Obesity in elderly people with nocturia: cause or consequence?

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Objective: *To assess the relationship of nocturia and sleep to body weight.*
Materials and methods: *A questionnaire survey among all (n = 10216) members of a pensioners´ association in the Swedish counties of Västerbotten and Norrbotten.*
Results: *A total of 6103 evaluable questionnaires were received, of which 39.5% were from men. The response rate was 61.3%. The ages of the male and female participants were 73.0 (6.0) [mean (SD)] and 72.6 (6.7) years, respectively. Body mass index (BMI) was 25.4 (3.1) in men and 25.4 (3.7) in women. BMI increased in parallel with increasing number of nocturnal micturition episodes in women, while the corresponding increase in men did not reach statistical significance (p = 0.10). The habit of nocturnal eating and the occurrence of poor appetite in the daytime increased in parallel with increasing number of nocturnal micturition episodes in both men and women.*
Conclusion: *Obesity increased in parallel with increased nocturnal voiding, and both nocturnal eating and daytime loss of appetite increased correspondingly. The pattern of increase of these symptoms may support the interpretation that frequent nocturnal micturition increases the risk of obesity, partly as a consequence of its negative impact on sleep.*

Key Words: appetite, body mass index, nocturia, nocturnal eating, sleep

Introduction

During recent years the relationship between overweight and symptoms from the urinary tract has attracted increasing interest. Nocturia is a common symptom in the elderly, with an age-related increase and with a profound influence on perceived health and quality of life.[1] Obesity has been described as an epidemic by reasons of the rapid increase in the number of overweight and obese individuals over the past 20 years.[2] As, accordingly, the coexistence of obesity and urinary tract symptoms is common in the society, particularly in the elderly, and as the life expectancy is increasing, the interaction between them is an important area for further study.

In men of ages 60 years and over, occurrence of one or more symptoms from the urinary tract, such as nocturia, urgency, urge and stress incontinence, is increased among obese individuals.[3] The prevalence of nocturia has been found to increase in parallel with an increasing body mass index (BMI) after adjustment for a number of possible confounders.[4] In a recent questionnaire survey in Finland comprising 1726 men and 2003 women aged 43.5 ± 15.3 (mean ± SD) and 42.0 ± 15.7 years, respectively, it was found that obesity was associated with increased nocturnal voiding, and that this increase was more pronounced in women than in men.[5] No mechanism explaining this relationship was suggested.

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There is a connection between sleep impairment and obesity. In a questionnaire survey with more than 1.1 million participants, both men and women of ages 30 to 102 years, elevated BMI was found to be increased in association with habitual sleep durations below 7 h - 8 h, and this relationship was stronger in men than in women.[6] In a prospective study covering 13 years, a longitudinal association between sleep curtailment and future weight gain was identified.[7]

In the elderly, nocturia is a condition related to profound sleep impairment.[1] Middelkoop et al found that nocturia was the major cause of disturbed sleep maintenance in people over 50 years of age.[8] Frequent awakenings, difficulty in falling asleep after nocturnal awakenings, and early morning awakening are all increased in elderly people with nocturia.[1] The occurrence of nightmares and lying awake for more than half an hour after going to bed are also positively associated with the number of nocturnal micturition episodes.[9] The occurrence of short sleep (≤ 5 hours) is increased in parallel with an increasing number of nocturnal voiding episodes in a stepwise manner; in men from 9.1% (no voids) to 13.2% (≥ 3 voids), and in women, correspondingly, from 10.7% to 26.3%.[10] In a questionnaire survey among women of ages 40 to 64 years poor sleep and lack of sleep were more strongly correlated to the number of nocturnal voids than to age.[9]

The aim of the present study was to investigate whether the increased prevalence of obesity in elderly people with nocturia might be a result of nocturnal disturbance of sleep, causing disturbances of appetite and eating behavior.

Materials and methods

All 10216 members of the pensioners´ association SPF in the Swedish counties of Västerbotten and Norrbotten were asked to participate in a questionnaire survey. A further questionnaire was sent to those who failed to respond within 1 month.

The questions concerned the general state of health, body height and weight, the occurrence of somatic diseases and symptoms, everyday habits and behavior, sleep, eating habits and appetite. In addition, there was a question on the number of nocturnal voiding episodes.

In the present study answers to questions concerning nocturnal micturition, nocturnal eating and appetite in the daytime were analyzed. The response to the statement" I get up to eat at night" was "often" or "seldom or never" and to a question on appetite in the daytime the alternative answers were: "poor" or "good". BMI was calculated from body weight and height as reported in the questionnaire, as body weight in kilograms/square of height in meters. Questions were asked about total time in bed, total sleep time at night, and length of time from falling asleep to the first nocturnal awakening. Sleep efficiency was calculated as total time asleep/time in bed*100.[11]

Statistical methods

Standard methods were used for calculating mean values and standard deviations (SD). Group comparisons of non-numerical data were made with the chi-square test. For comparison of two numerical variables, student's t-test was used.

Results

The questionnaire was completed initially by 4544 people. After a reminder, a further 1559 answers were received. Thus there were 6103 evaluable questionnaires, of which 39.5% were from men. The response rate was 61.3%. The ages (SD) of the male and female participants were 73.0 (6.0) years and 72.6 (6.7) years, respectively.

BMI was 25.4 (3.1) in men and 25.4 (3.7) in women. Three percent of the men and 5.3% of the women often ate during the night ($p < 0.001$). Poor appetite in the daytime was reported by 4.3% of the men and 6.1% of the women ($p < 0.01$). BMI increased in parallel with an increasing number of nocturnal micturition episodes in women, while the corresponding increase in men did not reach statistical significance ($p = 0.10$), Figure 1. The habit of nocturnal eating,

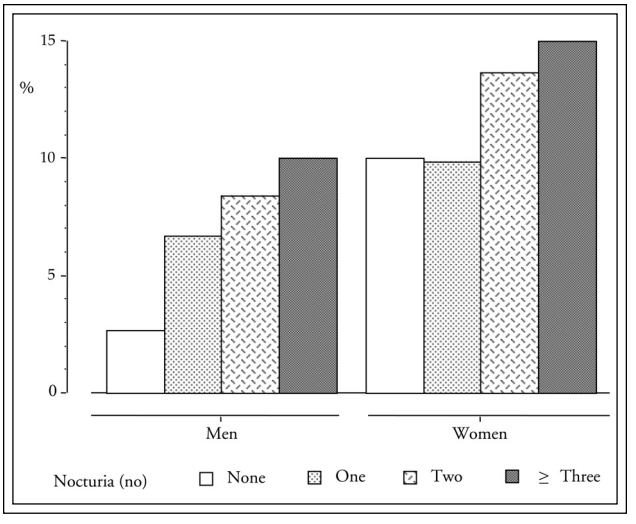

Figure 1. The occurrence of obesity (BMI ≥ 30 kg/square meter;%) in men and women with different numbers of nocturnal voiding episodes: men $p = 0.10$ [NS], women $p < 0.001$.

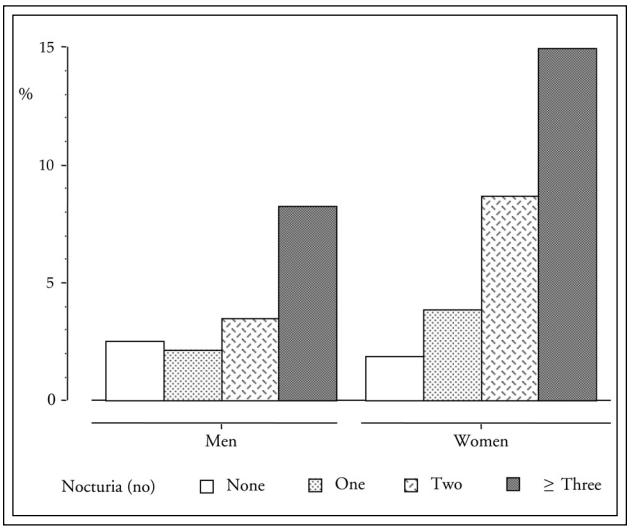

Figure 2. The occurrence of nocturnal eating (%) in men and women with different numbers of nocturnal voiding episodes: men $p < 0.01$, women $p < 0.0001$.

Figure 2, and the occurrence of poor appetite in the daytime, Figure 3, increased in parallel with an increasing number of nocturnal micturition episodes in both men and women.

Poor sleep was reported by 14.4% of the men and 28.1% of the women ($p < 0.0001$). The length of time in bed increased in parallel with increased nocturnal micturition, while total sleep time, time to the first awakening and sleep efficiency decreased, Table 1.

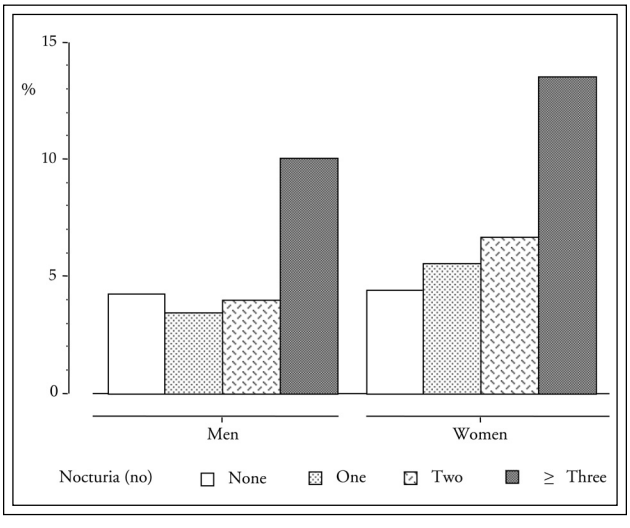

Figure 3. The occurrence of poor appetite in the daytime (%) in men and women with different numbers of nocturnal voiding episodes: men $p < 0.01$, women: $p < 0.0001$.

TABLE 1. **Total sleep time at night, time to first nocturnal awakening, total time in bed (all in minutes) and sleep efficiency (%) in men and women with two or fewer and with three or more nocturnal micturition episodes. Mean (SD)**

	≤ 2	≥ 3	P =
Total sleep time			
Men	415 (70)	398 (85)	< 0.01
Women	399 (74)	369 (78)	< 0.0001
Time to first awakening			
Men	302 (108)	194 (111)	< 0.0001
Women	284 (106)	185 (102)	< 0.0001
Time in bed			
Men	520 (64)	536 (63)	< 0.01
Women	537 (60)	565 (65)	< 0.0001
Sleep efficiency			
Men	84 (12)	80 (14)	< 0.0001
Women	80 (13)	76 (14)	< 0.0001

Discussion

In the present study it was found that the prevalence of obesity, generally defined as BMI ≥ 30,[12] increased in parallel with increasing nocturnal micturition, Figure 1. Such a relationship has been observed previously.[4,5,9] Tikkinen et al[5] suggested that nocturia is a consequence of obesity, which seems to be a reasonable assumption, as the body weight is often increased in persons with sleep apnoea, a condition with nocturia and nocturnal polyuria as prevalent symptoms. However, in the present study the participants with nocturia also showed an increased propensity for nocturnal eating and a reduced appetite in the daytime. These two symptoms do not seem to have been reported in association with sleep apnoea. The increased occurrence for nocturnal eating and appetite loss in persons with nocturia may support the view that the prevalence of overweight is increased as a consequence of nocturia, under the assumption that nocturia and overweight, by some mechanism, are linked in a cause-and-consequence relationship. The sometimes profound sleep deterioration in association with nocturia should be considered in this connection.[1,9,13]

The habit of eating during the night was increased in both men and women with increased nocturnal micturition, Figure 2. Recent studies have shown that sleep impairment is associated with a substantial risk of obesity.[13] During normal sleep the level of ghrelin,

a "hunger-inducing" hormone which is produced in the gut, is low. Reduced sleep duration is associated with increased levels of ghrelin, thereby stimulating eating behavior. Release of ghrelin is also stimulated by food restriction and weight loss, conditions normally associated with increased appetite.[13] Another hormone, leptin, with an effect on appetite opposite to that of ghrelin, is reduced in short sleepers.[13] Thus, the simultaneous decrease in sleep, increase in the ratio of ghrelin to leptin and almost unlimited availability of food may contribute to the epidemic increase in obesity in Western countries.[2,13]

A condition referred to as "the night eating syndrome" (NES) has been identified. It is characterized by morning anorexia, evening hyperphagia, insomnia, and awakenings frequently accompanied by eating.[14] The prevalence of obesity is increased in NES. In a questionnaire survey among patients in two psychiatric outpatient clinics in the USA, a significant relation between NES and BMI has been found (NES: BMI 33.1 (9.2) kg/square meter versus no NES: BMI 27.7 (6.6); $p < 0.001$).[15]

The data obtained in the present study would seem to indicate that nocturia increases the risk of obesity through its propensity to impair sleep. The total sleep time was moderately reduced, being one quarter of an hour shorter in subjects with three or more nocturnal micturition episodes compared with those with two or fewer such episodes. However, the period of uninterrupted sleep between falling asleep in the evening and the first nocturnal awakening was about 2 hours shorter in the former than in the latter group. Reardon et al found that in subjects with NES actigraphically monitored arousals occurred earlier during sleep (128 minutes after sleep onset versus 193 minutes, $p = 0.01$) and had more nocturnal awakenings than did controls (1.5 ± 1.0 per night versus 0.5 ± 0.5; $p < 0.001$).[16]

Improvement of nocturia has a favorable influence on sleep, as demonstrated in persons with nocturia caused by nocturnal polyuria. In a study during 12 months of treatment of adult men and women with an optimal dose of oral desmopressin (0.1 mg, 0.2 mg or 0.4 mg) or placebo, the mean duration of the first sleep period gradually increased from 157 to 288 minutes in men and from 142 to 310 minutes in women between baseline and the end of the 12-month period. The feeling of being well rested in the morning and the daytime performance improved in parallel with sleep improvement.[17]

Sleep disturbances in persons with nocturia resulted in a longer total time in bed, morning sleepiness, and lying in bed longer after the final awakening, all in turn resulting in reduced sleep efficiency, Table 1, as has been reported previously.[10]

Poor appetite in the daytime was also more common in men and women with increased nocturnal voiding, Figure 3. Loss of appetite, particularly in the first hours of the day, is one of the symptoms of NES.[14]

It remains to be shown whether overweight can be reduced by improvement of night sleep through treatment of nocturia. This would be valuable, as increasing body weight is one of the most threatening health-related conditions in global public health, and all possible efforts should be made to promote weight reduction, which would reduce the risk of metabolic syndrome, cardiovascular diseases and diabetes.[2]

Conclusion

Obesity and nocturia are associated with sleep impairment. In this study it was found that the prevalence of obesity increased in parallel with increased nocturnal voiding, and that both nocturnal eating and appetite loss in the daytime increased correspondingly. The concurrence of the increase in these symptoms may support the view that frequent nocturnal micturition increases the risk of obesity, partly as a consequence of its negative impact on sleep, leading in turn to nocturnal eating. □

References

1. Asplund R, Aberg H. Health of the elderly with regard to sleep and nocturnal micturition. *Scand J Prim Health Care* 1992;10:98-104.
2. Bray GA, Bellanger T. Epidemiology, trends, and morbidities of obesity and the metabolic syndrome. *Endocrine* 2006;29:109-117.
3. Muscatello DJ, Rissel C, Szonyi G. Urinary symptoms and incontinence in an urban community: prevalence and associated factors in older men and women. *Intern Med J* 2001;31:151-160.
4. Bulpitt CJ, Palmer AJ, Battersby C, Fletcher AE. Association of symptoms of type 2 diabetic patients with severity of disease, obesity, and blood pressure. *Diabetes Care* 1998;21:111-115.
5. Tikkinen KA, Auvinen A, Huhtala H, Tammela TL. Nocturia and Obesity: A Population-based Study in Finland. *Am J Epidemiol* 2006;163:1003-1011.
6. Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. *Arch Gen Psychiatry* 2002;59:131-136.
7. Hasler G, Buysse DJ, Klaghofer R, Gamma A, Ajdacic V, Eich D, Rossler W, Angst J. The association between short sleep duration and obesity in young adults: A 13-year prospective study. *Sleep* 2004;27:661–666.

8. Middelkoop HAM, Smilde-van den Doel DA, Neven AK, Kamphuisen HA, Springer CP. Subjective sleep characteristics of 1,485 males and females aged 50-93: effects of sex and age, and factors related to self-evaluated quality of sleep. *J Gerontol A Biol Sci Med Sci* 1996;51:M108-M115.
9. Asplund R, Åberg H. Nocturnal micturition, sleep and well-being in women of ages 40-64 years. *Maturitas* 1996;24:73-81.
10. Asplund R. Micturition habits and diuresis in relation to sleep and well-being in elderly subjects with emphasis on antidiuretic hormone. (Thesis) Stockholm 1992.
11. Tsai LL, Li SP. Sleep patterns in college students: gender and grade differences. *J Psychosom Res* 2004;56:231-237.
12. NHLBI Expert Panel on the Identification Evaluation and Treatment of Overweight and Obesity in Adults. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults — the evidence report. National Institutes of Health. *Obes Res* 1998;6(Suppl 2):51S–209S.
13. Taheri S, Lin L, Austin D, Young T, Mignot E. Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS Med* 2004 Dec;1(3):e62. Epub 2004 Dec 7.
14. Stunkard A, Berkowitz R, Wadden T, Tanrikut C, Reiss E, Young L. Binge eating disorder and the night-eating syndrome. *Int J Obes Relat Metab Disord* 1996;20:1-6.
15. Lundgren JD, Allison KC, Crow S, O'Reardon JP, Berg KC, Galbraith J, Martino NS, Stunkard AJ. Prevalence of the night eating syndrome in a psychiatric population. *Am J Psychiatry* 2006;163:156-158.
16. O'Reardon JP, Ringel BL, Dinges DF, Allison KC, Rogers NL, Martino NS, Stunkard AJ. Circadian eating and sleeping patterns in the night eating syndrome. *Obes Res* 2004;12:1789-1796.
17. Lose G, Mattiasson A, Walter S, et al. Clinical experiences with desmopressin for long-term treatment of nocturia. *J Urol* 2004;172:1021-1025.