The Association Between Feeding Habits, Nutritional Parameters and Quality of Sleep in Hemodialysis Patients

Hemodiyaliz Hastalarında Beslenme Parametreleri, Beslenme Alışkanlığı ve Uyku Kalitesi Arasındaki İlişki

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ABSTRACT

OBJECTIVE: Poor sleep and sleep-related breathing disorders are common in hemodialysis (HD) patients. However, it is not well known whether there is a relation between nutritional habit and quality of sleep. The aim of this study was to investigate the relation between quality of sleep and nutritional characteristics.

MATERIAL and METHODS: The study population included 84 HD patients. Data were collected with the questionnaire developed by the researchers and included questions about socio-demographic features, biochemical findings, and anthropometric data.

RESULTS: The quality of sleep was poor in 51.2% of the patients. These patients were relatively older than the patients with good quality of sleep (44.0±13.0 and 37.4±11.8 year respectively, p<0.001). The patients with the good quality of sleep consumed significantly more meat-offal-cheese-egg (p<0.01) and fruit (p<0.05). The patients with the poor quality of sleep had significantly lower albumin (p<0.01), pre-albumin (p=0.02) and total lymphocyte counts (p=0.02). The patients who more frequently had gastrointestinal complaints (especially abdominal discomfort and flatulence) had the poor quality of sleep.

CONCLUSION: There are some associations between sleep quality and nutritional aspects. Nutritional habits should be evaluated in HD patients having poor sleep quality.

KEY WORDS: Hemodialysis, Nutrition, Quality of Sleep, Albumin, Prealbumin

ÖZ

AMAÇ: Hemodiyaliz (HD) hastalarında uyku bozukluğu ve bununla ilişkili solunum sıkıntısı sık görülmektedir. Beslenme alışkalığı ile uyku kalitesi arasındaki ilişki iyi bilinmemektedir. Bu çalışmanın amacı, uyku kalitesi ile beslenme alışkanlığı arasındaki ilişkiyi araştırmaktır.

GEREÇ ve YÖNTEMLER: Çalışmaya 84 HD hastası alındı. Veriler, sosyo-demografik özellikler, biyokimyasal bulgular ve antropometri hakkında sorular içeren anket sayesinde toplandı.

BULGULAR: Hastaların % 51,.2'sinin uyku kalitesi kötü idi. Bu hastalar uyku kalitesi iyi olan hastalara kıyasla daha yaşlı idi (44,0±13,0 ve 37,4±11,8 yıl, p<0,01). uyku kalitesi iyi olan hastalar anlamlı bir şekilde daha fazla et, sakatat, peynir, yumurta ve meyve tüketmeydeydi (p<0,01). Kötü uyku kalitesi olan hastaların, albümin (p<0,01), pre-albümin, (p=0,02) ve total lenfosit sayısı (p=0,02) uyku kalitesi iyi olan hastalara kıyasla anlamlı bir şekilde daha düşüktü. Gastrointestinal şikayeti (abdominal şişkinlik) fazla olan hastaların uyku kalitesi bozuktu.

SONUÇ: Beslenme durumu ile uyku kalitesi arasında ilişki mevcuttur. Uyku bozukluğu olan HD hastalarının beslenme durumları gözden geçirilmelidir.

ANAHTAR SÖZCÜKLER: Hemodiyaliz, Beslenme, Uyku kalitesi, Albümin, Prealbümin

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INTRODUCTION

Sleep apnea is common in patients with chronic kidney disease (CKD) and increases as kidney function declines. Almost 50% of patients with CKD experience nocturnal hypoxia, which may contribute to loss of kidney function and increased cardiovascular risk (1). However, a well-functioning renal graft does not cure the poor sleep pattern that now emerges as a problem even in early CKD. Studies from Turkey have shown that the prevalence of subjective sleep problems is 50%-80% in hemodialysis (HD) patients (2).

Limited daily activities, ESRD related metabolic changes, pain, dyspnea, tiredness, cramps, presence of peripheral neuropathy affecting the upper respiratory nerves, and emotional problems may have a role in sleep problems in HD patients (3). Improvements in sleep problems have been reported to be an indicator of increased quality of life (4, 5). To improve the quality of sleep, factors likely to impair sleep should be identified and appropriate precautions should be taken. Nutrition is a factor which may influence the quality of sleep and therefore, it is of great importance in patients undergoing hemodialysis. Apart from medical treatment of these patients, their nutritional status plays an important part in treatment outcomes (6).

To our knowledge, there have not been any studies in the literature about whether there is a relation between the quality of sleep, and feeding habits, nutritional elements and biomarkers in patients receiving HD. The aim of this study was to reveal the relation between the quality of sleep and nutritional characteristics and laboratory markers.

MATERIAL and METHODS

Material

We conducted a cross-sectional study. The study population included 105 patients undergoing HD and the study sample included 84 patients fulfilling the inclusion criteria and agreeing to participate in the study. Inclusion criteria were receiving 3 HD sessions per week for three months or longer and being at the age of 18-60 years.

Exclusion criteria were chronic obstructive lung disease, sleep apnea syndrome, obesity, neoplastic diseases, active rheumatologic disorders, cardiovascular disease (these patients are clinically defined by clinical evidence of actual or past history of cardiac disease, unstable angina, heart failure and previous stroke or myocardial infarction), iron deficiency, restless legs syndrome, periodic limb movement disorder, chronic diseases likely to affect sleep quality such as psychiatric diseases and taking antidepressants and sedatives. All the patients were receiving HD for four hours a week.

Laboratory Results

Blood samples were taken for glucose, urea, creatinine, serum albumin, prealbumin, potassium, phosphorus, total cholesterol, Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), triglyceride, hematocrit, hemoglobin, total protein, uric acid, sodium, calcium, total lymphocyte count, iron and iron binding capacity in all patients before HD. The latest laboratory results at the time of the study were included into the analysis.

Questionnaire

The questionnaire developed by the researchers included 17 questions about socio-demographic features including gender, age, marital status, education, financial status, employment, health insurance, the number of people in the household and whether the house/flat was rented or not, time to start treatment, frequency and duration of HD, primary renal disease, fluid intake between two dialyses, smoking and the number of cigarettes smoked and taking medicine.

The Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate the quality of sleep (7) PSQI, a reliable test which has an internal validity and which can be replicated, is used to reveal the quality of sleep in the last one month ($\acute{\alpha}$= 0.77). It is a reliable tool that can differentiate between patients sleeping well and patients with poor sleep. Items of this index include various factors associated with the quality of sleep. These questions are used to determine duration and latency of sleep and frequency and severity of sleep related problems. Higher scores for the index show the poor quality of sleep. The index does not show whether there is a sleep disorder or the severity of sleep disorders. It has been reported that total scores of 5 or higher for the index indicate the poor quality of sleep. Scores of 0-5 show the poor quality of sleep, while scores of 6-21 indicate the good quality of sleep and are interpreted by comparing scores from different groups of people. The diagnostic sensitivity of the index is 89.6% and the specificity of the index is 86.5.

Arizona Food Frequency Questionnaire

Anthropometric findings (body mass index, circumference of the upper middle arm and skin thickness on the triceps), biochemical findings and Arizona Food Frequency Questionnaire (AFFQ) were used to evaluate nutritional status. AFFQ is composed of questions about 65 foods that belong to five main categories and 25 dietary habits. Questions about dietary habits include life style, dietary history and habits, consumption of coffee, tea, sugar and salt, dental problems and gastrointestinal complaints. The questionnaire is used to reveal the frequency of consumption of foods in each major category and their portions in 12 months.

The Subjective Global Assessment used to evaluate patients' nutritional status does not yield results consistent with biochemical parameters and does not give sufficient information about nutritional status of patients undergoing HD (8). There is no gold standard test for evaluation of both the quality of sleep and nutritional status. Therefore, AFFQ, adapted to Turkish by

Çelik et al., was used to evaluate nutritional status of the patients receiving HD in this study (9). In the adapted version of the questionnaire, there are 7 categories of food and the number of foods is increased. The validity and reliability of AFFQ were tested by Matinez et al. on cancer patients (10). Answers to the questions about gastrointestinal complaints (for patients frequently experiencing these problems) and dental problems were either yes or no.

Laboratory findings were obtained from patient records and all data were collected by the researchers at face-to-face interviews.

Statistical Analysis

Data were analyzed with SPSS 15.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics (numbers, percentages, mean and standard deviation) were used. Whether the quality of sleep varied with socio-demographic features and the disease related characteristics were determined and data were analyzed with Chi-square test and t test for continuous variables independent groups. T test for independent groups was used to determine there was a significant difference between the quality of sleep and biochemical findings and nutritional status. $p<0.05$ was considered significant. The two dimensional hypothesis was taken into consideration in all analyses. Logistic regression analysis was used to determine risks for the quality of sleep in the patients receiving hemodialysis.

RESULTS

Out of 84 patients, 51.2% had the poor quality of sleep and 48.8% had the good quality of sleep. Table I shows the distribution of socio-demographic features and laboratory results of the patients by the quality of their sleep. Although there was no significant difference between gender and the quality of sleep ($p=0.128$), the patients with the good quality of sleep were younger and had significantly higher albumin, prealbumin and total lymphocyte counts. There was no significant difference in fasting blood sugar levels, hemoglobin, creatinine levels and weight gain between two dialysis sessions between the patients with the good quality of sleep and those with the poor quality of sleep ($p>0.05$).

Table II shows the distribution of intake of fluid and food categories by the quality of sleep based on data from AFFQ. The patients with the good quality of sleep were found to eat significantly more meat-offal-cheese-egg and fruit ($p<0.01$).

Table I: The distribution of demographic features and several laboratory results by the quality of sleep.

Parameters	Poor quality of sleep	Good quality of sleep	P
Age	44.0±13.0	37.4±11.8	<0.001
Gender (F/M) (n)	26/17	17/24	NS
BMI (kg/m^2)			
Lower than 18.5	9	5	<0.05
18.5-24.9	23	25	NS
25-29.9	11	11	NS
Duration of Hemodialysis (months)	36.0±23.6	35.1±25.6	NS
Primary renal disease			
Hypertension	13	12	NS
Diabetes mellitus	7	2	<0.01
Glomerulonephritis	12	13	NS
Cystic renal disease	4	5	NS
Other	7	9	NS
Hemoglobin (gr/dl)	10.9±1.3	11.5±1.2	NS
Albumin (gr/dl)	3.4±0.5	3.8±0.3	<0.05
Prealbumin (mg/dl)	30.2±7.1	34.0±6.1	0.02
Total lymphocyte count (%)	22.7±7.5	26.6±8.1	0.02
Fasting blood glucose (mg/dl)	89.1±11.2	92±8.2	NS
Serum creatinine (mg/dl)	7.8±1.9	8.1±2.1	NS

NS: Not significant, **F/M:** Female/Male, **BMI:** Body mass index.

Table II: The distribution of fluid intake and food categories by the quality of sleep.

Variables	Poor quality of sleep ($\bar{x} \pm SD$)	Good quality of sleep ($\bar{x} \pm SD$)	T	P
Fluid intake	2755±1025	2780±1090	0.107	NS
Milk-yoghurt	22.3±5.4	22.1±6.4	0.194	NS
Vegetables	48.2±17.0	53.9±12.2	1.744	NS
Bread-desserts	67.1±19.1	73.1±21.2	1.365	NS
Meat-offal-cheese-egg	46.9±11.8	54.0±13.3	2.598	0.01
fat-sugar	34.0±9.4	35.0±8.7	0.387	NS
Fruit	62.0±18.0	71.0±19.0	2.266	0.02
Legumes	13.0±6.0	15±8.3	1.788	NS

NS: Not significant.

Table III: Distribution of gastrointestinal complaints by the quality of sleep.

Gastrointestinal complaints	Poor quality of sleep (n)	Good quality of sleep (n)	P
Yes	36	24	0.02
No	7	17	0.02

Table IV: Logistic regression analysis of variables affecting the quality of sleep.

Variables	ß	SE	Wald	P	Odd(s) coefficient (confidence interval)
Age	-0.056	0.02	7.753	0.005	1.058 (1.017-1.100)
meat-offal-cheese-egg	-0.046	0.02	5.310	0.02	0.955 (0.919-0.993)
Albumin	-0.920	0.958	0.921	0.337	0.399 (0.061-2.607)
Prealbumin	-0.015	0.067	0.049	0.825	0.985 (0.864-1.124)
Total lymphocyte	-0.079	0.040	3.808	0.051	0.924 (0.854-1.000)
Fruit	-0.025	0.017	2.087	0.149	0.975 (0.943-1.009)
Flatulence	1.011	0.645	2.458	0.117	2.749 (0.777-9.729)
Stomachache	1.293	0.813	2.532	0.112	3.644 (0.741-17.917)
GIS complaints	0.503	0.857	0.345	0.557	1.654 (0.308-8.867)

GIS: Gastrointestinal, **ß:** regression coefficient, **SE:** Standard error of regression coefficient. **Wald:** Wald test statistic.

According to results of the logistic regression analysis, there was a relation between consumption of little meat-offal-cheese-egg, fruit and the quality of sleep, the patients with the poor quality of sleep consumed less cola, coffee and tea and this did not affect the quality of sleep.

As presented in Table III, 71.4% of all the patients had gastrointestinal complaints. Eight-three point seven percent of the patients with poor quality of sleep and 58.5% of the patients with good quality of sleep experienced gastrointestinal problems, with a significant difference ($p<0.05$). Table IV shows variables affecting the quality of sleep based on the results of logistic regression analysis.

DISCUSSION

There have been several studies showing that patients undergoing HD more frequently have sleep problems than the normal population (2, 4, 11). This is the first study to investigate effects

of food categories on the quality of sleep. The results of logistic regression analysis made to determine risks in the patients with the good quality of sleep and those with the poor quality of sleep revealed a significant effect of age and meat-offal-cheese-egg on the quality of sleep. Health promoting behaviors vary from culture to culture.

Out of 84 patients included into the study, 51.2% had the poor quality of sleep. This rate of the poor quality of sleep is lower than those obtained before (2, 4, 12). Kusleikaite et al., using PSQI in their study on 81 patients receiving HD, found that 67.7% of the patients had the poor quality of sleep (5). Pai et al., using PSQI in their study on 245 patients undergoing HD, found that 74.4% of the patients had the poor quality of sleep (12). Iliescu et al. in their study on 89 patients on HD did not find a difference in the quality of sleep between genders (4). Consistent with their results, we did not find a significant difference in the quality of sleep between genders. However, Çölbay et al. reported that the quality of sleep was affected 3.7 times higher in the female gender than the male gender (11).

AFFQ was used to determine nutritional status of the patients. To our knowledge, there have not been any studies using AFFQ in patients undergoing HD. However, AFFQ has been one of the main tools used to reveal diseases and foods in many epidemiological studies (13). In addition, there have not been any studies on the relation between the quality of sleep and nutritional status in patients.

According to the registry obtained by Turkish Society of Nephrology from the HD center in 2009, most of the patients undergoing HD are aged 45-65 years (14). Many studies have revealed a significant relation between increased age and impaired quality of sleep. In a study by Çölbay et al. using PSQI in 94 patients receiving HD, increased age was significantly related to impaired sleep (11). Logistic regression analysis revealed that age was an important variable and that the patients with the poor quality of sleep had a higher mean of age. Unlike from the results of the studies described above, the degree of impact was based on Odds number in the logistic regression analysis in this study. It is striking that the analysis helped to determine the real risk coefficient.

Based on the results of the logistic regression analysis in this study, another risk factor affecting the quality of sleep was the food category of meat-offal-cheese-egg. In fact, there was a significant relation between consumption of little meat-offal-cheese-egg and the quality of sleep. These foods are rich in protein. Protein containing foods facilitate falling asleep. L-Tryptophan (essential amino acid) found in foods is the precursor of serotonin, a transmitter. Therefore, a diet lacking this essential amino acid can impair sleep. Since the foods with high amounts of protein (milk, yoghurt, cheese and eggs etc.) contain tryptophan, they help to fall asleep (15). Impaired sleep quality in the patients included in this study can be attributed to their consumption of little meat-offal-cheese-egg. In addition to this category of food, legumes, i.e. beans like vegetables also contain protein. In the present study, both the patients with the good quality of sleep and the patients with the poor quality of sleep consumed low amounts of these vegetables. There have not been any studies in the literature about the relation between the quality of sleep and consumption of legumes.

Serum albumin is the most frequently used test in clinical practice to determine protein concentrations. Since it has a long half-life (14-20 days), it can be used to evaluate long-term nutrition. When serum albumin is higher than 4 gr/dl in patients receiving HD, mortality is low and when it is lower than 3.0 gr/dl, mortality is considerably increased (16). In the present study, albumin levels were significantly low in the patients with the poor quality of sleep. Consistent with the results of the present study, De Santo et al. reported that as albumin levels decreased so did the quality of sleep (3). It can be suggested that monitoring albumin levels can be useful in predicting the quality of sleep.

Serum prealbumin levels are useful in showing visceral protein concentrations. It is shorter half-life than albumin (2-3 days). Serum albumin levels of lower than 20 mg/dl are closely related to mortality and malnutrition should also be kept in mind (17). There is no data about the relation between albumin/prealbumin levels and the quality of sleep. Low albumin and prealbumin levels are associated with the poor quality of sleep and patients with the poor quality of sleep consume fewer amounts of foods rich in protein. It can be suggested that since consumption of foods rich in protein can increase albumin and prealbumin levels, the quality of sleep will increase.

In the present study, there was no significant relation in hemoglobin levels between the patients with good quality of sleep and those with the poor quality of sleep. However, De Santo et al. failed to show a relation between hemoglobin levels and the quality of sleep (3). Many studies have shown that low hemoglobin levels decreased the quality of sleep (4, 12). While we found that phosphorus did not influence the quality of sleep, Unruh et al. in their study on 71 dialysis patients revealed that high phosphorus levels had a negative impact on the quality of sleep (17). In the present study, the total lymphocyte count was significantly higher in the patients with a poor quality of sleep. To the best of our knowledge, there have not been any studies comparing the total lymphocyte count and the quality of sleep.

We also found that the patients with poor quality of sleep consumed less fruit. Consumption of little fruit can have a negative effect on the quality of sleep. However, in this study, consumption of cola, coffee and tea were not found to affect the quality of sleep. Similarly, De Santo et al. reported that caffeine did not affect the quality of sleep (3).

In this study, 83.7% of the patients with the poor quality of sleep had gastrointestinal problems. HD patients frequently suffer from gastrointestinal problems due to uremic toxins (4, 6,

13). We found that 67.4% of the patients with the poor quality of sleep had stomachache and that 62.8% of the patients with the poor quality of sleep had flatulence. These results suggest that stomachache and flatulence affect the quality of sleep in hemodialysis patients.

Some medications such as SSRI can also cause severe side effects; including sleep disorders and loss of appetite (18). However, none of our patient was taking antidepressants or sedatives.

There are lots of complex factors contributing to poor sleep in patients undergoing hemodialysis. It has been shown that dialysis adequacy may influence sleep quality (19). However, in our dialysis center, Kt/V was 1.2 or higher.

In this study, there was no significant relation between body mass index and the quality of sleep. This study has some limitations. This is not a prospective study. Therefore, the factors associated with the quality of sleep could not be studied and the possible results could not be evaluated.

CONCLUSION

HD patients have a poor quality of sleep and there is a significant relation between the quality of sleep and age, albumin and prealbumin levels, total lymphocyte count and consumption of meat-offal-cheese-egg and fruit. Gastrointestinal problems more frequently appear in HD patients with the poor quality of sleep. It can be recommended that nutritional contents and parameters should be monitored and that gastrointestinal complaints should be treated. Sleep problems should be eliminated especially in elderly HD patients. Serum albumin, and prealbumin levels and total lymphocyte count should be used for objective evaluation of the relation between nutrition and sleep. Further studies with larger homogenous samples of specific patients will confirm the importance of the results of this study.

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