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Original article

Evaluation of the effects of allergic rhinitis treatment on sexual functioning, sleep, and fatigue parameters

Évaluation des effets du traitement de la rhinite allergique sur les paramètres de la fonction sexuelle, du sommeil et de la fatigue

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ABSTRACT

Study objective. – To evaluate the impact of intranasal corticosteroids on quality of life (QoL) in AR patients compared to control groups.

Patients and methods. – In a prospective study, we enrolled AR subjects (18–45 years old) and healthy controls at Amiralmomenin Hospital, Guilan University of Medical Sciences, in 2014–2015. After signing informed consent, participants completed the Pittsburgh Sleep Quality Index (PSQI) and the Multidimensional Fatigue Inventory (MFI), as well as the Female Sexual Function Index (FSFI) or the International Index of Erectile Function (IIEF) questionnaires. Patients were then treated with intranasal corticosteroids. After 6 weeks, the outcomes were re-evaluated. Statistical analysis of the extracted data was conducted using Stata 13.0.

Results. – A total of 96 subjects (48 males and 48 females) and 96 controls participated in this study. We measured optimal control of allergic rhinitis using the CARAT (U) questionnaire. Improvement in SNOT-22 score in men and women was 14.0 and 5.2 points, respectively. Men with AR had a significantly worse sexual function score. After treatment, erectile dysfunction improved significantly. However, there was no significant difference in overall FSFI score at baseline between women with AR and controls. At baseline, 62.5% of men and 54.2% of women in the AR group reported pathologic fatigue, which with treatment fell to 22.9% and 35.4%, respectively.

Conclusion. – We noted detrimental effects of allergic rhinitis on various aspects of QoL in men and women. Intranasal corticosteroids diminished these negative effects of allergic rhinitis.

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R É S U M É

Objectif de l'étude. – Évaluer l'impact du corticostéroïde par voie intranasale sur la qualité de vie des patients atteints de PR par rapport aux groupes témoins.

Patients et méthodes. – Dans une étude prospective, nous avons recruté des sujets AR (âgés de 18 à 45 ans) et des témoins sains à l'hôpital Amiralmomenin de l'université des sciences médicales de Guilan en 2014–2015. Après avoir signé leur consentement éclairé, les participants ont rempli les questionnaires Indice de qualité du sommeil de Pittsburgh (PSQI), Inventaire de fatigue multidimensionnelle (MFI) et Indice de la fonction sexuelle féminine (FSFI) ou Indice international de la fonction érectile (IIEF). Ensuite, les patients traités avec des corticostéroïdes intranasaux. Après 6 semaines, les résultats ont été réévalués. L'analyse statistique des données extraites a été réalisée à l'aide de stata version 13.0.

Mots clés :

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Résultats. – Au total, 96 sujets (48 hommes et 48 femmes) et 96 témoins ont participé à cette étude. Nous avons mesuré le contrôle optimal de la rhinite allergique par le questionnaire CARAT (U). L'amélioration du score SNOT-22 chez les hommes et les femmes était de 14,0 et 5,2 points, respectivement. Les hommes atteints de RA présentaient un score significativement plus mauvais en termes de fonctionnement sexuel. Après le traitement, la dysfonction érectile s'est nettement améliorée. Cependant, il n'y a pas de différence significative dans le score FSFI global de référence entre les femmes atteintes de RA et les témoins. Au départ, 62,5 % des hommes et 54,2 % des femmes du groupe RA ont signalé une fatigue pathologique, qui a diminué à 22,9 % et à 35,4 % avec l'intervention, respectivement.

Conclusion. – Nous avons constaté des effets néfastes de la rhinite allergique sur différents aspects de la qualité de vie des hommes et des femmes. Le traitement par corticostéroïdes intranasaux a diminué ces effets négatifs de la rhinite allergique.

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1. Introduction

Rhinitis is defined as inflammation of the nasal mucosa. Allergic rhinitis (AR) is the most common type of chronic rhinitis. This disease affects 10–20% of the population [1]. Classic symptoms of AR include nasal congestion, rhinorrhea, sneezing, and itching of nose, throat, and eyes. Severe AR may impact on sleep, work productivity and quality of life (QoL). Blaiss et al. revealed that 68% of patients with perennial AR and 48% of seasonal sufferers reported poor sleep quality [2]. Several studies showed that alleviation of nasal congestion resulted in significant improvement of sleep quality, daytime somnolence, fatigue and QoL [3,4]. One important aspect of the QoL in adults is sexual function, which often is neglected. Sexual dysfunction has been scarcely studied in AR patients. Kirmaz et al. attempted to assess sexual dysfunction in patients with allergic rhinoconjunctivitis. The overall scores showed a statistically significant decrease in sexual functioning in men and women with allergic rhinoconjunctivitis and improvement after treatment [5]. Benninger et al. evaluated sexual functioning with the specific question of the Rhinosinusitis Disability Index in AR patients. This survey showed a substantial impact of AR on sexual function [3].

According to Togias, there are intricate interactions between mast cell products and mediators of the acute allergic reaction, such as cytokines, chemokines and the adhesion molecule system. Therefore, a local allergic reaction could lead to the systemic effects. Tai et al. revealed an association between chronic inflammatory airway diseases, such as chronic obstructive pulmonary disease (COPD), asthma and chronic rhinosinusitis with erectile dysfunction (ED) [6].

To our knowledge, only three studies, based on subjectively reported questionnaires, had assessed sexual function and the quality of life of AR patients. The aim of the present study was to evaluate the severity of sexual dysfunction in the patients before and after treatment of AR, compared with a group of healthy subjects, and to assess its relationship with nasal and some extra-nasal symptoms (sleep and fatigue), to better understand the role of AR on the quality of life in males and females.

2. Patients and methods

The study protocol was approved by the ethical committee of Guilan University of Medical Sciences (GUMS), Iran and complied with the rules delineated in the Helsinki Declaration. Written informed consent was obtained from each subject before the start of the study. This prospective study was performed in the Amiralmomenin hospital, which is a tertiary university center in Rasht, North of Iran. All patients were invited to participate in this study from October 2014 to March 2015. The age- and sex- matched healthy control population were recruited from the hospital personnel, relatives of the hospital personnel or other ENT patients who did not

have any problem in upper or lower airway tract. The inclusion and exclusion criteria are described in detail in a previous article [7], but will be presented briefly here. The inclusion criteria included participants of ages 18 to 45, married, and secondary or higher educational level. The eligible patients had a diagnosis of moderate to severe persistent AR, which was confirmed by skin prick test. The exclusion criteria included pregnant or lactating women, patients with active mental illness, presence of chronic diseases and patients with a history of pelvic surgery.

The scores for the questions regarding AR symptoms were evaluated by SNOT-22 questionnaire. In an effort to assess sexual function in AR patients, we used two validated Female Sexual Function Index (FSFI) and International Index of Erectile Function (IIEF) questionnaires. Also, sleep disorder and fatigue were independently evaluated. AR patients received intranasal corticosteroid sprays (INCS, mainly 256 µg Budesonide nasal spray). After two weeks, all patients were visited by an otolaryngologist and in case of inadequate response to INCS treatment, an oral antihistamine (mainly Fexofenadine 120 mg daily) was added to the treatment regimen of patients. After six weeks intervention, the patients were re-evaluated.

2.1. Measurements

Female Sexual Function Index (FSFI): This 19-item self-reported tool evaluates female sexual dysfunction in 6 domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. The total score of the assessment is the sum of all the points obtained in each domain multiplied by a factor, with a maximum score of 36. A higher score indicates better performance of sexual function. A score of less than 27 points is considered indicative of some degree of dysfunction [8]. Persian version of FSFI questionnaire has been previously validated in an Iranian study [9].

International Index of Erectile Function (IIEF): This questionnaire consists of 15 items, which measures 5 domains of male sexual function, including erectile function (score 1–30), orgasm (score 2–10), desire (score 2–10), intercourse (score 0–15) and overall satisfaction (score 2–10). Lower scores of each domain indicate more severe sexual dysfunction. The range of total score is between 5 and 75. A Score ≤ 60 indicates some degree of dysfunction. Also the severity of erectile dysfunction was classified into five categories: severe (score 6–10), moderate (score 11–16), mild (score 17–25), and no ED (score ≥ 26) [8]. Pakpour et al. showed that IIEF is a validated tool to assess sexual function in Iranian men [10].

Pittsburgh Sleep Quality Index (PSQI): This 18-item questionnaire assesses seven areas including sleep quality, sleep onset latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The total score of the PSQI is from 0 to 21 which 0 indicates no difficulty and 21

Table 1
Clinical characteristics of patients with allergic rhinitis and healthy controls.

	Allergic rhinitis	Healthy controls	P value
Age (year, mean $\pm$ SD)			
Male	35.4 $\pm$ 4.6	34.9 $\pm$ 7.2	0.69
Female	33.9 $\pm$ 7.5	33.5 $\pm$ 7.7	0.80
BMI (mean $\pm$ SD)			
Male	35.4 $\pm$ 4.6	34.9 $\pm$ 7.2	0.69
Female	33.9 $\pm$ 7.5	33.5 $\pm$ 7.7	0.80
Marriage duration (month, mean $\pm$ SD)			
Male	14.8 $\pm$ 10.9	11.4 $\pm$ 7.9	0.08
Female	12.4 $\pm$ 8.1	11.7 $\pm$ 7.9	0.67
Education > 12 years (number, percentage)			
Male	23, 47.9%	22, 45.8%	0.84
Female	17, 35.4%	23, 47.9%	0.21

indicates severe difficulties in all areas. Farrahi Moghaddam et al. showed that the Persian version of the PSQI is a reliable and valid questionnaire [11].

Multidimensional Fatigue Inventory (MFI): this self-report questionnaire assesses the impact of fatigue and comprises five dimensions: general fatigue, physical fatigue, reduced motivation, reduced activity and mental fatigue. Scores on each subscale range from 4 to 20, with higher scores showing more fatigue. Pathological fatigue was defined as a score equal or more than 12 on the general fatigue subscale. The validity and reliability of the Persian version of MFI were showed in done by Ghajarzadeh study [12].

Sinonasal Outcome Test 22 (SNOT 22): This validated tool assesses nasal symptoms as well as their impact on psychological status, sleep, ear and facial symptoms. The range of the total score is 0–110, with lower scores implying a better QoL. The SNOT-22 items could be divided into 5 domains: rhinological (score range: 0–30), extranasal rhinological (score range: 0–15), ear/facial (score range: 0–25), sleep (score range: 0–25), and psychological (score range: 0–35) [13].

Control of Allergic Rhinitis and Asthma Test (CARAT): this questionnaire is developed to measure upper and lower airway symptoms in the last 4 weeks. It is composed of 10 questions divided into two scores: upper airway (U) and lower airway (L). All items are scored on a Likert scale of four points. The CARAT (U) includes four questions and score more than 8 is indicative of good control [14].

Table 2
Comparative analysis of sexual function, sleep and fatigue among men or women with allergic rhinitis and healthy controls.

	Pre-intervention	Post-intervention	P value	Corrected P value
Male				
SNOT-22				
Total score	45.0 $\pm$ 19.5	31.3 $\pm$ 13.9	<0.001	<0.001
Rhinologic symptoms	15.2 $\pm$ 5.7	8.9 $\pm$ 3.8	<0.001	<0.001
Extranasal rhinologic symptoms	6.5 $\pm$ 3.3	3.9 $\pm$ 1.3	<0.001	<0.001
Ear/facial symptoms	9.5 $\pm$ 5.9	6.4 $\pm$ 3.3	0.003	0.02
Psychological dysfunction	13.4 $\pm$ 9.9	11.1 $\pm$ 4.8	0.12	0.58
Sleep dysfunction	9.1 $\pm$ 6.3	5.7 $\pm$ 3.5	<0.001	0.003
CARAT (U) score	5.8 $\pm$ 2.2	9.7 $\pm$ 1.2	<0.001	
Female				
SNOT-22				
Total score	39.2 $\pm$ 21.7	33.9 $\pm$ 12.4	0.13	0.66
Rhinologic symptoms	12.0 $\pm$ 5.8	9.5 $\pm$ 3.4	0.02	0.12
Extranasal rhinologic symptoms	4.3 $\pm$ 3.0	4.1 $\pm$ 1.4	0.22	1.0
Ear/facial symptoms	7.8 $\pm$ 5.6	7.4 $\pm$ 2.9	0.72	1.0
Psychological dysfunction	13.8 $\pm$ 9.0	11.7 $\pm$ 4.2	0.15	0.78
Sleep dysfunction	8.6 $\pm$ 5.6	6.3 $\pm$ 3.0	0.02	0.94
CARAT (U) score	6.0 $\pm$ 2.2	9.6 $\pm$ 1.1	<0.001	

Individual domains that are still significant after correction for multiple comparisons are shown in bold type. Bonferroni correction was applied to adjust for *P*. *P* values less than 0.05 considered significant after correction.

2.2. Statistical analyses

Subject demographics were reported using descriptive statistics and compared between patients and controls using a Student's *t*-test or Chi² test as appropriate. Comparisons between pre- and post-intervention were performed using a paired *t*-test. Two-tailed, bivariate correlations were used to evaluate the relationship between sexual function relative to sleep status, fatigue and sinonasal symptoms. Statistical analysis of the extracted data was conducted using stata version 13.0. Statistical significance was inferred at a two-sided *P*-value of <0.05.

3. Results

In this study, 96 AR patients (48 male and 48 female) and 96 healthy controls were evaluated. There was no significant difference in demographic characteristics of participants (Table 1). The prevalence of other allergic diseases such as asthma (12.5% vs. 5.2%) and medical illnesses between the two groups was not significantly different. Among 96 patients, 20 (20.8%) were smokers, 12 (12.5%) had diabetes, and 4 (4.2%) had controlled hypertension, and 16 (32.7%) had dyslipidemia. The prevalence of smoking, diabetes and controlled hypertension in 96 healthy controls were 13.5%, 16.7%, and 5.2%, respectively. Although men and women among AR group and controls showed insignificant differences in mean body mass index (BMI), a higher proportion of AR females had BMI > 25 compared to healthy women (56.3% vs. 45.8%). It is merit to note that only 5 men and 3 women had nasal polyposis.

We measured optimal control of AR by the CARAT (U) questionnaire at baseline, 2 weeks and 6 weeks after intervention. The mean score of the CARAT (U) among men and women for baseline was 5.8 ($\pm$ 2.2) and 6.0 ($\pm$ 2.2), respectively. The results showed a mean change in score of 3.9 in men and of 3.5 in women from baseline (paired *t*-test, all *P*s < 0.001). This result indicated that a majority of patients had received appropriate care. The distribution of scores of the SNOT-22 and its dimensions was normal by Shapiro–Wilk test. The improvement of the overall score (–14.0) was greater than accepted minimal clinically important difference (MCID) of 9.0 [15]. Moreover, the comparative analyses of different dimensions of SNOT-22 showed a significant improvement in all dimensions (except psychological dysfunction). However, women showed an insignificant improvement of 5.2 points on total score following the intervention. Also, we found only significant improvement in

Table 3
Comparison of sexual functioning, sleep and fatigue among patients with allergic rhinitis and healthy controls.

	Allergic rhinitis	Healthy controls	P value (t test)
Male			
Sexual functioning			
Before	49.8 ± 9.5	56.6 ± 9.8	<0.001
After	51.0 ± 6.7		0.002
P value (paired t test)	0.49		
Sleep			
Before	6.9 ± 2.6	5.5 ± 2.5	0.009
After	5.4 ± 1.8		0.82
P value (paired t test)	0.001		
Fatigue			
Before	67.8 ± 10.5	72.4 ± 12.5	0.04
After	60.1 ± 9.8		<0.001
P value (paired t test)	<0.001		
Female			
Sexual functioning			
Before	26.1 ± 2.4	25.1 ± 4.2	0.16
After	26.4 ± 2.9		0.08
P value (paired t test)	0.65		
Sleep			
Before	6.0 ± 2.9	6.5 ± 2.2	0.34
After	5.4 ± 2.0		0.01
P value (paired t test)	0.35		
Fatigue			
Before	66.6 ± 16.9	63.0 ± 11.4	0.22
After	60.7 ± 8.5		0.17
P value (paired t test)	0.06		

rhinologic symptoms (2.4 points), which was less than accepted MCID of 3.8 (Table 2).

Differences in sexual function observed between AR patients and controls are presented in Table 3. There is no significant difference in baseline overall FSFI score between women with AR and controls ($P > 0.05$). A significantly worse overall score was also observed in the IIEF questionnaire in men, the most affected dimension being desire. Although the total score in patients showed an insignificant difference after intervention and was lower than controls, erectile dysfunction improved significantly after the intervention. In total, 9 patients (18.8%) had moderate to severe erectile dysfunction. After treatment of AR, this proportion decreased to 14.6%.

The prevalence of poor sleep quality (PSQI ≥ 5) in male and female healthy controls were 68.8% and 62.5%, respectively. At baseline, 87.5% of men with AR complained from poor quality sleep. This prevalence was higher than women with AR (64.6%). In both men and women, sleep quality became better with intervention (Table 3). When looking at subdomains of the PSQI, there were statistically significant differences between the pre and post scores of men with AR in only sleep onset latency and sleep disturbances components. In women with AR, the pre- and post-scores significantly differed in sleep onset latency, sleep disturbances and use of sleeping medications components.

After treatment, men and women with AR showed some degree improvement in fatigue, measured by MFI (P values < 0.001 and 0.06), which reached to lesser scores than the healthy controls. The proportion rate of the pathologic fatigue in healthy men and women was 20.8% and 18.8%, respectively. At baseline, 62.5% of men with AR reported pathologic fatigue, which showed an odds ratio of 6.3 (95%CI: 2.3–17.6). The prevalence of pathologic fatigue decreased to 22.9% with the intervention (paired t -test, $P < 0.001$). Also, a significantly larger proportion of women with AR (54.2%) experienced pathologic fatigue, compared to the healthy controls (odds ratio 5.1, 95%CI: 1.9–14.5). Post-intervention, only 12 women (35.4%) met the criterion for pathologic fatigue (paired t -test, $P = 0.004$).

Table 4
Results of coefficient of correlation of sexual functioning in men and women with other measured variables.

	Male		Female
	Overall	Erectile dysfunction	Overall
Age	0.03	0.11	0.15
BMI	0.30	0.19	–0.32
Marital duration	–0.15	–0.14	0.07
SNOT-22	–0.51***	–0.51***	–0.41**
CARAT (U)	0.53***	0.52***	0.51***
PSQI	–0.40**	–0.15	–0.22
MFI	–0.62***	–0.52**	–0.35*

* $P \leq 0.05$.

** $P \leq 0.01$.

*** $P \leq 0.001$.

Post-hoc analysis showed that there were statistical relations between sexual function in men and sinonasal symptoms, sleep quality and fatigue. In women, significant correlations were observed only with sinonasal symptoms and fatigue (Table 4).

4. Discussion

Quality of life is an individual's perception of his/her physical and mental health. Allergic rhinitis is an IgE-mediated disease of the upper airway that has a potential impact on different aspects of the quality of life. Therefore, diagnosis and management of AR is important.

Consistent with the study of Marshal et al. [16], the evaluation of fatigue in our patients with AR revealed worse scores compared with healthy controls. We observed that AR patients had an improved score in MFI-20 questionnaire with intranasal corticosteroids. It seems that allergy effects are mainly on the central nervous system. In addition to nasal congestion, other allergic symptoms may lead to reduced sleep quality and sleep disturbance in individuals with AR. Allergic reactions through the release of inflammatory mediators, such as IL-1 and TNF- α , could affect the central nervous system and cause malaise, weakness, inability to concentrate and loss of interest in daily activities [16].

It is well known which sexual function is a key factor in individuals' overall quality of life. In studies of individuals with different chronic diseases, 18–83% of the patients were found to have lower sexual satisfaction [17,18]. There are some studies on the sexual activities of patients with AR [3,5–7,19–21]. These studies revealed that sexual function may be linked to severity of allergic rhinitis, side effects of drugs, diminished quality of sleep and fatigue. Nevertheless, these studies were criticized due to small sample size, lack of a control group, and the usage of non-specific instruments. Consistent with previous studies, we found a significantly worse overall score of the IIEF in men with AR compared to the healthy controls. In pairwise comparisons, which were conducted in male sexual functioning, we found sexual dysfunction severity was higher in the subjects with higher scores in SNOT-22. An interesting finding in the study of Gurlek et al. [19] was higher mild erectile dysfunction rate in patients with AR compared to healthy controls. Su et al. analyzed data of a cohort in Taiwan and found increased the rate of ED development by 2.37-fold in subjects with AR [21].

As shown in Table 4, severity of sexual dysfunction was found to be significantly related to sleep quality and fatigue. It is merit to note that erectile dysfunction was decreased from 18.8% to 14.6% after treatment. This finding is line of the study of Kirmaz et al. [5], which revealed the treating rhinitis symptoms using medications, provides improvement in sexual function and quality of life. Despite Benninger et al. [3] did not use any specific questionnaire to evaluate sexual function, they concluded AR had unfavourable impact on sexual function. Elevated serum levels of soluble

intercellular adhesion molecule-1 (ICAM-1) and vascular cell adhesion molecule-1 (VCAM-1) in perennial AR patients have been reported [22]. Evidence from prospective studies has identified the plasma levels of these molecules as a useful marker in predicting further cardiovascular events [23]. Silvestro et al. [24] reported that the increased plasma level of soluble VCAM-1 has a negative prognostic impact on peripheral arterial disease. Expression of adhesion molecules can be induced by proinflammatory cytokines, such as tumor necrosis factor- α (TNF- α) released by mast cells during the allergic response [25]. More research is required to elucidate the role of adhesion molecules in the relationship between AR and ED.

Assessing sexual satisfaction in female participants, we found similar scores between women with AR and controls. This finding suggests that this factor is much more protected in women, compared to men and might depend on many different factors and the sexual partner [26]. In spite of this issue, we observed a trend of improvement in sexual satisfaction after treatment. Like our male patients, we found a correlation between the score of sexual function and AR severity, sleep quality, and severity of subjectively perceived fatigue. Seehuus and Pigeon [27] suggested several reasons for this relationship. Interesting explanations are the shared time and location for majority of sleep and sexual behavior and possibility of a shared third variable such as stress, depression and anxiety. Kling et al. [28] examined the association between sleep duration, insomnia, and sexual activity and sexual satisfaction. They found that women who slept less than 7–8 h per night were less likely to be sexually active and sexually satisfied. Daytime fatigue, concentration problems and decreased sexual satisfaction were observed in women with insomnia.

Nasal congestion, seen in AR, is a known risk factor for sleep-disordered breathing [4]. The mechanisms behind these sleep disturbances are largely attributed to antigen-antibody reactions and inflammatory mediators, especially cytokines, interleukins, bradykinin and histamine [29].

Researches believe that intranasal corticosteroids are first-line therapy when nasal congestion is a major symptom. Intranasal corticosteroids relieve the nasal symptoms, including nasal congestion, and decrease inflammatory mediators secreted from activated lymphocytes, epithelial cells, mast cells and other inflammatory cells [29]. However, oral antihistamines are less effective against nasal congestion. Moreover, sedating antihistamines are contraindicated in those experiencing daytime sedation, fatigue, and functional impairment [30].

It is worth noting some of the limitations of this study. Some effective and uncontrollable factors such as stress, financial problems, and marital problems may be possible confounding factors in our study. Secondly, some personal information, including smoking, alcohol drinking and substance usage, was not available in the administrative data, which might interact with ED development. Thirdly, laboratory findings are required to advocate in a larger group of patients. Fourthly, further studies are required to test patients for mood disorder such as depression and anxiety using a validated questionnaire. Finally, some patients received intranasal corticosteroid and oral antihistamine. Further research needs to assess the effect of adding oral antihistamines on sleep, fatigue and sexual functioning.

5. Conclusion

In summary, we found detrimental effects of AR on different aspects of the quality of life in men and women. Sexual function, an important aspect of the QoL was correlated with nasal symptoms, especially nasal congestion, sleep quality and fatigue. Treatment with intranasal corticosteroid mitigates these negative effects of

AR. More researches to clarify biochemical changes and mechanism of sexual dysfunction in subjects with AR

Disclosure of interest

The authors declare that they have no competing interest.

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References

- [1] Small P, Kim H. Allergic rhinitis. *Allergy Asthma Clin Immunol* 2011;7(1):S3.
- [2] Blaiss M, Reigel T, Philpot E. A study to determine the impact of rhinitis on sufferers' sleep and daily routine. *J Allergy Clin Immunol* 2005;115(2):S197.
- [3] Benninger MS, Benninger RM. The impact of allergic rhinitis on sexual activity, sleep, and fatigue. *Allergy Asthma Proc* 2009;30(4):358–65.
- [4] Young T, Finn L, Kim H. Nasal obstruction as a risk factor for sleep-disordered breathing. The University of Wisconsin Sleep and Respiratory Research Group. *J Allergy Clin Immunol* 1997;99(2):S757–62.
- [5] Kirmaz C, Aydemir O, Bayrak P, Yuksel H, Ozenturk O, Degirmenci S. Sexual dysfunction in patients with allergic rhinoconjunctivitis. *Ann Allergy Asthma Immunol* 2005;95(6):525–9.
- [6] Tai S-Y, Wang L-F, Tai C-F, Huang Y-T, Chien C-Y. Chronic Rhinosinusitis Associated with Erectile Dysfunction: A Population-Based Study. *Scie Rep* 2016;6:32195.
- [7] Jalali MM, Gerami H, Soleimani R, Alizadeh P. Quality of life in patients with allergic rhinitis in the North of Iran. *J Clin Diagn Res* 2018;12(6):MC01–4.
- [8] Soto JC, Rojas JV, Padilla AG, Marina NM, Garcia JR, Pinedo CS, et al. Impact of asthma on the sexual functioning of patients. A Case-Control Study. *Arch Bronconeumol* 2017;53(2):667–74.
- [9] Mohammadi K, Heydari M, Faghizadeh S. The female sexual function index (FSFI): validation of the Iranian version; 2008.
- [10] Pakpour AH, Zeidi IM, Yekaninejad MS, Burri A. Validation of a translated and culturally adapted Iranian version of the International Index of Erectile Function. *J Sex Marital Ther* 2014;40(6):541–51.
- [11] Moghaddam JF, Nakhaee N, Sheibani V, Garrusi B, Amirakafi A. Reliability and validity of the Persian version of the Pittsburgh Sleep Quality Index (PSQI-P). *Sleep Breath* 2012;16(1):79–82.
- [12] Ghajjarzadeh M, Jalilian R, Eskandari G, Ali Sahraian M, Reza Azimi A. Validity and reliability of Persian version of Modified Fatigue Impact Scale (MFIS) questionnaire in Iranian patients with multiple sclerosis. *Disabil Rehab* 2013;35(18):1509–12.
- [13] DeConde AS, Mace JC, Bodner T, Hwang PH, Rudmik L, Soler ZM, et al. SNOT-22 quality of life domains differentially predict treatment modality selection in chronic rhinosinusitis. *Int Forum Allergy Rhinol* 2014;4(12):972–9.
- [14] Azevedo P, Correia-de-Sousa J, Bousquet J, Bugalho-Almeida A, Del Giacco SR, Demoly P, et al. Control of Allergic Rhinitis and Asthma Test (CARAT): dissemination and applications in primary care. *Prim Care Respir J* 2013;22(1):112.
- [15] Chowdhury NI, Mace JC, Bodner TE, Alt JA, Deconde AS, Levy JM, et al. Investigating the minimal clinically important difference for SNOT-22 symptom domains in surgically managed chronic rhinosinusitis. *Int Forum Allergy Rhinol* 2017;7(12):1149–55.
- [16] Marshall PS, O'hara C, Steinberg P. Effects of seasonal allergic rhinitis on fatigue levels and mood. *Psychosom Med* 2002;64(4):684–91.
- [17] Avci D, Dogan S. The impact of sexual dysfunction on quality of life of patients with asthma in Turkey. *Sexual Disabil* 2017;35(1):107–18.
- [18] Zhang Q, Zhou C, Chen H, Zhao Q, Li L, Cui Y, et al. Rheumatoid arthritis is associated with negatively variable impacts on domains of female sexual function: evidence from a systematic review and meta-analysis. *Psychol Health Med* 2018;23(1):114–25.
- [19] Gürlük F, Taşdemir E, Çoban S. Does allergic rhinitis have effect on erectile dysfunction? *J Reconstr Urol* 2018;8(2):44–9.
- [20] Ozler GS. Quality of sexual life in males with allergic rhinitis. *J Clin Anal Med* 2014;7(112):155–7.
- [21] Su VY, Liu CJ, Lan MY, Chen YM, Su KC, Lee YC, et al. Allergic rhinitis and risk of erectile dysfunction – A Nationwide Population-Based Study. *Allergy* 2013;68(4):440–5.
- [22] Ohashi Y, Nakai Y, Tanaka A, Kakinoki Y, Ohno Y, Washio Y, et al. Soluble vascular cell adhesion molecule-1 in perennial allergic rhinitis. *Acta Otolaryngol* 1998;118(1):105–9.
- [23] Blankenberg S, Rupprecht HJ, Bickel C, Peetz D, Hafner G, Tiret L, et al. Circulating cell adhesion molecules and death in patients with coronary artery disease. *Circulation* 2001;104(12):1336–42.
- [24] Silvestro A, Brevetti G, Schiano V, Scopacasa F, Chiariello M. Adhesion molecules and cardiovascular risk in peripheral arterial disease. Soluble vascular cell adhesion molecule-1 improves risk stratification. *Thromb Haemost* 2005;93(3):559–63.

- [25] Ahmad S, Azid NA, Boer JC, Lim J, Chen X, Plebanski M, et al. The Key Role of TNF-TNFR2 Interactions in the Modulation of Allergic Inflammation: A Review. *Front Immunol* 2018;9:2572.
- [26] Chevret M, Jaudinot E, Sullivan K, Marrel A, De Gendre AS. Impact of erectile dysfunction (ED) on sexual life of female partners: assessment with the Index of Sexual Life (ISL) questionnaire. *J Sex Marital Ther* 2004;30(3):157–72.
- [27] Seehuus M, Pigeon W. The sleep and sex survey: relationships between sexual function and sleep. *J Psychosom Res* 2018;112:59–65.
- [28] Kling JM, Manson JE, Naughton MJ, Temkit M, Sullivan SD, Gower EW, et al. Association of sleep disturbance and sexual function in postmenopausal women. *Menopause* 2017;24(6):604–12.
- [29] Lunn M, Craig T. Rhinitis and sleep. *Sleep Med Rev* 2011;15(5):293–9.
- [30] Bridgeman MB. Overcoming barriers to intranasal corticosteroid use in patients with uncontrolled allergic rhinitis. *Integr Pharm Res Pract* 2017;6:109–19.