Sexual Dysfunction in Premenopausal Women With Obstructive Sleep Apnea

Zahide Yilmaz[1*], Pinar Bekdik Sirinocak[1], Bekir Voyvoda[2], Levent Ozcan[2]

Purpose: Sexual functions in the males with obstructive sleep apnea syndrome (OSAS) have been well investigated in the literature; however sexual functions in the premenopausal women with OSAS have been studied to a lesser extent.

Materials and methods: The study included 22 premenopausal women diagnosed as OSAS by the polysomnographic (PSG) evaluation. The control group included 13 premenopausal women suspected of sleep-related respiratory disorder, but whose PSG tests were determined to be normal. Both groups were administered Epworth Sleep Scale (ESS), Beck Depression Scale (BDS), and Female Sexual Function Index (FSFI) questionnaire forms. Relations between disease parameters, and the total FSFI score, and scores of the six FSFI parameter were analyzed.

Results: The total FSFI score in the cases with OSAS, was determined to be significantly lower than that of the control subjects ($P = .031$). Scores of the desire, arousal, and orgasm were determined to be significantly lower in the patient group, compared to control group ($P = .034$; $P = .048$; $P = .039$). The total FSFI scores, and scores of the desire, arousal, lubrication, orgasm, satisfaction and pain subscales in the cases did not correlate significantly with the apnea-hypopnea index (AHI), Non-Rapid Eye Movement 1 (NREM1)%, NREM2%, NREM3%, REM%, the time spent with saturation $O_2 < 90\%$, minimum oxygen saturation (%), ESS scores, and BDS scores (all $P > .05$).

Conclusion: Women with OSAS experience sexual dysfunction when compared with normal population. Clinical evaluation has to include also the evaluation of sexual life in women.

Key words: obstructive sleep apnea; sexual dysfunction; women.

INTRODUCTION

Female sexual dysfunction (FSD) is a highly prevalent and often underestimated problem in the general community.[1] FSD may occur at any age, and it affects roughly 40% of women at some point in their lifetime, with 12% of women reporting afflictive sexual problems.[2] FSD is a public health problem, but little epidemiological data are available regarding its extent and magnitude of the psychogenic and organic causes of decreased sexual desire, arousal, and orgasm, as well as pain, which all cause personal distress. Previous studies discovered that factors, such as age, obesity, menopausal status, educational level, financial income, psychological factors, hormonal dysfunction, particularly thyroid disease, and physical health status of women, could affect women's chances of having FSD.[3-5] Among the multitude of factors influencing the sexual integrity of women, the different aspects of lifestyle are considered to play a significant role in the genesis of FSD.[6,7] However effect of obstructive sleep apnea syndrome (OSAS) on sexual dysfunction in premenopausal women has not been well defined yet.

OSAS is a chronic disease characterized by the repetitive episodes of apnea and upper airway collapse during sleep. OSAS affects the middle-aged men nearly by 4%, and the middle-aged women by 2%.[8] OSAS has been known for more than 30 years. As it is the case in many chronic diseases, sexual functions are affected by sleep apnea both in the males and females. Especially erectile dysfunction has been a frequently reported sexual dysfunction in the males with OSAS. These patients have been shown to improve by the continuous positive airway pressure (CPAP) treatment.[8,9]

Female sexual dysfunction is vastly under-recognized but has been previously described in chronic disease states. Sexual dysfunction in male patients with OSAS is well described, but not in females. In light of these informations we aimed in this study to evaluate sexual dysfunction by the use of Female Sexual Function Index (FSFI), in the premenopausal women diagnosed with sleep apnea.

MATERIALS AND METHODS

Study design

Patients who were newly diagnosed with OSAS at the Sleep and Sleep Disorders Laboratory of the Neurology Clinic of Kocaeli Derince Education and Research Hospital, Turkey between 2015 and 2016 were included

[1]Derince Training and Research Hospital, Department of Neurology, Kocaeli, Turkey.
[2] Derince Training and Research Hospital, Department of Urology, Kocaeli, Turkey.
*Correspondence: Derince Training and Research Hospital, Department of Neurology, 41900 Derince, Kocaeli, Turkey.
Tel: (+90) -262-317 8000. Fax: (+90)- 262- 233 4641. E-mail: yilmazzahide@hotmail.com.
Received February 2017 & Accepted June 2017

Table 1. Evaluation of descriptive characteristics of the groups.

		Total (n=35)	Patient (n=22)	Control (n=13)	p
Age (year)					
Min-Max (Median)	35-54(42)	35-51 (44)	35-54 (40)	[a]0,100	
	Meant ± SD	42.06 ± 5.60	43,59 ± 4,82	40.54 ± 5.70	
BMI (Kg/m^2)	Min-Max (Median)	21,5-46,9 (32,5)	21,9-46,9 (33,9)	21,5-43,3 (31,3)	[a]0,116
	Meant ± SD	32,91 ± 6,88	34,24 ± 6,65	30,65 ± 6,92	
Education (year)	Elementary	26 (74,3)	16 (72,7)	10 (76,9)	[b]0,698
	Secondary	7 (20,0)	4 (18,2)	3 (23,1)	
	High school	2 (5,7)	2 (9,1)	0 (0)	
Operations	None	16 (45,7)	11 (50,0)	5 (38,5)	[b]0,904
	Once	11 (31,4)	7 (31,8)	4 (30,8)	
	Twice	6 (17,1)	3 (13,6)	3 (23,1)	
	3 times	2 (5,7)	1 (4,5)	1 (7,7)	
Parity	None	2 (5,7)	0 (0)	2 (15,4)	[b]0,022*
	Once	4 (11,4)	1 (4,5)	3 (23,1)	
	Twice	11 (31,4)	10 (45,5)	1 (7,7)	
	3 times	13 (37,1)	7 (31,8)	6 (46,2)	
	≥ 4 times	5 (14,3)	4 (18,2)	1 (7,7)	
Hypertension		6 (17,1)	2 (9,1)	4 (30,8)	[c]0,106
Diabetes		10 (28,6)	7 (31,8)	3 (23,1)	[c]0,576
COPD		2 (5,7)	1 (4,5)	1 (7,7)	[c]1,000
Cardiac disease		1 (2,9)	0 (0)	1 (7,7)	-
Smoking habit		18 (51,4)	13 (59,1)	5 (38,5)	[c]0,305

Abbreviations: BMI, Body Mass Index; DM, Diabetes Mellitus; COPD, Chronic Obstructive Pulmonary Disease.
[a]Mann Whitney U Test; [b]Fisher-Freeman-Halton Test; cFisher's Exact Test; *$p < 0,05$.

in the study.

Ethical approval

An informed consent was obtained from each participant.The study protocol was approved by the local Ethics Committeeof KocaeliUniversty Non-Intervational Clinical Researches Ethics Board with the permission number and date of KU GOKAEK-2017/11. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Study population

Participants who had no sexual activity within the past month were not included in the study. Participants with sexual problems, including decreased libido, a history of sexual abuse; organic, and/or psychiatric disorders were excluded from the study. Peri- and postmenopausal women, psychoactive medication users, and patients with depression, diabetes and cancer were also excluded.

Sample size

The study included a total of 22 premenopausal women diagnosed with OSAS by the PSG results. The control group included 13 premenopausal women suspected of sleep-related respiratory disorder, but whose PSG results were found to be normal.

Measurements

Patients were questioned for the following variables :

Table 2. Evaluation of disease variables in the groups.

		Total (n=35)	Patient (n=22)	Control (n=13)	[a]p
NREM1 %	Min-Max (Median)	1,5-34,3 (7,5)	1,5-34,3 (7,3)	1,8-32,8 (7,7)	0,322
	Mean ± SD	9,68 ± 8,44	8,56 ± 7,73	11,56 ± 9,55	
NREM2 %	Min-Max (Median)	2,9-49,1 (20,4)	2,9-47,2 (20,6)	3,1-49,1 (16,4)	0,733
	Mean ± SD	21,39 ± 14,27	20,12 ± 12,21	23,55 ± 17,54	
NREM3 %	Min-Max (Median)	12,1-77,3 (48)	14,5-77,3(53,3)	12,1-75,7(35,6)	0,306
	Mean ± SD	47,24 ± 19,66	50,05 ± 18,63	42,48 ± 21,17	
REM %	Min-Max (Median)	0-22,8 (11,9)	4,2-22,8 (13,9)	0-18,8 (10,9)	0,068
	Meant ± SD	11,35 ± 5,10	12,47 ± 4,77	9,46 ± 5,27	
TIME SO_2 < %90 %	Min-Max (Median)	0-22,5 (0)	0-22,5 (0)	0-0 (0)	0,009**
	Mean ± SD	1,94 ± 5,95	3,09 ± 7,32	0,00 ± 0,00	
Min SO2 %	Min-Max (Median)	67,8-95 (90)	67,8-93 (88,5)	91-95 (93)	0,001**
	Mean ± SD	89,05 ± 5,59	86,81 ± 5,97	92,85 ± 1,14	
ESS	Min-Max (Median)	0-17 (7)	0-17 (6)	0-17 (11)	0,266
	Mean ± SD	7,69 ± 5,06	6,91 ± 4,77	9,00 ± 5,45	
BECK	Min-Max (Median)	0-38 (19)	0-38 (21)	2-27 (17)	0,047*
	Mean ± SD	18,66 ± 7,99	20,50 ± 8,17	15,54 ± 6,89	
Disease duration(year)	Min-Max (Median)	0,33-20 (4)	1-20 (5)	0,33-10 (3)	0,346
	Mean ± SD	5,58 ± 5,20	6,45 ± 5,84	4,10 ± 3,66	
AHI	Min-Max (Median)	0,7-102,7 (7,4)	5,2-102,7(12,1)	0,7-4,4 (1,9)	
	Mean ± SD	14,29 ± 20,27	21,44 ± 22,96	2,18 ± 1,11	
Disease severity; n (%)	Normal	13 (37,1)	0 (0)	13 (100)	
	Mild	13 (37,1)	13 (59,1)	0 (0)	
	Moderate	4 (11,4)	4 (18,2)	0 (0)	
	Severe	5 (14,3)	5 (22,7)	0 (0)	

Abbreviations: NREM, Non-Rapid Eye Movement; REM, Rapid Eye Movement; TIME SO_2 < %90, Time Saturation Oxygen <%90;Min SO_2, Minimum Saturatin Oxygen; ESS, Epworth Sleep Scale; BDS, Beck Depression Scale; AHI,Apnea-Hypopnea Index
[a]Mann Whitney *U* Test; [b]Yates Continuity Correction Test; [c]Fisher's Exact Test; *$p < 0,05$; **$p < 0,01$

Table 3. Evaluation of groups with regard to the FSFI scale.

		Total (n=35)	Patient (n=22)	Control (n=13)	[a]*p*
DESIRE	Min-Max (Median)	2-10 (5)	2-7 (5)	2-10 (6)	0,034*
	Meant ± SD	4,94 ± 1,98	4,36 ± 1,59	5,92 ± 2,25	
AROUSAL	Min-Max (Median)	0-19 (11)	0-16 (9,5)	6-19 (11)	0,048*
	Meant ± SD	10,31 ± 4,32	9,14 ± 4,26	12,31 ± 3,77	
LUBRICATION	Min-Max (Median)	0-20 (13)	0-20 (12)	8-20 (14)	0,100
	Mean ± SD	12,54 ± 5,65	11,27 ± 6,28	14,69 ± 3,66	
ORGASM	Min-Max (Median)	0-14 (10)	0-13 (9)	4-14 (11)	0,039*
	Mean ± SD	8,86 ± 3,99	7,82 ± 4,28	10,62 ± 2,75	
SATISFACTION	Min-Max (Median)	2-15 (10)	2-15 (9,5)	3-15 (10)	0,547
	Mean ± SD	9,37 ± 3,72	8,95 ± 4,02	10,08 ± 3,17	
PAIN	Min-Max (Median)	0-15 (11)	0-15 (10,5)	3-15 (11)	0,201
	Mean ± SD	9,46 ± 4,64	8,59 ± 5,10	10,92 ± 3,45	
Total FSFI Score	Min-Max (Median)	5-85 (56)	5-77 (54)	35-85 (63)	0,031*
	Mean ± SD	54,74 ± 20,53	48,95 ± 21,64	64,54 ± 14,45	

Abbreviations: FSFI, Female Sexual Function Index
[a]Mann Whitney *U* Test; *$p < 0,05$

age, body mass index (BMI), number of obstetric-gynecologic operations, parity, hypertension (HT), diabetes mellitus (DM), cardiac disease, chronic obstructive pulmonary disease (COPD), disease duration, and smoking habit. In addition, PSG parameters were recorded. Both groups were administered the Epworth Sleep Scale (ESS), Beck Depression Scale (BDS), and FSFI questionnaire forms. All patients were grouped as mild, moderate, and severe OSAS based on the Apnea-Hypopnea Index (AHI). Mild, moderate, and severe sleep apneas were defined as (AHI) 5-15/hour, 15-30/hour, and 30 and over/hour, respectively.

The FSFI questionnaire was previously validated in the native language of the participants[10] and partner version of the premature ejaculation profile scale (PEP) for the assessment of sexual function. The women filled the PEP form (in Turkish) themselves. The FSFI includes a total of 19 questions in six categories: desire, arousal, lubrication, orgasm, satisfaction, and pain. Scores range from 2 to 36, and lower scores indicate more severe female sexual dysfunction.[11]

Patients were also administered BDS. This scale includes 21 questions. Higher scores indicate higher levels of clinical signs related with depression.[12]

The patients and control subjects underwent PSG analysis all night long (Embla N 7000). The PSG evaluation included electroencephalogram, electrooculogram, chin, and tibial electromyogram, electrocardiogram, snoring, oro-nasal thermistor, nasal pressure transducer, finger pulse oximeter, thoracic and abdominal respiratory movements, and body position. Scoring was performed according to the criteria of the American Academy of Sleep Medicine (AASM), 2007. Apnea was defined as a reduction in the amplitude of oro-nasal thermistor signal by ≥ 90% for at least 10 sec, compared to the baseline. Hypopnea was defined as a reduction in the amplitude of nasal cannula signal by ≥50 % for at least 10 sec, compared to the baseline, a decline in oxygen saturation by ≥ 3 %, or it was considered to be related with arousal.

Statistical Analysis

Statistical analyses were performed using the Number Cruncher Statistical System(NCSS, 2007) (Kaysville, Utah, USA) software. Descriptive data were expressed in mean, standard deviation (SD), median, frequency, percentage, and minimum and maximum values. The Mann-Whitney U test was used to compare abnormally distributed quantitative variables between the two groups. Qualitative data were compared using the Fisher-Freeman-Halton test, Fisher's Exact test, and Yates' Continuity Correction test (Yates corrected chi-square). Relations between the variables were evaluated using the Spearman's correlation analysis. *P* values of < 0.01 or < 0.05 were considered statistically significant.

RESULTS

The study included a total of 35 participants (22 patients and 13 controls) with a mean age of 42.06 ± 5.60 (range: 32 to 54) years. The mean age and BMI did not differ significantly between the groups ($p > 0.05$). Only the rate of two-childbearing (higher parity) was higher in the patient group ($P = .022$). Education status, number of obstetric-gynecologic operations, and comorbidities such as HT, DM, and COPD, and smoking habit also did not show significant differences between the groups ($P > .05$). Demographic data of the OSAS and control groups are presented in **Table 1**.

The BDS scores were statistically significantly higher in the patient group, compared to the control group (*P*

Table 4. Evaluation of FSFI scale scores with regard to disease severity.

	Mild (n=13)	Moderate+severe (n=9)	[a]*p*
n=22	Mean ± SD (Median)	Mean ± SD (Median)	
DESIRE	4,23 ± 1,48 (4)	4,56 ± 1,81 (5)	0,539
AROUSAL	9,77 ± 3,79 (10)	8,22 ± 4,94 (9)	0,421
LUBRICATION	11,23 ± 4,55 (11)	11,33 ± 8,51 (15)	0,402
ORGASM	8,08 ± 3,40 (9)	7,44 ± 5,53 (10)	0,638
SATISFACTION	9,92 ± 2,75 (10)	7,56 ± 5,22 (9)	0,439
PAIN	9,46 ± 3,71 (10)	7,33 ± 6,67 (11)	0,813
Total FSFI Score	51,69 ± 15,97 (54)	45,00 ± 28,58 (56)	0,894

Abbreviations: FSFI, Female Sexual Function Index
[a]Mann Whitney *U* Test

Table 5. Evaluation of relations between the FSFI subscale scores and total scores, and the other variables in the patient group.

	DESIRE		AROUSAL		LUBRICATION		ORGASM		SATISFACTION		PAIN		Total	
n=22	r	*P*	r	*p*	R	*p*	r	*p*	R	*p*	r	*p*	r	*p*
AHI	0,046	0,840	-0,208	0,354	0,120	0,596	0,030	0,894	-0,186	0,408	-0,064	0,777	0,007	0,974
NREM1 %	0,033	0,885	-0,091	0,688	-0,161	0,475	-0,071	0,752	-0,051	0,821	0,011	0,961	-0,131	0,561
NREM2 %	0,035	0,876	0,092	0,684	-0,176	0,433	0,112	0,619	-0,073	0,747	0,034	0,880	0,084	0,709
NREM3 %	-0,196	0,382	-0,057	0,802	-0,044	0,847	-0,237	0,288	-0,014	0,952	-0,007	0,974	-0,094	0,676
REM %	-0,201	0,370	0,219	0,327	0,110	0,627	0,060	0,790	0,246	0,269	0,195	0,384	0,197	0,380
sO_2<90 %	0,051	0,821	-0,164	0,467	0,096	0,671	0,054	0,813	-0,190	0,396	0,083	0,715	0,076	0,736
Min sO_2 %	-0,059	0,796	0,041	0,858	-0,137	0,542	-0,047	0,835	0,183	0,414	-0,262	0,239	-0,166	0,461
ESS Disease	-0,153	0,496	0,127	0,573	0,051	0,820	-0,002	0,992	-0,076	0,738	0,403	0,063	0,169	0,453
duration (year)	-0,112	0,619	-0,100	0,657	0,120	0,595	0,117	0,603	-0,250	0,261	0,131	0,560	0,039	0,864
Age	-0,033	0,883	-0,093	0,679	-0,136	0,546	-0,073	0,745	-0,210	0,347	-0,051	0,820	-0,076	0,735
BMI (kg/m^2)	0,052	0,819	-0,027	0,904	0,019	0,933	0,083	0,713	-0,044	0,845	0,024	0,917	0,071	0,753

Abbreviations: r, Spearman's coefficient of correlation; AHI,Apnea-Hypopnea Index; NREM, Non-Rapid Eye Movement; REM, Rapid Eye Movement; TIME SO_2 < %90, Time Saturation Oxygen<%90; Min SO_2, Minimum Saturatin Oxygen; BMI, Body Mass Index

= .047). Disease variables of both groups are shown in **Table 2**.

The mean scores of desire, arousal, and orgasm were found to be significantly lower in the patient group, compared to the control group (P = .034; P = .048; P = .039). The mean scores of lubrication, satisfaction, and pain did not differ significantly between the groups (P > .05). The mean value of total FSFI score in the patient group was significantly lower, compared to the control group (P = .031). Evaluation of the patient and control groups with regard to the FSFI subscales is shown in Table 3.

The mean scores of the desire, arousal, lubrication, orgasm, satisfaction, and pain, which are the FSFI subscales, did not show statistically significant differences among the patients, depending on the disease severity (P > .05). The mean value of total FSFI score also did not differ significantly between patients, depending on disease severity (P > .05). Evaluation of FSFI scale with regard to disease severity is presented in Table 4.

No statistically significant correlations between the values of total FSFI scores of the patients, and the AHI, Non-Rapid Eye Movement 1 (NREM1) %, NREM2 %, NREM3 %, Rapid Eye Movement(REM) %, time spent with saturation oxygen (O_2) < 90%, minimum saturation oxygen(min sO_2) %, ESS scores, BDS scores, and BMI were seen (p > 0.05). Scores of FSFI subscales, which are the sexual desire, sexual arousal, lubrication, orgasm, satisfaction and pain, did not correlate significantly with the AHI, NREM1 %, NREM2 %, NREM3 %, REM %, time spent with sO_2< 90%, min sO_2 %, ESS scores, BDS, disease duration, age, and BMI in the patient group (P > .05).

In addition, we found no significant correlations between the values of total FSFI scores of the cases and the disease duration (P > .05).

Evaluation of correlations between the FSFI subscale scores and total scores, and the other variables in the patient group, are shown in **Table 5**.

DISCUSSION

In this study, by excluding postmenopausal or perimenopausal women, we excluded the potential effects of menopause or estrogen deficiency itself as well as that of aging, both of which are independent factors of FSD. Our results shows a high prevalance of sexual dysfunction in pre-menopausal women with OSAS compared to healthy controls.

Sexual function in females is related with complex neurophysiological and psychological processes. The pathophysiology of sexual dysfunction in females with OSAS is multifactorial. Endothelial dysfunction has been demonstrated to play a critical role.[13-15]

The genital tract is primarily innervated by the pudendal nerve. The integrity of the pudendal nerve is important for the normal female sexual function. It has been reported that peripheral neuropathy may develop in OSAS, which is related with severity of the chronic intermittent nocturnal hypoxia.[16] In addition, CPAP treatment has been shown to improve neural functions in males.[17] Levels of testosterone have been shown to be lower in the women with OSAS, which was found to be related with the severity of disease.[18] The quality of life, and the mood may also contribute to sexual dysfunction in women.[8]

Sexual dysfunction has been well defined in the males with OSAS. The rate of sexual dysfunction has been reported to be 30 to 50 % in the men with OSAS.[19,20] There is a considerably limited number of studies related to sexual dysfunction in the females with OSAS. In a prospective study on pre-menopausal women with OSAS in Turkey, Koseoglu et al.[21] found a high prevalence of impaired sexual function.They also found that all scores in sexual function domains except enjoyment and pain decreased significantly with increasing severity of OSAS. In our study, the total FSFI score in the patient group was significantly lower than that of the control group. The patient group had significantly lower scores of sexual desire, sexual arousal, and orgasm, compared to the controls.

In our study, the total FSFI scores, and the scores of desire, arousal, lubrication, orgasm, satisfaction, and pain subscales were not found to be significantly correlated with the AHI, NREM1 %, NREM2%, NREM3 %,

REM %, time spent with sO_2< 90 %, min sO_2, and ESS scores. In the study of Stavaras et al.[22], MinSat was found to be correlated with all FSFI subscales, except the sexual desire. Koseoğlu et al.[21] found that MinSat was determined to be significantly correlated with only orgasm. However, we were unable to find such a correlation, possibly due to the small sample size in our study.

In our study, the total FSFI scores in the patient group did not show statistically significant correlation with the time spent with sO_2 < 90%. Fanfulla et al.[23] reported in 2013, OSAS group existing with sexual dysfunction had a longer time spent with sO_2 < 90 %, than the patients with OSAS who did not have sexual dysfunction. Our patient group included 22 cases; of these, 13 patients had mild, and nine patients had moderate-to-severe OSAS. This may be the reason for low values of time spent with sO_2 < 90% in our study. We believe that, with a larger number of patients with severe OSAS, such a correlation can be demonstrated.

In the present study, scores of desire, arousal, lubrication, orgasm, satisfaction, and pain subscales of FSFI in the cases, did not differ significantly depending on disease severity. The degree of disease also did not significantly affect the total FSFI score in the patient group. In accordance with our results, Onem et al.[14] found that OSAS presented with sexual dysfunction in women, although the degree of sexual dysfunction was not related with OSAS severity. The authors concluded that this might be due to the relations of sexual dysfunction in women with OSAS, with both organic and psychogenic problems. On the contrary, Stavaras et al.[22] found an association between the severity OSAS and sexual dysfunction in women.

Additional factors including depression are also known to affect sexual dysfunction.[24,25] In several studies, the prevalence of depression has been found to be higher in patients with OSAS.[26] In our study, we found a statistically significant relationshipbetween the BDS scores and OSAS in the patient group; however total FSFI scores did not correlate with the scores of BDS. In addition, in our study, the total FSFI scores in the patient group did not correlate with BMI, consistent with previous study findings.[8,23]

Nonetheless, the limited number of cases in both groups is the main limitation to our study. The reason of this issue is the lesser frequency of OSAS in premenopausal women.

CONCLUSIONS

In conclusion, there is a relationship between OSAS and sexual dysfunction in women. We, therefore, recommend sexual life evaluation during clinical examination in patients with OSAS.

CONFLICT OF INTEREST

None declared.

ACKNOWLEDGEMENTS

We acknowledge that all authors have made substantial contribution to the work, and all have read and approved the final manuscript.

REFERENCES

1. Raina R, Pahlajani G, Khan S, Gupta S, Agarwal A, Zippe CD. Female sexual dysfunction: classification, pathophysiology, and management. FertilSteril. 2007; 88, 1273–84.
2. Kammerer-Doak D, Rogers RG. Female sexual function and dysfunction. ObstetGynecolClin North Am. 2008; 35:169–83.
3. Addis IB, Van Den Eeden SK, Wassel-Fyr CL, Vittinghoff E, Brown JS, Thom DH. Sexual activity and function in middle aged and older women. Obstet Gynecol. 2006; 107:755–64.
4. Chedraui P, Perez-Lopez FR, San Miguel G, Avila C. Assessment of sexualityamong middle- aged women using the Female Sexual Function Index. Climacteric. 2009;12:213–21.
5. Pasquali D, Maiorino MI, Renzullo A, Bellastella G, Accardo G, Esposito D et al. Female sexual dysfunction in women with thyroid disorders. J Endocrinol Invest. 2013 .
6. Salonia A, Munarriz RM, Naspro R, Nappi RE, Briganti A, Chionna R et al. Women's sexual dysfunction: a pathophysiological review. BJU Int. 2004; 93: 1156–64.
7. Imbimbo C, Gentile V, Palmieri A, Longo N, Fusco F, Granata AM et al. Female sexual dysfunction: an update on physiopathology. J Endocrinol Invest. 2003; : 102-104.
8. Subramanian S, Bopparaju S, Desai A, Wiggins T, Rambaud C, Surani S.Sexual dysfunction in women with obstructive sleep apnea. Sleep Breath. 2010;14:59-62.
9. Goncalves MA, Guilleminault C, Ramos E, Palha A, PaivaT. Erectil dysfunction, obstructive sleep apnea syndrome and nasal CPAP treatment. Sleep Med. 2005; 6: 333-9.
10. Oksuz E, Malhan S. Prevalence and risk factors for female sexual dysfunction in Turkish women. J Urol. 2006; 175: 654–658.
11. Rosen R, Brown, C, Heiman J, Leiblum S, Meston C, Shabsigh R et al. The Female Sexual Function Index (FSFI): Amultidimensional self-report instrument for the assessment of female sexual function. J Sex Marita.lTher. 2000; 26, 191–208.
12. Michele D,Marleide da Mota G. Obstructive sleep apnea (OSA) and depressive symptoms. Arq. Neuro-Psiquiatr. 2009 67.
13. Popovic RM, White DP. Upper airway muscle activity in normal women: influence of hormonal status. J Appl Physio.1998;84:1055-62.
14. Onem K, Erol B, Sanli O, Kadioglu P, Yalin AS, Canik U et al. Is sexual dysfunction in women with obstructive sleep apnea-hypopnea syndrome associated with the severity of the disease? A pilot study. J Sex Med. 2008; 5: 2600-9.
15. Jurado-Gámez B, Fernandez-Marin MC, Gómez-Chaparro JL, Muñoz-Cabrera L, Lopez-Barea J, Perez-Jimenez F, et

al.Relationship of oxidative stres and endothelial dusfunction in sleep apnoea. EurRespir J. 2011;37:873-9.

16. Mayer P, Dematteis M, Pépin JL, Wuyam B, Veale D, Vila Aet al.Peripheral neuropathy in sleep apnea: a tissue marker of the severity of nocturnal desaturation. Am J Cirt Care Med.1999;159: 213-9.

17. Dziewas R, Schilling M, Engel P, Boentert M, Hor H, OkegwoAet al. Treatment for obstructive sleep apnoea; effect on peripheral nerve function. J NeurolNeurosurgpsychiatry 2007;78:295-7.

18. Behan M, WenningerJM.Sexs steroidal hormones and respiratory control. RespirPhysiolNeurobiol. 2008; 164:213-21.

19. Fanfulla F, Malaguti S, Montagna T, Salvini S, Bruschi C, Crotti Pet al. Erectile dysfunction in men with obstructive sleep apnea: an earlysign of nevre involvement. Sleep. 2000; 23:775-80.

20. Karkoulias K, Perimenis P, Charokopos N, Efremidis G, Sampsonas F, KaparianosAetal. Does CPAP therapy improve erectile dysfunction in patients with obstructive sleep apnea syndrome? Clin Ter. 2007; 158: 515-8.

21. Koseoğlu N, Koseoğlu H, Itil O, Oztura I, Baklan B, Ikiz AO et al. Sexual function status in women with obstructive sleep apnea syndrome. J SexMed 2007; 4:1352-7.

22. Stavaras C, Pastaka C, Papala M, Gravas S, Tzortzis V, Melekos M et al. Sexual function in pre-and post-menopausal women with obstructive sleep apnea syndrome. Int J Impot Res. 2012;24:228-233.

23. Fanfulla F, Malaguti S, Montagna T, Salvini S, Bruschi C, Crotti P, et al. Erectile dysfunction in men with obstructive sleep apnea: an earlysign of nevre involvement. Sleep. 2000;23:775-80.

24. Reynaert C, Zdanowicz N, Janne P, Jacques D. Depression and sexuality. PsychiatrDanub. 2010; 22(sppl 1): S: 111-3.

25. Shindel AW, Eisenberg ML, Breyer BN, Sharlip ID, Smith JF. Sexual function and depressive symptomsamong female North American medical students. J Sex Med. 2011;8:391-9.

26. Harris M, Glozier N, Ratnavadiel R, Grunstein RR. Obstructive sleep apnea and depression. Sleep Med Rev. 2009; 13:437-44.