

Prevalence of Poor Sleep Quality and Its Determinants Among Men Suffering from Erectile Dysfunction

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What's known on the subject? and What does the study add?

Erectile dysfunction is frequent among men with sleep disorders. Men with current sleep disturbances have also increased the risk for erectile difficulty in their future life. The correlation between sleep quality and erectile function and determinants of poor sleep quality among men who suffer from erectile dysfunction are still obscure. Near half of the men with erectile dysfunction are poor sleepers. Quality of sleep correlates with erectile function. Lean body mass, younger age, and severe depression are the main predictors of poor sleep quality.

Abstract

Objective: Recent findings implicate a higher prevalence of erectile dysfunction (ED) among men with sleep disorders. We investigated sleep quality among men with ED.

Materials and Methods: A prospective study was conducted at 12 different andrology outpatient clinics among men with complaints of insufficient erections. The subjective quality of sleep was measured using the Pittsburgh Sleep Quality Inventory. Erectile function and its dimensions were measured using the International Index of Erectile Function (IIEF) questionnaire. The age-adjusted Charlson comorbidity index and Beck Depression Inventory were used to evaluate interrelations with comorbid disease severity and depression of the subjects consecutively in the study.

Results: Among 431 eligible men, the median age of the participants and their erectile function scores in the IIEF were 51 [interquartile range (IQR)=43-59] and 16 (IQR=11-19), respectively. Poor sleep was observed in 192 of 431 (44.5%) subjects. Multivariable analysis revealed that younger age [odds ratio (OR)=0.95, p=0.01], lower body mass (OR=0.86, p=0.01), lower serum high-density lipoprotein cholesterol (OR=0.95, p=0.02), and higher severity of depression (OR=2.1, p=0.0001) were predictors of poor sleep quality among men with ED.

Conclusion: Nearly half of the men with ED also suffer from poor sleep. Younger age, lean body mass, and severe depression were the main predictors of poor sleep quality among ED sufferers.

Keywords: Erectile dysfunction, sexual satisfaction, sleep quality

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Introduction

As an important pillar of good health, such as diet and exercise, sleep quality is hypothesized to be closely related to erectile function (1). Recent data obtained from large population-based surveys reveal the prevalence of poor sleep quality about 8.3% which is also associated with advanced age, female gender, smoking, the presence of cardiovascular diseases, respiratory diseases, anxiety, and depression (2-5). Sleep disorders and their association with erectile dysfunction (ED) are increasing topics of interest in recent studies (1,6-13). Data obtained from several studies with few human subjects who suffered from sleep dysfunction demonstrated that ED is frequent among men with sleep disorders (6-13). Furthermore, recent longitudinal studies have emphasized increased odds of ED in the future life of men with current sleep disturbances (3). In this manner, several conditions were proved to be associated with sleep dysfunction such as higher body mass index (BMI), advanced age, comorbid diseases such as diabetes, depression and, anxiety among men accompanied with ED (1,6-13).

Although there are several studies indicating the higher prevalence of ED or worse outcomes by the means of erectile function among men who have sleep dysfunction, reverse association still needs to be clarified. In other words, "How much attention should be given to sleep quality in men complaining of ED?". Does the quality of sleep correlate with erectile function in patients with ED? Furthermore, determinants of the sleep quality among men complaining of ED are awaiting validation.

In this study, investigation of subjective sleep quality, the prevalence of poor sleeping, and the role of associated factors like BMI, age, and comorbid diseases among men who were admitted with ED complaints to andrology clinics were aimed.

Materials and Methods

Subjects

We conducted a cross-sectional study among men who were admitted to andrology outpatient clinics with complaints of ED. Patients who had a stable heterosexual relationship in the last six months and who gave informed consent to participate in this questionnaire-based study were eligible. Subjects who had proven neurological disease or used psychotropic medications (antidepressants, sedatives, anxiolytics, and so on) were excluded from the study. The study design was approved by Ethical Review Board of the Niğde Ömer Halisdemir University (no: 2019/33, date: 01.11.2019) and permission of the provincial health management office (2019-11/02). The study was conducted between November 2019 and November 2020 following institutional review board recommendations from

12 different training hospitals. Informed consent was obtained from all participants, and survey administration was conducted face-to-face by researchers in all participating centers.

Outcome Measures

Erectile function severity was measured by the International Index of Erectile Function (IIEF) and degree of sleep quality was measured using the Pittsburgh Sleep Quality Inventory (PSQI). The presence and degree of depression measured by the Beck Depression Inventory (BDI) were the main outcome measures of the current study. Validated versions of the three questionnaires were used (14-16).

Data Management

Demographic characteristics, BMI and waist circumference measurements, summary of the age-adjusted Charlson comorbidity index (AACCI) ratings, and serum measurements of fasting blood glucose (FBG), cholesterol total, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, and serum testosterone levels (as nanogram per dL) obtained from routine baseline initial evaluations were recorded (17). All recorded data were submitted by each participating author to a web-based data management program. The presence of ED was attributed to the subjects' ratings in the erectile function domain of the IIEF (below 21 points indicated ED). Scores in the BDI were interpreted as follows: 0-9, minimal level; 10-16, mild level; 17-29, moderate level; and 30-63, severe level of depression. The PSQI consists of 19 items (15 rated 0-3 and 4 open ended) that generate seven components of sleep as follows: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of medications for sleep, and daytime disturbance (14). The global PSQI score is calculated by the sum of all of the above components (14). We used the original version of this questionnaire, with 5 points or greater used as the global score cut-off for which to define poor sleep quality (14,18).

Statistical Analysis

We anticipated to enroll at least 270 subjects in the study due on the sample size estimation summary obtained from a G*Power analysis with a power value of 80% and an alpha error probability of 5.0%. The latest version of PASW (IBM, Armonk, NY, USA) was used for statistical analysis. A reliability analysis of the PSQI scores of our cohort was performed. We used the chi-square test and non-parametric tests. Binomial logistic regression for dichotomous outcomes and stepwise hierarchical linear regression for the measured variables. P-values of 0.05 or lower were considered significant, while p-values of 0.01 indicated strong correlations in the correlation analysis.

Results

Among the 431 eligible subjects, the median age was 51 [interquartile range (IQR)=43-59]. The demographic characteristics of the subjects are depicted in Table 1. During the initial physical examination, palpable Peyronie's plaque and benign scrotal pathologies were noted in 5 (1.0%) and 8 (1.8%) patients, respectively. Sixty-two (14.6%) patients had taken a previous medication for ED in the last 6 months, which included tadalafil, sildenafil, and intra-cavernous injection therapy (10.7%, 3.0%, and 0.5%, respectively).

Among participants, the mean IIEF erectile function score was 14.3 ± 6.5 . The distribution of subjects according to categories of

erectile function in IIEF was as follows: 108 (26%) with severe ED, 142 (33%) with moderate ED, 139 (32%) with mild-to-moderate ED, 34 (7.0%) with mild ED, and no ED in 8 (2.0%). The mean BDI score of the subjects was 13.9 ± 8.1 . We noticed a moderate to severe degree of depression in 147 (34%) subjects in our cohort. The distribution of the depression categories was as follows: 32%, minimal; 34%, mild; 30%, moderate; and 4.0%, severe. The mean global PSQI score in our cohort was 4.7 ± 2.9 . Reliability analysis among the seven components of the PSQI questionnaire revealed a high level of consistency (Cronbach's $\alpha=0.66$). We observed that 192 of 431 (44.5%) responders in our cohort were poor sleepers. The distribution of variables between the good and poor sleepers is shown in Table 2.

Age	<40	40-49	50-59	60-69	>70	
	13%	30%	34%	18%	5%	
Graduation	Primary School	High School	University	Master, PhD etc.		
	28%	43%	28%	1%		
Count of children	0	1	2	3	4	>5
	10%	13%	34%	24%	9%	10%
Smoking status	No	Yes				
	56%	44%				
Alcohol consumption	No	Yes				
	88%	12%				
AACCI	0	1	2	3	4	>5
	33%	27%	20%	10%	6%	4%
Main co-morbid diseases	DM	CAD	PVD	COPD	CTD	Peptic Ulcer
	25%	8%	3%	3%	2%	1%

	Good sleepers n=233	Poor sleepers n=192	p-value
Age	52.9±11.6	48.6±10.8	0.0001
BMI (kg/m ²)	28.3±3.9	27.5±4.0	0.04
WC (cm)	92.4±11.3	94.4±13.9	0.18
AACCI score	1.5±1.6	1.3±1.5	0.10
FBG level	117.7±57.3	118.6±63.7	0.87
Total-Cholesterol level	199.2±42.3	195.6±48.1	0.42
LDL-C level	127.4±82.5	118.7±48.2	0.22
HDL-C level	47.6±15.1	44.2±12.7	0.01
Triglycerides	165.1±99.4	193.4±147.4	0.02
Serum Testosterone level (ng/dL)	301.0±224.5	307.2±233.4	0.78
Erectile function (IIEF)	15.3±6.1	13.1±6.7	0.001
Orgasmic function (IIEF)	5.4±2.7	5.3±3.1	0.59
Sexual desire (IIEF)	5.6±1.9	5.5±2.1	0.70
Sexual satisfaction (IIEF)	6.5±3.2	5.8±3.4	0.02
Overall satisfaction (IIEF)	5.0±2.0	4.5±2.0	0.01
Depression score (BDI)	11.2±6.2	17.1±8.8	0.0001

Correlation Analysis

We noticed correlations between the EF scores of the subjects and their AACCI scores (Spearman's Rho=-0.20), FBG (Spearman's Rho=-0.15), BDI scores (Spearman's Rho=-0.19), and PSQI scores (Spearman's Rho=-0.14). The means of the sexual satisfaction IIEF domain and the overall satisfaction scores of our cohort were correlated with the global PSQI scores (Spearman's Rho=-0.11 and Spearman's Rho=-0.11). Additionally, the global PSQI scores of the patients were correlated with their BDI scores (Spearman's Rho=0.42), age (Spearman's Rho=-0.17), degree of graduation (Spearman's Rho=0.19), consumption of alcohol (Spearman's Rho=0.20), and serum HDL levels (Spearman's Rho=-0.14). Finally, the BDI scores of the patients were correlated with age (Spearman's Rho=-0.13). We noticed a higher estimate of coincidence between the presence of poor sleep quality (global PSQI score ≥ 5) and moderate to severe depression (according to their BDI scores) in our cohort [odds ratio (OR)=3.4 (95% confidence interval (CI) 2.2-5.3), $p=0.0001$].

Multivariable analysis: In our multinomial logistic regression analysis, the BMI of the subjects significantly predicted the presence of ED (OR=1.2, $p=0.03$). Poor sleep quality was predicted by age (OR=0.95, $p=0.01$), waist circumference (OR=1.04, $p=0.03$), BMI (OR=0.86, $p=0.01$), serum HDL level (OR=0.95, $p=0.02$), BDI (OR=2.1, $p=0.0001$), and IIEF score (OR=0.89, $p=0.03$). The level of serum testosterone (OR=1.002, $p=0.01$) and global PSQI score (OR=1.45, $p=0.0001$) of the enrolled subjects were predictors for the presence of depression.

Finally, a path analysis using hierarchical linear regression was applied. Our results with path analysis using the erectile function score of the subjects as the dependent outcome variable, are depicted in Figure 1. Our model demonstrates that the erectile function of subjects is predicted by a score of comorbidity index and depression level, while sleep quality and depression level of the subjects are in relation with bidirectional way.

Discussion

We evaluated the prevalence and contribution of poor sleep quality in men with ED in a hospital setting. Poor sleep according to questionnaire-based evaluations has been observed in nearly half of the men having ED. Poor sleepers were younger, had lower BMI values, had more severe ED and had poor satisfaction with intercourse and more depression compared with men who had good sleep quality. However, erectile function predicted by sleep quality in the unadjusted model along with depression levels and BMI values of the ED sufferers were the predictors of sleep quality in our final model.

Subjective sleep quality in the current study was measured using a self-reported questionnaire (PSQI), which is accepted as the

most useful tool in both clinical and non-clinical settings (18). The results of the internal consistency level of the questionnaire were in accordance with the previously reported results and support the higher internal reliability of the questionnaire components (18-20). The prevalence of poor sleep quality among our study subjects was higher than that reported in the general population (2-5,21-23). The mean global score of our study subjects was also higher than that previously reported in the general population of Shanghai (5). The prevalence of sleep quality measured by the same tool among ED sufferers has been evaluated previously in a Chinese study, and they found slightly higher prevalence rates (24). We noticed that in our study, the cut-off level to define poor sleep quality in the PSQI was lower and the mean age of the participating ED sufferers was higher than that in the Chinese study, which might have contributed to the difference. Furthermore, previous surveys demonstrated a higher prevalence of ED among sleep disorders, and a higher incidence of ED in longitudinal studies among patients with poor sleep quality (2-7,13,25-27). Our study results contribute to the literature by describing the presence of a reverse association.

Our study clarifies that sleep quality is predicted by erectile function, and poor sleep quality is related to lower BMI, lower serum HDL level, younger age, higher WC, and severe depression. The adjusted hierarchical model in our study emphasizes the severity of depression and lean body mass among men with ED as the main predictors of sleep quality. Previous surveys conducted in the general population have demonstrated that sleep disturbance is predicted by older age, smoking, lower educational level, more comorbid diseases, higher anxiety,

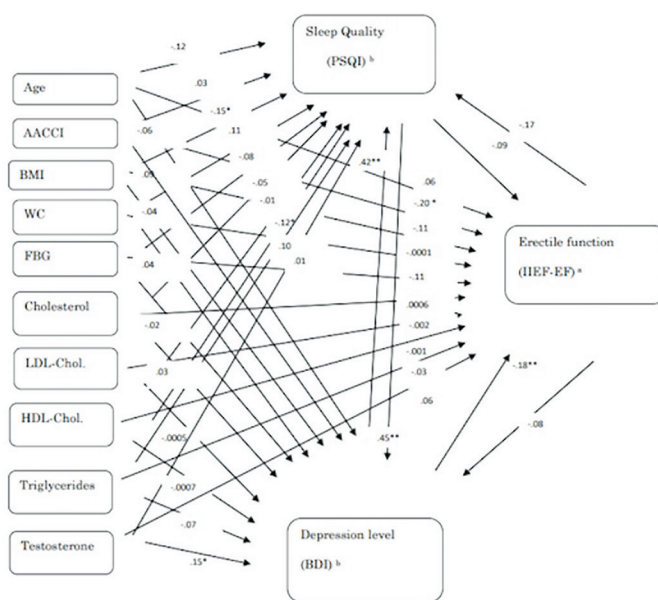


Figure 1. Results of path analysis

* p -value of <0.05 , ** p -value <0.01 , ^aHigher score indicates better outcome, ^bHigher score indicates worse outcome

and depression (2,4,5). Cross-sectional studies investigating interactions between erectile functions and sleep disorders revealed an association between sleep disturbances and ED, perceived stress, and depression (2,7,26,28). To understand the type of interrelation, our study revealed consistent findings with the study by Seehuus and Pigeon (3) that concluded an association between sleep disturbance and ED. We found a depression-dependent relationship between sleep quality and erectile function, which was independent of a previous survey. In a previous study, Seehuus and Pigeon (3) demonstrated a relationship between erectile function and insomnia severity, rather than sleep quality. In this regard, we conclude that the tools used to evaluate sleep disturbance (sleep quality vs. insomnia severity) and the differences in the populations studied may play roles in this issue.

Our study findings regarding the correlation between ED and age were concordant with those of Cheng et al.'s (24) study; however, our findings were in contrast to the findings of Martin et al. (27). In the study by Martin et al. (27), the independent interrelation of sleep disturbance with erectile function was demonstrated only in older men (ages >65 years old) (27). However, in the latter study, obstructive sleep problems were evaluated methodologically, which is different from our study (27). Our findings support a depression-dependent relationship between ED and subjective sleep quality in relatively younger patients. In this context, we conclude that the knot untier of this complex interrelation appears to be age. Age-dependent mediators, such as depression, exist in younger populations with poor sleep quality, as well as endothelial risk factors that manifest as obstructive sleep problems and insomnia in relatively older men with ED.

In our study subjects, ED predicted only the BMI of men in the multivariate model. The quality of erectile function was hierarchically related to sleep quality, depression, and the quantity of comorbid diseases after regression analysis. Current knowledge in the literature about the possible role of sleep disorders in the etiopathogenesis of ED is limited. A clinical study performed in a small population demonstrated lower serum melatonin levels in patients with ED than in those without non-ED patients, as well as an association with ED severity (29). The preventive role of melatonin on the morphological changes in erectile tissue induced by diabetes and chronic ischemia has also been clarified in a few preclinical studies (30,31). There are also clinical studies reporting improvements in erectile function with the treatment of accompanying obstructive sleep disorders alone (9-12,32). With the current findings, we are still far from making a precise conclusion. However, our study clarifies that comorbid diseases and accompanying depression should be considered when considering sleep disorders as a risk factors for ED.

Study Limitations

Ongoing concerns about the use of the PSQI as a diagnostic tool to differentiate between good and poor sleepers and the lack of objective sleep measurements via methods such as polysomnography are limitations of the current study. The lack of health- and sex-related quality of life measurements in our study subjects is another limitation. The recruitment period of the study overlapped with the first wave of the COVID-19 pandemic. As we had already established our study protocol prospectively, we had not performed any of the COVID-19 tests. However, subjects the study had no proven COVID-19 infection while they could admit us for their erectile difficulty. However, we cannot ignore either the effects of asymptomatic COVID-19 infection or the acute traumatic effects of a pandemic on the psychological health of the study subjects, which might be rendered as a limitation theoretically.

Conclusion

We revealed the frequency of poor sleep and determinants of sleep quality among patients with ED. A considerable number of subjects were poor sleepers within the representative sample of men with ED. The quality of sleep correlated with erectile function among patients with ED. Poor sleep quality was more frequent in younger men, and lean body mass among ED sufferers, and was associated with worse satisfaction, erectile function, and depression. Depression is central to the interrelation between sleep dysfunction and ED. Longitudinal and multidisciplinary studies are required on this topic.

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Ethics

Ethics Committee Approval: The study design was approved by ethical review board of the Niğde Ömer Halisdemir University (no: 2019/33, date: 01.11.2019) and permission of the provincial health management office (2019-11/02).

Informed Consent: Informed consent was obtained from all participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.C., Concept: A.C., İ.O.K., K.E.A., Design: A.C., İ.O.K., K.E.A., Data Collection or Processing: A.C., İ.O.K., M.B.D., Ö.Y., A.B., Ü.G., E.H., Y.K., T.T., H.İ.Ç., B.Ş., Analysis or Interpretation: A.C., B.Ş., Literature Search: A.C., Writing: A.C.

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References

1. Cho JW, Duffy JF. Sleep, Sleep Disorders, and Sexual Dysfunction. *World J Mens Health* 2019;37:261-275.
2. Zheng W, Luo XN, Li HY, Ke XY, Dai Q, Zhang CJ, Cassidy RM, Zhang XY, Ning YP. Gender differences in the prevalence and clinical correlates of sleep disturbance in general hospital outpatients. *Psychiatry Res* 2018;269:134-139.
3. Seehuus M, Pigeon W. The sleep and sex survey: Relationships between sexual function and sleep. *J Psychosom Res* 2018;112:59-65.
4. Li N, Xu G, Chen G, Zheng X. Sleep quality among Chinese elderly people: A population-based study. *Arch Gerontol Geriatr* 2020;87:103968.
5. Wu W, Jiang Y, Wang N, Zhu M, Liu X, Jiang F, Zhao G, Zhao Q. Sleep quality of Shanghai residents: population-based cross-sectional study. *Qual Life Res* 2020;29:1055-1064.
6. Steinke E, Palm Johansen P, Fridlund B, Broström A. Determinants of sexual dysfunction and interventions for patients with obstructive sleep apnoea: a systematic review. *Int J Clin Pract* 2016;70:5-19.
7. Chen KF, Liang SJ, Lin CL, Liao WC, Kao CH. Sleep disorders increase risk of subsequent erectile dysfunction in individuals without sleep apnea: a nationwide population-base cohort study. *Sleep Med* 2016;17:64-68.
8. Jara SM, Hopp ML, Weaver EM. Association of Continuous Positive Airway Pressure Treatment With Sexual Quality of Life in Patients With Sleep Apnea: Follow-up Study of a Randomized Clinical Trial. *JAMA Otolaryngol Head Neck Surg* 2018;144:587-593.
9. İrer B, Çelikhisar A, Çelikhisar H, Bozkurt O, Demir Ö. Evaluation of Sexual Dysfunction, Lower Urinary Tract Symptoms and Quality of Life in Men With Obstructive Sleep Apnea Syndrome and the Efficacy of Continuous Positive Airway Pressure Therapy. *Urology* 2018;121:86-92.
10. Pascual M, de Batlle J, Barbé F, Castro-Grattoni AL, Auguet JM, Pascual L, Vilà M, Cortijo A, Sánchez-de-la-Torre M. Erectile dysfunction in obstructive sleep apnea patients: A randomized trial on the effects of Continuous Positive Airway Pressure (CPAP). *PLoS One* 2018;13:e0201930.
11. Barbosa FT, Silva MP, Fontes LES, Pachito DV, Melnik T, Riera R. Non-invasive positive airway pressure therapy for improving erectile dysfunction in men with obstructive sleep apnoea. *Cochrane Database Syst Rev* 2021;9:CD013169.
12. Yang Z, Du G, Ma L, Lv Y, Zhao Y, Yau TO. Continuous positive airway pressure therapy in obstructive sleep apnoea patients with erectile dysfunction-A meta-analysis. *Clin Respir J* 2021;15:163-168.
13. Mostafa RM, Kamel NM, Elsayed EM, Saad HM. Assessment of sexual functions in male patients with obstructive sleep apnea. *Am J Otolaryngol* 2021;42:102899.
14. Buysse DJ, Hall ML, Strollo PJ, Kamarck TW, Owens J, Lee L, Reis SE, Matthews KA. Relationships between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/polysomnographic measures in a community sample. *J Clin Sleep Med* 2008;4:563-571.
15. Beck AT, Steer RA BG. Beck Depression Inventory. 2nd ed. Manual. San Antonio, TX: Psychol Corp 1996;40.
16. Rosen RC, Riley A, Wagner G, Osterloh IH, Kirkpatrick J, Mishra A. The international index of erectile function (IIEF): a multidimensional scale for assessment of erectile dysfunction. *Urology* 1997;49:822-830.
17. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;40:373-383.
18. Fabbri M, Beracci A, Martoni M, Meneo D, Tonetti L, Natale V. Measuring Subjective Sleep Quality: A Review. *Int J Environ Res Public Health* 2021;18:1082.
19. Salahuddin M, Maru TT, Kumalo A, Pandi-Perumal SR, Bahammam AS, Manzar MD. Validation of the Pittsburgh sleep quality index in community dwelling Ethiopian adults. *Health Qual Life Outcomes* 2017;15:58.
20. Becker NB, de Neves Jesus S. Adaptation of a 3-factor model for the Pittsburgh Sleep Quality Index in Portuguese older adults. *Psychiatry Res* 2017;251:298-303.
21. Morin CM, LeBlanc M, Daley M, Gregoire JP, Mérette C. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep Med* 2006;7:123-130.
22. Ohayon MM, Reynolds CF 3rd. Epidemiological and clinical relevance of insomnia diagnosis algorithms according to the DSM-IV and the International Classification of Sleep Disorders (ICSD). *Sleep Med* 2009;10:952-960.
23. Cho YW, Shin WC, Yun CH, Hong SB, Kim J, Earley CJ. Epidemiology of insomnia in Korean adults: prevalence and associated factors. *J Clin Neurol* 2009;5:20-23.
24. Cheng QS, Liu T, Huang HB, Peng YF, Jiang SC, Mei XB. Association between personal basic information, sleep quality, mental disorders and erectile function: a cross-sectional study among 334 Chinese outpatients. *Andrologia* 2017;49.
25. Lin HH, Ho FM, Chen YF, Tseng CM, Ho CC, Chung WS. Increased risk of erectile dysfunction among patients with sleep disorders: a nationwide population-based cohort study. *Int J Clin Pract* 2015;69:846-852.
26. Soterio-Pires JH, Hirotsu C, Kim LJ, Bittencourt L, Tufik S, Andersen ML. The interaction between erectile dysfunction complaints and depression in men: a cross-sectional study about sleep, hormones and quality of life. *Int J Impot Res* 2017;29:70-75.
27. Martin SA, Appleton SL, Adams RJ, Taylor AW, Vincent A, Brook NR, Catcheside PG, Vakulin A, McEvoy RD, Antic NA, Wittert GA. Erectile dysfunction is independently associated with apnea-hypopnea index and oxygen desaturation index in elderly, but not younger, community-dwelling men. *Sleep Health* 2017;3:250-256.
28. Kellesarian SV, Malignaggi VR, Feng C, Javed F. Association between obstructive sleep apnea and erectile dysfunction: a systematic review and meta-analysis. *Int J Impot Res* 2018;30:129-140.
29. Bozkurt A, Karabakan M, Aktas BK, Gunay M, Keskin E, Hirik E. Low serum melatonin levels are associated with erectile dysfunction. *Int Braz J Urol* 2018;794-799.
30. Sawada N, Nomiya M, Zarifpour M, Mitsui T, Takeda M, Andersson KE. Melatonin Improves Erectile Function in Rats With Chronic Lower Body Ischemia. *J Sex Med* 2016;13:179-186.
31. Zhang JL, Hui Y, Zhou F, Hou JQ. Neuroprotective effects of melatonin on erectile dysfunction in streptozotocin-induced diabetic rats. *Int Urol Nephrol* 2018;50:1981-1988.
32. Schulz R, Bischof F, Galetke W, Gall H, Heitmann J, Hetzenecker A, Laudenburg M, Magnus TJ, Nilius G, Priegnitz C, Randerath W, Schröder M, Treml M, Arzt M; German Sleep Apnea Research Network (GERSAN). CPAP therapy improves erectile function in patients with severe obstructive sleep apnea. *Sleep Med* 2019;53:189-194.