Sleep Medicine 13 (2012) 1079–1085

Contents lists available at SciVerse ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Sleep duration and central obesity in women – Differences between short sleepers and long sleepers ☆,☆☆

Jenny Theorell-Haglöw [a,*], Lars Berglund [b], Christer Janson [a], Eva Lindberg [a]

[a] Department of Medical Sciences, Respiratory Medicine and Allergology, Uppsala University, Sweden
[b] Department of Medical Sciences, Uppsala Clinical Research Center (UCR), Uppsala University, Sweden

ARTICLE INFO

Article history:
Received 20 January 2012
Received in revised form 15 May 2012
Accepted 5 June 2012
Available online 26 July 2012

Keywords:
Sleep duration
Central obesity
Short sleepers
Long sleepers
Women
Population-based

ABSTRACT

Objective: To assess characteristics of short sleepers and long sleepers and to assess association between sleep duration and central obesity in a population-based sample of women.
Method: Non-pregnant women ⩾20 years that were randomly selected from the population-registry of Uppsala, Sweden, answered a questionnaire ($n = 6461$) including questions on sleeping habits and somatic disorders.
Results: There was a U-shaped association between sleep duration and waist circumference. Short sleeping women (<5 h) had a waist circumference of 89.2 ± 14.9 cm (mean ± SD) decreasing to 82.9 ± 11.9 cm for women sleeping 7–<8 h and increasing to 89.0 ± 16.7 cm for women sleeping ⩾10 h. Both short sleepers and long sleepers were more often physically inactive, smokers, ill or taking medication, and psychologically distressed than normal sleepers (6–<9 h). In women <50 years both short and long sleep duration were risk factors for central obesity. Short sleep duration remained a risk factor for central obesity, whereas the association with long sleep duration did not reach statistical significance after adjustments.
Conclusions: Short sleepers and long sleepers showed differences in characteristics compared to normal sleepers. Furthermore, we showed an independent association between short sleep duration and central obesity, which was strongest in younger women. It is important to identify short sleepers, especially in younger women.

1. Introduction

Over the past decades sleep duration has decreased [1–3] and, parallel to this, there has been an increase in the prevalence of obesity [4]. Several studies have found relationships between the two conditions [5–11]. Inverse relationships between self-reported sleep duration and obesity as well as U-shaped relationships have been found in both men and women [12,13]. Moreover, short sleep duration is also reported to predict weight gain and obesity later in life [6,8]. In earlier studies the focus has primarily been on sleep duration in relation to general obesity [5–7], whereas the association with central obesity is less clear. Central obesity is a stronger risk factor than body mass index (BMI) for both cardiovascular disease and type 2 diabetes mellitus [4,14,15]. Further, there may be differences in factors related to central obesity in short sleepers versus long sleepers [16–18].

In a previous study in women we found an inverse relationship between objectively measured sleep duration and central obesity [19]. This study included 400 women from a population-based sample. Therefore, we wanted to investigate the relationship between sleep duration and central obesity in a larger population and also assess if there are different factors associated with central obesity in short sleepers compared to long sleepers. We hypothesized that both short and long sleep duration was related to central obesity and that there may be differences between the groups in factors related to central obesity. We further hypothesized that there may be differences between younger and older women. Consequently, the aim of this study was to analyze associations between self-reported sleep duration and central obesity and also to assess different factors in relation to central obesity in short and long sleepers in a population-based sample of women.

2. Methods

In this population-based study ("Sleep and Health in women") [20], a questionnaire on sleeping habits and somatic disorders

☆ *Work attributed to:* Department of Medical Sciences, Respiratory Medicine and Allergology, Uppsala University, Sweden.
☆☆ *Funding by:* The Swedish Heart Lung Foundation, The Swedish Heart Lung Association and the Uppsala County Association against Heart and Lung Diseases.
* Corresponding author. Address: Department of Medical Sciences, Respiratory Medicine and Allergology, Uppsala University, Box 256, 751 05 Uppsala, Sweden. Tel.: +46 18 611 02 42; fax: +46 18 611 02 28.
E-mail address: jenny.theorell-haglow@medsci.uu.se (J. Theorell-Haglöw).

1389-9457/$ - see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.sleep.2012.06.013

was sent to women aged ⩾20 years, randomly selected from the population registry of the city of Uppsala, Sweden The response rate was 71.6% (n = 7051). The final study population included the 6461 non-pregnant women who had reported their sleep duration and waist circumference.

The questionnaire consisted of 109 questions and has previously been described in detail [20]. Briefly, the questionnaire comprised questions on sleep duration, snoring habits, insomnia, occupational status, shift work, civil status, physical activity, smoking, alcohol dependence, and anxiety and depression. To assess sleep duration (h/night) the women were asked "How many hours do you on average sleep during the night?" Sleep duration was grouped by hours slept but was also classified into three categories: short sleepers (<6 h/night), normal sleepers (6–<9 h/night), and long sleepers (⩾9 h/night). In conjunction with the questionnaire, the women were given a tape measure and instructions on how to measure their waist circumference [20]. A waist circumference ⩾88 cm was used to define central obesity according to NCEP (National Cholesterol Education Program) criteria [21]. BMI was calculated from self-reported height and weight.

Six questions assessed smoking habits. Based on the participants' responses they were categorized as "current smokers," "ex-smokers" (i.e., had quit smoking at least six months before answering the questionnaire), or "non-smokers" (i.e., never smoked). Alcohol dependence was assessed by the CAGE (acronym for cut down, annoyed by criticism, guilty about drinking, and eye-opener drinks) alcohol and screening questionnaire [22]. Psychological distress was assessed using the Hospital Anxiety and Depression (HAD) scale [23]. The participants' physical activity was analyzed by four questions adopted from a questionnaire used in a large population-based study on the correlation of physical activity and mortality [24].

Occupational status was categorized into the following categories: working full-time (⩾30 h/week), working part time (<30 h/week)/working at home, student, unemployed, sick leave/early retirement. The participants were also asked to ascertain how many months they had been working nights or shifts over the past 10 years. A cut-off point of 60 months was chosen when analyzing working nights or shifts as risk factors for EDS and fatigue. Civil status was classified into two categories: married/living together and single (including divorced and widowed women).

The women were asked if they had any somatic disease(s) that required regular medical attention. Somatic diseases were: asthma/chronic obstructive pulmonary disease (COPD), cardiovascular disease, diabetes, gastric ulcer/reflux, back/joint problems, fibromyalgia, gynecological problems and neurological problems. In addition, the women were asked if they were taking any medication on a regular basis. Medication was indicated if taking any of the following: beta blockers, beta 2 agonists, diabetes medication, or benzodiazepines/sleep medicine as these were considered to potentially affect sleep or obesity.

3. Statistical analyses

Statistical analyses were performed using Stata 10 (Stata Corporation, College Station, TX, USA). Univariate analyses were conducted using the unpaired t-test for continuous variables and the chi-squared test for categorical variables to compare the sleep duration groups. All significant variables from the univariate analyses were then entered into a multiple model, which was performed using logistic regression with central obesity as a dependent variable. The results from the logistic regression are presented as adjusted odds ratios (ORs) with 95% confidence intervals (95% CI).

Associations between sleep duration and central obesity (waist circumference) were analyzed using a multiple regression analysis. Results from the regression analysis are presented as adjusted β-values with p-values. To analyze the presence of a U-shaped relationship between sleep duration and central obesity the squared sleep duration was entered into the multiple regression analysis. A two-sided p-value < 0.05 was considered a statistically significant result.

In a previous study we have seen that short sleep duration has most importance in younger women (age < 50 years) [19] and, in addition, there was a significant interaction between age and sleep duration (p = 0.014) for central obesity. Therefore, the population was divided by age above and below 50 years in some analyses.

The study was approved by the Ethics Committee of the Medical Faculty at Uppsala University and all participants gave their informed consent before participating.

4. Results

Compared with normal sleepers (6–<9 h), both short sleepers and long sleepers were more centrally obese and had greater neck and waist circumference and short sleepers were even more centrally obese than long sleepers. Both short and long sleepers were more physically inactive, more likely to be smokers, had an illness, or were taking medication, and more often suffered from psychological distress compared with normal sleepers. In addition, both short sleepers and long sleepers were more often married or living with someone and were more often sick leaved or retired early. In contrast, compared with normal sleepers, short sleepers were older and had higher BMI, whereas there were no differences for the long sleepers. Long sleepers, on the other hand, were more often students or seeking employment compared with normal sleepers short sleepers. When further comparing short sleepers with long sleepers, the short sleepers were more seldom alcohol dependent and were more often suffering from physical illness and also from psychological distress. There were also differences in occupational status as short sleepers were more often working full-time and also part-time, but also more often on sick-leave or early retirement than long sleepers (Table 1).

In younger women (age < 50 years), both short sleepers and long sleepers shared many of the same characteristics as in the whole group. However, increased neck circumference (33.1 ± 3.6 versus 32.7 ± 2.5 cm; p = 0.011) and waist circumference (84.1 ± 14.7 versus 80.3 ± 10.9 cm; p < 0.0001) were seen only in short sleepers in the younger age group. Short sleepers were also older (36.6 ± 8.5 versus 33.4 ± 8.9 years; p < 0.0001). As in the whole population, long sleepers in the younger age group were more seldom working full-time (19.0% versus 42.8%; p < 0.0001) and were more often students (41.7% versus 25.5%; p < 0.0001) or seeking employment (7.4% versus 2.4%; p < 0.0001) compared with normal sleepers (6–<9 h). Furthermore, long sleepers were also younger (29.4 ± 8.6 versus 33.4 ± 8.9; p < 0.0001) and more often living with someone (41.9% versus 33.0%; p = 0.011) compared with normal sleepers. In comparison with long sleepers, short sleepers in the younger age group were older (36.6 ± 8.5 versus 29.4 ± 8.9 years; p < 0.0001), had greater waist circumference (84.1 ± 14.7 versus 81.0 ± 13.0 cm; p = 0.016), higher BMI (24.5 ± 5.0 versus 23.5 ± 4.3 cm; p = 0.024), and were more likely to be smokers (28.2% versus 22.7%; p = 0.026). In addition, the short sleepers were more often suffering from physical illness (25.6% versus 18.0%; p = 0.036), anxiety, and depression (31.4% versus 14.5%; p < 0.0001) and were more often working full-time (43.5% versus 19.0%; p < 0.0001), on sick-leave or early retired (10.4% versus 7.8%; p < 0.0001), and there were also more shift workers among the short sleepers (8.3% versus 3.2%; p = 0.042).