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Soy Isoflavone Intake and Sleep Parameters over 5 Years among Chinese Adults: Longitudinal Analysis from the Jiangsu Nutrition Study

Yingting Cao, MMSc; Anne W. Taylor, PhD; Shiqi Zhen, MD; Robert Adams, MD, PhD; Sarah Appleton, PhD; Zumin Shi, MD, PhD

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ABSTRACT

Background Soy isoflavone is beneficial for menopausal/postmenopausal symptoms, including sleep complaints. However, little is known about its longitudinal association with sleep in the general population.

Objective Our aim was to investigate the association between soy isoflavone intake and sleep duration and daytime falling asleep among Chinese adults.

Design A longitudinal analysis was performed. Soy isoflavone intake was assessed by food frequency questionnaire. Sleep duration was self-reported at two time points. Occurrence of daytime falling asleep was determined at follow-up. Short and long sleep were defined as sleep <7 h/day or ≥9 h/day, respectively.

Participants/setting Adults aged 20 years and older from the Jiangsu Nutrition Study (2002-2007) with complete isoflavone intake and sleep duration data at both time points (n=1,474) were analyzed (follow-up, n=1,492).

Main outcome measures We measured sleep duration in 2002 and 2007 and daytime falling asleep occurrence in 2007.

Statistical analyses performed Mixed-effects logistic regression was performed for repeated measures between isoflavone intake and sleep duration. Logistic regression was performed for daytime falling asleep at follow-up. Demographic, anthropometric, and social factors were adjusted in the analyses.

Results The prevalence of long sleep duration was 18.9% in 2002 and 12.6% in 2007, and the prevalence of daytime falling asleep was 5.3%. Compared with the lowest quartile of isoflavone intake, the highest quartile was associated with a lower risk of long sleep duration (odds ratio=0.66; 95% CI 0.48 to 0.90; *P* for trend=0.018) over 5 years. Compared with persistent low intake of isoflavone (less than median intake of isoflavone at two time points), persistent high intake was associated with a reduced risk of daytime falling asleep in women (odds ratio=0.20; 95% CI 0.06 to 0.68), but not men. No consistent association between soy isoflavone intake and short sleep duration was found.

Conclusions Soy isoflavone intake was associated with a low risk of long sleep duration in both sexes and a low risk of daytime falling asleep in women but not men. J Acad Nutr Diet. 2017;117:536-544.

A LARGE NUMBER OF STUDIES HAVE SUGGESTED associations between short sleep duration and various health outcomes, including cardiovascular diseases and metabolic syndrome.^{1,2} Relatively less attention has been paid to long sleep duration and its health consequences. Several studies have demonstrated a U-shaped relationship between sleep duration and type 2 diabetes,³ as well as all-cause mortality.⁴ These studies emphasize the adverse effect of long sleep duration on health. Although the exact mechanism of the association between long sleep duration and mortality remains unclear, depression and low socioeconomic status have been suggested as potential factors.⁵ Self-reported sleep symptoms, including snoring and daytime sleepiness accompanied by altered sleep duration, have also been found to be associated

with increased risk of cardiovascular diseases in older ${\rm adults.}^6$

Estrogen plays a role in the central nervous system involved in sleep regulation.⁷ A randomized trial has confirmed the effects of estradiol on sleep quality among perimenopausal and postmenopausal women.⁸ Isoflavones, a class of phytoestrogens found mostly in soybeans and legumes, have been indicated as potential alternative therapies for hormone-dependent conditions, including cancer, cardiovascular diseases, and postmenopausal symptoms.⁹ Studies on the association between isoflavone intake and sleep are scarce. Two clinical trials have demonstrated the beneficial effects of isoflavone treatment on sleep disorders in postmenopausal women.^{10,11} The mechanism may be partly explained by the relieved vasomotor symptoms, as sleep complaints (insomniac symptoms) are common among perimenopausal and postmenopausal women.^{12,13} Recently, a Japanese cross-sectional study investigated the association between isoflavone intake and sleep in the general population, trying to explore the association beyond the laboratory and perimenopausal and postmenopausal women-only settings.¹⁴ In that study, higher daily isoflavone intake (\geq 18 mg/ 1,000 kcal/day) was associated with optimal sleep duration (7 to 8 h/day) and sleep quality. However, due to the nature of cross-sectional studies, causal effects cannot be examined.

Like many other Asian countries, China has a high intake of soy, with adequate variation within the population. This makes it possible to study the effects of soy isoflavone on health at the population level. The present study aimed to investigate the longitudinal association between isoflavone intake and sleep duration among the Chinese population during a 5-year period. Another aim was to examine the association between isoflavone intake at baseline and selfreported daytime falling asleep at follow-up.

METHODS

Participants

Data from the Jiangsu Nutrition Study cohort with participants older than 20 years were used. A detailed methodology has been described previously.¹⁵ In 2002, a total of 2,849 adults at least 20 years of age living in two cities and six counties in Jiangsu Province took part in the Chinese National Nutrition and Health Survey. A multistage cluster sampling method was used to select participants. Rural samples were chosen from three randomly selected small towns within each of the six counties. Urban samples were chosen from three randomly selected streets within each of the two cities. In each town/street, two villages/neighborhoods were randomly selected, from which 90 households were then randomly selected.¹⁵ In 2007, an attempt to recontact all of the original participants was made. Due to attrition, 1,682 were identified for follow-up and 1,492 participated in the follow-up interview. For the current analysis, we included only those participants with sleep duration records in both 2002 and 2007 (n=1,474). Compared to the original sample with 2,849 participants in 2002, the sample included in the present study was older, with lower body mass index (BMI; calculated as kg/m²) and smaller waist circumference, but there was no difference in sex and energy intake. The study was conducted according to the guidelines in the Declaration of Helsinki, and all procedures were approved by the Jiangsu Provincial Centre for Disease Control and Prevention. Written informed consent for participation was obtained from each participant.

Data Collection and Measurements

Participants were interviewed at their homes by trained health workers using a precoded questionnaire. Interviews took about 2 hours to complete and included questions on diet, sociodemographic information, medical history, cigarette smoking, physical activity, and other lifestyle factors.

Dietary Measurement

Isoflavone intake was determined by a series of detailed questions about the usual frequency and quantity of intake of 33 food groups and beverages using a food-frequency questionnaire (FFQ). The FFQ has been validated and reported to be useful in face-to-face interviews in the Chinese population.¹⁶ The questionnaire asked the frequency of consumption of these foods per day, per week, per month, per year, and mean quantity per time over the past 12 months. Soy isoflavone intake was calculated based on the following soy foods: tofu (wet and dry), soy milk, and dried beans. Mean daily isoflavone intake in milligrams was calculated according to the Chinese Food Composition Table.¹⁷ Macronutrient and total energy intake were estimated from the 3-day weighed food intake using an in-house SAS software program.¹⁸

Sleep Measurement

At baseline in 2002, only sleep duration was collected, but both sleep duration and self-reported daytime falling asleep were collected at follow-up in 2007. Sleep duration was determined by the question "How many hours do you usually sleep each day?" Short sleep duration was defined as <7 hours per day and long sleep duration was defined as \geq 9 hours per day, as in most studies.⁴ Extreme long sleep duration (\geq 14 hours) (n=1) and missing value (n=1) were excluded. Self-reported falling asleep during the day was determined by the question "Do you fall asleep involuntarily during the day?"

Anthropometric Measurement and Other Variables

In both 2002 and 2007, anthropometry was conducted using standard protocols and techniques. Body weight was measured in light indoor clothing without shoes and rounded to the nearest 0.1 kg. Height was measured without shoes using a stadiometer and rounded to the nearest millimeter. BMI was categorized into the following groups: underweight (<18.5), normal weight (18.5 to 23.9), overweight (24 to 27.9), and obese (>28), according to the guideline for Chinese adults.¹⁹ Waist circumference was measured to the nearest millimeter midway between the inferior margin of the last rib and the crest of the ilium, in the mid-auxillary line in a horizontal plane. Blood pressure was measured twice with a mercury sphygmomanometer on the right upper arm of the subject, who was seated for 5 minutes before the measurement. The mean of these two measurements was used in the analyses. Hypertension was defined as a systolic blood pressure >140 mm Hg and/or a diastolic blood pressure >90 mm Hg, or the use of antihypertensive drugs.

Cigarette smoking was assessed by asking the frequency of daily cigarette smoking in the past 30 days. Frequency of alcohol consumption was determined (none, 1 to 2 days/wk, 3 to 4 days/wk, and daily). Education was recoded into "low" (illiteracy, elementary school); "medium" (middle school); and "high" (high school or higher), based on six categories of education levels in the questionnaire. Occupation was recoded into "manual" or "nonmanual" based on a question with 12 occupational categories. Income information was obtained by the question "What was your family income per person in 2001?" Three yearly income levels were categorized: low (<1,999 Chinese Yuan), medium (2,000 to 4,999 Chinese Yuan), and high (>5,000 Chinese Yuan). Sedentary activity was recoded into four categories: <1 h/day, 1 to 2 h/day. 2 to 3 h/day, and \geq 3 h/day based on questions asked on hours spent per day on sedentary activities, including watching Download English Version:

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