



Prevalence of Malnutrition According to the Global Leadership Initiative on Malnutrition Criteria in Community-dwelling Older Adults in Turkey

Türkiye'de Toplumda Yaşayan Yaşlılarda Malnütrisyonda Küresel Liderlik Girişimi Kriterlerine Göre Malnütrisyon Prevalansı

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ABSTRACT

Objective: This study aimed to investigate the prevalence of malnutrition according to the Global Leadership Initiative on Malnutrition (GLIM) criteria in community-dwelling older adults in Turkey.

Methods: Malnutrition was assessed based on the GLIM criteria, and Mini-Nutritional Assessment-Short Form was used for screening. The severity of malnutrition was determined as severe or moderate based on the phenotypic criteria of GLIM.

Results: Five hundred sixty-nine (69% female, mean age 74.42 ± 6.58 years) community-dwelling older adults participated in this study. The educational statuses of the participants were as follows: 17.2%, illiterate; 13.3%, literate; 35.3%, primary school; 7.0%, secondary school; 11.1%, high school; and 16.2%, university graduates. Among the participants, 16.4% were living alone, whereas 43.9% of them were living with their spouses. The rest were living with their extended families. According to the GLIM criteria, 24.5% (n=139) of the participants had malnutrition, and 13.9% of the total population had severe malnutrition. Age was significantly associated with malnutrition [odds ratio 1.064, 95% confidence interval (CI) 1.034-1.096, $p<0.0001$]. No significant difference was found between genders ($p=0.207$), education groups ($p=0.323$), and living status ($p=0.434$) in terms of malnutrition. However, women had higher malnutrition rates than men (26.0% vs. 21.0%) (risk ratio 0.757, 95% CI 0.494-1.160, $p=0.207$).

Conclusions: The prevalence of malnutrition was 24.5%, whereas the rate of severe malnutrition was 13.9% in community-dwelling older adults. Women had higher rates of malnutrition, and age was associated with malnutrition. We recommend for researchers and clinicians to integrate the GLIM criteria into their practices to create a common language in malnutrition assessment.

Keywords: Malnutrition, Global Leadership Initiative on Malnutrition (GLIM), aged, geriatric assessment, energy intake

ÖZ

Amaç: Bu çalışmada amaç, Türkiye'de toplumda yaşayan yaşlılarda Malnütrisyonda Küresel Liderlik Girişimi (GLIM) kriterlerine göre malnütrisyon prevalansını araştırmaktır.

Yöntemler: Malnütrisyon, GLIM kriterlerine göre değerlendirildi ve tarama için Mini-Nutrisyonel Değerlendirme-Kısa Formu kullanıldı. Malnütrisyonun şiddeti GLIM fenotipik kriterlerine göre şiddetli veya orta olarak belirlendi.

Bulgular: Bu çalışmaya 569 (%69 kadın, ortalama yaşı $74,42 \pm 6,58$ yıl) toplum içinde yaşayan yaşlı katıldı. Katılımcıların eğitim durumu %17,2 okur-yazar değil, %13,3 okur-yazar iken; %35,3 ilkokul, %7,0 ortaokul, %11,1 lise ve %16,2 üniversite mezunu şeklindeydi. Katılımcıların %16,4'ü yalnız yaşarken; %43,9'u eşiley birlikte yaşamaktaydı. Popülasyonun geri kalanı geniş aileleriyle yaşıyordu. GLIM kriterlerine göre bireylerin %24,5'inde (n=139) malnütrisyonu vardı. Tüm katılımcıların %13,9'u şiddetli malnütrisyonu sahipti. Yaş, malnütrisyonla anlamlı şekilde ilişkiliydi [olasılık oranı: 1,064, %95 güven aralığı (CI): 1,034-1,096, $p<0,0001$]. Cinsiyet ($p=0,207$), farklı eğitim grupları ($p=0,323$) ve yaşam durumu ($p=0,434$) arasında malnütrisyon açısından istatistiksel olarak anlamlı fark yoktu. Bununla birlikte, kadınlarında erkeklerle kıyasla malnütrisyon oranı daha yüksekti (%26,0'a karşı %21,0) (risk oranı: 0,757, 95% CI: 0,494-1,160, $p=0,207$).

Sonuçlar: Sonuç olarak, toplumda yaşayan yaşlılarda malnütrisyon prevalansı %24,5 iken şiddetli malnütrisyon oranı %13,9 idi. Kadın cinsiyette malnütrisyon daha yüksekti. Ek olarak, yaş malnütrisyon ile ilişkiliydi. Araştırmacılarla ve klinisyenlere, malnütrisyon değerlendirmesinde ortak bir dil oluşturmak için GLIM kriterlerini uygulamalarına entegre etmelerini öneririz.

Anahtar kelimeler: Malnütrisyon, Malnütrisyonda Küresel Liderlik Girişimi (GLIM), yaşlı, geriatrik değerlendirme, enerji alımı

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INTRODUCTION

The prolongation of life expectancy increased the proportions of older people in the population and the interest in the nutritional status of older adults¹. The European Society for Clinical Nutrition and Metabolism (ESPEN) defines malnutrition as "a condition caused by inadequate or irregular food intake, resulting in deterioration of body composition (reduction in lean mass) and body cell mass, reduced physical and mental function, and worsening of clinical outcomes from disease." Malnutrition may result from inadequate nutrition, starvation, disease, or advanced aging (e.g., >80 years)^{1,2}. It is closely associated with a poor quality of life, increased mortality and morbidity rates, long hospital stays, and disability, which in turn result in high healthcare costs¹. Therefore, evaluating the nutritional status of older adults is crucial.

Various screening tools are available for malnutrition diagnosis³, such as the Mini-Nutritional Assessment-Short Form (MNA-SF)⁴, Nutrition Risk Screening 2002⁵, and Malnutrition Universal Screening Tool⁶. However, the prevalence of malnutrition and malnutrition risk varies widely, depending on the scale used and the population analyzed in the study³. For example, the prevalence of malnutrition in community-dwelling older adults varies between 5% and 30%, and these rates increase even more in nursing home residents and inpatients³. Although malnutrition is a frequently encountered and important geriatric syndrome associated with poor clinical outcomes and may be treated if detected early, a global definition and diagnostic criteria of malnutrition have not been established yet.

In a large meta-analysis published in 2017, which investigated the validity and reliability of malnutrition rating scales in community-dwelling older adults⁷, none of the nutritional assessment tools had reached adequate validation, and the authors could not suggest any tool to diagnose malnutrition in this group.

To develop a more inclusive and global assessment scale that can be used in all clinical settings, four leading clinical nutrition societies (ESPEN, American Society for Parenteral and Enteral Nutrition, Federación Latinoamericana de Terapia Nutricional, Nutrición Clínica y Metabolismo, and The Parenteral and Enteral Nutrition Society of Asia) formed a consensus to create the Global Leadership Initiative on Malnutrition (GLIM) criteria. According to these criteria, the diagnosis of malnutrition is made based on phenotypic [i.e., low body mass index (BMI), weight loss, and low fat-free muscle index] and etiological (i.e., reduced food intake, or malabsorption,

and chronic or recurrent inflammatory activity) criteria. At least one phenotypic criterion and one etiological criterion are required for diagnosis. The severity of malnutrition is determined based on the phenotypic criteria².

The GLIM criteria are advantageous compared with other assessment tools, as it includes both phenotypic and etiological criteria to diagnose malnutrition. Furthermore, it does not only diagnose malnutrition but also grades its severity, which in turn guides the intervention protocol². Although age alone is not a criterion in the GLIM, it offers an opportunity to evaluate older adults in more detail, including muscle strength, muscle mass, as well as sarcopenia.

In their brilliant cohort study SarcoPhAge, Lengelé et al.⁸ showed that GLIM may be also a predictor of sarcopenia. Another study reported that GLIM criteria predicted 5-year mortality better than other assessment tools⁹.

In this study, we aimed to investigate individuals admitted to the geriatric outpatient clinic according to the GLIM criteria in terms of malnutrition, which has been an indispensable part of the comprehensive geriatric evaluation.

MATERIALS and METHODS

This observational study was conducted in the Geriatric Outpatient Clinic of University of Health Sciences Turkey, Umraniye Training and Research Hospital. The University of Health Sciences Turkey, Umraniye Training and Research Hospital Ethics Committee approved this study on October 28, 2021 (decision no: 316). All procedures in this study were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

The community-dwelling older adults who applied to the outpatient clinic were assessed for eligibility. The inclusion criteria were as follows: a) age ≥ 65 years and b) a native Turkish speaker. Those who had severe cognitive problems were excluded from the study.

A sociodemographic form was filled out by the researchers based on the information received from the patients and their medical files. Then, the researchers proceeded with the examinations using the outcome measures.

GLIM-based assessment of the malnutrition was performed as described in a previous study². The Turkish version of MNA-SF was used in the screening^{4,10}. The first item of the phenotypic questions was evaluated based

on the answers received from the patients and their caregivers. The amount of weight that was involuntarily lost in the last 6 months was queried, and the answer was recorded. If the individual had lost $>5\%$ of the body weight within the past 6 months or $>10\%$ beyond 6 months, the first criterion was confirmed. For the second phenotypic criteria, a researcher measured the height and weight of the individual. This information was used to calculate BMI. If the BMI was $<20 \text{ kg/m}^2$ for individuals aged <70 years, or $<22 \text{ kg/m}^2$ for those aged ≥ 70 years, the BMI was categorized as low. A reduction in muscle quantity was measured using TANITA[®] TBF 300 bio-impedance analysis. The normative values for appendicular lean mass index (kg/m^2) in Turkey were derived from a previous study¹¹.

Regarding the etiological criteria, statements of both patients and caregivers and the medical records were cross-checked. For the first criteria, the patients were asked whether they had experienced a reduction in food intake or assimilation related to a gastrointestinal problem². In the second criteria, acute inflammation (such as trauma, major infections, and burns)² was omitted since the study was conducted in an outpatient clinic. Comorbidities such as ischemic heart disease, chronic heart failure, chronic obstructive pulmonary disease, and cancer were recorded to assess chronic inflammation².

A blood test indicator of the active inflammation [i.e., serum C-reactive protein (CRP)] was also considered. If the serum CRP level was $>5 \text{ mg/dL}$, inflammation was present¹². Individuals who had at least one phenotypic criterion (i.e., low BMI, weight loss, and low muscle mass) and one etiological criterion (reduced food intake, or malabsorption, and chronic or recurrent inflammatory activity) were diagnosed with malnutrition.

The severity of the malnutrition was also evaluated based on the diagram put forward by Cederholm et

al.² after the diagnosis of malnutrition. As described in this previous study, severity was determined based on the phenotypic criteria. Severe malnutrition occurred if the individual had a weight loss $>10\%$ within the past 6 months, or $>20\%$ beyond 6 months, low BMI ($<18.5 \text{ kg/m}^2$ if <70 years or $<20 \text{ kg/m}^2$ if ≥ 70 years), and severe deficit in muscle mass².

Statistical Analysis

Statistical analysis was conducted using IBM SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are reported as means \pm standard deviations for continuous variables and as numbers and frequencies for binary and categorical variables. The diagnosis of malnutrition was performed with frequency analysis for GLIM criteria. We performed a chi-square test to determine the difference between the educational and living arrangement status. Binomial regression was used to analyze the association between age and malnutrition. The significance level was set at $p=0.05$.

RESULTS

A total of 569 (69% female) community-dwelling older adults participated in this study. The mean age was 74.42 ± 6.58 years. The educational statuses of the participants were as follows: 17.2%, illiterate; 13.32%, literate but no formal education; 35.3%, primary school; 7%, secondary school; 11.1%, high school; and 16.2%, university graduates. Among the participants, 16.4% were living alone, whereas 43.9% were living with their spouses. The rest of the participants were living with their extended families (with 3-8 people). Tables 1 and 2 show the sociodemographic and clinical characteristics of the study participants based on sex.

According to the GLIM criteria, 24.5% ($n=139$) of the participants had malnutrition. Among them, 56.8% ($n=79$, 13.9% of the total population) had severe

Table 1. Characteristics of the participants based on sex.

	Female (n=392) Mean \pm SD	Male (n=177) Mean \pm SD
Age (years)	73.92 ± 6.42	75.51 ± 6.80
BMI (kg/m^2)	29.22 ± 5.21	27.29 ± 4.96
ALMi (kg/m^2)	7.99 ± 1.73	11.02 ± 2.53
Anthropometric measurements		
Waist (cm)	98.24 ± 12.75	101.41 ± 11.51
Hip (cm)	107.51 ± 10.53	104.97 ± 8.78
Arm (cm)	29.66 ± 3.95	28.48 ± 3.36
Calf (cm)	36.56 ± 4.50	36.48 ± 3.58
BMI: Body mass index, ALMi: Appendicular lean mass index, SD: Standard deviation		

malnutrition. Table 3 represents the distribution of the study population according to each GLIM criterion based on sex. No significant difference was found between the sexes in terms of malnutrition (26.0% in women vs. 21.0% in men) [risk ratio, 0.757; 95% confidence interval (CI), 0.494-1.160, $p=0.207$].

Further analysis revealed no difference in GLIM-based nutritional status between education groups ($p=0.323$) and between participants who were living alone, with spouses, or extended families ($p=0.434$). Age was significantly associated with malnutrition (odds ratio, 1.064; 95% CI, 1.034-1.096, $p<0.0001$).

DISCUSSION

In this study, the prevalence of malnutrition was 24.5% in community-dwelling older adults, whereas the rate of severe malnutrition was 13.9%. No significant difference was found between sexes, although malnutrition was more common in women. However, the risk ratio was close to 1. In addition, the frequency of malnutrition increased with age. However, the association between malnutrition and age was weak in this study. Thus, investigating the prevalence of GLIM-based malnutrition in outpatients is valuable.

According to the data from the World Health Organization (WHO), the number of people aged >60 years, which was over one billion in 2019, is expected to be 1.4 billion in 2030 and 2.1 billion in 2050¹³. In addition, WHO has declared healthy aging a priority for its work on aging between 2016 and 2030¹⁴. The aim was that older adults, whose numbers are increasing rapidly, can maintain their independent lives by ensuring their well-being. This approach is in line with the desires of community-dwelling older adults who also want to stay in their homes as long as possible. Therefore, the early recognition of malnutrition and designing appropriate interventions play a key role in achieving these goals.

Poor nutritional status and risk of malnutrition in the community exist before the disease occurs¹⁵. Thus, not only hospitalized patients but also community-dwelling older adults should be evaluated in terms of malnutrition. A systematic and structured nutritional screening is recommended for the early detection of malnutrition to prevent a decline in health status caused by deficiencies in macro- and micronutrients¹⁵.

In a meta-analysis by Kaiser et al.¹⁵, including 4,507 people aged >65 years, the malnutrition rate was 22.8%. In the analysis of studies investigating the prevalence of

Table 2. Distribution of comorbidities based on sex.

Comorbidities	Female (n=392) n, %	Male (n=177) n, %	Overall n, %
Hypertension	295 (75.3%)	115 (65.3%)	410 (72.2%)
Diabetes mellitus	134 (34.2%)	63 (35.8%)	197 (34.7%)
Ischemic heart disease	51 (13.0%)	50 (28.4%)	101 (17.8%)
Chronic heart failure	4 (1.0%)	3 (1.7%)	7 (1.2%)
COPD	26 (6.6%)	14 (8.0%)	40 (7.0%)
Cancer	27 (6.9%)	17 (9.7%)	44 (7.7%)

COPD: Chronic obstructive pulmonary disease

Table 3. Distribution of the study population according to each GLIM criterion based on sex.

GLIM criteria	Female (n=392) n (%)	Male (n=177) n (%)	Overall n (%)
Malnutrition	102 (26.0%)	37 (21.0%)	139 (24.5%)
Phenotypic criteria			
1. Involuntary weight loss	96 (24.9%)	32 (18.1%)	128 (22.8%)
2. Low BMI	20 (5.1%)	19 (10.7%)	39 (6.9%)
3. Reduced muscle mass	153 (39.0%)	43 (24.4%)	196 (34.5%)
Etiologic criteria			
1. Reduced nutrition intake	94 (24.4%)	23 (13.1%)	117 (20.8%)
2. Inflammation	102 (26.0%)	69 (39.2%)	171 (30.1%)

GLIM: Global Leadership Initiative on Malnutrition; BMI: Body mass index

malnutrition in Turkey, the malnutrition rate was 13%, and the risk of malnutrition was 31% in community-dwelling older adults¹⁶ and 33.1% in older adults who were admitted to home healthcare services in Istanbul¹⁷. The risk of malnutrition was 28% in community-dwelling older adults in Ankara¹⁸. In a comprehensive, multicenter study conducted in nursing homes, the risk of malnutrition was 38.4%, and the malnutrition rate was 11.9%¹⁹.

In another study in which 252 outpatients were evaluated according to the GLIM criteria in the Central Anatolia Region of Turkey, malnutrition was found in 32.2% of the participants²⁰. The discrepancies between the aforementioned studies and ours may originate from two factors: 1) use of different diagnostic tools and 2) income distribution. For instance, Istanbul, where the current study is conducted, has the highest income rate in Turkey²¹, and this may lead to lower malnutrition rates in our study than in the study by Ozer et al.²⁰.

According to Balci et al.⁹, the prevalence of GLIM-based malnutrition was 35.9% in patients hospitalized for acute illnesses. In a different study²², malnutrition prevalence ranged from 46.6% to 75.0% using ultrasound imaging for different muscles in hospitalized patients. The difference in findings between these studies and the current study may be the result of analyzing different patient populations. Malnutrition was reported to be higher in hospitalized patients than in their community-dwelling peers²³. Thus, it is rational to find a lower rate of malnutrition in the current study than in the aforementioned studies^{9,22}.

Similar to our results, the prevalence of GLIM-based malnutrition was 23.4% in a study evaluating older adults admitted to various outpatient clinics in Belgium²⁴. In another large-scale study conducted in Japan, GLIM-based malnutrition rates were 25.7% in individuals aged ≥70, which is also consistent with our findings²⁵.

Previous studies have suggested a higher rate of protein-energy malnutrition in women^{23,26,27}. Additionally, in a large-scale meta-analysis evaluating malnutrition rates in older adults in Europe, the prevalence was higher in women, and malnutrition rates got higher as individuals aged, similar to our finding²⁷. Other studies from Turkey also reported that women had higher malnutrition rates¹⁸⁻²⁰. However, it was not fully clarified whether the higher malnutrition rates in women were due to physical differences or social and economic inequalities²⁶. The factors that cause the difference between sexes should be investigated and explained in future studies.

In the present study, only 16.4% of the participants lived alone. Although living alone has been a risk factor

for malnutrition in older adults²⁸, we did not find such a relationship between GLIM and malnutrition. In the cultural traditions of our country, elderly care is accepted as the responsibility of family members, and as we expected, the majority of our study participants lived with their families. Thus, we might not succeed to reach adequate power to compare the groups.

This study has a few limitations. First, the distribution between sexes was not equal. This may cause insignificant results between sexes in terms of malnutrition. Similarly, the distribution of living status (i.e., alone, with a spouse, or with extended family) was heterogeneous. However, our study contributes to the literature, as it has been conducted on a large cohort using the most recent assessment method defined in the literature.

CONCLUSION

In this study, the prevalence of malnutrition was 24.5%, whereas the rate of severe malnutrition was 13.9% in community-dwelling older adults. Women had higher rates of malnutrition. Additionally, increased age was associated with higher odds of malnutrition. Considering the high rate of malnutrition, community-dwelling older adults should be regularly screened for malnutrition risk. At this point, we hope that the GLIM criteria will enable the use of a common language in malnutrition assessment. Thus, better outcomes and better quality of life can be achieved with early diagnosis and treatment of nutritional problems.

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Ethics

Ethics Committee Approval: The University of Health Sciences Turkey, Umraniye Training and Research Hospital Ethics Committee approved this study on October 28, 2021 (decision no: 316).

Informed Consent: All patients admitted to the hospital, or their legal guardian when appropriate, were informed that their medical information could be used for research purposes.

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Author Contributions

Surgical and Medical Practices: F.D., O.P., Concept: F.D., E.N.K., Design: F.D., E.N.K., O.P., Data Collection and/or Processing: F.D., E.N.K., Analysis and/or

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