# Sürekli Ayaktan Periton Diyalizi Hastalarında Beslenme ve Antropometrik Ölçümlerin Anemi Durumuna Göre Değerlendirilmesi

# *Evaluation of the Nutritional Status and Anthropometric Measurements in Continuous Ambulatory Peritoneal Dialysis (CAPD) Patients According to the Anemia Status*

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## ÖZET

Serum albümini gibi biyokimyasal beslenme belirteçleri ve vücut kitle indeksi (VKİ) gibi antropometrik ölçümler diyalizde beslenme durumunu değerlendirmede yararlı ve ulaşılabilir araçlardır. SAPD tedavisi uygulanan 42 hasta çalışmaya alındı. Anemik ve hedef hematokrit değerine sahip olan hastalar beslenme parametreleri ve antropometri ile değerlendirildi. Cinsiyet, yaş, SAPD süresi, diyaliz yeterliliği, beslenme ve ekonomik durum VKİ ve serum albümin düzeyleri üzerinde etkili bulundu. Hematokrit düzeyleri ile VKİ (r=0.331, p=0.0032), yağ kitlesi (r=0.383, p=0.012), orta kol çapı (r=0.365, p=0.017) ve serum albümin düzeyleri (r=0.416, p=0.006) arasında pozitif korelasyon bulundu. Hedef hematokrit düzeylerine ulaşmak VKİ ve orta kol çevresinde düzelme sağlayabilir; ancak biyokimyasal belirteçlerde böyle bir düzelme sağlanamaz.

**Anahtar sözcükler:** anemi, nütrisyonel durum, antropometrik ölçümler, periton diyalizi

## ABSTRACT

Nutritional biochemical markers such as serum albumin and anthropometric measurements such as BMI are valid and useful tools in assessing the nutritional status in dialysis. Forty-two patients on CAPD therapy were enrolled in the study. Anemic patients and patients who were at target hematocrit levels were evaluated by nutritional parameters and anthropometry. Gender, age, duration of CAPD, dialysis adequacy, educational and economic status had significant affect on BMI and serum albumin. There were positive significant correlations between hematocrit levels and BMI (r=0.331, p=0.0032), and FM (r=0.383, p=0.012), and MAMC (r=0.365, p=0.017) and serum albumin levels (r=0.416, p=0.006). Achieving target hematocrit levels may improve BMI and MAMC, but not biochemical parameters.

**Keywords:** anemia, nutritional status, anthropometric measurements, peritoneal dialysis

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## Introduction

Erythropoietin (rHuEPO) has been commonly used in the treatment of anemia seen in dialysis patients. Although rHuEPO improves anemia, it may have some effects on other important clinical parameters (1). RHuEPO has beneficial effect on nutritional status by improving the appetite and increasing the dietary intake (2,3).

Nutritional status is an important factor in the long term survival of CAPD patients. It has been reported that serum albumin, along with anthropometric measurements, are surrogate markers of nutritional status in patients with chronic disease (4).

The aim of our study was to evaluate the nutritional status and anthropometric measurements in relation to anemia status in 42 patients on CAPD.

## Patients and Methods

The study included all 42 CAPD patients at the dialysis center (DC) of the hospital of Faculty of Me-

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dicine in Dicle University. To be eligible patients had to be on CAPD for at least six months. The study design was cross sectional. All patients were using 4x2 L exchanges per day. The demographic features (gender, age, duration of dialysis), dialysis adequacy (weekly Kt/V), educational and economic status of the patients were obtained from the registry of the DC. The blood biochemistry including the nutritional parameters such as serum albumin, creatinine, prealbumin, transferrin and serum cholesterol were measured after a fasting period of 12 hours. Beside these parameters, hematocrit (hct) levels were measured. The anthropometric measurements [waist/hip ratio (W/H), body mass index (BMI), fat mass (FM), free fat mass (FFM), total body water (TBW), mid-arm muscle circumference (MAMC)] were measured in the morning at the DC. These anthropometric measurements except waist, hip and mid arm muscle circumferences were measured by TANITA (Tanita corporation/Tokyo, Japan). Tanita's Body Fat Monitors and Body Composition Monitors use Bioelectrical Impedance Analysis (BIA) to help calculate results by foot to foot . The waist, hip and mid arm muscle circumference was measured by tape measure. BMI was defined as underweight <18.5 kg/m$^2$, normal weight=18.5-24.9 kg/m$^2$, overweight >25-29.9 kg/m$^2$ and obesity >30 kg/m$^2$.

The patients were divided in two groups; low hematocrit (hct=33%, group 1) and on-target hematocrit (hct ≥33%, group 2). The educational status was categorized as graduated from elementary school, and non-graduated. The economic status of the patients was categorized according to their income (below and above the minimum wage or salary). Educational and economic status, dialysis

**Table I.** The demographic features, Kt/V, educational and economic status of the groups

| Parameters | Group 1 n=28 | Group 2 n=14 | P |
|---|---|---|---|
| Gender (F/M) | 18/10 | 4/10 | **0.029** |
| Age (years) | 38.0 ± 11.3 | 40.4 ± 12.8 | 0.536 |
| Duration of CAPD (months) | 51.8 ± 27.7 | 40.6 ± 25.5 | 0.212 |
| Weekly Kt/V | 2.0 ± 0.51 | 1.85 ± 0.41 | 0.354 |
| Education (0/1) | 8/20 | 1/13 | 0.111 |
| Economic Status (0/1) | 9/19 | 2/12 | 0.215 |
| Dose of rHuEPO/weekly | 2714.2 ± 1959.9 | 1000.0 ± 2038.0 | **0.012** |

**Table II.** The anthropometric measurements, nutritional parameters and hematocrit levels of the groups

| Parameters | Group 1 n=28 | Group 2 n=14 | P |
|---|---|---|---|
| W/H (cm) | 0.87 ± 0.08 | 0.90 ± 0.08 | 0.337 |
| BMI (kg/cm$^2$) | 20.9 ± 3.7 | 23.1 ± 3.9 | 0.084 |
| FM (kg) | 8.3 ± 6.4 | 12.2 ± 6.5 | 0.071 |
| TBW (kg) | 33.4 ± 5.2 | 37.2 ± 7.4 | 0.065 |
| MAMC (cm) | 21.8 ± 3.7 | 24.3 ± 2.6 | **0.034** |
| Predialysis urea (mg) | 133.2 ± 35.0 | 121.8 ± 26.9 | 0.294 |
| Albumin (mg) | 2.8 ± 0.4 | 3.2 ± 0.5 | **0.032** |
| Creatinine (mg) | 10.1 ± 2.2 | 10.9 ± 3.9 | 0.433 |
| Prealbumin (mg) | 41.3 ± 15.7 | 38.8 ± 10.4 | 0.600 |
| Transferrin (mg) | 202.0 ± 51.9 | 191.2 ± 56.4 | 0.538 |
| Cholesterol (mg) | 191.0 ± 44.0 | 190.2 ± 34.7 | 0.954 |
| Hematocrit (%) | 27.2 ± 3.3 | 36.7 ± 4.8 | **<0.001** |

adequacy, anthropometric measurements, nutritional parameters, and hematocrit levels of two groups were compared. The statistical analysis was done by student's t test for continuous variables, chi-square test for categorical variables and Pearson's correlation and linear regression. The data are shown as mean ± SD. A p value of <0.05 was considered statistically significant.

## Results

Forty-two patients were included in the study (28 in group 1 and 14 in group 2). There were more females in group 1 (p=0.029). The mean weekly dose of rHuEPO dose was higher in group 1 (p=0.012). While 20 (71.4%) patients were under rHuEPO therapy in group 1, only 3 (21.4%) patients were on rHuEPO therapy in group 2 (p=0.002). Demographic characteristics, weekly Kt/V, doses of rHuEPO, status of formal education and economics are shown in Table I.

Age (p=0.536), duration of CAPD (p=0.212), weekly Kt/V (p=0.354) formal education (p=0.111) and economic status (p=0.215) did not differ statistically between the groups.

The gender, age, duration of CAPD, dialysis adequacy, formal education and economic status of the patients had significant positive effect on BMI (R-square=0.367, p=0.010) and on serum albumin (R-square=0.397, p=0.005) in the linear regression analysis.

Among the anthropometric measurements, statistically significant differences between the groups were found only in MAMC where the means ± SD were 21.8 ± 3.7 cm in group 1 and 24.3 ± 2.6 cm in group 2 (p=0.034). With regard to the BMI; 6 (21.5%) patients were underweight, 21 (75%) patients were normal weight and 1 (3.5%) patient was overweight in group 1 and those were 3 (21.5%), 6 (43%) and 5 (35.5%) patients respectively in group 2 (p=0.016). Serum albumin levels were low in both groups but differ significantly (p=0.032).

There were significant positive correlations between hematocrit level and BMI (r=0.331, p=0.0032), FM (r=0.383, p=0.012), MAMC (r=0.365, p=0.017) and serum albumin level (r=0.416, p=0.006). The associations between hct levels with BMI and serum albumin levels are shown in Figures 1 and 2.

There were significant positive correlations between BMI and FM (r=0.852, p<0.001), TBW (r=0.530, p<0.001) and MAMC (r=0.851 p<0.001) and significant negative correlation between BMI and BIA (r=-0.411, p=0.007). A positive significant association was found between serum albumin level and creatinine level (r=0.328, r=0.034) and a negative association was found between serum albumin and age (r=-0383, p=0.012).

## Discussion

Serum albumin, prealbumin, creatinine, cholesterol and predialysis urea concentrations are valid bi-

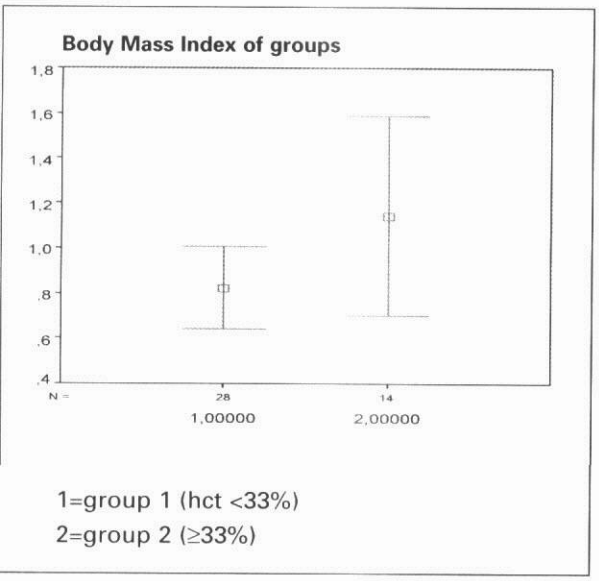


**Figure 1.** BMI of groups according to anemia status.

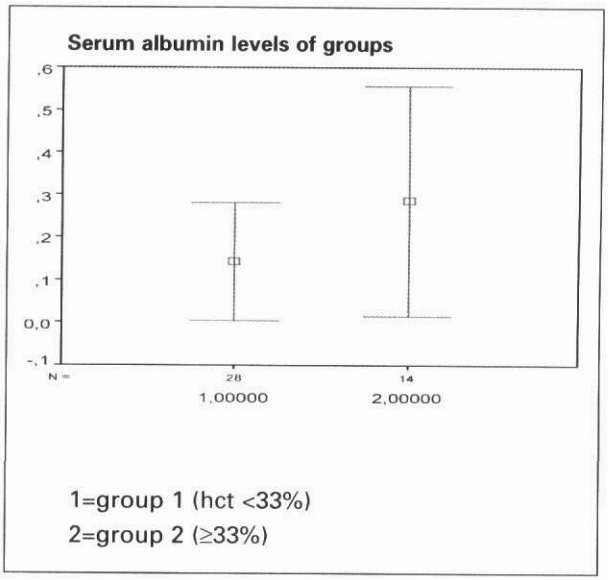


**Figure 2.** Serum albumin levels of groups according to anemia status.

ochemical markers in assessing the nutritional status of the patients on CAPD. These parameters are recommended by NKF/DOQI (5) for assessing the nutritional status of the CAPD patients. Some of these parameters have various correlations with patients' demographics, erythropoietin dose and hct levels. The Peritoneal Dialysis Core Indicators Study suggested that serum albumin levels negatively correlated with age, female gender and erythropoietin dose. In the present study, a negative correlation was found between serum albumin level and age (6). No correlation was observed between serum albumin level and erythropoietin dose or female gender. This result may be due to the small number of patients and low dose of erythropoietin. Furthermore, we found a positive correlation between serum albumin and creatinine levels and hematocrit levels.

On the other hand, some of the demographic features such as gender, dialysis adequacy, duration of CAPD, economic and educational status, and age may have associations with nutritional parameters and anthropometric measurements. We established that gender, age, duration of CAPD, dialysis adequacy, formal education and economic status of the patients had significant positive association with BMI (R square=0.367, p=0.010) and serum albumin levels (R square=0.397, p=0.005).

Although a negative association was found between dialysis adequacy and BMI (r=-0.336, p=0.032) (this is because everybody is on the same dose which results lower Kt/V in larger people) Lo WK et al (7) suggested that there was not any significant correlation between indices of adequacy and serum albumin or composite nutritional index. In agreement with Lo WK et al study, we did not find any significant correlation between dialysis adequacy and nutritional parameters (p=0.890). The recent prospective, randomized ADEMEX study suggested that target of Kt/V must be 1.8 (8). Lo WK et al recommended that the minimal target of total Kt/V should be above 1.7 (9). Furthermore, we know that the K/DOQI recommendations are based on large observational studies; and target weekly Kt/V value of 2.0 assumed for hemodialysis adequacy in patients on CAPD. In our study we established that the Kt/V as 2.0 ± 0.51 in group 1 and 1.85 ± 0.41 in group 2 (p=0.354), so it can be said that we achieved the target Kt/V. It should be remembered that Kt/V is only a mathematical formula and only reflects the low solute clearance. Thus dialysis adequacy must be evaluated with adequate fluid removal, peritoneal equilibrium test, calcium-phosphate product, anthropometric measurements, anemia, nutritional status, cardiovascular problems and clearance of middle molecules. For this reason every effort must be taken to achieve a good clinical status including the nutritional status, acceptable anthropometric measurements, adequate fluid removal, controlled blood pressure, achieved target hct level and to allow diagnosis of any changes towards a worse clinical outcome as soon as possible.

Tzamaloukas AH et al reported that young age is a predictor of low BMI in the CAPD population (10). In the present study we could not find any correlation between age and BMI.

In our study, according to the BMI, 21.4% (n=6/28) of the patients in group 1 and 21.4% (n=3/14) of the patients in group 2 were underweight and the hematocrit level was higher in group 2 than in group 1. Thus, we established that hematocrit level positively correlated with BMI (r=0.331, p=0.0032), with FM (r=0.383, p=0.012) and with MAMC (r=0.365, p=0.017). Nevertheless, erythropoietin has negative association with age (r=-0.386, p=0.012), with hct (r=-0.549, p<0.001), with BMI (r=-0.367, p=0.017), with FM (r=-0.405, p=0.008) and with MAMC (r=-0.312, p=0.044).

In conclusion, achieving target hematocrit level may improve body mass index and mid arm muscle circumference but not biochemical parameters. The gender, age, duration of CAPD, dialysis adequacy, educational and economic status of the patients had significant positive effect on BMI and on serum albumin.

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