Nutrition 61 (2019) 32–37

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

Dietary inflammatory index and parameters of diet quality in normal weight and obese patients undergoing hemodialysis

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ARTICLE INFO

Article History:
Received 28 January 2018
Received in revised form 13 September 2018
Accepted 25 September 2018

Keywords:
Hemodialysis
Obesity
Dietary inflammatory index
Malnutrition inflammation score
Diet quality

ABSTRACT

Objective: Better nutritional reserves are proposed as a mechanism for the protective role of obesity in hemodialysis. Little is known about the quality of diet as a major contributor to nutritional status, specifically body mass index and obesity. The aim of this study was to assess dietary inflammatory index (DII®) score and other parameters of diet in normal-weight and obese patients undergoing hemodialysis to understand whether there is a benefit for obese patients.

Methods: This cross-sectional study included 85 hemodialysis patients (44 obese and 41 normal-weight). Four-day 24-h dietary recalls and anthropometric measurements were collected. DII, energy-adjusted DII (E-DII), dietary energy density (DED), mean adequacy ratio (MAR), and malnutrition inflammation score (MIS) were calculated.

Results: Median E-DII score (1 [0.29–1.47] versus 0.42 [0.12–1.27]; $P = 0.047$) was higher and DII score (1.18 [0.03–2.26] versus 1.79 [0.47–2.49]; $P = 0.046$) was lower in the obese group. Obese patients had higher DED (1.52 ± 0.23 versus 1.43 ± 0.28; $P = 0.034$) and lower MIS (6.3 ± 2.5 versus 10.5 ± 3.1; $P < 0.001$) compared with the normal weight group. There was no significant difference in MAR between groups ($P = 0.358$). E-DII had significant positive correlation with weight ($r = 0.226$; $P = 0.037$), triceps skinfold thickness ($r = 0.239$; $P = 0.035$), and DED ($r = 0.227$; $P = 0.036$). MAR had significant negative correlation with MIS ($r = -0.287$; $P = 0.008$).

Conclusions: Observed higher diet inflammatory potential and energy density and lower wasting in the obese group, along with similar adequacy of nutrients intake between groups, indicates that lower wasting, but not other indicators of nutritional status, are involved in better prognosis of obese patients with hemodialysis. Further studies are required to assess the potential dietary factors involved in determining wasting in advanced kidney failure.

Introduction

Protein-energy wasting (PEW) is a major concern in patients on hemodialysis and is associated with increased morbidity and mortality [1,2]. Wasting originates from an interaction between insufficient dietary intake, inflammation, endocrine disorders, anorexia, oxidative stress, and other disorders. Inadequate dietary intake and inflammation are two major contributors to wasting in hemodialysis [3,4]. Different oral or intradialytic parenteral nutrition supplementations may be required to prevent and treat PEW in renal patients [5]. Better nutritional status and consequently

This research was supported by Tehran University of Medical Sciences and Health Services grant 22404. NS and JRH were supported by grant no. R44 DK103377 from the U.S. National Institute of Diabetes and Digestive and Kidney Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. JRH owns controlling interest in Connecting Health Innovations LLC (CHI), a company planning to license the right to his invention of the dietary inflammatory index (DII) from the University of South Carolina to develop computer and smartphone applications for patient counseling and dietary intervention in clinical settings. NS is an employee of CHI. The subject matter of this article will not have any direct bearing on that work, nor has that activity exerted any influence on this project.

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https://doi.org/10.1016/j.nut.2018.09.036
0899-9007/

reduced inflammation are among the suggested explanations [6] for the inverse association between obesity and mortality in hemodialysis. In fact, several studies in the past 2 decades have shown that, contrary to a normal population, overweight or obese patients with advanced kidney failure or undergoing hemodialysis have better survival, a phenomenon that is known as the "obesity paradox" or "reverse epidemiology" [7,8].

Maintaining a diet that can provide adequate energy, protein, and other nutrients without disturbing electrolyte balance is a challenge in uremic conditions. Due to the importance of specific nutrients and electrolytes, including protein, sodium, and potassium in patients with kidney failure, the main focus of many studies in dialysis was to investigate these nutrients. However, evaluating the different aspects of diet as a whole could be as important as focusing on specific nutrients.

In recent decades, different nutritional indexes and scores have been developed to investigate the quality of diet and its relationship with metabolic disorders [9,10]. The dietary inflammatory index (DII®) is a novel tool used to determine the overall inflammatory potential of an individual's diet. A higher DII score indicates that the diet has more proinflammatory effects, and a lower score indicates that diet has less proinflammatory potential [9]. A review study showed that there is a direct association between DII score and higher risk for cardiovascular disorders, metabolic syndrome, and all-cause mortality [11]. Additionally, it has been shown recently that DII is associated with declining kidney function and higher prevalence of chronic kidney disease [12]. Despite the pivotal role of diet quantity and quality in hemodialysis, few studies have studied DII or other diet-associated parameters, including dietary energy density (DED) and mean adequacy ratio (MAR) in this population, thus far [13]. Additionally, little has been done to assess the relationship of these parameters with obesity in advanced kidney failure to understand whether there is a benefit for obese patients.

Altogether, the importance of diet has been well recognized in hemodialysis; however, little is known about DII and other related scores in hemodialysis considering obesity. Thus, the aim of this study was to assess DII and other parameters of diet quality in normal weight and obese patients undergoing hemodialysis.

Materials and methods

Participants

In this cross-sectional study, DII was the main parameter used to calculate the sample size. To have a power of 80% to detect 0.5 unit difference between the two groups, when the standard deviation (SD) of the score was assumed to be 0.8 (based on our pilot study), a sample size of 41 in each group was calculated. We included 45 participants in each group to account for possible lost data. Finally, data from 41 patients in the normal weight group and 44 in the obese group were analyzed. Baseline characteristics including age, sex, and cause and duration of disease were collected through interview or available records. Patients were recruited from dialysis centers affiliated with the Tehran and Shahid Beheshti Universities of Medical Sciences.

Inclusion criteria for this study were regular dialysis three times a week for at least 6 mo and body mass index (BMI) >18.5 to <25 and ≥30 kg/m^2 for normal weight and obese patients, respectively. People with a history of inflammatory or infection diseases, organ failure, and cancer were excluded. Patients with myocardial infarction or cerebrovascular accident or any other critical conditions, those participating in intentional weight change programs, and those regularly using high-dose dietary supplements in the previous 3 mo were not eligible for this study. Patients were included after obtaining informed consent. The study was approved by the Ethics Committee of Tehran University of Medical Sciences.

Anthropometric measurements

Measurements of height, weight, waist circumference (WC), and other anthropometries including mid-upper arm circumference (MUAC), mid-arm muscle circumference (MAMC), and triceps skinfold thickness (TSF), were performed until 30 min after hemodialysis. Height was measured in standing position, without shoes, heels together and touching the measurement surface, knees and spine without bending, by a calibrated stadiometer (Seca, Germany) and was recorded to the nearest 0.5 cm. Dry weight was measured while participants were minimally clothed and barefoot, using a calibrated scale (Seca, Germany) and recorded to the nearest 0.1 kg. BMI was calculated as weight divided by the square of height (kg/m^2). WC was measured as the midpoint between the upper edge of the hip bone and the lower edge of the chest and the last rib, at the end of normal exhalation, using a non-stretch tape measure. MUAC was measured at the midpoint between the tip of the shoulder and the elbow of the bare non-vascular access arm, using a non-stretch tape measure. MAMC was calculated according to the following formula:

$$\mathrm{MAMC(cm)} = \mathrm{MUAC(cm)} - 3.142 \times \mathrm{TSF(cm)}$$

TSF was measured at triceps muscle of the same arm, using calibrated caliper (C-120 Slim Guide Skinfold Caliper).

Dietary assessment

Initially, 24-h dietary recalls were completed for two dialysis and two non-dialysis days. Data were analyzed using Nutritionist IV software (N Squared Computing, San Bruno, CA, USA), adapted for some local foods. Dietary intakes of 29 food parameters or nutrients including energy, protein, carbohydrates, fats, saturated fats, polyunsaturated fatty acids (PUFAs), monounsaturated fatty acids (MUFAs), ω-3 fatty acids, ω-6 fatty acids, cholesterol, fiber; vitamins A, C, D, E, B_6, B_{12}, thiamin, riboflavin, niacin, folate, β-carotene; and the minerals iron, zinc, magnesium, selenium; as well as onion, green/black tea, and caffeine, were used to calculate the DII. DII scores were calculated by an expert research fellow. A world database of the means and SDs for each nutrient or food parameter was available. The standard mean was subtracted from the actual intake and divided by its SD to create a z-score. These z-scores were converted to proportions and centered by doubling the value and subtracting 1 to avoid skewness and to normalize the scoring system. The centered percentile value for each food parameter was multiplied by its respective overall food parameter score to obtain the food parameter–specific DII score. Finally, the DII score was determined by summing all of the food parameter–specific DII scores. A higher DII score indicated that diet was more proinflammatory, and a lower DII score indicated that diet was less proinflammatory [9]. Energy-adjusted DII (E-DII) scores were calculated by adjusting DII for energy through the approach wherein we converted all nutrients to per 1000 kcal. MIS is a valid score used to assess PEW in patients undergoing dialysis and describes overall nutritional and inflammatory status. MIS has been shown to be superior to other conventional scores such as subjective global assessment and could predict dialysis outcomes. MIS was completed by a trained researcher at dialysis centers, as described previously [10].

DED (kcal/g) was computed for each patient by dividing daily energy intake into total weight of foods consumed (based on Nutritionist IV data). Milk was the only beverage included and was the main caloric beverage used in this population due to dietary restrictions. Non-caloric beverages such as water and tea were not included, as they could influence the overall DED due to substantial amount of water. Nutrient adequacy ratio (NAR) was used to determine the adequacy of protein, fiber, and 12 other micronutrient (including vitamins A, B_6, B_{12}, C, thiamin, riboflavin, niacin, folate and the minerals calcium, iron, zinc and magnesium). NAR for each nutrient was calculated by dividing the patient's daily intake by the recommended dietary intake (specific for sex) in adult hemodialysis patients [14–17]. MAR was used to determine total adequacy of the diet. MAR was computed as the sum of NAR values of the aforementioned 14 nutrients divided by 14. To determine the MAR, NAR values >1 were truncated at 1 to avoid high consumption levels of some nutrients compensating for low levels of others [18,19]. Therefore, NAR and MAR had a range from 0 to 1; values <1 were considered deficiency.

Homeostatic model assessment of insulin resistance

Homeostatic model assessment of insulin resistance (HOMA-IR), as a potential covariate, was calculated as follows:

$$\mathrm{HOMA-IR} = \text{fasting blood glucose(mg/dL)} \times \text{fasting insulin}(\mu\mathrm{U/mL})/405.$$

Fasting blood glucose was quantified using enzymatic colorimetric methods and serum fasting insulin was measured using a radioimmunoassay kit (DiaSource, Louvain-la-Neuve, Belgium).

Statistical analysis

To present data, the mean, SD, median, and interquartile range were used. To assess the normal distribution of data, Kolmogrov–Smirnov test and Q-Q plot were used. To compare the groups, *t* test, Mann–Whitney test, χ^2 test, and Fisher exact test were used, when appropriate. To obtain the difference between two groups

adjusted for possible effective factors, including age, sex, HOMA-IR, and use of lipid-lowering and antihypertensive medications, analysis of covariance was used. All statistical analysis performed by SPSS® version 22 (IBM Armonk, NY, USA). DII was calculated using SAS® 9.4 software (SAS Institute, Cary, NC, USA). All tests were two-sided, and $P < 0.05$ was considered statistically significant.

Results

General characteristics

Baseline characteristics of the study population (Table 1) indicated no statistically significant differences between the two groups in terms of age, sex, and dialysis duration. The prevalence of diabetes was significantly higher in the obese group.

DII and other parameters

After adjusting for potential confounders, DII score was significantly lower in obese than in normal weight patients (1.18 [0.03–2.26] versus 1.79 [0.47–2.49]; $P = 0.046$), whereas E-DII was significantly higher in the obese than in the normal weight group (1 [0.29–1.47] versus 0.42 [0.12–1.27]; $P = 0.047$). DED was also considerably higher in the obese patients compared with the normal weight group (1.52 ± 0.23 versus 1.43 ± 0.28; $P = 0.034$). MIS was significantly lower in obese than in normal weight patients (6.3 ± 2.5 versus 10.5 ± 3.1; $P < 0.001$). There were no significant differences in MAR and NAR between the two groups (Table 2).

Details about the mean or median values of each component of NAR are presented in Table 3. NAR for vitamin B_2 was significantly lower in obese than in normal weight patients ($P = 0.032$). The NARs of the other 13 nutrients did not differ significantly between the two groups.

The results also indicated that the reported dietary intake of protein (%; $P < 0.001$), but not energy (kcal/kg; $P = 0.826$), was considerably higher in normal weight than in obese patients. Additionally, normal weight patients had significantly higher intakes of potassium (mg/kg) and phosphorus (mg/kg; $P < 0.001$). The reported dietary intakes of fat (%; $P = 0.002$), PUFAs ($P = < 0.001$), and MUFAs ($P = 0.006$) were significantly lower in normal weight than in obese patients (Table 4).

Correlations between the main variables

E-DII score had a significant positive correlation with weight ($r = 0.226$; $P = 0.037$), TSF ($r = 0.239$; $P = 0.035$), and MUAC ($r = 0.232$; $P = 0.041$) and a negative correlation with percentage of calories from protein ($r = -0.503$; $P < 0.001$). DII had a significant positive correlation with MIS ($r = 0.344$; $P = 0.001$) and a negative

Table 1
Baseline characteristics of the study population

	Total (N = 85)	Normal (n = 41)	Obese (n = 44)	*P*-value
Age, y	57 ± 12.6	57 ± 14.7	56.9 ± 10.4	0.980*
Male, n (%)	43 (50.6)	25 (61)	18 (40.9)	0.084†
Dialysis duration, mo	36 (20–72)	42 (24–72)	36 (16.3–72)	0.535‡
Diabetes, n (%)	36 (42.4%)	11 (26.8%)	25 (56.8%)	0.008†
Dry weight, kg	69.1 ± 16.3	55.3 ± 7.3	82 ± 10.7	<0.001*
BMI, kg/m^2	29.2 (22.4–32.5)	22.4 (20.7–23.6)	32.3 (30.7–34.4)	<0.001‡
WC, cm	97.8 ± 16.1	83.4 ± 8.4	110.8 ± 8.6	<0.001*
HOMA-IR	6.9 (4.5–12.7)	6.7 (4.5–10)	7.3 (4.3–14.8)	0.392‡
Lipid-lowering drugs, n (%)	11 (12.9)	6 (14.6)	5 (11.4)	0.752†
Antihypertensive drugs, n (%)	50 (60.2)	32 (80)	18 (41.9)	0.001†

BMI, body mass index; HOMA-IR, homeostatic model assessment of insulin resistance; WC, waist circumference.
Values are presented as mean ± SD, median (IQR) or frequency (percentage)
*Based on *t* test.
†Based on χ^2 test.
‡ Based on Mann–Whitney test.

Table 2
DII, E-DII, DED, MAR, NAR, and MIS in obese and normal weight groups

	Total (N = 85)	Normal (n = 41)	Obese (n = 44)	*P*-value	Adjusted difference*	95% CI		*P*-value*
						Lower	Upper	
DII								
Median (IQR)	1.38 (0.32–2.41)	1.79 (0.47–2.49)	1.18 (0.03–2.26)	0.232†	0.699	0.014	1.384	0.046
E-DII								
Median (IQR)	0.72 (0.09–1.37)	0.42 (0.12–1.27)	1 (0.29–1.47)	0.065†	−0.456	−0.906	−0.006	0.047
DED								
Mean ± SD	1.48 ± 0.26	1.43 ± 0.28	1.52 ± 0.23	0.130‡	−0.141	−0.27	−0.011	0.034
MAR								
Mean ± SD	0.86 ± 0.35	0.85 ± 0.27	0.87 ± 0.41	0.783‡	−0.085	−0.267	0.098	0.358
NAR								
Mean ± SD	12.09 ± 4.92	11.94 ± 3.83	12.23 ± 5.79	0.783‡	−1.184	−3.736	1.368	0.358
MIS								
Mean ± SD	8.4 ± 3.5	10.5 ± 3.1	6.3 ± 2.5	<0.001‡	4.173	2.780	5.566	<0.001

DED, dietary energy density; DII, dietary inflammatory index; E-DII, energy-adjusted DII; HOMA-IR, HOMA, homeostatic model assessment of insulin resistance; MAR, mean adequacy ratio; MIS, malnutrition inflammation score; NAR, nutrient adequacy ratio
*Adjusted for age, sex, HOMA-IR, use of lipid-lowering and antihypertensive medications, based on analysis of covariance.
†Based on Mann–Whitney test.
‡Based on *t* test.

Table 3
The components of nutrient adequacy ratio in obese and normal weight groups

	Total (N = 85)	Normal (n = 41)	Obese (n = 44)	*P*-value
Protein	1.11 ± 0.42	1.17 ± 0.39	1.06 ± 0.448	0.196*
Fiber	0.52 ± 0.28	0.46 ± 0.23	0.57 ±0.31	0.061*
Vitamin A	0.43 (0.3–0.66)	0.44 (0.29–0.61)	0.4 (0.3–0.7)	0.958†
Vitamin B_1	1.56 (1.17–1.95)	1.38 (1.15–2.02)	1.63 (1.22–1.9)	0.473†
Vitamin B_2	0.97 ± 0.41	1.07 ± 0.41	0.88 ± 0.40	0.032*
Vitamin B_3	1.73 ± 0.68	1.72 ± 0.61	1.75 ± 0.74	0.835*
Vitamin B_6	0.12 (0.98–0.16)	0.12 (0.1–0.16)	0.13 (1–0.16)	0.772†
Folic acid	0.27 (0.19–0.38)	0.26 (0.19–0.41)	0.29 (0.21–0.38)	0.712†
Vitamin B_{12}	0.76 (0.55–1)	0.78 (0.61–1)	0.69 (0.49–0.96)	0.120†
Vitamin C	0.64 ± 0.56	0.56 ± 0.53	0.71 ± 0.57	0.109*
Calcium	0.45 ± 0.19	0.46 ± 0.16	0.44 ± 0.22	0.694*
Iron	1.36 ± 0.99	1.35 ± 0.88	1.38 ± 1.1	0.881*
Zinc	0.53 (0.42–0.68)	0.53 (0.43–0.68)	0.53 (0.41–0.7)	0.667†
Magnesium	1.02 (0.78–1.26)	0.88 (0.74–1.33)	1.09 (0.85–1.21)	0.170†

Values are presented as Mean ± SD or median (IQR)
*Based on *t* test.
†Based on Mann–Whitney test.

correlation with NAR/MAR ($r = -0.882$; $P < 0.001$), energy (kcal/kg; $r = -0.748$; $P < 0.001$), and protein (g/kg; $r = -0.653$; $P < 0.001$).

DED had a significant positive correlation with E-DII ($r = 0.227$; $P = 0.036$), fat (g; $r = 0.271$; $P = 0.012$), and MUFA ($r = 0.270$; $P = 0.012$) and a negative correlation with protein (%; $r = -0.336$; $P = 0.002$). Significant negative correlations were observed between NAR/MAR and MIS ($r = -0.287$; $P = 0.008$), fat (%; $r = -0.473$; $P < 0.001$), and the ratio of ω-6 to ω-3 ($r = -0.224$; $P = 0.039$). On the other hand, NAR/MAR had significant positive correlations with energy (kcal/kg; $r = 0.843$; $P < 0.001$), protein (g/kg; $r = 0.810$; $P < 0.001$), fat (g; $r = 0.584$; $P < 0.001$), SFA ($r = 0.652$; $P < 0.001$), and MUFA ($r = 0.618$; $P < 0.001$).

Discussion

This cross-sectional study was carried out to compare the DII and other parameters of diet quantity and quality between normal-weight and obese patients undergoing hemodialysis. The findings showed that the obese patients had significantly lower DII and MIS but significantly higher E-DII and DED compared with the normal-weight group. There was no significant difference in NAR and MAR between the two BMI groups. There was a direct correlation between E-DII and anthropometric factors including weight and BMI and with DED. MAR was negatively correlated with MIS.

Few studies have investigated the DII and E-DII while considering the BMI of patients with advanced kidney failure. A recent study in patients on hemodialysis demonstrated an inverse relationship between DII and BMI [13]. At first glance, these observations could indicate that obese patients on hemodialysis have lower DII scores, indicating a diet with less proinflammatory potential, and thus introducing preferable diet quality as a potential contributor to better prognosis for obese people on hemodialysis. However, further analysis showed opposite results for E-DII score, which was adjusted for total energy intake.

Some studies in individuals with normal renal function also demonstrated an inverse relationship between DII score and obesity [20–23]. Potential reasons might include underreporting of dietary intake, especially in women, and different numbers of nutrients or foods used to calculate DII. Other population-based studies have reported a direct association between DII score and indices of general and abdominal obesity [24] and found a significantly higher BMI in participants in the highest tertile of DII [25]. They have proposed that a proinflammatory diet might contribute to obesity in susceptible populations. It has been shown that patients with higher DII scores consumed more animal protein and total, saturated, and monounsaturated fats and less fiber, fruits and vegetables, cereals, and legumes [24,25], all of which are associated with obesity.

E-DII score was significantly higher in the obese group and was directly correlated with anthropometric indexes including weight, TSF, and BMI in all of the patients. To our knowledge, no previous study has investigated the E-DII in hemodialysis. A recent study in patients with pancreatic cancer showed a direct association between E-DII and BMI [26], similar to the present findings. However, a population-based study did not observe significant differences in E-DII between different BMI categories. The authors suggested that the narrower range of E-DII compared with other studies, which indicates that reduced small variability in exposure, may have limited the ability to find a significant association [27]. There was an inverse relationship between E-DII and percentage of calories from protein.

MIS was significantly lower in the obese group compared with the normal-weight group. This finding was extensively discussed elsewhere [28]. Obese patients also had significantly lower unintentional weight loss; poor appetite; anorexia; and higher MUAC, MAMC, TSF, and TIBC levels compared with normal weight patients [28]. There was no significant correlation between MIS and E-DII scores in this study. MIS is a valid tool used to show PEW in

Table 4
Dietary intakes in obese and normal weight groups

	Total (N = 85) Mean ± SD	Normal (n = 41) Mean ± SD	Obese (n = 44) Mean ± SD	*P*-value
Energy (kcal/kg)	30.4 (23.6–37.2)	29.8 (22.8–38.9)	31.5 (25.3–35.3)	0.826†
Protein (g/kg)	1.34 ± 0.5	1.4 ± 0.5	1.3 ± 0.5	0.196‡
Protein (%)	16.6 ± 3	17.7 ± 2.7	15.5 ± 2.8	<0.001‡
Carbohydrate (%)	55.6 ± 6.9	56.3 ± 7	55 ± 6.9	0.390‡
Fat (%)	28.1 ± 6.2	26 ± 6.2	30 ± 5.6	0.002‡
Cholesterol (mg)	194.6 (148.6–268.8)	217.1 (161.4–260.3)	179.9 (127.8–301.8)	0.325†
SFAs (g)	10.9 (8.5–14)	11.1 (8.5–13.6)	10.7 (8.6–14.5)	0.699†
MUFAs (g)	12.4 (10.2–15.2)	11.5 (9.6–13.2)	13.6 (10.8–17.5)	0.006†
PUFAs (g)	24 ± 6.7	20.2 ± 5.5	27.6 ± 5.8	<0.001‡
Vitamin D (μg)	0.27 (0.18–0.53)	0.35 (0.18–0.53)	0.18 (0.02–0.53)	0.212†
Potassium (mg/kg)	28.1 (22.4–39.9)	36.6 (27.4–44)	25.8 (19.5–31.2)	<0.001†
Phosphorus (mg/kg)	14.3 (10.8–19.6)	18.6 (13.4–22.8)	11.8 (9–15.1)	<0.001†

MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; SFA, saturated fatty acid
Values are presented as Mean ± SD or median (IQR)
†Based on Mann–Whitney test.
‡Based on *t* test.

dialysis, which in turn has been found to be associated with inflammatory markers in some studies [29]. DII was developed as a tool for predicting the inflammatory potential of diet [9]. Thus, theoretically a direct correlation was expected between E-DII and MIS; however, this was not supported by the present results. It should be considered that MIS consists of different variables, including medical and nutritional history, fat and muscle stores, biochemical factors, and BMI [10]. Dietary intake, which is the basis of DII calculation, is only one parameter of MIS. It seems that despite a conceptual relation between the two variables, higher MIS is not necessarily indicative of higher E-DII, indicating a diet with more proinflammatory effect.

The present study demonstrated that the obese patients had significantly higher DED compared with the normal-weight group. To our knowledge, only one study investigated DED in chronic kidney disease and indicated no significant difference in BMI across DED tertiles [30]. A recent systematic review and meta-analysis of observational studies in individuals with normal kidney function showed that DED was directly associated with BMI and risk for weight gain [31].

The present study also showed that DED had a significant positive correlation with E-DII score, but there were no significant differences in NAR and MAR between the two groups or any significant association with BMI and other variables. Thus, it seems that the adequacy of nutrient intake was similar in all of the patients and probably DED, and consuming a diet rich in nonhealthy foods contributed to higher E-DII in the obese group. Few studies investigated the association between NAR/MAR and BMI. It has been reported that BMI was positively related to NAR for protein, niacin, and phosphorus in Korean male adolescents [32]. There also was a significant negative correlation between NAR/MAR and MIS, indicating more adequate intake of protein and essential micronutrients are associated with lower wasting status. However, it should be considered that the number and type of nutrients used for calculation of NAR and MAR varies in different studies, which could affect the findings.

The main strength of the present study was its ability to assess diet quality and quantity in patients undergoing hemodialysis with respect to obesity and BMI status. Evaluation of the association between inflammatory potential of diet and obesity provides a novel insight into factors that might play a role in prognosis of the disease.

The present study had some limitations. First, dietary data were collected through a 4-d dietary recall and analyzed with Nutritionist IV; therefore, we could not include all food items or nutrients involved in the calculation of DII. Second, the cross-sectional nature of the study did not allow an understanding of the causal inference based on a the temporal relationship between DII score and other indices of diet quantity and quality with obesity. Third, inflammatory markers were not reported in this study. Finally, direct assessment of body composition is required in future studies to understand the relationship between obesity and diet inflammatory potential more precisely.

Conclusion

The current findings showed that obese patients undergoing hemodialysis had significantly higher E-DII and DED scores and lower MIS than the normal-weight group. Diet inflammatory potential, quality, and energy density do not seem to be among the potential contributors; however, lower wasting based on MIS might play a role. Further studies are required to investigate the potential dietary factors involved in determining wasting and better prognosis of obese patients with hemodialysis.

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