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# An Analytical Cross-Sectional Study of Malnutrition in Hemodialysis Patients in Gorgan, Iran, 2020

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***ABSTRACT***

**Background**: Malnutrition is relatively common in hemodialysis (HD) patients, which increases the risk of mortality. Seven Point Subjective Global Assessment (7-point SGA) tool is recommended to evaluate and monitor malnutrition in HD patients. The aim of this study was to investigate malnutrition using 7-point SGA in HD patients referred to dialysis centers in Gorgan city (north-eastern of Iran) in 2020. **Methods**: The nutritional status of 133 HD patients referred to Gorgan city dialysis center in 2020 were assessed using the 7-point SGA tool. Weight, percentage of fat, and muscle mass were measured by Omron BF511. Height was measured using the SECA portable stadiometer. Serum hemoglobin levels were recorded based on the latest recorded routine tests during the last month. A demographic information questionnaire was completed for all individuals. Medications and supplements taken by patients as well as visits by a nutrition consultant and adherence to a special diet were investigated by reviewing the medical file and asking the patient. **Results**: Out of 133 patients, 43.61% had no malnutrition and 56.39% had moderate malnutrition. The nutrition status was not different regarding gender and education level, but was different regarding household size ($P$=0.032). Patients with moderate malnutrition were older and had less weight and body mass index (BMI), but there was no statistically significant difference between height, dialysis time span, body fat and muscle mass percentage, and serum hemoglobin concentration. **Conclusion**: This study showed a considerable rate of malnutrition in HD patients, which should be regarded by clinicians and health policymakers.

**Keywords:** *Malnutrition; Nutrition assessment; Renal dialysis; Kidney failure*

## introduction

Malnutrition is a condition that results from an increase or decrease in energy, protein, and micronutrients, and ranges from underweight to overweight and nutrient deficiency. In

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hemodialysis (HD) patients, dietary restriction, anorexia, loss of some nutrients during HD, hormonal disorders, changes in absorption and also increased catabolism due to increased inflammatory cytokines can lead to poor nutritional status (Sahathevan *et al.*, 2020). Increased inflammatory cytokines increase lipolysis, muscle protein breakdown, negative nitrogen balance, and ultimately malnutrition. Therefore, protein wasting is relatively common in HD patients (Fouque *et al.*, 2008). Malnutrition reduces the quality of life, increases incidence of diseases, increases costs and length of hospital stay, and increases mortality (Sahathevan *et al.*, 2020). The physical effects of malnutrition include decrease in body mass, decrease in respiratory muscle mass and strength, and decreased heart function (Hébuterne *et al.*, 2001). It has also been shown that malnutrition is associated with high risk of mortality in dialysis patients (Rambod *et al.*, 2009). Therefore, early detection of malnutrition to initiate on time nutritional support has an essential role in increasing the survival of these patients (Netherlands Cooperative Study on the Adequacy of Dialysis-2 Study, 2009).

Biochemical methods provide relatively accurate information about the nutritional status of individuals compared to clinical and anthropometric methods, but a basic challenge in the biochemical study of malnutrition in kidney patients is the validity of routine nutritional biomarkers including albumin, ferritin, etc. Given that it is affected by inflammatory conditions, it will not truly reflect the nutritional status (Spatola *et al.*, 2019).

Subjective global assessment (SGA) is a cheap, fast, non-invasive tool and also the most common tool for nutritional assessment of various hospitalized patients (Fontes *et al.*, 2014, Steiber *et al.*, 2004). SGA consists of two main parts including medical history and clinical examination. By means of SGA, the patient's lost weight during the last 6 months, dietary changes during the last two weeks, gastrointestinal symptoms including nausea, vomiting, anorexia, and diarrhea (more than 2 weeks), functional capacity, metabolic stress caused by the disease (the effect of the disease on nutritional needs), subcutaneous fat (chest and triceps) and muscle mass (quadriceps and deltoid), edema (sacral and ankle) or ascites and cachexia can be assessed (Fontes *et al.*, 2014, Steiber *et al.*, 2004). The validity and reliability of SGA in various diseases (Steiber *et al.*, 2004) including HD patients (Steiber *et al.*, 2007) have been demonstrated. However, studies have shown that SGA is mainly effective in diagnosing severe cases of malnutrition (Fouque *et al.*, 2007, Visser *et al.*, 1999) and it is probably not accurate enough in detecting changes in nutritional status (Visser *et al.*, 1999). For this reason, the use of a relatively similar tool called 7-Point SGA is recommended to evaluate and monitor malnutrition in patients undergoing HD (Netherlands Cooperative Study on the Adequacy of Dialysis-2 Study, 2009, Visser *et al.*, 1999).

The 7-point SGA results are almost identical to the SGA, except that it also reveals small changes in nutrition status over a shorter period of 1 month. Its score varies from 1 to 7. A score of 1 to 2 indicates severe malnutrition, a score of 3 to 5 indicates mild to moderate malnutrition, and a score of 6 to 7 indicates well-nourished status (Lim *et al.*, 2016). One-point decrease in 7-point SGA is associated with a quarter increase in the risk of death. 7-point SGA has a positive correlation with body mass index (BMI) and mid-arm circumference (MAC), i.e. by increasing BMI and MAC, 7-point SGA score also increases (Detsky *et al.*, 1987, Espahbodi *et al.*, 2014, Lim *et al.*, 2016, Makhija and Baker, 2008).

Given the importance of malnutrition in the prognosis of patients undergoing HD and the need for timely intervention, this study was performed to investigate malnutrition using 7-point SGA in patients referred to dialysis centers in Gorgan City (northeastern of Iran) in 2020.

## Materials and Methods:

*Study design and participants:* This was an analytical cross-sectional study in which all the patients undergoing hemodialysis referred to Gorgan city dialysis centers in 2020 were included.

*Measurements:* Patients' nutritional status was


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assessed using the 7-point SGA tool and was classified into three levels including well-nourished, mildly to moderately malnourished, and severely malnourished. SGA 7-point is similar to SGA, indicating that it consists of two parts including medical history and physical examination of the patient, except that small changes in nutritional status can be detected within a shorter period of 1 month. This questionnaire examines the patient lost weight during the last 6 months, dietary changes during the last two weeks, gastrointestinal symptoms including nausea, vomiting, anorexia, and diarrhea (more than 2 weeks), functional capacity, metabolic stress caused by the disease (the effect of the disease on nutritional needs), subcutaneous fat analysis (chest and triceps) and muscle mass (quadriceps and deltoid), edema (sacral and ankle) or ascites and cachexia. Its scores range from 1 to 7; a score of 1-2 indicates severe malnutrition, 3-5 mild to moderate malnutrition, and a score of 6-7 indicates proper nutrition (Lim *et al.*, 2016).

Weight, percentage of fat, and muscle mass were measured within a maximum of 1 hour after the dialysis session using a portable body analyzer, Omron BF511 (Kyoto, Japan). Height was measured using the SECA portable stadiometer.

Patients' serum hemoglobin levels were recorded based on the latest recorded routine tests during the last month. In addition, a demographic information questionnaire was completed for all individuals. Medications and supplements taken by patients as well as visits by a nutrition consultant and adherence to a special diet were checked by reviewing the medical file and asking the patient.

*Ethical considerations:* This project was carried out following the approval of the ethics committee of Golestan University of Medical Sciences (GOUMS), ethic code: IR.GOUMS.REC.1398.315 available at:

"https://ethics.research.ac.ir/EthicsProposalView.php?id=107003". All patients undergoing HD referred to Gorgan City Dialysis Centers in 2020 were invited to participate in the study. Informed written consent was obtained from the volunteers prior to participation in the study.

*Data analysis:* Data were analyzed using STATA v.14 software at a significance level of 0.05. Independent t-test or Mann-Whitney U test for comparison of quantitative variables between groups (no severe malnourished patient was found) following Kolmogorov–Smirnov test for normality, and Chi-square test for comparison of qualitative variables between groups were used.

## Results

In this analytical cross-sectional study, out of 180 patients referred to Gorgan dialysis centers, 133 (73.9%) accepted to voluntarily participate, and their nutritional status was assessed using the 7-Point SGA tool. The height and weight of all the 133 patients and the percentage of fat and muscle percentage of 83 of them were measured (the rest declined to cooperate).

Sixty-nine patients (59.1%) were women with a mean age of 55.3 ± 14.6 years and mean dialysis time span of 47.5 ± 47.4 months, and the rest 64 patients (40.1%) were men with a mean age of 57.0 ± 14.5 years, and mean dialysis time span of 29.2 ± 42.8 months (Median: 14, IQR: 32). The mean age and dialysis time span of all the patients were 56.1 ± 14.5 years and 38.6 ± 46.0 (Median: 19, IQR: 44) months, respectively.

Mean height, weight, BMI, body muscle percentage, body fat percentage, and serum hemoglobin were 164.0 ± 9.6 cm, 68.2 ± 13.1 kg, 25.4 ± 4.7 kg/m$^2$, 33.2 ± 6.0%, 27.4 ± 10.6%, and 11.1 ± 1.4 g/dl, respectively.

Out of 133 patients, 58 (43.61%) had no malnutrition and 75 (56.39%) had mild to moderate malnutrition. None of the patients had severe malnutrition.

There was no statistically significant difference between male and female patients in terms of malnutrition (**Figure 1**). Patients with moderate malnutrition were older and had less weight and BMI than patients without malnutrition. However, there was no statistically significant difference between height, dialysis time span, percentage of body fat and muscle mass, and serum hemoglobin concentration (**Table 1**).

The rate of malnutrition was significantly


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higher in patients with hypertension (HTN) (*P*=0.003), but there was no difference in the rate of malnutrition between patients with type 2 diabetes mellitus and other patients. In addition, there was no statistically significant difference in the rate of malnutrition between patients taking Nephrovit or Nephrotonic, injectable iron (Venofer), Sevelamer (phosphate binder), Erythropoietin (EPO), Calcium carbonate, Calcitriol, and Folic acid with patients who did not take each of these drugs and dietary supplements (**Table 2**).

In this study, the level of literacy and education of individuals was classified into 4 levels including illiterate, basic literacy and elementary, elementary to diploma, and university education. The highest rate of malnutrition was seen in illiterate and university education groups. However, these differences were not statistically significant (**Figure 2**).

There was a significant difference between patients with different household sizes in terms of malnutrition (*P*=0.032). The highest rate of malnutrition was in patients living alone (**Figure 3**). Out of 133 patients, 130 (97.7%) did not receive nutritional counseling and out of the remaining 3, only 2 patients adhered to the diet advised by a dietitian.

**Table 1.** Comparing mean of some variables in term of the nutritional statuse.

| Variables | Nutritional status | N | Mean | SD | Min | Max | P-value[a] |
|---|---|---|---|---|---|---|---|
| Age (Year) | Well nourished | 58 | 49.8 | 15.1 | 19.0 | 73.0 | <0.001 |
| | Moderately malnourished | 75 | 61.0 | 12.0 | 26.0 | 86.0 | |
| Dialysis time span (month) | Well nourished | 58 | 29.5 | 42.5 | 1.0 | 276.0 | 0.1 |
| | Moderately malnourished | 75 | 45.6 | 47.6 | 1.0 | 180.0 | |
| Height (cm) | Well nourished | 58 | 164.8 | 10.4 | 130.0 | 189.0 | 0.39 |
| | Moderately malnourished | 75 | 163.4 | 9.0 | 143.0 | 185.0 | |
| Weight (kg) | Well nourished | 58 | 71.4 | 12.1 | 42.3 | 94.4 | 0.007 |
| | Moderately malnourished | 75 | 65.7 | 13.4 | 41.5 | 99.4 | |
| Body mass index (kg/m$^2$) | Well nourished | 58 | 26.4 | 4.7 | 17.0 | 38.5 | 0.027 |
| | Moderately malnourished | 75 | 24.6 | 4.6 | 15.8 | 38.8 | |
| Body muscle (%) | Well nourished | 44 | 32.4 | 6.2 | 20.4 | 43.5 | 0.22 |
| | Moderately malnourished | 39 | 34.0 | 5.7 | 23.4 | 46.9 | |
| Body fat (%) | Well nourished | 44 | 29.5 | 10.7 | 7.2 | 53.1 | 0.057 |
| | Moderately malnourished | 39 | 25.1 | 10.1 | 5.3 | 48.9 | |
| Serum hemoglobin (g/dl) | Well nourished | 58 | 11.1 | 1.3 | 8.3 | 13.7 | 0.79 |
| | Moderately malnourished | 75 | 11.1 | 1.6 | 7.4 | 15.3 | |

[a]: Independent sample t-test

**Table 2.** Comparison of nutritional status in terms of disease history, and using drugs and supplements.

| Variables | | Well nourished | Moderately malnourished | P-value[a] |
|---|---|---|---|---|
| Diabetes Mellitus | No | 41 (30.8) | 47 (35.3) | 0.36 |
| | Yes | 17 (12.8) | 28 (21.1) | |
| Hypertension | No | 36 (27.1) | 27 (20.3) | 0.003 |
| | Yes | 22 (16.5) | 48 (36.1) | |
| Nephrovit / Nephrotonic | No | 20 (15.0) | 27 (20.3) | 0.86 |
| | Yes | 38 (28.6) | 48 (36.1) | |
| Oral Iron | No | 51 (38.3) | 75 (56.4) | 0.002 |
| | Yes | 7 (5.3) | 0 (00.0) | |
| Injection Iron | No | 10 (7.5) | 18 (13.5) | 0.39 |
| | Yes | 48 (36.1) | 57 (42.9) | |







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|---|---|---|---|---|
| Sevelamer | No | 47 (35.3) | 63 (47.4) | 0.65 |
| | Yes | 11 (8.3) | 12 (9.0) | |
| Erythropoietin (EPO) | No | 4 (3.0) | 4 (3.0) | 0.72 |
| | Yes | 54 (40.6) | 71 (53.4) | |
| Folic acid | No | 15 (11.3) | 18 (13.5) | 0.84 |
| | Yes | 43 (32.3) | 57 (42.9) | |
| B-complex | No | 0 (00.0) | 0 (00.0) | ... |
| | Yes | 58 (43.6) | 75 (56.4) | |
| Calcium carbonate | No | 14 (10.5) | 14 (10.5) | 0.44 |
| | Yes | 44 (33.1) | 61 (45.9) | |
| Calcitriol | No | 28 (21.1) | 46 (34.6) | 0.13 |
| | Yes | 30 (22.5) | 29 (21.8) | |

[a]: Chi-square test

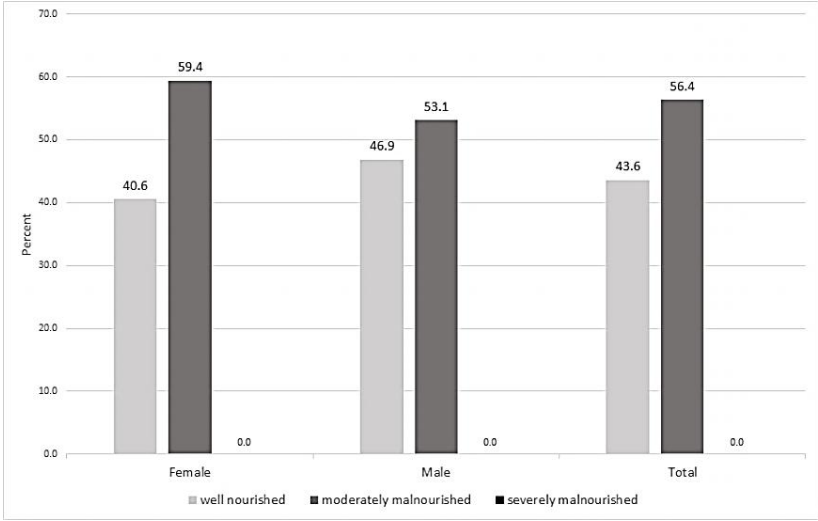


**Figure 1.** The malnutrition rate between males and females (*P*=0.46).

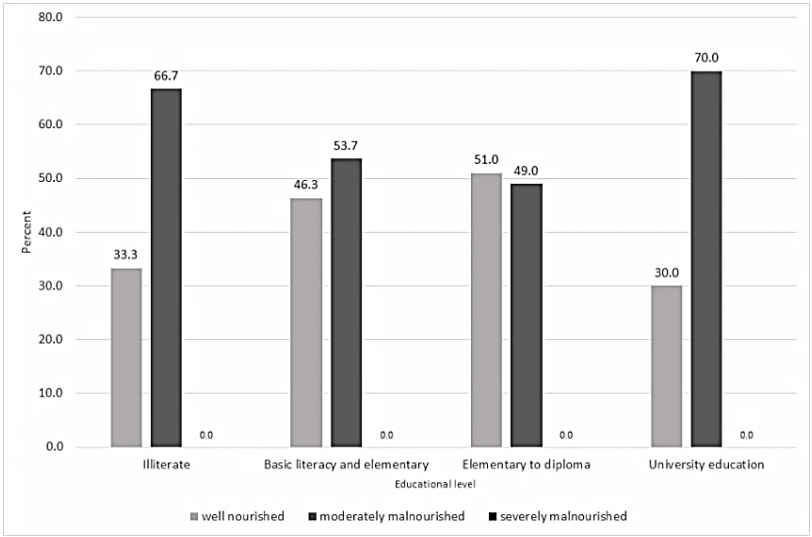


**Figure 2.** Malnutrition in HD patients categorized by literacy level (*P*=0.33).


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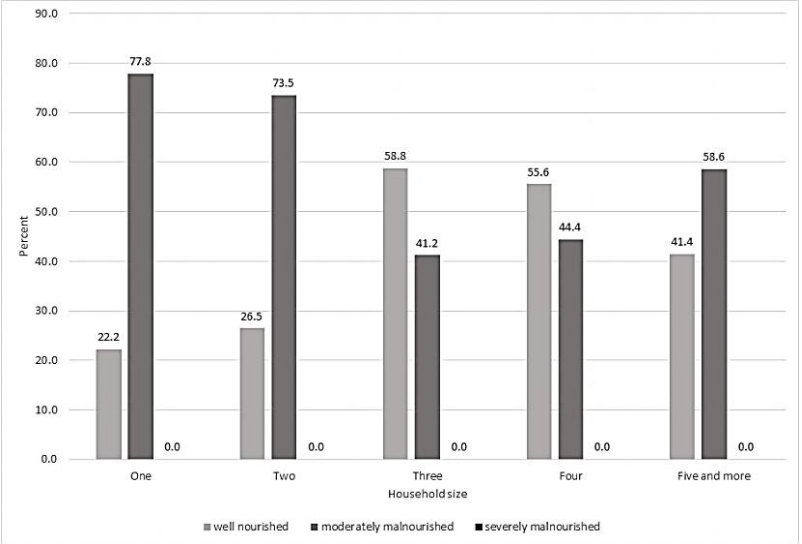


**Figure 3.** Malnutrition in HD patients regarding household size (*P*=0.032)

## Discussion

In this study, 56.39% of the studied patients had mild to moderate malnutrition. None of the patients had severe malnutrition. In the study of Amirkhanloo S, in which 116 HD patients (64 males and 52 females) in Gorgan City were evaluated using the SGA tool, 29.66% of patients had normal nutritional status, 69.82% moderate malnutrition, and 0.9% severe malnutrition (Amirkhanloo *et al.*, 2016). Due to the similarity of the target population between this study and the study by Amirkhanloo S *et al.*, it can be interpreted that malnutrition in HD patients in Gorgan City had a decreasing trend from 2013 to 2020. It might be due to an improvement in the quantitative and qualitative condition of dialysis equipment and consequently the increase in the number of dialysis sessions per patient. Interventional studies have shown that by increasing the number of dialysis sessions per week, the amount of energy intake increases and anthropometric and laboratory indices improve (Rashidi *et al.*, 2009).

A study on 291 HD patients in Tehran city using SGA showed that 60.5% were mild to moderately malnourished and 1% were severely malnourished (As'habi *et al.*, 2010), which is consistent with the results of the present study. High prevalence of malnutrition has been reported in other studies (Essadik *et al.*, 2017, Pourghaderi *et al.*, 2015, Rezeq *et al.*, 2018, Tayyem *et al.*, 2008).

Malnutrition in dialysis patients is associated with changes in body composition, and such changes are mainly associated with a decrease in the level of lean body mass (LBM), which is associated with an increase in mortality (Zhang *et al.*, 2019). However, in the current study, there was no statistically significant difference between patients with varying degrees of malnutrition in terms of body composition levels.

There were also no differences between patients with different degrees of malnutrition in terms of dialysis time span, serum hemoglobin, underlying disease (except for HTN), literacy level, and prescribed medications and supplements. Patients with moderate malnutrition were significantly older than patients without malnutrition and had lower body weight and BMI. In addition, patients' nutritional status was affected by household size, which indicates that living alone is a predictor for malnutrition in HD patients. Inability to prepare food, psychological problems, higher age, and probably low income might be the reasons for the higher rate of malnutrition in patients who live alone (Ekramzadeh *et al.*, 2014, Mikami *et al.*, 2022).

Nutrition in kidney disease is one of the most important topics in nutrition science references . The role of nutrition counseling in improving the


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nutritional indicators of end-stage renal disease patients has been emphasized in various studies (Clark-Cutaia *et al.*, 2014, Ghani *et al.*, 2017, Jo *et al.*, 2017, Luis *et al.*, 2016, Raza *et al.*, 2004, Sakai *et al.*, 2017). Nevertheless, only 3 patients in this study had received nutritional counseling.

Anorexia, metabolic acidosis, depression, chronic inflammation, insufficient dialysis efficacy, poor nutritional knowledge, lack of dietary counseling by dietitian, socioeconomic and behavioral barriers, and inadequate dietary intake starting from dialysis days are proposed as main causes of malnutrition in dialysis patients (Bergström, 1996, Beyaz *et al.*, 2021, Ekramzadeh *et al.*, 2014, Gebrie and Ford, 2019, Sahathevan *et al.*, 2020, Sharma and Sahu, 2001).

Regular visits by experienced dietitian, early start of a dialysis specific diet, socioeconomic support, psychological counseling, appetite stimulant and anti-inflammatory drugs, and adequate dialysis duration and sessions, and intradialytic parenteral nutrition are suggested for prevention and treatment of malnutrition in dialysis patients (Bossola *et al.*, 2005, Bossola *et al.*, 2009, Chazot, 2004, Ekramzadeh *et al.*, 2014, Vijaya *et al.*, 2019). Limitations of this study included lack of biochemical and dietary intake evaluation, low participation rate, and lack of cooperation of some patients in evaluating body composition.

## Conclusion

Malnutrition is still common among HD patients in Gorgan city especially among those on longer dialysis duration, as well as alone and older patients. Most of them had mild to moderate malnutrition, and severe malnutrition was not observed. Only three patients were visited by dietitian, of whom only one was adhered to the prescribed diet. It is recommended that HD patients should be screened regularly for malnutrition by an experienced dietitian before starting the dialysis.

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## Conflict of interest

None.

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## Authors' contributions

Rafinezhad R, Vahidinia A, Honarvar MR and Amirkhanlou s involved in designing of the study; acquisition of the data; revision of the manuscript. Sharifi A participated to Literature search; the conception and design of the study; carry out the study, acquisition, statistical analysis, and interpretation of the data; drafting the manuscript. All authors approved the final version of the manuscript for publishing the work and agreement to be accountable for all aspects of the work.

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