Assessment of Nutritional Status Among ESRD Patients in Jordanian Hospitals

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Objective: Our objective was to assess nutritional status and compare quality of treatment among hemodialysis patients in public and private hospitals in Jordan.

Design: We utilized a cross-sectional survey.

Setting: Our setting involved hospital hemodialysis units.

Patients: This study was undertaken in five large Jordanian hospitals between 2004 and 2005. One hundred and eighty participants diagnosed with end-stage renal failure (ESRD) were enrolled. These participants (91 women and 89 men) who underwent hemodialysis treatment were recruited using a convenience sampling technique. Data from participants who received hemodialysis treatment in public hospital settings were compared with equivalent data from participants treated in private hospital settings.

Main Outcome Measures: Subjective global assessment (SGA), anthropometry, and biochemical measurements were used as evaluative tools.

Results: In the anthropometric measurement of triceps skinfold thickness (TSF), we found a statistically significant difference ($P < .05$) between participants treated in the two hospital settings. In addition, approximately 62% of all participants, regardless of treatment site, were found to be moderately to severely malnourished. Anthropometric measurements showed some significant increase between prehemodialysis and posthemodialysis weight and body mass index in private hospitals; this was not unexpected. There were no statistically significant differences in the measured mean levels of eight different biochemical parameters, with the exception of plasma phosphorus and sodium levels.

Conclusions: The prevalence of malnutrition and the quality of treatment in our two groups of participants were similar.

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Protein-energy malnutrition and wasting are common problems among patients with end-stage renal disease (ESRD).1,2 These patients with ESRD are routinely treated with hemodialysis. In hemodialyzed patients, nutritional status is strongly associated with morbidity and mortality.3,4 In addition, the quality of life for patients undergoing hemodialysis is negatively correlated with poor nutritional status.5,6

Several studies showed an increased risk of morbidity and mortality in patients treated at “for profit” (private) facilities, compared with patients treated at “not for-profit” (public) facilities.7–10 The increased risk of morbidity and mortality in “for profit” treatment centers may be explained by several factors. Privately run centers were reported to employ fewer personnel, with lower-quality skills and less experience. Also, the economic challenge to provide quality treatment at a lower price is implicated in the decreased quality of reported dialysis treatment in privately run treatment centers.9

Nutritional status may be assessed by measuring anthropometric variables, using several methods. These methods include dual-energy X-ray absorptiometry, bioelectric impedance analysis, and total body protein.11–14 However, these methods are expensive, cumbersome, rarely available, and impractical for routine use.15

Furthermore, the assessment of malnutrition using common anthropometric measurements (such as body mass index and skinfold thickness) and biochemical measurements (such as albumin and transferrin) in isolation may not be specific or reliable. For example, a reduction in serum albumin may result from inflammation, but may be attributed wrongly to poor nutritional status. Thus, using more than one type of measurement (anthropometric and biochemical) may be more reliable and may more accurately reflect nutritional status. Nutritional parameters that were independently correlated with nutritional status in hemodialysis patients include reduced body mass index (BMI), decreased fat mass and lean body mass, and low serum albumin, prealbumin, transferrin, and C-reactive protein.16,19

More recently, subjective global assessment (SGA) was used to assess nutritional status in hemodialysis patients. It was reported that the use of SGA in detecting malnutrition is simple, valid, noninvasive, and applicable, and its use correlates significantly with nutritional parameters.23,24

In Jordan, there is a lack of data regarding the nutritional status of hemodialysis patients in either public or private hospital treatment centers. This lack of data may have arisen because assessing the nutritional status of hemodialysis patients is not a routine practice in this region. Therefore, this study sought to compare nutritional status, and thus investigate possible differences in treatment, in two representative groups of patients suffering from ESRD. This representative group of hemodialysis patients included individuals undergoing treatment at publicly administered and privately administered treatment centers.

The nutritional status of these patients was assessed using the SGA questionnaire, together with anthropometric measurements (dry weight, BMI, fat percentage, fat mass, triceps skinfold thickness, mid-arm circumference, and mid-arm muscle circumference). Additional measurements included the biochemical quantitation of albumin, total proteins, hematocrit, hemoglobin, creatinine, urea, cholesterol, phosphorus, and calcium and potassium.

Methods

Sample

Using convenience sampling and informed consent, 269 participants were recruited into the study. After the screening process, 89 participants were removed from the study: 59 participants withdrew their consent to participate because of the “invasiveness of the procedure” and an unwillingness to answer some questions on grounds of “privacy.” Twenty-two participants were excluded after they were diagnosed with acute morbidity, e.g., infections, elevated body temperature, wounds, or respiratory and gastrointestinal problems. This group of participants was excluded to avoid the misleading influence of their condition on their nutritional status. Eight participants were excluded because they were being treated with drugs other than phosphate-binders. These drugs included vitamin D analogues, erythropoietin, lipid-lowering agents (statins), and antihypertensive drugs.

The final number of participants in our study was 180 (91 females and 89 males). These were further divided into two groups. Group 1, consisting of 106 participants, was previously assigned to government (public)-administered, hospital-based hemodialysis treatment centers. Group 2, consisting of 74 participants, was treated at privately administered hemodialysis centers. The selected hemodialysis centers were located in the cities of Amman and Irbid, and the study period covered the years 2004 and 2005. The main causes for renal failure in the 180 participants were primary hypertension (35%), diabetic neuropathy (30%), chronic glomerulonephritis (16%), polycystic kidney disease (7%), and other causes (12%).

The following criteria were used to recruit participants into the study: participants had been diagnosed with ESRD, had been undergoing hemodialysis as an outpatient for at least 6 months, and were between ages 17 and 75 years.

Data Collection

Standard socio-demographic characteristics of participants (age, sex, educational status, marital status, and occupation) were collected. The SGA questionnaire was administered, and patients’ history and physical examinations were obtained. Each participant’s history consisted of the following components: weight loss (during the previous 6 months), gastrointestinal symptoms, food intake, functional capacity, and comorbidities. Some of the required information in the SGA was collected from participant’s
medical file (weight and weight changes, and disease state/comorbidities related to nutritional needs). Additional information (dietary intake, gastrointestinal symptoms, and functional capacity) were obtained directly from the patient. Each of these components was rated separately as A, B, and C, indicating degree of malnutrition according to Detsky et al.\(^{24}\) An overall score of A (well-nourished), B (moderately-malnourished), or C (severely-malnourished) depended on the most predominant score (A, B, or C) in the different parts of the SGA.

Anthropometric measurements included dry weight (weight after dialysis session), BMI (weight \(\text{[kg]/height}^2 \text{[m]}^2\)), fat %, fat mass, triceps skinfold thickness (TSF), mid-arm circumference (MAC), mid-arm muscle circumference (MAMC), and arm muscle area (AMA). The TSF measurements were taken using a Lange skinfold caliper (Beta Technology, Inc., Cambridge, MD), whereas MACs were measured with Sammon Preston Rolyan’s Flexible Tape (Sammon Preston, West Germany). Fat % was determined using the body-fat monitor Omron 300 (Omron, Matoukasa Co. Ltd., Japan).\(^{25}\) Percentiles of TSF, MAC, MAMC, and AMA of participants were calculated according to Frisancho.\(^{26}\) All measurements were taken after dialysis, on the right arm. In some cases, measurements were taken on the left arm because the right arm was functionally impaired because of an arteriovenous fistula.

Anthropometric parameters as well as SGA grades were obtained by one experienced renal dietitian, to minimize personal measurement errors. Blood was routinely drawn immediately before starting a hemodialysis session, and was analyzed as part of the biochemical profile for all hemodialyzed participants. The average values of biochemical components, albumin, total protein, hematocrit, hemoglobin, creatinine, urea, cholesterol, phosphorus, calcium, and potassium were calculated from results obtained during a 3-month period.

### Ethical Considerations

This research and its methodology were approved by the Research Committee of Hashemite University, and by the Human Subjects Committees and hospital administrators of their respective organizations. Written, signed, informed consents were obtained from participants before their inclusion in the study.

### Data Analysis

Statistical analyses were performed using SPSS version 11 (2001, SPSS, Inc., Chicago, IL). Continuous variables included age, length of hemodialysis session, time on hemodialysis, and anthropometric measures (predialysis and post-dialysis weight, BMI, fat %, fat mass, TSF, MAC, MAMC, and AMA). Biochemical parameters (levels of albumin, total protein, hematocrit, hemoglobin, creatinine, urea, phosphorus, calcium, potassium, and sodium) were calculated, and means and standard deviations were obtained. Data of continuous variables were compared between public and private hemodialysis treatment centers, using independent \(t\)-tests. Categorical variables using percentages and proportions were analyzed using the chi-square test. Statistical significance was accepted at \(P < .05\).\(^{27}\)

### Results

The results are summarized in Tables 1 to 4. Table 1 indicates no significant difference in the SGA grades of participants in either group of treatment centers. The frequencies of SGA grades (38% public and 39% private) were classified as grade A, i.e., well-nourished. A larger percentage of participants (8.5% in public treatment compared with 1.4% in private treatment) was found to be severely malnourished. The durations of dialysis sessions in private centers were 10.3 hours per week, compared with 9.2 hours per week at public centers. Coincidentally, participants in private treatment centers had spent an average of 74 months of total treatment time receiving hemodialysis, while their counterparts in public centers spent an average of 82.3 months on hemodialysis.

Table 2 summarizes the anthropometric measurements obtained. The results showed no significant difference in the measured anthropometric parameters except for predialysis and post-dialysis body weight \((P = .021 \text{ and } .027, \text{ respectively})\) and BMI \((P = .049)\).

Table 3 gives the percentiles of TSF, MAC, MAMC, and AMA of participants computed according to Frisancho.\(^{26}\) There was no significant difference between the two groups of participants among the obtained percentiles except for TSF. Approximately 60% to 80% of participants were in the \(\leq 25\text{th}\) percentile in each of the four measured categories (fat %, TSF, MAMC, and AMA).
Table 4 summarizes data in regard to blood biochemical components. Results of biochemical measurements were not significantly different between the two groups in 7 of 9 parameters analyzed. The exception was phosphorus, with a value for the private treatment group of 4.2 mg/dL, compared with 5.1 mg/dL for the public treatment group (statistically significant at \( P < .001 \)). A similar increment in plasma sodium level was detected in public hospitals compared with private hospitals.

**Discussion**

The main aim of this study was to compare quality of treatment and the prevalence of malnutrition among two groups of participants receiving hemodialysis in both public and private hospital treatment centers. Malnutrition was assessed using SGA questionnaire, and anthropometric and biochemical variables. These are standard measurement tools. They are typically used in the assessment of nutritional status, and in clinical estimation of the “quality” of the dialysis process.

We found that approximately equal percentages of participants (38% private and 39% public; Table 1) were well-nourished. This result is in agreement with published results of 36% in this category for a Swedish study. Similarly, the percentage of participants in either treatment group found to be moderately malnourished was not significantly different (54% in private treatment compared with 60% in public treatment). In the assessment of severely malnourished status, approximately 1% of the privately treated group of participants was included in this category. In comparison, a significantly higher percentage of participants in the publicly treated group (approximately 9%) were found to be in the severely malnourished category. This difference in the severely malnourished category in our study may be explained in terms of economics and education. Typically, less educated participants were also found to be at a lower socioeconomic level. Hence, these individuals were more likely to be reliant on public treatment facilities. These participants may not have been very fastidious regarding their diets, and more importantly, their economic position adversely

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Public (n = 106) (Mean ± SD)</th>
<th>Private (n = 74) (Mean ± SD)</th>
<th>( P ) Value*</th>
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<tbody>
<tr>
<td>Predialysis weight (kg)</td>
<td>61.7 ± 16.7</td>
<td>67.8 ± 17.1</td>
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<tr>
<td>Postdialysis weight (kg)</td>
<td>58.8 ± 16.3</td>
<td>64.4 ± 16.5</td>
<td>.027</td>
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<td>BMI</td>
<td>22.3 ± 5.1</td>
<td>24.0 ± 5.3</td>
<td>.049</td>
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<tr>
<td>Fat %</td>
<td>21.1 ± 9.0</td>
<td>21.9 ± 9.6</td>
<td>.616</td>
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<td>Fat mass (kg)</td>
<td>14.4 ± 9.2</td>
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<td>.811</td>
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<td>TSF (mm)</td>
<td>13.2 ± 8.4</td>
<td>12.5 ± 7.0</td>
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<tr>
<td>MAC (cm)</td>
<td>25.2 ± 4.7</td>
<td>26.0 ± 3.6</td>
<td>.189</td>
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<td>MAMC (cm)</td>
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<td>AMA (cm²)</td>
<td>28.4 ± 12.5</td>
<td>31.1 ± 10.3</td>
<td>.133</td>
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TSF, triceps skinfold thickness; MAC, mid-arm circumference; MAMC, mid-arm muscle circumference; AMA, arm muscle area; BMI, body mass index.

*\( P \) values were determined using t-test.
affected their ability to procure the proper types of food necessary for their diets. In the severely malnourished category, the percentage (approximately 9%) in the publicly treated group of our study is similar to the percentage category ranking worldwide (6% to 8%). In contrast, a similar study in Sweden reported that 13% of participants were severely malnourished.2

The combined prevalence of malnutrition in the present study (moderately malnourished and severely malnourished), at approximately 61% and 63% in the private and public groups, respectively, is similar to the percentages reported in this category by Qureshi et al.2 in their study based in Sweden. However, the percentages in this category were somewhat lower (from 34% to 36%) in Australia,6 The Netherlands,29 and Germany.30

The results for body weights (predialysis and postdialysis) and BMI for the two groups showed that participants in public treatment centers had a proportionately lower weight and BMI than their counterparts in private treatment centers. This difference was statistically significant. However, the difference was not considered clinically important or significant. This difference was no doubt influenced by the larger number of females (i.e., 60) in the public group, compared with 30 females in the private group (Table 1).

Table 3 summarizes the anthropometric variables, fat, TSF, MAMC, and AMA. Except for TSF, all other variables showed no significant difference among the percentiles in either treatment group. Moreover, the patients’ proportions at different fat %, TSF, MAMC, and AMA percentiles showed that an average of 70% of both public and private hospital patients were fallen at and below the 25th percentile. This is in agreement with measured anthropometric variables as well as SGA results which showed that there was no significant difference between public and private hospitals in the most measured outcomes.

The biochemical parameters (Table 4), especially creatinine and urea, are good indicators of the “completeness” or quality of the hemodialysis treatment process. The results obtained in the present study showed that serum phosphorus and sodium blood levels were lower for participants in the privately treated group compared with the publicly treated group. Extensive studies31–36 showed that to effectively remove toxins and compounds such as phosphorus and sodium from the blood of ESRD patients, longer dialysis time is

<table>
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<th>Table 3. Percentiles of Fat %, TSF, MAMC, and AMA (n = 180)</th>
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<tr>
<td>Percentiles</td>
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<td>≤5</td>
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Source of percentiles was Frisancho.26
TSF, triceps skinfold thickness; MAMC, mid-arm muscle circumference; AMA, arm muscle area.

*P values were determined using chi-square test.
required. In our study, we found that participants in the publicly treated group spent an average of 1 hour less per dialysis session than their counterparts in the private group (Table 1). Also, responses in the publicly treated group spent an average of 62% in both groups of study participants, indicates the urgent need for a strict nutritional and dietary counseling program, to help and advise patients on the most basic ways to improve their nutritional status and to better assess the quality of their hemodialysis.

Conclusions

Clinically, the combined prevalence of malnutrition in the present study (moderately malnourished and severely malnourished), at approximately 62% in both groups of study participants, indicates the urgent need for a strict nutritional and dietary counseling program, to help and advise patients on the most basic ways to improve their nutritional status and to better assess the quality of their hemodialysis.

Acknowledgments

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