



The effects of iron deficiency anemia on sleep and life qualities

✉ Gulden Sincan^{a,*}, ✉ Suat Sincan^b, ✉ Muharrem Bayrak^c

^aDepartment of Hematology, Medical School, Ataturk University, Erzurum, Turkey.

^bDepartment of Family Medicine, Medical School, Ataturk University, Erzurum, Turkey.

^cDepartment of Internal Medicine, University of Health Sciences, Erzurum Regional Education and Research Hospital, Erzurum, Turkey.

Abstract

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Aim: Iron deficiency anemia is an important public health problem all over the world. We aimed to determine the effects of anemia on sleep and life qualities in patients with iron deficiency anemia.

Material and Methods: Ninety-nine iron deficiency anemia patients and forty healthy cases were recruited. Short-Form 36-Item Health Survey questionnaire and Pittsburgh Sleep Quality Index questionnaire were used to measure the qualities of life and sleep, respectively. A Pittsburgh Sleep Quality Index global score >5 was defined as poor sleep quality. The gathered data were analyzed using descriptive, independent-t-test, chi-square tests.

Results: The global Pittsburgh Sleep Quality Index score was 10.23 ± 2.87 in patients with iron deficiency anemia and it was 3.65 ± 1.4 in control group ($p < 0.001$). The scores of each item for the Pittsburgh Sleep Quality Index were worse in patients with anemia than control group. The quality of life scores in the control group were higher compared with the anemia group ($p < 0.001$). We also found a positive significant association between sleep quality and life quality in patients with anemia ($p < 0.001$).

Conclusion: We found that iron deficiency anemia negatively affects the qualities of sleep and life in adult patients. Therefore, we suggest that iron deficiency anemia should be investigated in the etiology of impaired sleep and quality of life.



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Introduction

Iron deficiency anemia (IDA) is the most common cause of anemia in the world. Iron deficiency affects about 30% of the world's population, and women's more affected with IDA than men. The symptoms of IDA are weakness, fatigue, loss of appetite, palpitations, pale skin, headache, cold intolerance, tinnitus, impairments in cognitive and intellectual functions. Iron plays an important role in monoamine metabolism in the brain; therefore monoamine oxidase activity is disturbed in iron deficiency. This is the reason for apathy and restlessness in IDA (1). Also, monoamine oxidase plays a role in sleep physiology and sleep disorders can occur in IDA. It was reported that IDA in children caused sleep disturbance by affecting neurotransmitters (2, 3). However, there are few studies examining the relationship between IDA and sleep quality in adults. The life quality is a subjective parameter that evaluates the physical, psychological and social health status of the person (4). Life quality may be impaired by symptoms related to anemia, especially fatigue. Impaired sleep quality causes daytime sleepiness and decreased performance. It can disrupt the quality of life by causing physical and mental disorders. Some studies have

found that the life quality of patients with anemia improved after treatment of anemia (5).

The sleep quality can be assessed using various quantitative and qualitative methods. Polysomnography (PSG) is an objective test for evaluating sleep quality, but PSG device not available in every hospital. Stanford Sleepiness Scale, Pittsburgh Sleep Quality Index (PSQI) Scale, Berlin Questionnaire, Stop and Stop-Bang Survey are subjective questionnaires used for sleep quality assessment. PSQI scale is the most commonly used scale to evaluate sleep quality in adults (6). Its Turkish reliability and validity studies were conducted by Ağargün et al. (7). World Health Organization Quality of Life Scale (WHOQOL), 36-Item Short Form Health Survey (SF-36), Nottingham Health Profile, European Quality of Life Scale (EuroQol Instrument / EQ5-D) can be used to evaluate life quality. SF-36 questionnaire is a short and comprehensive general health survey conducted by Ware in 1992 (8). Turkish validity and reliability were determined by Koçyiğit et al. in 1999 (9). In this study, we aimed to determine the effects of IDA on sleep and life qualities.

Materials and Methods

We analyzed 99 patients with IDA and 220 healthy peoples who were applied to the XXX Hospital in this study. Cases with psychiatric illness, chronic obstructive pulmonary disease, obesity, rheumatological disease, cardiac disease, impaired cogni-

*Corresponding author:

Email address: guldensincan@gmail.com (✉ Gulden Sincan)

tive function were excluded from this study. Other exclusion criteria included insufficient sociocultural status to answer the questionnaires. In accordance with the World Health Organization's definition of anemia; hemoglobin value < 12 g/dl in women, < 13 g/dl in men, transferrin saturation < 15% and ferritin < 15 ng/ml were considered IDA. The control group was composed of healthy volunteers. Ethical committee approval was obtained from the Ataturk University Medical Faculty, Hospital Ethics Committee on 01.07.2019 with the decision number 2019/10-114. Informed consent form was signed by all participants. The age, gender, residential location and smoking habits were recorded. The levels of serum hemoglobin, hematocrit, iron and iron binding capacity, transferrin saturation, ferritin and red blood cell count were determined of all patients after 8-10 hours of fasting. The sleep quality of the patients was evaluated with the PSQI scale and the quality of life was determined with the SF-36 questionnaire.

Statistical Methods

SPSS 20.0 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp) package program was used for analysis of data. Frequency, percentage, mean and standard deviation were used as descriptive statistics. Histogram distribution and analytical methods (Kolmogorov-Smirnov and Shapiro-Wilk tests) were used to test normality by comparing our data with a normal distribution with the same mean and standard deviation as our sample. It was found that the data for each of the quantitative variables were appropriate for normal distribution. So in comparison of anemia and control groups independent T test was applied. Chi-square test was used for comparison of categorical parameters. SF-36 scale scores and PSQI scale scores were compared using the independent t-test. A p value less than 0.05 was accepted as significance.

Pittsburgh sleep quality index (psqi) scale

PSQI scale is a questionnaire used to evaluate the sleep quality, amount of sleep, presence and severity of sleep disorders for the past 1 month. This scale consists of 19 items and 7 sub components: sleep quality (C1), sleep latency (C2), sleep duration (C3), habitual sleep efficiency (C4), sleep disturbances (C5), use of sleeping medication (C6) and daytime dysfunction (C7). Each component was equally weighed on a 0 (no difficulty) - 3 (severe difficulty) scale. The global PSQI score is the sum of all the sub components (ranging from 0–21). A score of greater than 5 indicates poor sleep quality (2). There are 5 additional questions that don't used in the scoring. Bed partner answers these questions about snoring, witnessed apnea, twitching in the legs, confusion and restlessness during sleep. We used the Turkish version of PSQI scale.

36-item short form health survey (sf-36)

SF-36 is a generic health questionnaire, which contains 36 items that measures 8 health-related domains. The eight domains are general health perception (5 items), physical function (10 items), role limitations due to physical problems (4 items), role limitations due to emotional problems (3 items), social function (2 items), bodily pain (2 items), vitality (4 items), mental health (5 items). This scale evaluates general health status the previous 4 weeks. Scores on each scale range from 0–100, with a score of 100 indicating the highest rating of health (15). In this study, we used the Turkish version of SF-36.

Results

The mean age of 99 IDA cases was 32.5 ± 12.1 years, 72 (72.7%) cases were female and 27 (27.3%) cases were male. In the control group, the mean age was 30.5 ± 7.5 years, 165 (75.0%) of all cases were female and 55 (25.0%) cases were male. IDA and control groups were similar in terms of age and gender distribution. Education level, marital status, tobacco use, residential location is significantly different in control and anemia groups (Table 1).

We detected more sleep problems in patients with IDA compared to control group. There was a significant difference between the IDA and control groups in terms of sleep quality ($p < 0.001$), sleep latency ($p < 0.001$), sleep duration ($p < 0.001$), habitual sleep efficiency ($p < 0.001$), sleep disturbances ($p < 0.001$), use of sleeping medication ($p < 0.001$), daytime dysfunction ($p < 0.001$) and global sleep quality index ($p < 0.001$) (Table 2). Type of sleep disturbance of IDA patients was showed in Table 3. Total score of SF-36 scale was lower in IDA patients compared to health peoples (Table 4). In addition, all subgroups of quality of life were significantly better in the group with good sleep quality (Table 5).

Discussion

Sleep is a period of physical and mental recess and is characterized by altered consciousness, decreased muscle activity and interaction with the environment. The frequency of sleep disturbances is around 40% in the general population. Chronic diseases, alcohol, pain, environmental factors, stress, medications, anemia can be the causes of sleep disturbance. In the SLEEPO study, a positive relationship was found between low hemoglobin level and impaired sleep quality (10). Ten hemodialysis patients with anemia were examined by polysomnography and it was reported that the improvement of anemia increased sleep quality, reduced nighttime awakenings, less disruption of sleep in this study. In addition, a negative correlation has been reported between the PSQI scores and the Hb levels in hemodialysis patients in another studies (11, 12). In our study, all dimensions of PSQI score and global PSQI score were worse in patients with IDA compared to the control group. But we could not re-evaluate sleep quality of our cases after anemia treatment.

There are some studies that did not detect a relationship between anemias and sleep quality (13). The reason for the contradictory results may be the presence of conditions such as nicotine addiction, depression, and obesity that affect sleep quality. The sleep qualities of 104 patients with iron deficiency anemia and 80 healthy controls were evaluated by Murat et al. (14). In this study, total PSQI score, subjective sleep quality, sleep latency, sleep efficiency, sleep disturbance, general dysfunction scores were higher than the control group in patients with anemia, while the sub-scores of sleep duration and use of sleeping pills were similar in both groups. Wali et al. evaluated 44 patients with sickle cell anemia and 45 patients with chronic anemia (thalassemia, hemolytic anemia, chronic disease) by the PSQI questionnaire (15). There is no difference between the two anemia groups in terms of sleep quality and they concluded that hemoglobin level was not a determinant in sleep quality. The relationship between sleep duration and anemia in British patients who over 50 years old was evaluated, and they reported that short sleep duration can cause low Hb level and sleep disturbances can increase the risk of anemia (16). In

Table 1. Socio-demographic features in IDA and control groups

	IDA group n (%)	Control group n (%)	p value
Education Level			
Illiterate	4 (4.0%)	No case	<0.001
Primary school graduate	22 (22.2%)	No case	
Secondary school graduate	28 (28.3%)	88 (40.0%)	
High school graduate	45 (45.5%)	110 (50.0%)	
University graduate	No case	22 (10.0%)	
Marital Status			
Single	68 (68.7%)		0.030
Married	31 (31.3%)		
Tobacco Use			
	46 (46.5%)		0.009
Residential Location			
City	29 (29.3%)		<0.001
Town	29 (29.3%)		
Willage	41 (41.4%)		

Table 2. PSQI scale in IDA and control groups.

PSQI component score	IDA group n (%)	Control group n(%)	p value
Sleep quality			
Good	52 (52.5%)		<0.001
Poor	47 (47.5%)		
Sleep latency (minutes)			
≤ 15	No case		<0.001
16-30	12 (12.1%)		
31-60	57 (57.6%)		
≥ 60	30 (30.3%)		
Sleep duration (hours)			
≤ 6	14 (14.1%)		<0.001
6.1-7.0	32 (32.3%)		
7.1-8.0	26 (26.3%)		
≥ 8.1	27 (27.3%)		
Habitual sleep efficiency (%)			
≥ 85	No case	77 (35%)	<0.001
75-84	25 (25.3%)	66 (30.0%)	
65-74	42 (42.4%)	66 (30%)	
<65	32 (32.3%)	11 (5.0%)	
Sleep disturbances			
Not during the past month	No case	132 (60.0%)	<0.001
<once a week	14 (14.1%)	88 (40.0%)	
1-2 times peer week	69 (69.7%)	No case	
≥ 3 times peer week	16 (16.2%)	No case	
Use of sleeping medication			
Not during the past month	48 (48.5%)	66 (30.0%)	<0.001
<Once a week	37 (37.4%)	154 (70.0%)	
1-2 times peer week	12 (12.1%)	No case	
≥ 3 times peer week	2 (2.0%)	No case	
Daytime dysfunction			
Never	6 (6.1%)	132 (60.0%)	<0.001
<Once a week	61 (61.6%)	88 (40.0%)	
1-2 times peer week	30 (30.3%)	No case	
≥ 3 times peer week	2 (2.0%)	No case	
Global sleep quality index	10.2±2.9	3.7±1.4	

Table 3. Types of sleep disturbance in IDA patients

Type of sleep disturbance		n (%)
Pain	0	32 (32.3%)
	1	47 (47.5%)
	2	16 (16.2%)
	3	4 (4.0%)
Using the bathroom	0	No case
	1	40 (40.4%)
	2	55 (55.6%)
	3	4 (4.0%)
Bad dreams	0	8 (8.1%)
	1	57 (57.6%)
	2	28 (28.3%)
	3	6 (6.1%)
Too cool	0	2 (2.0%)
	1	6 (6.1%)
	2	42 (42.4%)
	3	49 (49.5%)
Difficulty breathing	0	2 (2.0%)
	1	8 (8.1%)
	2	50 (50.5%)
	3	39 (39.4%)
Coughing or snoring loudly	0	66 (66.7%)
	1	29 (29.3%)
	2	4 (4.0%)
	3	No case
Too hot	0	14 (14.1%)
	1	69 (69.7%)
	2	16 (16.2%)
	3	No case
Middle night or early morning awakening	0	No case
	1	4 (14.1%)
	2	69 (69.7%)
	3	16 (16.2%)

Table 4. Quality of Life (SF-36 Scale) in IDA group and control group

Sf-36 Scale	IDA	Control Group	p value
General Health	45.0±33.7	88.8±21.1	< 0.001
Mental health	45.3±22.2	64.5±20.5	< 0.001
Role-functioning	45.5±50.0	65.0±48.3	0.030
Role-emotional	57.6±49.7	70.0±46.4	0.040
Physical functioning	42.4±36.7	80.0±24.8	< 0.001
Bodily pain	59.2±22.5	77.0±18.9	< 0.001
Vitality	46.3±21.3	79.0±16.3	< 0.001
Social functioning	52.9±18.6	78.0±12.6	< 0.001
Total Score	47.8±9.7	65.7±12.9	< 0.001

Table 5. The association with sleep quality and life quality in IDA patients

Sf-36 Scale	Good Sleepers (n:39)	Bad Sleepers (n:60)	p value
General Health	68.6 ± 19.1	47.5 ± 23.7	< 0.001
Mental health	66.4 ± 31.5	55.5 ± 32.1	< 0.001
Role-functioning	58.5 ± 36.3	43.4 ± 37.0	< 0.001
Role-emotional	72.3 ± 41.4	54.6 ± 47.7	< 0.001
Physical functioning	81.2 ± 31.8	44.4 ± 39.3	< 0.001
Bodily pain	78.9 ± 22.9	59.8 ± 26.3	< 0.001
Vitality	79.2 ± 26.1	49.3 ± 23.4	< 0.001
Social functioning	80.0 ± 22.1	56.3 ± 27.1	< 0.001

our study, sleep duration was found ≤ 7 hours in 46 (47.9%) of all patients with iron deficiency anemia.

Iron deficiency anemia affects dopaminergic system. This system plays a role the quality and quantity of REM sleep (17). Peirano et al. found that REM sleep attacks were longer and more in the first third of sleep, short and less in the last third of sleep in patients with anemia compared to the control group (18). Fifel et al. investigated the effect of dopaminergic nigrostriatal system lesions on changes in circadian rhythms in non-human primate models. They found that dopamine deficiency was associated with sleep/wake disturbances, especially in non-optimal lighting conditions. These parameters could not be evaluated in our study.

138,670 people between the ages of 18-93 years were examined in the Netherlands and anemia was found in 4% of all cases and 2.8% of cases over 60 years old. In patients with under 60 years of age, anemia had a limited effect on quality of life and had no effect on overall survival. However, it was detected in patients over 60 years of age that anemia significantly affected overall survival and quality of life (especially in subgroups representing physical functionality) (19). Kim et al. evaluated the quality of life of patients with anemia in South Korea between 2008 and 2016 using the EuroQol five-dimensional (EQ-5D) questionnaire. They found the quality of life worse in patients with anemia (especially mobilization, self-care and daily activity) (20). Due to the fact that hemoglobin carries oxygen in the body, tissue oxygenation may be impaired in cases with anemia and physical activity may be impaired. In addition, anemia can impair the quality of life by affecting muscle strength (21). In our study, in accordance with the literature, the quality of life in patients with anemia was worse than healthy individuals.

Sleep disturbances affect an individual's health status and life activity (22). Chronic sleep disorders cause deterioration in the quality of life by causing daytime sleepiness, cognitive functions and mood disorders. Çelik examined 386 pregnant women in a study. They stated that as sleep quality deteriorated, the quality of life decreased (23). This result has been supported by other studies. (24, 25). In our study, the quality of life score is worse in participants with sleep disorder.

In conclusion iron deficiency anemia is an important treatable public health problem. Sleep quality is poor in patients with anemia and sleep disorders negatively affect the quality of life of patients. The sleep quality of patients with anemia should be evaluated. If necessary, interventions to increase sleep qual-

ity should be done. Thus, an improvement can be achieved in the quality of life of individuals. Also, iron deficiency anemia should be investigated in the etiology of impaired sleep and quality of life.

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