Sleep Medicine 27-28 (2016) 92–98

Contents lists available at ScienceDirect

Sleep Medicine

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

Original Article

Association between sleep duration and the prevalence of hypertension in an elderly rural population of China

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ARTICLE INFO

Article history:
Received 18 March 2016
Received in revised form
23 May 2016
Accepted 4 August 2016
Available online 27 October 2016

Keywords:
Hypertension
Sleep duration
Siesta
Nighttime
Elderly population

ABSTRACT

Background: Previous studies have examined an association between sleep duration and hypertension, but the conclusions remain inconsistent.
Methods: We conducted a cross-sectional study in a community-based rural elderly population of Beijing, China. A total of 2397 participants (967 male and 1430 female) completed the survey. Sleep duration was assessed in a face-to-face interview and was self-reported. Hypertension was defined as systolic blood pressure (BP) $\geq$ 140 mm Hg and/or diastolic BP $\geq$ 90 mm Hg and/or receiving treatment for hypertension. Multiple logistic regression was used to estimate the association between gender-specific sleep duration and hypertension prevalence.
Results: Overall, no significant differences were observed among female participants and the total participants, and the differences were statistically significant only in men. After adjusting for potential confounding variables, the odds ratio (OR) and 95% confidential interval (CI) of having hypertension was 1.33 (1.00, 1.77) in men who slept for $\geq$9 h compared with those slept for six to eight hours per 24-h period. Furthermore, a one hour nap was associated with less likelihood of hypertension in men compared with those who did not nap, with an adjusted OR (95% CI) of 0.61 (0.41, 0.90).
Conclusion: In a community-based rural elderly population of China, we found that sleep duration of six to eight hours per 24-h period and a one hour nap were significantly associated with lower risk of hypertension only among male participants after adjustment for potential confounders. Further studies are still needed to determine the relationships between 24-h, nighttime, and daytime sleep duration separately with hypertension, and to explore the biological mechanisms underlying the gender-related association.

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1. Introduction

With increasing prevalence both in adults and in younger individuals, hypertension remains one of the most important chronic noncommunicable diseases in many populations [1–3]. Kearney et al. analyzed the worldwide data and estimated that the proportion of adults with hypertension would increase by approximately 60% by the year 2025 [3]. In China, the prevalence of hypertension has increased dramatically over the past few decades [4,5]. Furthermore, epidemiological studies have consistently reported that hypertension is an important risk factor for various negative health outcomes, such as cardiovascular disease (CVD) and mortality [6,7]. Therefore, it is urgent to identify the risk factors associated with hypertension so as to prevent the occurrence of hypertension and to decrease its subsequent related disease burden.

As a primitive behavior, sleep occupies about one-third of our lifetime. It will have great public health implications if sleep duration is demonstrated to have a significant impact on

Abbreviations: CVD, cardiovascular disease; BMI, body mass index; BP, blood pressure; TC, total cholesterol; TG, triglycerides; HDL-C, high-density lipoprotein; LDL-C, low-density lipoprotein; FPG, fasting blood glucose; OR, odds ratio; CI, confidence interval; SD, standard deviation.

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http://dx.doi.org/10.1016/j.sleep.2016.08.015
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hypertension. Previous evidence has shown an association between sleep duration and hypertension, but the conclusions remain inconsistent [8–11]. One possible explanation of the controversial results might be attributed to the diverse races, different ages, and various lifestyles and sleeping habits across studies. Additionally, the definition of sleep duration was heterogeneous in different studies. The majority of the published studies have not differentiated between nighttime and daytime sleep duration.

In China, the percentage of elderly individuals has dramatically increased during recent decades [12]. However, the association between sleep duration and hypertension in Chinese elderly persons is still uncertain. Therefore, we conducted a cross-sectional study to investigate the relationship of daytime and nighttime sleep duration separately with hypertension, and to explore its possible gender difference in a community-based rural elderly population of Beijing, China.

2. Methods

2.1. Study design

Between May and September 2014, we performed a cross-sectional study in the Jugezhuang and Fengjiayu towns of the Miyun district; this is a metropolitan area, representative of the geographic and economic characteristics of rural Beijing. The residents were aged 60 years or above, and those in all of the selected 26 villages were invited to participate to our study. A total of 2589 residents who had lived in the local district for more than one year were selected and invited for the screening. Finally, a total of 2397 participants (967 males and 1430 females) completed the survey, with a response rate of 92.6%.

This study was approved by the Independent Ethics Committee of the Chinese People's Liberation Army General Hospital (EC0411-2001). Signed informed consent was obtained from each participant.

2.2. Data collection and measurement

All participants completed a face-to-face interview and a standardized questionnaire including demographic factors (age, gender, educational level marital status, etc), medical history, family history of chronic disease (diabetes, hyperlipidemia, cardiovascular disease, etc) and lifestyle characteristics (physical activity, use of tobacco and alcohol, etc).

Trained nurses and physicians measured the height, weight, and blood pressure of each participant according to a standardized protocol. Height was measured without shoes. Weight was measured with heavy clothing removed. Body mass index (BMI) was computed as weight in kilograms divided by height squared in meters [13]. Cigarette smoking was defined as having smoked at least one cigarette per day for more than one year [14]. Alcohol consumption was defined as drinking alcohol at least 12 times during the past year [15]. Overnight fasting blood specimens were obtained from measure of serum lipids and glucose. Samples were sent to the central certified laboratory of Chinese People's Liberation Army general hospital within 30 min.

2.3. Measurement of sleep duration and definitions

Sleep duration was assessed in the face-to-face interview by questions listed as follows: “On average, how many hours of sleep do you usually get in a 24-h period and at night?” The results were classified into three categories of 24-h sleep duration (<6 h, 6–8 h, and ≥9 h), three categories of nighttime sleep duration (<6 h, 6–8 h, and ≥9 h) [16], and three categories of daytime sleep duration (0 h, 1 h, and ≥2 h). We also recorded the subjective sleep quality of each participant.

2.4. Blood pressure measurement and definitions

The participants were advised to avoid the use of alcohol, cigarette, coffee and tea prior to the survey. Two blood pressure recordings were obtained from the right arm of each participant using standardized mercury sphygmomanometers. If the difference between the two measurements was >5 mm Hg, then a third measurement was made. The average value of the last two measurements was used as the final value. Hypertension was defined as systolic blood pressure (BP) ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg and/or receiving treatment for hypertension in the previous two weeks [17].

2.5. Statistical analysis

Data were entered using the software of Epidata (version 3.1). All analyses were performed using SPSS for Windows (version 19.0) (SPSS Inc., Chicago, IL, USA). A two-sided p value of <0.05 was considered statistically significant.

Descriptive data were described mean ± SD (standard deviation) for continuous variables and percentage for categorical variables. In the 1729 participants without antihypertensive treatment, the difference between the average values of systolic and diastolic BPs by sleep duration category was assessed using analysis of variance. Of the 2397 participants with completed data at baseline, a multiple logistic regression model was used to estimate the association between gender-specific sleep duration and the prevalence of hypertension. We calculated the unadjusted and adjusted odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) of the relationship of sleep duration with hypertension.

3. Results

The baseline characteristics of study participants by gender are presented in Table 1. A total of 2397 participants completed the survey, including 1430 (59.7%) women and 967 (40.3%) men. Overall, the mean age of the participants were 69.5 ± 6.8 years, ranging from 60 to 95 years. The prevalence of hypertension in this district was 51.4%, and the women had a higher prevalence of hypertension (56.2% for women vs 44.4% for men, $p < 0.001$). The average sleep duration of 24-h, nighttime, and daytime were 7.9 ± 1.9 h, 6.9 ± 1.7 h, and 0.9 ± 0.8 h, respectively. Men had longer sleep duration in the 24-h period (8.1 ± 1.8 h) and at nighttime (7.1 ± 1.6 h), compared with the women (7.7 ± 2.0 h per 24-h period and 6.8 ± 1.8 h per night, respectively).

3.1. Mean systolic and diastolic BP by sleep duration category

In participants without antihypertensive treatment (n = 1729), Table 2 presents the mean values of systolic and diastolic BP by sleep duration category by gender. In general, men who slept for six to eight hours per 24-h, six to eight hours per night, and took a one hour nap had the lowest mean values of systolic and diastolic BP. The results of the analysis of variance showed that men who slept for six to eight hours per night had significantly lower diastolic BP ($p < 0.05$). No significant differences were observed among the total study participants and the female participants; these results revealed gender-specific differences in the present study.

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