

Short sleep duration is associated with greater alcohol consumption in adults

By: Jean-Phillipe Chaput, [Jessica McNeil](#), Jean-Pierre Després, Claude Bouchard, and Angelo Tremblay

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Abstract:

The objective of this cross-sectional study was to examine the association between sleep duration and alcohol consumption in adults (301 men and 402 women aged 18–64 years) from the greater Quebec City area. Sleep duration (self-reported), alcohol consumption (3-day food record and questions on drinking habits), and disinhibition eating behavior trait (score ≥ 6 on the Three-Factor Eating Questionnaire) were assessed. Participants were categorized as short- (≤ 6 h), average- (7–8 h) or long- (≥ 9 h) duration sleepers. Overall, short-duration sleepers consumed significantly more alcohol than the two other sleep-duration groups. After adjusting for relevant covariates, short sleep duration was associated with an increase in the odds of exceeding the recommendations for sensible weekly alcohol intake of 14 drinks for men and 7 drinks for women compared to those sleeping between 7 and 8 h (OR 1.87, 95% CI 1.03–3.54, both sexes combined). In both men and women, daily alcohol intake was significantly higher in short-duration sleepers having a high disinhibition eating behavior trait. However, the prevalence of a binge drinking occasion (i.e. ≥ 5 drinks on one occasion) was more common in men than women. Men sleeping less than 6 h per night with a disinhibited eating behavior were more likely to report binge drinking (41% of them). In summary, the combination of short sleep duration with disinhibited eating behavior is associated with greater alcohol intake in adults.

Keywords: Alcohol intake | Beer | Drinking habits | Eating behavior | Wine | Sleep deprivation

Article:

Introduction

An accumulating body of evidence associates short sleep duration with obesity and weight gain (Chaput, Klingenberg, et al., 2010, Nielsen et al., 2011, Patel, 2009). A number of mechanisms have been invoked to account for this association, including an up-regulation of appetite-stimulating hormones, a longer exposure to an obesogenic environment as well as a decrease in spontaneous physical activity (Chaput, Klingenberg, et al., 2011, Schmid et al., 2009, Spiegel et al., 2009). Increased energy intake is commonly considered the most plausible explanation for

why short-duration sleepers have a higher risk of becoming obese (Brondel et al., 2010, Nedeltcheva et al., 2009, St-Onge et al., 2011). Interestingly, we have recently published results showing that the relationship between short sleep duration and subsequent body weight gain is dependent on disinhibited eating behavior in adults. Specifically, we observed that short-duration sleepers (≤ 6 h per night) with a high disinhibition eating behavior trait (i.e. score ≥ 6 on the Three-Factor Eating Questionnaire) had greater energy intake and gained more weight over time compared to short-duration sleepers with a low disinhibition eating behavior trait (Chaput, Després, Bouchard, & Tremblay, 2011). This finding further supports the notion that the hedonic or rewarding value of food intake is associated with short sleep duration (Chaput, 2010, Holm et al., 2009, Weiss et al., 2010).

Surprisingly, sleep duration as a correlate of alcohol consumption has not been studied extensively. Results from the 2004–2006 National Health Interview Survey indicated that adults aged 18–44 years who slept less than 6 h per night were more likely to have had five or more drinks in 1 day (33%) than adults in the same age group who slept 7–8 h (26%) or 9 h or more (26%) (Schoenborn & Adams, 2008). However, factors such as poverty and educational attainment were not assessed and could have confounded the results. Furthermore, short-duration sleepers might consume alcohol to facilitate sleep initiation. Indeed, behavioral studies suggest that up to 2–3 standard drinks – that is, 12 oz of beer, 5 oz of wine, or 1.5 oz of spirits – before bedtime initially promotes sleep; however, this effect diminishes with as few as 3 days of continued use (Stein & Friedmann, 2005).

In Canada, health and social problems resulting from alcohol consumption are becoming a concern. Over the last decade, both the annual volume of consumption and the prevalence of high-risk drinking have increased (Health Canada, 2008, Statistics Canada, 2008). Furthermore, the drinking act appears to differ across provinces as alcohol policies come under provincial jurisdiction. Using a sample comprising 10,466 current alcohol drinkers, aged 18–76 years across Canada, Paradis, Demers, and Picard (2010) recently reported that drinkers from Quebec, Ontario and British Columbia drink more often, drink wine more often, drink spirits less often, and drink more often during a meal than drinkers from the other provinces. The same patterns were observed in both sexes, although the differences across provinces were less pronounced among women.

The objective of the present observational, cross-sectional study was to investigate the relationship between sleep duration and alcohol consumption in adults from the greater Quebec City area. We hypothesized that short-duration sleepers (≤ 6 h per night) would be more likely to have a higher consumption of alcohol than those sleeping 7–8 h a day. Additionally, we hypothesized that short-duration sleepers with a high disinhibition eating behavior trait (i.e. score ≥ 6 on the Three-Factor Eating Questionnaire) would be more likely to report binge drinking episodes (≥ 5 alcoholic beverages on one single occasion) than short-duration sleepers with a low disinhibited eating behavior score.

Methods

Subjects

The Quebec Family Study was initiated at Laval University in 1978. The primary objective of this study was to investigate the role of genetics in the etiology of obesity and related cardiovascular risk factors. In phase 1 of the study (1978–1981), a total of 1650 individuals from 375 families were recruited and measured. Recruitment was conducted irrespective of body weight during phase 1, resulting in a cohort with a wide range of body mass index, ranging from 13.8 to 64.9 kg/m². In phase 2 (1989–1994) and 3 (1995–2001), 100 families from phase 1 were retested, and an additional 123 families with at least 1 parent and 1 offspring with a body mass index of 32 or higher were added to the cohort. Families were recruited through the media and were all French Canadians from the greater Quebec City area. Details of recruitment procedures have been published elsewhere (Bouchard, 1996). This cohort thus represents a mixture of random sampling and ascertainment through obese individuals. The present analyses are based on participants tested in phases 2 and 3 because some measurements were not available in phase 1. Adult individuals who were between 18 and 64 years of age were selected for cross-sectional analyses ($n = 851$). Additional inclusion criteria included a stable body weight (± 2 kg) over the 6 months preceding testing, no metabolic disease (e.g., diabetes or hypertension), and not being pregnant for women. The final sample consisted of 703 individuals (301 men and 402 women). All subjects provided written informed consent to participate in the study. The project was approved by the Medical Ethics Committee of Laval University.

Sleep duration assessment

The number of hours of sleep was assessed through a question inserted in a self-administered questionnaire on physical activity participation. The question formulation was: “On average, how many hours do you sleep a day?” We classified the participants into 3 sleep-duration groups: short-duration sleepers (≤ 6 h of sleep), average-duration sleepers (7–8 h of sleep) and long-duration sleepers (≥ 9 h of sleep), in agreement with our recent papers (Chaput, Després, et al., 2009, Chaput et al., 2008, Chaput, Leblanc, et al., 2009). We decided to classify the participants into three sleep-duration groups because of the U-shaped relationship between sleep duration and most outcome variables. Epidemiological evidence indicates that sleep duration of 7–8 h is optimal and associated with good health status in adults (Bixler, 2009).

Alcohol consumption assessment

Participants’ diet was evaluated with a 3-day food record, including 2 week days and 1 weekend day. Participants were shown how to complete the record by a dietician, who provided instructions about measuring the quantities of ingested foods. This method of dietary assessment has been shown to provide a relatively reliable measure of diet in this population (Tremblay, Sévigny, Leblanc, & Bouchard, 1983). Mean daily alcohol intake (g per day) from the 3-day food records was estimated by a dietician using a computerized version of the Canadian Nutrient File (1990). Weekly alcohol intake was estimated and participants were dichotomized on the basis of whether or not they exceeded the recommendations for “sensible” weekly intake of 14 drinks for men and seven drinks for women (Batty, Lewars, Emslie, Gale, & Hunt, 2009). Moreover, study participants were asked, as part of a self-administered questionnaire, about the number of alcoholic beverages they generally consume on one occasion. A drink was defined here as 341-mL (12-oz) glass of beer (5% alcohol by volume), 142-mL (5-oz) glass of wine (12% alcohol) or 43-mL (1.5-oz) glass of spirits (40% alcohol). These are all

considered standard servings in Canada. The latter data were analyzed as a continuous scale. The occurrence of a binge drinking occasion (i.e. ≥ 5 drinks on one occasion) was also used in our analyses.

Disinhibited eating behavior trait assessment

A French version of the 51-item Three-Factor Eating Questionnaire was completed by participants. The purpose of this questionnaire was to assess three factors related to cognition and eating behavior traits. These factors are cognitive dietary restraint (intent to control food intake), disinhibition (overconsumption of food in response to cognitive or emotional cues), and susceptibility to hunger (food intake in response to feelings and perceptions of hunger). The questionnaire has been shown to have acceptable reliability and validity (Laessle et al., 1989, Stunkard and Messick, 1985). We focused exclusively on disinhibition in the present paper because of its strong association with weight gain (Chaput et al., 2010) and poor eating habits (Bryant, King, & Blundell, 2008). Tertiles of disinhibition scores (≥ 6 , high disinhibition, and ≤ 3 , low disinhibition) were used as there is no consensus on what is considered a low or high score.

Covariates

Numerous covariates were measured via self-reported questionnaires. These included age, sex, smoking status (smoker or nonsmoker), highest education level (high school, college [CEGEP for Quebec], university), total annual family income (categorized into five groups ranging from $< \$10,000$ to $\$70,000$ or more), and coffee intake (number of cups per day). Additionally, body weight and height were directly measured and body mass index calculated as body weight divided by height squared (kg/m^2). Daily energy intake (kcal/day) was assessed from the 3-day food record (Tremblay et al., 1983). Finally, daily physical activity level and pattern were evaluated with a 3-day physical activity diary, as previously described (Bouchard et al., 1983). Moderate-to-vigorous physical activity participation over the 3 days was used for statistical analyses. The validity and reliability of the physical activity record have been previously reported (Bouchard et al., 1983).

Statistical analysis

Since there were some gender differences in the alcohol consumption pattern, the analyses were performed separately in men and women. Baseline characteristics of participants by sleep duration group were compared by analysis of variance (continuous variables) and chi-squared test (categorical variables). A Tukey post hoc test was used to contrast mean differences. Logistic regression analysis was used to predict the odds of exceeding the recommendations for sensible weekly alcohol intake (14 drinks for men and seven drinks for women) in short- and long-duration sleepers. The 7- to 8-h category was used as the reference group. The model was adjusted for age, body mass index, smoking habits, highest education level, total annual family income, coffee intake, energy intake and moderate-to-vigorous physical activity participation as covariates. Odds ratios (OR) and 95% confidence intervals (CI) were reported. Finally, alcohol consumption (g per day) as well as the occurrence of binge drinking occasions (i.e. ≥ 5 drinks on one occasion) in each sleep-duration group were computed by disinhibition eating behavior trait tertiles. An analysis of covariance was performed on the means of these variables, followed by a

Tukey post hoc test to determine which groups were significantly different. The model was adjusted for age, body mass index, smoking habits, highest education level, total annual family income, coffee intake, energy intake and moderate-to-vigorous physical activity participation as covariates. Because some individuals in this family study are biologically related, we adjusted for clustering in the analyses to avoid underestimation of standard deviations using generalized estimating equations. A 2-tailed P value of less than 0.05 was the threshold to indicate statistical significance. All statistical analyses were performed using the JMP version 9 program (SAS Institute, Cary, NC).

Results

Baseline characteristics of participants within each sleep-duration group are shown in Table 1. Both short- and long-duration sleepers had a significantly higher body weight and body mass index compared to those sleeping 7- to 8-h per night, as expected from previous observations. A significantly higher proportion (36%) of short-duration sleepers were smokers, compared with 22% and 17% for average- and long-duration sleepers, respectively. Only 13% of short-duration sleepers had a university degree compared with 25% for those in the 7- to 8-h sleeping category ($P < 0.05$). Likewise, individuals in the 7–8 h sleeping category had a significantly higher total annual income. Long-duration sleepers drank less coffee compared to the two other sleep-duration groups and short-duration sleepers had a higher disinhibition eating behavior score than those in the 7- to 8-h sleeping group ($P < 0.05$). Overall, short-duration sleepers consumed significantly more alcohol than the two other sleep-duration groups. More men than women consumed alcohol in the 7–8 h and ≥ 9 h sleeping groups ($P < 0.01$). Men also tended to drink more beer than women in one occasion and short-duration sleepers drank more beer in one occasion than those in the 7- to 8-h sleeping group. Finally, liquor consumption was significantly higher in short-duration sleepers compared to the two other sleep-duration groups.

The odds of exceeding the recommendations for sensible weekly alcohol intake (14 drinks for men and seven drinks for women) are shown in Fig. 1. Unadjusted logistic regression analysis showed a significant increase in the odds of exceeding the guidelines with ≤ 6 h of sleep per night (OR 2.08, 95% CI 1.16–3.67) compared to those sleeping between 7 and 8 h. After adjusting for age, body mass index, smoking habits, highest education level, total annual family income, coffee intake, energy intake, and moderate-to-vigorous physical activity participation, short sleep duration was still associated with an increased odds of exceeding the guidelines for sensible weekly consumption of alcohol (OR 1.87, 95% CI 1.03–3.54, both sexes combined). However, long sleep duration was not associated with an increase in the odds of exceeding these recommendations.

Table 1. Baseline characteristics of participants according to sleep-duration group.

| | ≤6 h per night (n = 77) | | 7–8 h per night (n = 500) | | ≥9 h per night (n = 126) | |
|---|----------------------------|-------------------|------------------------------|--------------------|-----------------------------|-------------------|
| | Men (n = 35) | Women (n = 42) | Men (n = 216) | Women (n = 284) | Men (n = 50) | Women (n = 76) |
| Age (years) | 41.8 ± 12.8 | 36.9 ± 14.1 | 38.4 ± 14.5 | 38.5 ± 13.5 | 37.9 ± 17.0 | 38.7 ± 14.8 |
| Body weight (kg) | 86.6 ± 18.6 | 72.5 ± 21.0* | 77.8 ± 15.9† | 68.3 ± 18.7*,† | 85.1 ± 17.9§ | 71.9 ± 24.2*,§ |
| BMI (kg/m ²) | 29.4 ± 6.0 | 28.5 ± 7.7 | 25.8 ± 4.9† | 26.4 ± 7.0† | 27.9 ± 7.9§ | 27.8 ± 9.7§ |
| Smoking habits | | | | | | |
| Nonsmoker | 25 (71) | 24 (57) | 172 (80)† | 218 (77)† | 39 (78)† | 66 (87)† |
| Smoker | 10 (29) | 18 (43) | 44 (20)† | 66 (23)† | 11 (22)† | 10 (13)† |
| Highest education level | | | | | | |
| High school | 22 (63) | 23 (55) | 70 (32) | 127 (45) **,‡ | 22 (44) | 31 (41) |
| Pre-university level | 6 (17) | 16 (38) | 86 (40) | 94 (33) **,‡ | 19 (38) | 28 (37) |
| University | 7 (20) | 3 (7) | 60 (28) | 63 (22) **,‡ | 9 (18) | 17 (22) |
| Total annual family income (\$) | 50,001 ± 31,921 | 46,351 ± 35,032 | 58,283 ± 28,686† | 55,787 ± 28,734† | 49,090 ± 25,455§ | 45,001 ± 27,688§ |
| Disinhibition eating behavior score | 6.01 ± 3.38 | 7.45 ± 3.87 | 4.17 ± 2.78‡ | 6.48 ± 3.54*,‡ | 4.70 ± 2.57 | 6.02 ± 3.43 |
| Coffee intake (cups per day) | 2.80 ± 2.41 | 3.51 ± 2.30 | 3.19 ± 3.16 | 2.70 ± 2.18 | 2.38 ± 1.94‡,§ | 2.01 ± 1.92‡,§ |
| Alcohol consumption (g per day) | 14.7 ± 13.4 | 13.2 ± 14.2 | 10.9 ± 16.2‡ | 4.7 ± 8.5*,‡ | 12.4 ± 21.9‡ | 4.3 ± 8.1*,‡ |
| Beer consumption (drinks on one occasion) | 2.79 ± 2.29 | 1.36 ± 1.36* | 1.92 ± 1.65‡ | 1.07 ± 1.32*,‡ | 2.66 ± 2.73 | 1.09 ± 1.17* |
| Wine consumption (drinks on one occasion) | 1.80 ± 1.51 | 1.59 ± 1.28 | 1.82 ± 1.38 | 1.81 ± 1.52 | 1.42 ± 1.45§ | 1.52 ± 1.56§ |
| Liquor consumption (drinks on one occasion) | 1.89 ± 4.02 | 0.97 ± 1.29 | 0.84 ± 1.57† | 0.67 ± 0.93† | 0.88 ± 1.72† | 0.53 ± 0.80† |
| Energy intake (kcal per day) | 2,826 ± 644 | 1,961 ± 459* | 2,736 ± 718 | 2,037 ± 531* | 2,690 ± 661 | 2,014 ± 494* |
| MVPA (min per day) | 53 ± 96 | 24 ± 39 | 24 ± 38† | 16 ± 27† | 24 ± 42† | 14 ± 25† |

Abbreviations: BMI, body mass index; MVPA, moderate-to-vigorous physical activity. Values are mean ± SD or n (%). Statistical significance was assessed by analysis of variance with continuous variables and by a chi-squared test with categorical variables. A Tukey post hoc test was conducted to contrast mean differences.

* $P < 0.01$ versus men.

** $P < 0.01$ versus men.

† $P < 0.01$ versus short-duration sleepers (≤6 h per night).

‡ $P < 0.05$ versus short-duration sleepers (≤6 h per night).

§ $P < 0.05$ versus 7–8 h sleeping group.

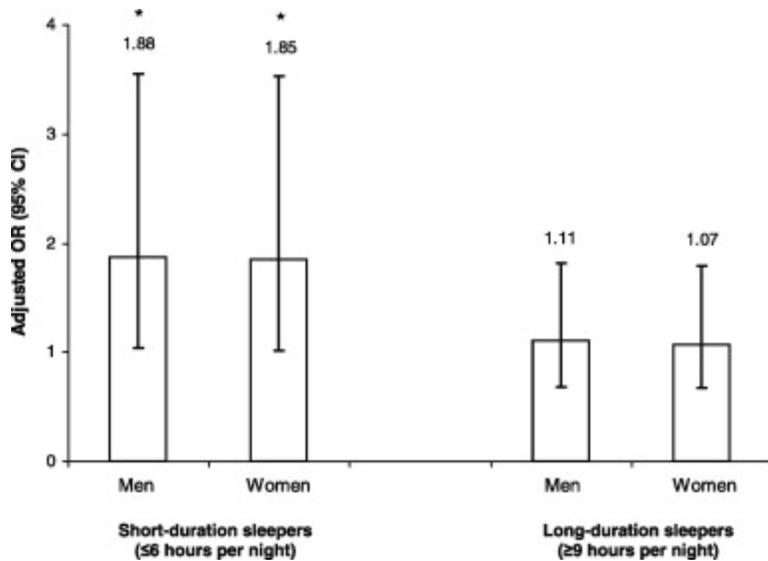


Fig. 1. Odds ratios for exceeding the recommended sensible weekly alcohol intake (14 drinks for men and seven drinks for women) compared with those sleeping between 7 and 8 h per night (reference category). Data are presented as odds ratios (OR) with 95% confidence intervals (CI). OR adjusted for age, body mass index, smoking habits, highest education level, total annual family income, coffee intake, energy intake, and moderate-to-vigorous physical activity participation. $n = 35$ men and 42 women (short-duration sleepers) and $n = 50$ men and 76 women (long-duration sleepers). * $P < 0.05$.

The occurrence of binge drinking occasions (i.e. ≥ 5 drinks on one occasion) for each sleep-duration group is shown in Table 2. Overall, we observed that the prevalence of binge drinking is rather low. Men were more likely than women to indulge in excessive beer drinking on one occasion and excessive beer drinking was less common in those sleeping between 7 and 8 h per night. Furthermore, the consumption of spirits was more common in men reporting short sleep duration.

Table 2. Occurrence of binge drinking (i.e. ≥ 5 drinks on one occasion) within each sleep-duration group.

| | ≤ 6 h per night ($n = 77$) | | 7–8 h per night ($n = 500$) | | ≥ 9 h per night ($n = 126$) | |
|--------|--------------------------------------|-----------------------|----------------------------------|------------------------|---------------------------------------|-----------------------|
| | Men ($n = 35$) | Women ($n = 42$) | Men ($n = 216$) | Women ($n = 284$) | Men ($n = 50$) | Women ($n = 76$) |
| Beer | 8 (23) | 1 (2)* | 18 (9)‡ | 5 (2)**,‡ | 9 (18)§ | 2 (3)*,§ |
| Wine | 0 (0) | 1 (2) | 6 (3) | 8 (3) | 0 (0) | 3 (4) |
| Liquor | 3 (9) | 1 (2)** | 5 (2)‡ | 2 (1)‡ | 2 (4) | 0 (0) |

Values are presented as n (%).

Statistical significance was assessed by a chi-squared test.

* $P < 0.01$ versus men.

** $P < 0.01$ versus men.

‡ $P < 0.05$ versus short-duration sleepers (≤ 6 h per night).

§ $P < 0.05$ versus 7–8 h sleeping group.

Finally, daily alcohol consumption and the prevalence of binge drinking were analyzed by sleep-duration group and disinhibition eating behavior trait tertile (i.e. low versus high score) and the

results are shown in Fig. 2. In both men and women, daily alcohol intake was significantly higher in short-duration sleepers with a high disinhibition eating behavior trait (overall mean of 16.6 g of alcohol per day, corresponding to slightly more than a drink per day). However, the prevalence of binge drinking was more common in men than women. Men sleeping less than 6 h per night and having a disinhibited eating behavior were more likely to report binge drinking (41% of them) for either beer, wine or spirits.

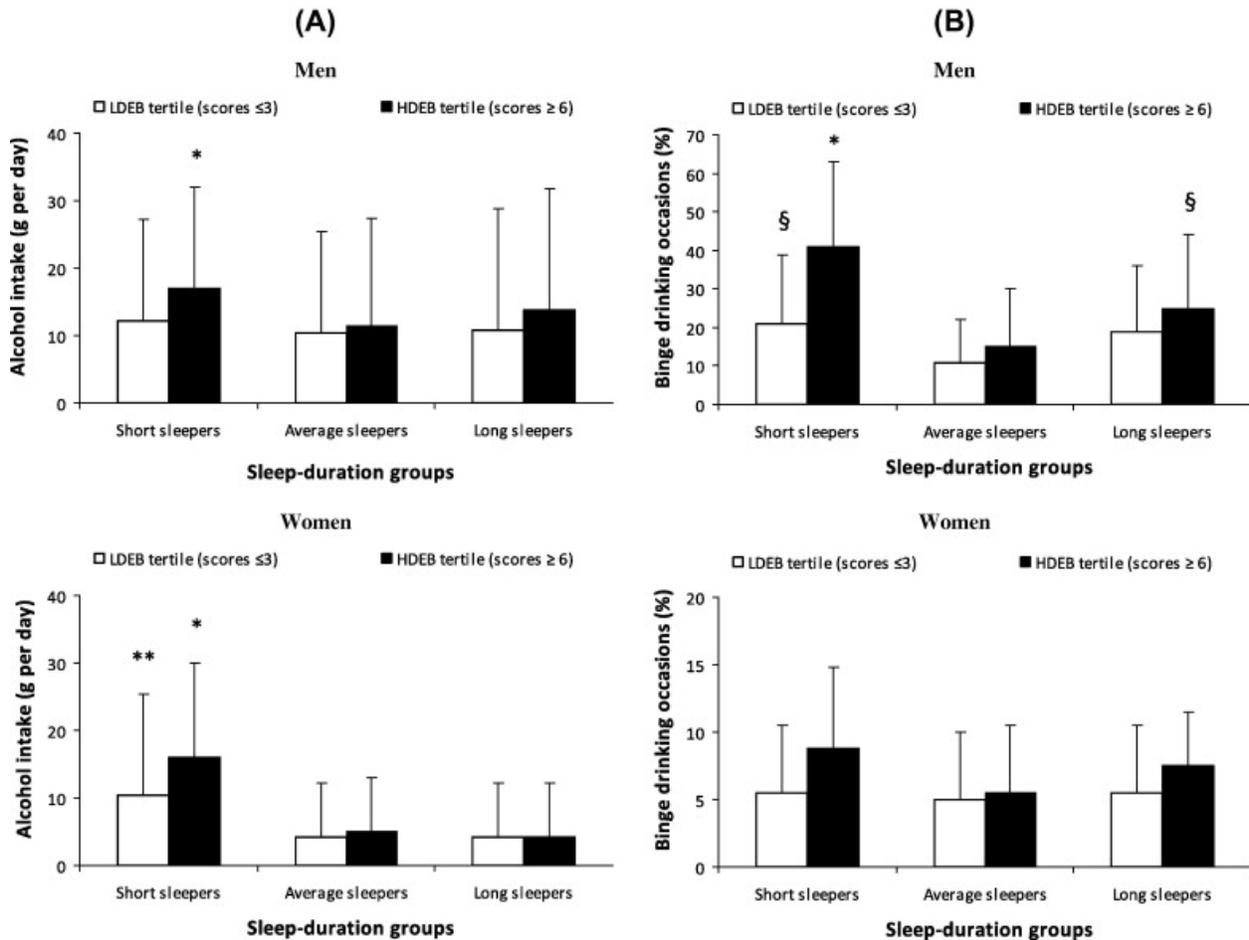


Fig. 2. Joint associations between sleep duration and disinhibition eating behavior trait with (A) daily alcohol consumption and (B) binge drinking. The occurrence of binge drinking was defined as ≥ 5 drinks on one occasion of beer, wine or spirits and was reported in relative values (%). Values are mean \pm SD. Statistical significance was assessed by analysis of covariance. The model was adjusted for age, body mass index, smoking habits, highest education level, total annual family income, coffee intake, energy intake and moderate-to-vigorous physical activity participation as covariates. A Tukey post hoc test was performed to determine which groups were significantly different. Abbreviations: LDEB, low disinhibition eating behavior; HDEB, high disinhibition eating behavior. In men, $n = 23$ for short-duration sleepers, $n = 144$ for average-duration sleepers, and $n = 33$ for long-duration sleepers. In women, $n = 28$ for short-duration sleepers, $n = 189$ for average-duration sleepers, and $n = 50$ for long-duration sleepers. * $P < 0.05$ versus all other groups; ** $P < 0.05$ versus average- and long-duration sleepers; § $P < 0.05$ versus average-duration sleepers.

Discussion

Collectively, our results showed that sleeping less than 6 h a day was associated with greater alcohol intake and an increased risk of exceeding the guidelines for sensible weekly alcohol intake in adults. After further characterization of our participants, we observed that daily alcohol intake was significantly higher in short-duration sleepers with a high disinhibition eating behavior trait in both sexes. However, the prevalence of binge drinking was more common in men (17%) than women (6%), and men sleeping less than 6 h per night with a high disinhibited eating behavior trait were more likely to report binge drinking.

The finding of a higher alcohol intake associated with the combination of short sleep duration with disinhibited eating behavior is concordant with recent results showing that a high disinhibition eating behavior trait significantly increased the risk of overeating and gaining weight in adults with short sleep duration (Chaput, Després, et al., 2011). These observations are relevant because they contribute to explaining some of the inter-individual differences in dietary patterns and weight gain when people are experiencing chronic short sleep duration. Disinhibited eating behavior (tendency toward overeating and eating opportunistically) has received increased attention in the literature in recent years because of its association not only with increased weight and obesity, but also with mediating variables such as less healthy food choices (Bryant et al., 2008, Hays et al., 2002). However, the interaction between sleep duration and disinhibition with regard to alcohol consumption has never been observed previously, possibly because studies were looking particularly at “food” and not “drink” intake. The phenotype of “disinhibited short sleeper” seems more likely to consume more alcohol (both sexes) and to binge drink (men).

Disinhibited eating behavior trait represents a set of endurable characteristics that influence an individual’s eating behavior and food choices (Bryant et al., 2008). In our sample, women tended to have a slightly higher disinhibition trait than men, mainly in the 7- to 8-h sleeping group. This finding agrees with previous studies in the field (Carmody et al., 1995, Carmody et al., 1999). High disinhibition has also been found to be associated with a higher rate of alcohol consumption in men (Borg, Fogelholm, & Kukkonen-Harjula, 2004) and women (Contento et al., 2005, Higgs and Eskenazi, 2007). Binge drinking also seems to be more prevalent in men than women, as previously reported (Paradis et al., 2010). This drinking pattern is concordant with our present finding showing that the combination of short sleep duration with disinhibited eating behavior trait was related to a high prevalence (41%) of binge drinking occasions in men. Interestingly, a recent study in adolescents reported that impaired sleep was associated with a decreased reactivity in the ventral striatum, one of the primary reward centers of the brain, when anticipating and receiving a monetary reward (Holm et al., 2009). This suggests that a greater quantity of this reward may be required to create the same level of neural activation in these individuals. Future studies will be necessary to evaluate the directions of these relationships and to elucidate the interplay between sleep duration and alcohol intake with an adequate characterization of the participants.

Extensive epidemiological evidence suggests that a sleep duration of 7–8 h per night in adults is associated with the maintenance of good health (Bixler, 2009). Suboptimal sleep duration and poor sleep quality are becoming widespread in modern society (Matricciani et al., 2012, Van Cauter et al., 2008). A growing body of evidence shows that insufficient sleep is associated with

mental distress, depression, anxiety, impaired academic performance, weight gain, hypertension, diabetes, high cholesterol levels, premature death, and adverse health behaviors such as physical inactivity and poor eating habits (Chaput & Tremblay, in press). There is thus a need to more clearly understand the determinants and mechanisms involved in regulating sleep duration and patterns and to identify high-risk individuals who are in greater need of preventive strategies. Results of this study showed that obesity, cigarette smoking, low socio-economic status, disinhibited eating behavior, alcohol consumption, and moderate-to-vigorous physical activity participation were all associated with short sleep duration. However, short sleep duration was still associated with an increased in the odds of exceeding the guidelines for sensible weekly consumption of alcohol after adjustment for these covariates, suggesting that the relationship between alcohol intake and sleep duration was independent of these covariates and potential confounders.

Although we tried to minimize the potential confounding effects of several covariates, our results need to be interpreted in light of the following. First, the direction of causality cannot be determined from cross-sectional data; however, the characterization of a “disinhibited short sleeper” phenotype at risk of over-consuming alcohol is novel and can provide useful information on possible clustering of behaviors known to be associated with unfavorable health outcomes. Second, although good agreement has been found in previous studies between self-reported sleep durations and those obtained through actigraphic monitoring (Hauri and Wisbey, 1992, Lockley et al., 1999), the single question approach does not provide information on sleep quality. Third, the external generalizability of our findings may be restricted to adults of Western European descent. Finally, we also have to keep in mind the limitations of questionnaire-based assessments commonly used in epidemiological studies.

In summary, the present study provides evidence that a combination of short sleep duration with a disinhibited eating behavior trait is associated with greater alcohol intake in adults. These results are novel and emphasize the need to identify high-risk individuals who are in greater need of preventive strategies.

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