutritional Status and Health. Healthcare (Basel). 2015;3(3):648–58. doi: 10.3390/healthcare3030648.