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ORIGINAL RESEARCH / *ÖZGÜN ARAŞTIRMA*

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Is There a Relationship Between Mortality Rates and Nutritional Factors in Critical Ill Patients with COVID-19?

COVİD-19'lu Kritik Hastalardaki Ölüm Oranları ile Beslenme Faktörleri Arasında Bir İlişki Var mıdır?

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ABSTRACT *Objective:* Our aim in this study was to examine whether critically ill patients with coronavirus disease-2019 (COVID-19) achieved the targeted calories (ATC) while being treated in the intensive care unit (ICU) and their relationship with the modified nitric score (mNUTRIC) and mortality.

Materials and Methods: The patients were categorized into two cohorts based on the attainment of the intended caloric intake during their stay in the ICU: the ATC group and the not achieved target calorie (NATC) group. A comparative analysis was conducted on the mNUTRIC scores, as well as the ICU and hospital mortality rates, between these two groups.

Results: The number of patients in the ATC group was 59 (63.4%) and the number of patients in the group that could NATC was 34 (36.6%). mNUTRIC scores on admission were 3 (2-4) in the ATC group and 5 (4-6) in the NATC group. In multivariate regression analysis, a mNUTRIC score of 5 and higher (p<0.01), hemodynamic instability (p=0.02) and male gender (p=0.04) were found to be significant as independent risk factors for NATC. ICU and hospital mortality was higher in the NATC group than in the ACT group (p<0.01, p<0.03 respectively).

Conclusion: Inability to reach the targeted calories and high mNUTRIC score might relate to mortality in critically ill COVID-19 patients treated in the ICU.

Keywords: Nutrition, targeted calory, intensive care, modified nutric score, mortality

ÖZ *Amaç:* Bu çalışmadaki amacımız, koronavirüs hastalığı-2019'lu (COVİD-19) kritik hastaların yoğun bakım ünitesinde (YBÜ) tedavi edilirken hedeflenen kaloriye (ATC) ulaşıp ulaşmadığını ve bunun modifiye nutrik skoru (mNUTRIC) ve mortalite ile ilişkisini incelemekti.

Gereç ve Yöntem: Hastalar YBÜ'de kaldıkları süre içerisinde hedeflenen kaloriye ulaşılıp ulaşılmadığına (ATC grubu) ve sağlanamamasına (NATC grubu) göre iki gruba ayrıldı. Hastaların mNUTRIC skorları, YBÜ ve hastane mortalite oranları her iki grup için karşılaştırıldı.

Bulgular: ATC grubundaki hasta sayısı 59 (%63,4), NATC gruptaki hasta sayısı ise 34 (%36,6) idi. Başvuru anında mNUTRIC puanları ATC grubunda 3 (2-4) ve NATC grubunda 5 (4-6) olarak bulundu. Çok değişkenli regresyon analizinde mNUTRIC puanı 5 ve üzeri (p<0,01), hemodinamik instabilite (p=0,02) ve erkek cinsiyet (p=0,04) NATC için bağımsız risk faktörleri olarak anlamlı bulundu. YBÜ ve hastane mortalitesi NATC grubunda ACT grubuna göre daha yüksekti (sırasıyla p<0,01, p<0,03).

Sonuç: YBÜ'de tedavi edilen kritik durumdaki COVİD-19 hastalarında hedeflenen kaloriye ulaşamama ve yüksek mNUTRIC puanı mortalite ile ilişkilendirilebilir.

Anahtar Kelimeler: Beslenme, hedeflenen kalori, yoğun bakım, modifiye nutrik skor, mortalite

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Introduction

Respiratory failure represents a primary cause for admitting patients with coronavirus disease-2019 (COVID-19) to the intensive care unit (ICU) (1). Among COVID-19 patients receiving ICU care, the mortality rate for those treated with invasive mechanical ventilation ranges from 40% to 60% (2). The entry of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) into various cell types, including lymphocytes, monocytes, lung alveolar type 2 cells, esophageal epithelial cells, enterocytes, and colonocytes, occurs through the angiotensin-converting enzyme 2 receptor. This leads to cellular damage resulting from rapid viral replication, triggering cytokine release and inflammation (3). In severe cases, elevated levels of proinflammatory cytokines in the plasma induce a cytokine storm (4). The cytokine storm contributes to organ damage. However, it has been emphasized that the initiation of nutritional therapy should not be hindered as the primary focus in cytokine storm management (5).

Critically ill patients often experience energy intake and utilization dysfunction due to systemic inflammatory response and organ dysfunction. Additionally, COVID-19 patients requiring invasive mechanical ventilation tend to have prolonged ICU stays, averaging around 9 days (6). Consequently, these patients are highly susceptible to severe malnutrition and muscle mass loss (5). Furthermore, the involvement of SARS-CoV-2 in the gastrointestinal system (GIS) has a detrimental impact on nutrition delivery and, consequently, the nutritional status of COVID-19 patients. This factor may contribute to the overall clinical outcome (7). Limited information is available regarding the effects of nutritional therapy in ICU patients with COVID-19 (8). Therefore, our objective is to assess the nutritional risks of COVID-19 patients upon ICU admission, determine the achievement of appropriate nutritional goals during the ICU stay, and investigate the relationship between nutritional status and clinical outcomes.

Materials and Methods

This retrospective observational study was conducted in the ICU that reserved for COVID-19 patients, with the approval of the Non-Interventional Research Ethics Committee of Dokuz Eylül University (decision no: 2021/02-17, approval date: 18.01.2021).

Since our study was conducted as a retrospective file review and data analysis, patient consent was waived. Between May and September 2020, COVID-19 93 patients who were approve by the polymerase chain reaction test and admitted to the intensive care unit were included in the study. Those who were younger than 18 years of age, those with less than 24 hours of intensive care stay, and with insufficient medical knowledge and anamnesis were excluded from the study. Pregnant and lactating patients were also not included in the study. Demographic data, medical histories, laboratory parameters, ventilator support and mortality were retrospectively collected from the hospital records.

Within the initial 24 hours of ICU admission, the disease severity of each patient was determined utilizing the Acute Physiology and Chronic Health Evaluation-II (APACHE-II) and Sequential Organ Failure Assessment (SOFA) scoring systems (9,10).

At the time of ICU admission, the nutritional risk of each patient was evaluated using the modified nitric score (mNUTRIC) score. This score, which excludes IL-6 values, incorporates the following five variables: age, APACHE-II score and SOFA score upon admission, the number of comorbidities present in the patient, and the duration of hospitalization before ICU admission (11).

It has been reported that a modified NUTRIC score of 5 and above indicates that the patient has a high nutritional risk (9).

Daily needed calories and achieved values of the patients' calories, types of nutritional support (oral, enteral or parenteral) were also recorded.

In this study, the patients were divided into two groups: group of achieved the target calories (ATC) and the group that did not achieved the target calories (NATC). In order to determine on which day the target calorie (TC) was achieved if it was achieved, the amount of calories that could be given to the patient on the 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 7^{th}, 10^{th} and 14^{th} days were calculated from the hospital records.

The daily calorie intake of patients was planned as 14 kcal/kg/day for patients with a body mass index (BMI) above 30 kg/m^2 and 25 kcal/kg/day for patients with a BMI below 30 kg/m^2 which is as recommended by the American Society for Parenteral and Enteral Nutrition and European Society for Parenteral and Enteral Nutrition (ESPEN) (12,13). The day on which the planned calories were achieved was recorded as the day on which target calory as achieved.

As hemodynamic status is an important parameter for feeding, the date of hemodynamic stabilization and the start of nutritional support were recorded. According to ICU feeding protocol systolic blood pressure of 90 mmHg and a mean arterial pressure of 65 mmHg and above without vasopressor support or with dopamine <5 µg/kg/min or norepinephrine <0.5 µg/kg/min support was considered as hemodynamic stabilization (14). The day which the patients were hemodynamically stable and started feeding, determined and recorded. We started parenteral nutrition (TPN) therapy for patients who could not tolerate enteral nutrition (EN) therapy [stopping planned feeding, GI intolerance (vomiting, diarrhea, bleeding) or high inotropic support].

Statistical Analysis

All continuous variables were reported as mean ± standard deviation or as median (interquartile range), while categorical variables were presented as numbers and percentages (%). In our study, we collected two types of data: categorical and numerical. For numerical data, we performed t-tests and Mann-Whitney U tests, depending on the distribution of the data. For categorical data, we used the chi-square independence test to assess associations.

To identify the risk factors for the inability to achieve the TC intake, we conducted multivariate logistic regression analysis. A p-value of <0.05 was considered statistically significant. The statistical analysis was performed using IBM SPSS Statistics version 26.0.

Results

A total of 93 confirmed COVID-19 patients were included into the study. Of the patients, 65 (69.9%) were male and 28 (30.1%) were female. Among the patients included in the study, the mean age of the ATC group was 68 (61-76), while the mean age of the NATC group was 70 (59-70) (Table 1).

Of them 59 were in ATC group and 34 were in NATC group. The median age of the patients in the (ATC) group was 68 (61-74) years, and the median age of the patients in the (NATC) group was 70 (59-77) years (p=0.89). Among

Table 1. Clinical characteristics of patient population

	All patients (n=93)	ATC group (n=59)	NATC group (n=34)	p-value
Age (year)	68 (61-76)	68 (61-74)	70 (59-77)	0.89
Gender (male)	65 (69.9)	36 (61)	29 (85.3	0.01
APACHE-II score	18 (14-27)	18 (12-24)	22 (6-20)	0.03
SOFA score	8 (5.5-10.5)	6(4-8)	8 (6-10)	0.02
GCS score	14 (7.5-15)	14 (6-15)	14 (8.5-15)	0.66
BMI (kg/m^2)	27 (24-31)	27 (24-32)	28 (24-31)	0.94
Hypertension	59 (63.4%)	38 (64.4)	21 (61.8)	0.80
Diabetes mellitus	37 (39.8)	23 (39.0)	14 (41.2)	0.83
Coronary artery disease	31 (33.3)	20 (33.9)	11 (32.4)	0.88
Chronic obstructive pulmonary disease	18 (19.4)	14 (23.7)	4 (11.8)	0.16
Chronic renal failure	10 (10.8)	7 (11.9)	3 (8.8)	0.65
Congestive heart failure	14 (15.1)	10 (16.9)	4 (11.8)	0.50
Atrial fibrillation	14 (15.1)	7 (11.9)	7 (20.6)	0.26
Cirrhosis	5 (5.4)	2 (3.4)	3 (8.8)	0.26
Acute kidney failure	30 (32.3)	18 (30.5)	12 (35.3)	0.63
Cerebro-vascular event	8 (8.6)	5 (8.5)	3 (8.8)	0.95
Dementia	7 (7.5)	4 (6.8)	3 (8.8)	0.72
Parkinson’s disease	2 (2.2)	1 (1.7)	1 (2.9)	0.69
Malignancy	10 (10.8)	7 (11.9)	3 (8.8)	0.65

All values are expressed as numbers (percentages) or median (interquartile range), APACHE-II: Acute Physiology and Chronic Health Evaluation-II, SOFA: Sequential Organ Failure Assessment, GCS: Glasgow coma score, BMI: body mass index, ATC: achieved the targeted calories, NATC: not achieved target calorie. SOFA score and APACHE-II was calculated 24th hour intensive care unit admission the patients, APACHE-II and SOFA scores were found to be significantly higher in the (NATC) group than (ATC) group [22 (6-20), p=0.03; 8 (6-20), p=0.02 respectively]. There was no significant difference between the BMI of (ATC) patients and (NATC) patients [28 (24-31); p=0.94] (Table 1).

There was no significant relationship between achieve TC and age [68 (61-74), p=0.89]. (Table 1).

The nutritional characteristics of all patients are presented in Table 2.

The majority of the patients (94.6%) received nutritional treatment with the EN method. TPN was started for only 5 critically ill COVID-19 patients. In the patient group in whom TPN was started, EN was tried to be continued at a trophic dose. All study patients received EN or TPN. The feeding tube route was used in all patients who underwent EN therapy.

The reasons that were observed for the interruption of feeding in the (NATC) group of the patients was as follows; stopping planned feeding (7, 20.6%) [due to surgical procedure (2, 5.9%); tracheostomy (5, 14.7%)], GIS intolerance (13, 38.2%) (vomiting, diarrhea, bleeding), high inotropic support (14, 41.2%). GIS intolerance and high inotropic support were found to be significantly higher in the (NATC) group [(13, 38.2%); (14, 41.2%) respectively p=0.03 and p<0.01] (Table 3).

The mNUTRIC scores on admission to the ICU were 3 (2-4) in the (ATC) group and 5 (4-6) in the (NATC) group (p<0.01). In addition, as stated in the ESPEN guideline, daily

Table 2. Nutiritional charactheristics of study groups

	ATC group (n=59)	NATC group (n=34)	p-value
Target calories*	1370 (300-1500)	1370 (300-1500)	
Mean values of calories on the 1st day (min-max)	1200 (800-1400)	760 (400-1050)	<0.01
Mean values of calories on the 2nd day (min-max)	1400 (1000-1500)	1000 (800-1225)	<0.01
Mean values of calories on the 3rd day (min-max)	1400 (1000-1500)	1200 (1000-1400)	<0.01
Mean values of calories on the 4th day (min-max)	1400 (1000-1500)	1200 (980-1440)	0.07
Mean values of calories on the 5th day (min-max)	1400 (1000-1500)	1200 (980-1440)	0.07
Mean values of calories g on the 7th day (min-max)	1400 (1000-1500)	1200 (1000-1440)	0.24
Mean values of calories on the 10th day (min-max)	1400 (1000-1455)	1200 (970-1400)	0.15
Mean values of calories on the 14th day (min-max)	1100 (1000-1360)	1300 (1000-1440)	0.32
Number of days to reach target calories	2 (2-3)	-	NA

*The target calorie amount calculated according to the ESPEN and ASPEN guidelines was found to be similar in both groups. ASPEN: American Society for Parenteral and Enteral Nutrition, ESPEN: European Society for Parenteral and Enteral Nutrition, ATC: achieved the targeted calories, NATC: not achieved target calorie, min-max: minimum-maximum

Table 3. mNUTRIC score and reasons for interruption of feeding

	ATC group (n=59)	NATC group (n=34)	p-value
mNUTRIC score	3 (2-4)	5 (4-6)	<0.01
Additional protein intake (Number of patients-percentage)	21 (35.6%)	1 (2.9%)	<0.01
Additional vitamin intake (Number of patients-percentage)	53 (89.6%)	26 (76.5%)	0.05
Nutrition shutdown: planned shutdown (Number of patients-percentage)	10 (16.9%)	7 (20.6%)	0.66
Suspension of feeding due to gastrointestinal intolerance (Number of patients-percentage)	11 (18.6%)	13 (38.2%)	0.03
Interruption of feeding due to hemodynamic instability (Number of patients-percentage)	9 (16.3%)	14 (41.2%)	<0.01

ATC: achieved the targeted calories, NATC: not achieved target calorie, mNUTRIC: modified nitric score

1.3 g/kg protein supplementation could be given to the ATC group, but not to the NATC group [(1, 2.9%); p<0.01)] (Table 3) (12).

When the laboratory results of the patients in the (NATC) group were analyzed, it was found that the serum albumin (ALB) levels on admission in the ICU the were statistically significantly lower [2.82 (2.35-3.21) g/dL, p=0.03] (Table 4).

Considering both the ICU mortality rates (88.2%) and hospital mortality rates (88.2%) of COVID-19 patients followed up as critically ill in the ICU, it was found to be significantly higher in the (NATC) group (p<0.01, p<0.03 respectively) (Table 5).

When the multivariate regression analysis of risk factors related to not achieve targeted calorie was performed,

Table 4. Laboratory findings on admission in the ICU

	All patients (n=59)	ATC group (n=34)	NATC group	p-value
Leukocyte 10^3/UI	11700 (9200-16000)	12800 (9700-16300)	9700 (8450-15050)	0.06
Lymphocyte 10^3/UI	500 (300-900)	500 (300-800)	550 (300-100)	0.60
Hemoglobin g/dL	12.4 (10.8-13.4)	12.6 (10.8-13.5)	12.1 (10.4-13.3)	0.64
C-reactive protein mg/L	146 (73-203)	141 (73-194)	161 (69-229)	0.40
Procalcitonin ng/mL	0.46 (0.11-2.19)	0.47 (011-1.53)	0.43 (0.14-3.54)	0.54
Ferritin ng/mL	476 (275-940)	461 (272-954)	620 (277-920)	0.88
Lactate dehydrogenase U/L	557 (386-728)	554 (403-684)	563 (320-761)	1.00
Alanine transaminase U/L	33 (22-64)	32 (23-65)	38 (21-60)	0.96
Aspartate aminotransferase U/L	48 (33-74)	47 (33-73)	50 (34-82)	0.51
Total bilirubin mg/dL	0.89 (0.63-1.10)	0.89 (0.62-1.11)	1.00 (0.65-1.22)	0.45
D-dimer ug/mL	1.73 (0.94-4.30)	1.50 (0.95-5.17)	1.90 (0.93-3.64)	0.67
Creatinine mg/dL	1.00 (0.76-1.80)	0.99 (0.76-1.76)	1.00 (0.79-1.85)	0.68
Albumin g/dL	3.07 (2.70-3.29)	3.07 (2.88-3.24)	2.82 (2.35-3.21)	0.03
Blood urea nitrogen mg/dL	33 (22-57)	32 (23-50)	35 (20-67)	0.65

ATC: Achieved the targeted calories, NATC: not achieved target calorie, ICU: intensive care unit

Table 5. Treatments and outcomes of study population

	All patients n=93	ATC (n=54)	NATC (n=34)	p-value
Renal replacement therapy	26 (28%)	18 (30.5)	8 (23.5)	0.47
Tocilizumab therapy	7 (7.5%)	6 (10.2)	1 (2.9)	0.20
Intravenous corticosteroids therapy	76 (81.7)	24 (70.6)	52 (88.1)	0.127
Pulse corticosteroid therapy*	34 (34.6)	25 (42.4)	9 (26.5)	0.04
Vasopressor need**	65 (69.9)	26 (44.1)	23 (66.7)	0.03
Those who received sedation	67 (72)	43 (72.9)	24 (70.6)	0.81
Oxygen mask	25 (26.9)	16 (27.1)	9 (26.5)	1.00
High-flow nasal cannula application	26 (28%)	17 (28.8)	9 (26.5)	1.00
Non-invasive mechanical ventilator therapy	14 (15.1%)	10 (16.9)	4 (11.8)	0.56
Invasive mechanical ventilation therapy	27 (29%)	15 (25.4)	12 (35.3)	0.34
Mechanical ventilation duration (days)	5 (2-11)	4 (1-10)	2 (1-5)	0.35
Hospitalization length of stay (days)	16 (9-22)	17 (10-23)	12 (6-21)	0.04
ICU length of stay (days)	9 (4-14)	9 (5-14)	8 (3-14)	0.24
Hospital mortality rate	70 (75.3)	40 (67.8)	30 (88.2)	0.03
ICU mortality rate	68 (73.1)	38 (64.4)	30 (88.2)	0.01

*Pulse corticosteroid >250 mg/day, **norepinephrine >30 μg/kg/min. ATC: achieved the targeted calories, NATC: not achieved target calorie, ICU: intensive care unit mNUTRIC score of 5 and higher [odds ratio: 0.05 (0.01-0.17), 95% confidence interval; p<0.01), hemodynamic instability (p=0.02) and gender (p=0.04) were found to be significant as independent risk factors (Table 6).

Both ICU mortality rates (88.2%) and hospital mortality rates (88.2%) were higher in the NATC group (p=0.01).

Discussion

Among the 93 critically ill patients with COVID-19 treated in this study, it was found that in 59 (%) patients TC was achieved. mNUTRIC, APACHE-II and SOFA scores in the first 24 hours were found to be significantly higher in the (NATC) group. Also in (NATC) group there was male predominancy. In the group whose TC could not be achieved, both ICU and hospital mortality were high. In the group whose targeted calorie could not be achieved, mNUTRIC score of 5 and above, hemodynamic instability and male gender were found to be significant as independent risk factors. As seen in the ICU, patients with severe forms of COVID-19 are generally aged, they have serious comorbidities, and therefore they are at risk of malnutrition and sarcopenia (15). COVID-19 patients are faced with severe respiratory tract infections and increased energy expenditure due to increased respiratory work Infection, hypermetabolism, and physical inactivity cause rapid muscle loss (16).

It was found that the general condition of the patients was poor, the critical illness scores were high, and the mortality rates were high in the group whose targeted calories could not be reached. The mNUTRIC score was also found to be high in the group that did not reach sufficient calories. Using the APACHE-II score and SOFA scores when calculating the mNUTRIC score, the mNUTRIC score was high in patients with the poor general condition due to the nature of the job. It was thought that effective nutritional therapy could not be applied in this patient group due to the reasons listed.

According to a study conducted in China, 14% of COVID-19 cases were classified as severe and 5% as critically ill (17,18). In a meta-analysis investigating the mortality rate of COVID-19 patients in the ICU in China, the mortality rate was found to be 41.6% (19). In our study, the ICU mortality of COVID-19 patients was 68%. This can be explained by the fact that patients admitted to the ICU are very severe, which is consistent with their high APACHE-II, SOFA and mNUTRIC scores within the first 24 hours of admission.

Apart from its impact on the respiratory system and the development of acute respiratory distress syndrome (ARDS), the coronavirus can also lead to dysfunction in other organs, such as sepsis and myocardial damage (20). Patients admitted to the ICU may be at a higher nutritional risk due to factors like a high viral load or an exaggerated immune response (8). Additionally, some patients experience gastrointestinal symptoms, further exacerbating their nutritional risk (20). A meta-analysis of 60 studies involving 4,243 patients, although not limited to critically ill individuals, revealed the following percentages: loss of appetite in 26.8% of patients, nausea and vomiting in 10.2%, diarrhea in 12.5%, and abdominal pain or discomfort in 9.2% (21). The development of these symptoms suggests that the severity of the disease increases (21). It has been reported that nutritional support should be started early in patients whose severity increased because intubated patients could not use the oral route during mechanical ventilation (22). EN should be preferred to TPN because it is known to be associated with a lower incidence of infectious complications, fewer days of hospital stay, and reduced mortality rates as stated in previous meta-analyses (21). Although nasogastric tube application caused concern due to the risk of transmission to healthcare workers in the early stages of the pandemic, the priority of EN was not compromised in our clinic and EN was applied except for only 5 patients who could not tolerate EN. It has been reported that TPN support can be given

Table 6. Multivariate regression analysis of independent risk factors for not achieved target calories group (95% CI: 95%)

	OR (95% CI)	p-value
mNUTRIC score ≥5	0.05 (0.01-0.17)	<0.01
Hemodynamic instability	0.23 (0.06-0.82)	0.02
Gender	4.48 (1.08-18.46)	0.04
BMI	0.95 (0.85-1.06)	0.39
APACHE-II score	0.95 (0.88-1.01)	0.14

APACHE-II: Acute Physiology and Chronic Health Evaluation-II, CI: confidence interval, OR: odds ratio, BMI: body mass index, mNUTRIC: modified nitric score to patients who cannot receive adequate calorie support through the enteral route (22). However, it is known that it is important to provide trophic doses of EN for the nutrition of the intestinal mucosa, even in cases where the required calorie needs of the patients cannot be met by the enteral route (10). Thus, bacterial translocation can be prevented by preventing atrophy of the intestinal mucosa and ensuring mucosal integrity (22,23). In our study group, trophic dose EN was tried in a limited number of patients with TPN, but it was not successful.

Additionally, vasopressor therapy may increase the risk of gastrointestinal intolerance in cases of hemodynamic instability characterized by hypovolemia, hypotension, hyperlactatemia and tissue hypoperfusion (24). In this study, the presence of GIS intolerance and high-dose inotropic use was found to be statistically significant in the patient group who could not reach the TC. In this patient group, the same approach was generally followed and additional risk factors were evaluated.

Therefore, a more comprehensive analysis of the clinical characteristics and nutritional status of critically ill COVID-19 patients admitted to the ICU is warranted. Researchers have emphasized the necessity of employing nutritional risk assessment scales specifically designed for adult patients with COVID-19 (25).

There is currently no universally accepted standard for determining nutritional risk or identifying malnutrition (24). Various tools and scoring systems have been developed to address this issue, including the Mini Nutritional Assessment-Short Form, Geriatric Nutrition Risk index, Nutritional Risk Screening 2002, Malnutrition Universal, as well as screening tools such as the Screening Tool, Nutritional Risk index, Short Nutrition Assessment Questionnaire, and Nutritional Risk in Critically Ill Patients. These tools and systems are practical and cost-effective (25). The utilization of the NUTRIC scoring system in ICU settings was initially proposed by Canadian researchers (26,27). Although the specific nutritional screening tool for critically ill patients with COVID-19 remains to be determined, the mNUTRIC score is a parameter that can be routinely employed in ICUs, including those dedicated to COVID-19 patients (11).

The mNUTRIC score is user-friendly, as the variables in this scoring system are objectively obtained from the routine data in the medical records of the patients and can be easily used in patients who cannot respond verbally (11). In addition, we thought that the mNUTRIC scoring system is more useful for determining the nutritional risk of patients, since IL-6 levels are not routinely checked in our hospital.

In critically ill COVID-19 patients, Li et al. (17) reported a high prevalence of nutritional risk in 61% of patients in a retrospective study with data from three ICUs in Wuhan, China. In another study conducted in Latin America, it was found that 66% of critically ill COVID-19 patients had a high nutritional risk according to mNUTRIC-score calculations during ICU admission (28). In our study, the group of patients whose mNUTRIC score was higher than 5 points when they were admitted to the ICU was 28%. This situation also indicates that patients with COVID-19 were at risk of malnutrition due to infection-related loss of apetite, shortness of breath, dysosmia, dysgeusia, stress, advanced age with fragility a various comorbidities, long hospital stay, isolation, and organizational problems limiting participation in meals in the period prior to their admission to the ICU (23).

Both ICU and hospital mortality rates were found higher in the NATC group. This can be explained by reasons such as increased susceptibility to infection, secondary infections, impaired immune response, higher incidence of ARDS, prolonged mechanical ventilation, acute myocardial damage, and shock (19). In addition, it is not surprising that the APACHE-II and SOFA scores, which indicate the severity of critical illness, are taken as a basis when calculating the mNUTRIC score, and the mortality rates are high in those with high nutritional risk (11).

In NATC group, the decrease in serum ALB level, which is one of the laboratory values obtained while being admitted to the ICU, was found to be statistically significant. ALB levels are the classic laboratory index in traditional nutritional assessment (29). Although not used as index of evaluation of nutritional status alone, it can provide insight into nutritional status or disease severity in clinical practice (30). Again, Wu et al. (30), found that patients who developed ARDS had lower levels of ALB, prealbumin, and lipoprotein cholesterol.

We could not use any anthropometric measurements for nutritional assessment in this study because these data were not available in our medical records. Secondly, 93 patients who met the inclusion criteria were included and studies with larger sample sizes may be useful in this regard. Finally, randomized and controlled studies are needed because of the limitations inherent in retrospective observational studies.

Conclusion

Providing appropriate nutritional support treatment for critically ill COVID-19 patients is crucial for meeting their energy requirements, mitigating the detrimental effects of metabolic disturbances on the disease course, reducing oxidative damage to cells, and regulating immune responses. Given the prolonged treatment duration for critical COVID-19 cases, nutritional support plays a vital role and necessitates increased attention.

Since there is currently no universally accepted standard for determining nutritional risk in critically ill COVID-19 patients, further advancements and research in developing disease-specific nutritional assessment tools are warranted. Therefore, the mNUTRIC score appears to be a suitable tool for assessing nutritional risk and predicting prognosis in critically ill COVID-19 patients.

Ethics

Ethics Committee Approval: This retrospective observational study was conducted in the ICU that reserved for COVID-19 patients, with the approval of the Non-Interventional Research Ethics Committee of Dokuz Eylül University (decision no: 2021/02-17, approval date: 18.01.2021).

Informed Consent: Since our study was conducted as a retrospective file review and data analysis, patient consent was waived.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.Ö., B.E., M.Ç.G., M.K., O.Ö.E.K., E.Y., A.N.G., Concept: Ö.Ö., B.E., M.Ç.G., M.K., O.Ö.E.K., E.Y., A.N.G., Design: Ö.Ö., M.Ç.G., M.K., O.Ö.E.K., E.Y., A.N.G., Data Collection and Process: Ö.Ö., B.E., M.Ç.G., O.Ö.E.K., E.Y., A.N.G., Analysis or Interpretation: Ö.Ö., M.K., E.Y., A.N.G., Literature Search: Ö.Ö., B.E., E.Y., A.N.G., Writing: Ö.Ö., M.K., O.Ö.E.K., E.Y., A.N.G.

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