Original article

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The relationship between the Geriatric Nutrition Risk Index (GNRI) and the prognosis of COVID-19 in diabetic geriatric patients

Abstract

Background: Malnutrition is one of the important conditions that determine the course of patients in acute critical illnesses. This study evaluated the relationship between Geriatric Nutrition Risk Index (GNRI) and COVID-19 prognosis in geriatric diabetic patients.

Patients and methods: In this study, 110 patients between the ages of 65 and 80 who were interned due to COVID-19 disease with a diagnosis of diabetes mellitus were included. Biochemical blood tests were analysed. The GNRI was calculated to assess the nutritional risk status. As a result of GNRI, the patients were divided into 4 groups according to their scores: severe risk (< 82 points), intermediate risk (82––91 points), low risk (92–97 points) and no risk (≥ 98 points). The length of stay, saturation levels, intubation status and discharge type of the patients were recorded. All parameters were compared in these groups.

Results: According to the GNRI, 11.8% of the patients had severe malnutrition, 20.9% had moderate and 8.1% had mild malnutrition, while 59.0% had no risk of malnutrition. When patients are divided into four groups according to GNRI groups, age, urea, creatinine, lymphocyte, procalcitonin, leukocyte, thrombocyte, haemoglobin, spo2 and po2 levels, intubation, and intensive care referral rates were significantly different ($p < 0.05$). In the correlation analysis, a negative significant correlation was found between GNRI and height, length of hospital stays, d-dimer, CRP, leukocyte, neutrophil-lymphocyte ratio and neutrophil.

Conclusions: There is a significant relationship between GNRI and the prognosis of COVID-19 in geriatric diabetic patients. Patients with a low GNRI score have a longer hospital stay, a higher need for intensive care and mechanical ventilation, and a poor prognosis.

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Keywords: Geriatric Nutrition Risk Index (GNRI), COVID-19, geriatrics, malnutrition

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Introduction

The new coronavirus disease (COVID-19), which emerged at the end of 2019 and caused a pandemic in a short time, affects all body systems [1]. It is known that COVID-19 progresses worse in older adults, those with low body resistance, and individuals with comorbid diseases [2]. Even though more than 23 million people have been infected all over the world due to COVID-19 infection, an effective antiviral treatment has still not been found [3]. Although there are antiviral agents used experimentally in the treatment, the most effective method in preventing and treating the epidemic is to support body resistance [3].

Nutrition is one of the important elements of health care [4]. Nutritional deficiency and imbalance are a direct cause of some diseases and an indirect cause of others [4]. The geriatric nutrition risk index (GNRI) is a simple and effective risk scale used to assess the risk of malnutrition [5]. Malnutrition increases the risk of contracting the disease, increases post-discharge mortality, and prolongs hospitalization, and re-hospitalizations [6]. Although these adverse effects of malnutrition are known in other diseases, there is not enough data on its effects on the course of COVID-19.

Patients and methods

This study was designed as a cross-sectional and a single-centre study. The study was approved by the ethics committee of the University of Health Sciences Umraniye Education and Research Hospital (Date: 11.03.2021; Number: B.10.1.TKH.4.34.H.GP.0.01/68). The principles of the Declaration of Helsinki were taken as a guide when designing and implementing the study. All patients were informed in detail and written consent was obtained. As a result of the power analysis, 110 patients aged 65–80 with a diabetes diagnosis, who were admitted to pandemic service due to COVID-19 disease, were included in the order of hospitalization. Patients under the age of 65 and over the age of 80 and patients with acute or chronic infections other than COVID-19, history of major surgery, and malignancy were excluded from the study. Biochemical blood tests were analysed and GNRI scores were calculated. Sampling for assays was taken between 08:00 and 10:00 after eight hours of fasting. Blood samples were analysed simultaneously.

Metabolic parameters

A real-time PCR test (Allplex 2019-nCoV; South Korea) was performed on samples from the nasopharynx of all patients to confirm the diagnosis of COVID-19. The creatinine level of the patients was measured using the Jaffe method. Blood urea nitrogen level was measured by spectrophotometer, albumin concentration was measured by an enzymatic colorimetric test, c-reactive protein immunoassay and ferritin level was measured by immunochemiluminescence method with Architect plus device. Haemogram parameters were measured with Mindray BC 6800 device by electrical impedance method. Procalcitonin was measured by the ELFA method with the Biomerieux vidas device. D-dimer was measured by the immunoturbidimetric method with the Sta device. Blood gas measurements were measured with the ABL800 FLEX device.

Anthropometric measurements

The height and weight of the patients were measured by the doctor according to standard measurement rules. Body mass index was calculated (kg/m^2).

Evaluation of malnutrition risk

The GNRI was used to assess the risk of malnutrition. GNRI was calculated using body mass index and serum albumin. The formula GNRI = serum albumin (g/dL) × 14.89 + body weight/(height) 2 × 41.7 × 22 was used. As a result of GNRI, the patients were divided into 4 groups according to their score; < 82 points: severe risk, ≥ 82– < 92 points: intermediate risk, ≥ 92 – < 98 points: low risk, and ≥ 98 points: no risk.

Evaluation of prognosis

Prognostic biomarkers, arterial blood gas parameters, intensive care follow-up of the patient, need for invasive mechanical ventilation, type of discharge from the hospital, and mortality status were used to determine the prognosis.

Statistical analysis

While evaluating the data, descriptive expressions such as mean, standard deviation, maximum and minimum were used. The normal distribution was confirmed by the Kolmogorov-Smirnov test. One-way ANOVA (Tukey) and Kruskal-Wallis test were used for the differences between the groups, and Pearson's r coefficient was used for univariate correlations. The Bonferroni test was used to correct multiple test errors in the results obtained from ANOVA. A multiple linear regression model was used to evaluate the independent relationship between the GNRI and disease prognosis and other variables. SPSS 21.0 was used in the analysis and the p-value was accepted < 0.05.

Results

This study was conducted on 110 (52 female, 58 male) diabetic patients with a mean age of

Table 1. Demographic data, anthropometric measurements, clinical and biochemical parameters of the patients (n = 110)

	Mean	SD	Median	Minimum	Maximum
Age [years]	73.48	4.583	74	65	80
GNRI score	104.70	21.59	101.17	55.75	165.95
Weight [kg]	78.42	20.15	76	43	169
Height [cm]	164.77	9.465	165	145	189
BMI [kg/m^2]	29.16	8.04	27.08	16.59	54.56
Length of Hospitalization [days]	6.71	2.767	6	2	24
Hba1c (4.7–5.6%)	7.92	2.31	7.1	6.6	11.2
Glucose (70–100 mg/dL)	186	82.1	186	68	347
Urea (5–11 mg/dL)	44.19	20.419	39	21	141
Creatinine (< 1 mg/dL)	0.8432	0.21435	0.82	0.55	1.78
Procalcitonin (< 0.50 ng/mL)	5.113	7.7207	2.445	0.1	33.4
C-reactive protein (< 3 mg/L)	42.63	42.202	24	1	179
D-dimer (0–550 μg/mL)	46.5865	173.8977	17.45	1.6	1775
Ferritin (20–500 mL/ng)	112.02	109.424	76.9	9	720
Albumin (3.5–5.5 g/dL)	3.319	0.7476	3.2	1	4.9
Neutrophil (1.5–8.0 103/μL)	13.13	6.89	11.68	1.74	31.68
Leukocytes (4.1–8.9 103/μL)	17.99	7.47	16.14	5.03	37.44
Lymphocyte (1.2–5.2 103/μL)	2.565	0.9664	2.525	1	5.9
Platelets (15–450.000/mm^3)	196.87	79.742	182.5	100	485
Haemoglobin (12.4–14.8 g/L)	14.07	1.478	14.3	9	18
Neutrophil lymphocyte ratio	5.9136	2.80544	4.93	1.78	14.5
Oxygen saturation (95–100%)	91.432	9.849	95	45.7	99.7
Partial oxygen pressure (80–100 mmHg)	81.95	35.888	77.05	28	201

BMI — body mass index; GNRI — Geriatric Nutrition Risk Index; SD — standard deviation

73.4 ± 4.5 years diagnosed with COVID-19. The GNRI score of the patients ranged from 55.75 to 165.95, with a mean of 104.6 ± 21.5. The mean length of hospital stay of the patients was 6.7 ± 2.7 days. The biochemical parameters, anthropometric measurements, and clinical data are summarized in Table 1.

According to the GNRI, 11.8% of the patients were at severe, 20.9% moderate and 8.1% mild malnutrition, while 59.0% had no malnutrition risk. When patients are divided as severe risk, intermediate risk, low risk, and no risk; there was a significant difference in age, albumin, urea, creatinine, procalcitonin, d-dimer, leukocyte, calcium, lymphocyte, haemoglobin, thrombocyte, po2 and spo2 levels, service length of stay, intubation and intensive care transfer rates between the groups ($p < 0.05$ for all) (Table 2).

In the correlation analysis, a significant and a negative correlation was found between GNRI and height, age, length of service, d-dimer, CRP, neutrophil, WBC, and neutrophil-lymphocyte ratio, a positive correlation between GNRI and weight, BMI and albumin (Table 3).

Seventy-seven (70.9%) patients included in the study were discharged from the pandemic service. Twenty-one patients (19.0%) were referred to the 1st level intensive care unit because their clinical condition deteriorated without being intubated. Eleven patients (10%) were referred to the tertiary intensive care unit because of the need for invasive mechanical respiratory support. One patient also died during the service follow-up. When the patients were divided into 3 groups as discharged from the service, referral to the 1st level ICU and referral to the 3rd level ICU, there was a significant difference between the groups in terms of GNRI score, age, albumin, d-dimer, oxygen saturation and partial oxygen pressure levels ($p < 0.05$ for all) (Table 4).

Table 2. Comparison of all biochemical parameters according to IIEF-5 scores

	Severe risk (n = 13)	Intermediate risk (n = 21)	Low risk (n = 10)	No risk (n = 66)	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Age [years]	78.3 ± 3.7	75.2 ± 4.9	71.8 ± 4.1	68.2 ± 3.4	0.009
Weight [kg]	77.7 ± 4.3	78.1 ± 6.5	77.4 ± 5.7	79.8 ± 4.8	0.059
Height [cm]	164.8 ± 5.8	165.9 ± 7.2	164.5 ± 8.3	164.6 ± 9.4	0.07
BMI [kg/m^2]	27.52 ± 5.4	28.41 ± 6.2	28.09 ± 7.03	28.93 ± 5.2	0.05
Length of hospitalization [days]	7.12 ± 3.4	7.03 ± 2.2	6.92 ± 2.5	6.99 ± 1.9	0.602
Hba1c (4.7–5.6%)	7.9 + 2.9	8.0 ± 3	7.91 ± 2.8	7.72 ± 1.9	0.934
Glucose (70–100 mg/dL)	206 ± 96	196 ± 58.3	189 ± 71.1	184 ± 79.2	0.096
Urea (5–11 mg/dL)	46.9 ± 14.1	41.2 ± 11.4	42.11 ± 14.2	39.5 ± 13.8	0.0085
Creatinine (< 1 mg/dL)	0.99 ± 0.47	0.97 ± 0.86	0.83 ± 0.20	0.78 ± 0.17	0.03
Procalcitonin (< 0.50 ng/mL)	9.8 ± 8.95	7.9 ± 2.8	4.2 ± 3.6	2.7 ± 5.2	0.04
C-reactive protein (< 3 mg/L)	43.1 ± 40.0	43.2 ± 41.2	41.93 ± 30.2	42.86 ± 32.1	0.139
D-dimer (0–550 μg/mL)	46.03 ± 96	45.33 ± 142	48.62 ± 86	44.23 ± 102	0.945
Ferritin (20–500 ml/ng)	120.32 ± 96	119.59 ± 65	111.13 ± 86	108.63 ± 74	0.052
Albumin (3.5–5.5 g/dL)	3.01 ± 0.7	3.13 ± 0.9	3.3 ± 0.6	3.29 ± 0.52	0.051
Neutrophil (1.5–8.0 103/μL)	13.15 ± 7.6	13.18 ± 4,.2	13.08 ± 5.7	12.15 ± 4.8	0.056
Leukocytes (4.1–8.9 103/μL)	19.1 ± 6.7	18.9 ± 4.2	17.8 ± 5.8	15.4 ± 6.5	< 0.01
Lymphocyte (1.2–5.2 103/μL)	2.9 ± 0.82	2.8 ± 0.91	2.5 ± 0.8	2.4 ± 0.7	0.045
Platelets (15–450.000/mm^3)	162.6 ± 53	175.7 ± 65	199.7 ± 53	203.4 ± 56	0.008
Haemoglobin (12.4–14.8 g/L)	11.5 ± 1.6	11.7 ± 2.4	13.9 ± 1.3	14.1 ± 1.7	< 0.05
Neutrophil lymphocyte ratio	6.12 ± 1.9	6.01 ± 3.2	5.92 ± 2.7	5.12 ± 1.6	0.051
Oxygen saturation (95–100%)	90.1 ± 9.5	91.2 ± 8.7	92.4 ± 9.6	93.3 ± 6.1	0.02
Partial oxygen pressure (80–100 mmHg)	80.2 ± 29.6	81.5 ± 35.9	81.9 ± 33.7	83.2 ± 38.9	0.03
Number of patients referred to intensive care	12	11	7	2	< 0.01
Number of intubated patients	6	3	2	1	< 0.01

BMI — body mass index; SD — standard deviation

Discussion

In this study, a clear relationship was found between GNRI and the prognosis of COVID-19 in diabetic geriatric patients. It was shown that patients at risk of malnutrition have a longer hospital stay and a greater need for intensive care and mechanical ventilation. It has been shown that the COVID-19 disease, caused by SARS-CoV-2, affected the whole world in a very short time, affects all body systems [1]. Currently, the main treatment is supportive care, as there is still no effective specific drug therapy in clinical practice [3]. The disease progresses worse in geriatric and comorbid patients compared to young and middle-aged individuals [2]. The reason for this is thought to be malnutrition in geriatric patients [6].

Malnutrition is a clinical condition resulting from inadequate nutrition in terms of content or amount, and the inadequacy of energy and nutrients provided despite the body's needs [7]. It is known that malnutrition can delay recovery from many diseases, and prolong hospital stay [6]. The GNRI is a simple screening tool for estimating the risk of nutritional morbidity and mortality in geriatric patients, calculated using body mass index and serum albumin level [5]. In recent, it has been shown that GNRI can be a guide in determining the prognosis of some diseases [8]. The prevalence of malnutrition is 20–30% in the normal population and over 40% in hospitalized patients [9]. In this cross-sectional study, 11.8% of geriatric patients were found to be at risk of severe malnutrition, 20.9% of moderate and 8.1% of mild malnutrition. This high

Table 3. Correlation analysis between GNRI score and all parameters

	GNRI score	
	r	p-value
Age [years]	0.006	0.94
Height [cm]	−0.046	0.009
Weight [kg]	0.01	0.008
BMI [kg/m^2]	0.315	0.037
Albumin (3.5–5.5 g/dL)	0.01	0.005
Length of hospitalization [days]	−0.336	0.049
Hba1c (4.7–5.6%)	0.025	0.779
Glucose (70–100 mg/dL)	0.007	0.941
Urea (5–11 mg/dL)	0.181	0.07
Creatinine (< 1 mg/dL)	−0.013	0.919
Procalcitonin (< 0.50 ng/mL)	0.175	0.068
C-reactive protein (< 3 mg/L)	−0.353	0.018
D-dimer (0–550 μg/mL)	−0.045	0.045
Ferritin (20–500 mL/ng)	−0.049	0.651
Albumin (3.5–5.5 g/dL)	0,119	0,31
Leukocytes (4.1–8.9 103/μL)	−0.045	0.504
Lymphocyte (1.2–5.2 103/μL)	0.172	0.091
Neutrophil (1.5–8.0 103/μL)	−0.548	0.04
Neutrophil lymphocyte ratio	−0.01	0.005
Platelets (15–450.000/mm^3)	0.141	0.159
Haemoglobin (12.4–14.8 g/L)	0.191	0.056
Oxygen Saturation (95–100%)	−0.004	0.963
Partial oxygen pressure (80–100 mmHg)	−0.01	0.94

BMI — body mass index; GNRI — Geriatric Nutrition Risk Index

rate is thought to be because the patients are diabetic and in acute infection.

Many factors that may affect the prognosis in patients with COVID-19 have been emphasized [10]. One of them is the nutritional status [11]. Nutrition is part of the treatment regimen for many acute and chronic diseases [6]. This becomes even more important, especially if the etiological cause is unclear or the clear treatment is not clear as in COVID-19. In a review, it was stated that there is a clear relationship between malnutrition and respiratory tract functions, and it was suggested that there was a decrease in respiratory rate, quality, and cough reflex in malnourished patients [12]. In addition, malnutrition can delay recovery, prolong hospital stay, increase susceptibility to secondary infections, decrease quality of life and increase mortality rate [6]. In another study, which included patients with pulmonary pathology and evaluated their nutritional status with NRS2002, it was observed that patients at risk of malnutrition had longer hospital stays [13]. The mean hospital stay in the present study was 6.7 ± 2.7 days, and this number was longer in patients with low GNRI scores. These results, in line with the literature, once again demonstrated the relationship between malnutrition and length of hospital stay.

The mortality status associated with COVID-19 is a multifactorial process such as the underlying disease, gender, and age [10]. It has been shown that the death rate is 3 times higher in patients over the age of 80 in China, where the epidemic occurred [14]. In Italy, it was noted that 83% of the deaths associated with COVID–19 were over the age of 70 [15].

When the studies evaluating the presence of malnutrition according to gender were examined, it was revealed in a study conducted on 3186 patients that the malnutrition rate in women was 29.4%, while the rate in men was 26.5% [16]. When the presence of malnutrition was examined according to gender and GNRI score, malnutrition was found in 19.8% of men and 21.2% of women in the present study.

Procalcitonin is an important biomarker in the diagnosis of bacterial pneumonia. Procalcitonin elevation is not seen in viral pneumonia alone. In a meta-analysis on this subject, it was stated that there was an increase in procalcitonin in very few cases of COVID-19, and this increase was due to bacterial coinfection, and the prognosis was worse in these patients [17]. In the present study, it was found that patients with high procalcitonin levels had a worse prognosis and had a lower GNRI score, in line with these data.

It is known that patients have an increased risk of abnormal coagulation parameters and venous thromboembolism in COVID-19, and it has been found that increased d-dimer levels are associated with increased mortality [18]. Consistent with these data, a statistically significant relationship was found between d-dimer and the way of discharge from the hospital and malnutrition status in this study. Patients with a lower GNRI index had higher d-dimer, and patients with a high d-dimer had a worse prognosis.

In the present study, it was determined that the prognosis and prognostic factors were worse in COVID-19 patients with a low GNRI score. This situation can be explained by several mechanisms. Firstly, while the level of inflammatory proteins such as C-reactive protein, ferritin, tumour necrosis factor-alpha, interleukin-6 and interleukin-1 increases in COVID-19, the level of proteins such as albumin, prealbumin and transferrin decreases [19]. Hypoalbuminemia is one of the important indicators commonly used in the

Table 4. Comparison of all biochemical parameters according to discharge from the pandemic clinic

	Discharged home (n = 77)	1. Stage ICU Referral (n = 21)	3. Stage ICU Referral (n = 11)	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age [years]	75.8 ± 2.4	76.7 ± 2.4	78.9 ± 3.3	0.04
GNRI score	122.6 ± 23.4	104.4 ± 18.2	90.2 ± 16.1	< 0.001
Weight [kg]	77.8 ± 2.7	77.2 ± 4.6	78.2 ± 5.8	0.391
Height [cm]	164.5 ± 8.8	164.8 ± 9.2	164.7 ± 5.2	0.398
BMI [kg/m^2]	27.99 ± 4.8	28.1 ± 6.12	27.63 ± 4.8	0.137
Hba1c (4.7–5.6%)	7.69 ± 1.7	7.89 ± 3.7	7.8 ± 2.8	0,087
Glucose (70–100 mg/dL)	182 ±63.9	190 ± 68.3	190 ± 96	0,059
Urea (–11 mg/dl)	38.1 ± 14.2	41.2 ± 12.8	47.0 ± 13.3	0.063
Creatinine (< 1 mg/dl)	0.77 ± 0.19	0.81 ± 0.19	0.98 ± 0.36	0.056
Procalcitonin (< 0.50 ng/mL)	4.1 ± 2.8	5.2 ± 1.9	5.9 ± 3.8	0.059
C-reactive protein (< 3 mg/l)	41.74 ± 23.5	42.89 ± 28.4	42.1 ± 31.0	0.507
D-dimer (0–550 μg/mL)	43.18 ± 85.1	49.59 ± 74.2	56.56 ± 79.9	0.024
Ferritin (20–500 ml/ng)	112.12 ± 68	111.85 ± 85	112.56 ± 56	0.529
Albumin (3.5–5.5 g/dL)	3.9 ± 1.0	3.1 ± 0.4	3.0 ± 0.3	0.035
Neutrophil (1.5–8.0 103/μL)	12.19 ± 4.1	13.09 ± 4.6	13.14 ± 5.5	0.056
Leukocytes (4.1–8.9 103/μL)	17.4 ± 3.7	17.9 ± 2.8	18.8 ± 2.9	0.065
Lymphocyte (1.2–5.2 103/μL)	2.4 ± 0.6	2.5 ± 1.9	2.6 ± 1.2	0.099
Platelets (15–450.000/mm^3)	196.78 ± 19	196.7 ± 13	196.6 ± 11	0.052
Haemoglobin (12.4–14.8 g/L)	14.09 ± 1.11	14.1 ± 1.5	14.11 ± 1.6	0.069
Neutrophil lymphocyte ratio	5.90 ± 1.8	5.91 ± 1.9	5.92 ± 2.1	0.068
Oxygen saturation (95–100%)	94.2 ± 4.5	90.2 ± 8.7	89.3 ± 7.7	< 0.005
Partial oxygen pressure (80–100 mmHg)	83.4 ± 32.8	81.8 ± 32.8	80.1 ± 28.5	0.04

BMI — body mass index; GNRI — Geriatric Nutrition Risk Index; SD — standard deviation

evaluation of malnutrition [5]. Since an albumin-based formula is used when calculating the GNRI score, it is expected that patients with a worse prognosis will have a lower GNRI score.

It is known that diabetic patients are prone to malnutrition due to diet incompatibility and malnutrition due to endocrine dysfunction [20]. The inflammatory response caused by COVID-19 disease and the use of glucocorticoids increases the severity of hyperglycaemia [21]. In this case, the authors think that it causes hypoalbuminemia and a decrease in the GNRI score in these patients.

Third, angiotensin-converting enzyme-2 was found to be highly expressed in the gastrointestinal tract as well as in the lungs [22]. This makes the gastrointestinal tract one of the main targets of the SARS-CoV-2 attack [22]. Diarrheal, abdominal pain, nausea and vomiting due to COVID-19 cause a decrease in oral intake in elderly patients [2]. As a result, a decrease may occur in the total protein amount and thus in the albumin level in patients. Since oral intake will decrease further in patients with more disease severity, hypoalbuminemia is expected in patients with poor prognoses.

In addition, generalized anxiety disorder occurs in patients due to COVID-19 [23]. Patients' fear of the current disease, long-term isolation anxiety and fear of death reduce their appetite and aggravate malnutrition [23]. In patients under intense anxiety, higher cortisol levels increase inflammation, causing a decrease in albumin levels and indirectly a decrease in the GNRI score. In addition, malnutrition causes impaired complement activation and thymic atrophy in the immune system [24]. A decrease in the number of macrophages and cytotoxic T cells in malnourished patients and a decrease in IL-2, IFN-y and leptin secretion occurs, making it difficult to fight infection. No study addresses the prognosis of COVID-19 disease by GNRI score in literature. This suggests that malnutrition, as previously observed in other respiratory

diseases, can greatly affect the course and outcome of COVID-19, especially in elderly and diabetic patients. The present study demonstrated that low GNRI is an independent risk factor for morbidity and mortality in COVID-19 disease.

Limitations of the study

The study had some limitations. First, it was a single-centre study with a relatively small number of patients. Second, this study was a cross-sectional study, so a causal relationship between the GNRI score and the prognosis of the disease could not be established. In addition, patients' albumin measurement and GNRI calculations were evaluated at a single time point. Finally, some other risk factors, such as physical activity, lifestyle habits, and social support, can significantly affect patients' nutritional status, and these factors were not analysed in this study. Another limitation of the study was the absence of a control group without young people or diabetes. More comprehensive clinical studies should be conducted with a larger number of patients and control groups on this subject.

Conclusions

In conclusion, a low GNRI score is associated with poor prognosis in diabetic geriatric patients hospitalized with the diagnosis of COVID-19. Patients at risk of malnutrition have a longer hospital stay, a greater need for intensive care and mechanical ventilation, and a poor prognosis. As a clinical consequence, physicians should be aware of an increased risk of malnutrition in patients with COVID-19. Detection of malnutrition in such patients is important in terms of nutritional therapy and preventive strategies.

Article information and declarations

Conflict of interest

The authors declare no conflict of interest.

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