



Association between self-reported food intake and subjective sleep quality among truck drivers in a city in Southern Brazil



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ABSTRACT

Introduction: Sleep is an activity of great importance for maintaining the homeostasis of the human body and some components may interfere with the quality of sleep, including the pattern of food consumption. Truck drivers may constitute a population particularly sensitive to this association, since they are routinely exposed to situations that may interfere with food intake and sleep quality. Thus, this study investigated the association between self-reported food intake and sleep quality in truck drivers.

Methods: This was a cross-sectional study, with drivers who traveled in a city in southern Brazil. Food intake was evaluated through the average of food intake over the last 30 days. Food intake was evaluated in two forms: division in food groups and evaluation only tryptophan-rich foods. Sleep quality was measured by the Pittsburgh Sleep Quality Index (PSQI). In addition to the descriptive analysis, to identify possible associations between food intake and sleep quality, linear regression, crude and adjusted for confounding variables, were performed to obtain the Beta and Beta adjusted (Betaadj), respectively, and p-value.

Results: A total of 352 truck drivers, mostly males, mean age 48.4 (± 11.6) years, with a frequent consumption of meat, fruits, vegetables, sweets, and energy drinks participated in this study. The frequent consumption of dairy products (Betaadj: -0.614 . p-value 0.004) and fruits (Betaadj: -0.342 . p-value 0.034) was associated with lower PSQI score, while the consumption of energy drinks was associated with a higher PSQI score (Betaadj: 0.923. p-value <0.001). The frequency of consumption of tryptophan-rich foods was not associated with sleep quality.

Conclusion: Fruits and dairy products are associated with better subjective sleep quality, while energy drinks are associated with worse sleep quality in truck drivers, whereas dietary tryptophan-rich foods intake was not associated with sleep quality.

1. Introduction

Sleep is a biological activity essential for the homeostasis maintenance and can be explained as a voluntary paralysis to restore the cognitive and physiological processes. All animals have a similar pattern of sleep, adapted accordingly with the species. Among humans, the recommended pattern of sleep is between six and eight hours/night, for adults [1]. Sleep can be influenced by light/dark cycles and can be induced by adenosine saturation in the pre-frontal cortex [2], as by melatonin release, which usually occurs by the sunset, peaking at 9 pm [3].

The homeostatic functioning of sleep can be interfered by external causes [4], as work conditions and eating behaviors, that can be associated with a worse sleep quality [5–7]. In this sense, the environment and occupation to which individuals are exposed may present different factors that

are associated with eating and sleep-related behaviors, reason why aspects of lifestyle are highlighted in epidemiological investigations [7–11]. Considering the importance of occupational factors, some occupations, such as truck drivers, have their entire routine shaped by professional practice [12,13]. Truck drivers have a high workload, prolonged driving hours, insecurity in roads related to places to eat and rest [12,13]. These factors can make it difficult to adhere to healthy behaviors, as regularly sleep time and healthy food intake [12–14].

Shift workers, as truck drivers, that do not have work journeys which allow an adequate rest [6,15], may consume a smaller amount of some micronutrients, like thiamine, riboflavin, niacin, pyridoxine, folate and especially tryptophan [16], elements that can influence the brain and the sleep hygiene once they participate in the sleep induction [17,18]. It is known that some diet pattern, as the occidental diet, that is characterized

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by a high intake of simple carbohydrates, fat, red meat and low fiber content, are associated with a worse sleep quality [19,20]. Regardless of the work shift, most Brazilian truck drivers tend to have the three main meals of the day (breakfast, lunch and dinner), mainly in restaurants close to highways and at gas stations, with meals rich in calories and lipids [12,21]. In addition, most truck drivers sleep, at least once a week, in the truck, which exposes them to uncontrolled conditions, and normally not adequate, in terms of light, noise and comfort [13,21]. Although the association between diet and sleep quality is well established in other populations [7–11,22], in truck drivers the results are still mixed, with no consensus on which food groups may or may not be associated with this outcome [13,23].

Considering the strategic work carried out by truck drivers and the importance of studies that evaluate the sleep and eating behaviors of these workers, in addition to the exceptional characteristics whose truck drivers are exposed and the absence of information correlating how the food intake can influence the sleep quality of these professionals, this study evaluates the association between self-reported food intake (SFI) and subjective sleep quality in truck drivers.

2. Methods

This is a cross-sectional study, with truck drivers interviewed in a gas station and dry port, both located in a medium size city, in the north of the state of Paraná, Southern Brazil. The inclusion criteria were truck drivers who traveled more than 500 km a week and worked exclusively with cargo transportation. The exclusion criteria were participants who used vitamin and mineral supplementation in the 30 days before data collection and participants who reported sleep of less than four hours a night.

The sample size was calculated using the software Epi Info, with the StatCalc package, using a 5% error, 95% to confidence interval and prevalence estimative of 50%, considering an infinite population. Furthermore, anticipating 25% of refusals, it was planned to interview 481 truck drivers. The data collection occurred during February and May 2021, and the sample was selected by convenience, during the vespertine period, from Monday to Friday.

The dependent variable analyzed was the subjective sleep quality, measured using the Pittsburgh Sleep Quality Index (PSQI). The PSQI was composed for ten questions which assesses sleep quality in the past thirty days. This questions was organization in seven components, and each component receives a score between zero and three points with the same weight, ranging from zero to 21 points, with a cut point of more than 5 for poor sleep quality [24,25]. The independent variable was the SFI, obtained from the average of food frequency questionnaire, that contained forty types of food, divided into eight main groups: nuts, meats, vegetables, fruits, cereals and legumes, candies, breads and energetic drinks (Supplement 1) [26].

Also, tryptophan-rich foods were investigated by summing the food intake frequency of the following foods: meat, eggs, milk, cheese, potato, rice, wheat, oat, bean and soybeans. After summing the frequencies, a score from 0–10 points was obtained, with each point indicating the regular intake of at least one tryptophan-rich food.

The characterization variables were gender (female and male), cohabitation (without partner and with partner), education (up to incomplete high school and complete high school or more), monthly family income (up to a eight hundred dollars and a eight hundred dollars or more - based on the average exchange rate at the middle of the data collection period; 5 Brazilian Reais = 1 US Dollar), body mass index (BMI) (continuous variable), waist circumference (continuous variable) [27], chronotype [28] and practice of physical activity (yes and no). The BMI was obtained by dividing the self-reported weight by self-reported height squared. The waist circumference was obtained from the measurement of the smallest circumference above the umbilical scar, at the midpoint between the last rib and the iliac crest, with the participant standing, after a normal expiration [27].

The chronotype was obtained by a single question: "there are people who preferred to sleep earlier (until 10 p.m) and wake up earlier (mattutine) and people who preferred to sleep later (more than 12 a.m)

and wake up later. Which one do you think you look like most?". The answers were: "no doubt, mattutine", "more mattutine than vespertine", "more vespertine than mattutine" and "no doubt, vespertine" [7]. For analysis, the data were dichotomized in predominantly mattutine (no doubt, mattutine and more mattutine than vespertine) and predominantly vespertine (more vespertine than mattutine and no doubt, vespertine) [26].

The labor-related variables were the type of transported cargo in the last six months (perishable, not dangerous non-perishable, dangerous non-perishable and other product) [29]; the work shift (night shift predominantly, day and night equally and day shift predominantly); driving for more than six uninterrupted hours (never/rarely, sometimes and almost every time/every time), traffic accidents in the last twelve months (yes and no), week mileage (continuously) and time as truck driver (continuously).

After the data collection, the data were typed in duplicate and consolidated using the Epi Info (version 3.5.1) software and subsequently compared with correction of discrepant data. The data were analyzed using the SPSS (version 20) software. Descriptive analysis, absolute and relative frequency for categorical variables and mean and standard deviation for continuous variables were performed. To identify possible associations between food intake and sleep quality, linear regression, crude and adjusted for confounding variables, were performed to obtain the Beta (B) and Beta adjusted (Badj), respectively, confidence intervals at 95% (CI95%) and p-value. The adjusted model had the inclusion of the variables BMI, age (continuously), gender, monthly income, chronotype, physical activity practice and work shift.

The study was approved by the Ethic Comitee in Human Studies. The participants were oriented on the study objectives, and, for those who consented, it was presented the Informed Consent Form, which was subsequently signed and dated by the participant, before starting the interview.

3. Results

A total of 481 truck drivers were approached in the collection sites, of which 352 truck drivers fit the inclusion criteria. Most participants were male (97.2%), with average age of 48.4 (± 11.6) years, uncompleted high school (60.5%) and with monthly family income of less than eight hundred dollars (68.2%) (Table 1). The average weight of the participants was 88.7 kg (± 18.1 kg) and the average waist circumference was 103.2 cm (± 17.6 cm). The average BMI was 29.2 kg/m² (± 5.0 kg/m²). The PSQI score presented an average of 5,3 ($\pm 3,2$), ranging from 0 to 18.

The average time of profession was 20.8 years (± 12.1 years), and 62.2% reported driving predominantly during the day. The average week mileage was 2774.7 kilometers (± 1441.7 kilometers) and the mostly

Table 1
Sociodemographic, lifestyle and health characterization of truck drivers interviewed in a medium size city of Paraná state, southern Brazil, 2021 (n = 352).

Variables	n	%
Gender		
Male	342	97.2
Female	10	2.8
Cohabitation		
Without partner	100	28.4
With partner	252	71.6
Education		
Uncompleted high School	213	60.5
Complete high school or more	139	39.5
Monthly family income (in US dollar)		
<800	246	69.9
≥ 800	106	30.1
Practice of physical activity		
Yes	105	29.8
No	247	70.2
Chronotype		
Predominantly matutine	237	67.3
Predominantly vespertine	115	32.7

Table 2

Labor characterization of truck drivers interviewed in a medium size city of Paraná state, southern Brazil, 2021 (n = 352).

Variables	n	%
Type of transported cargo in the last month		
Perishable	117	34.2
Not dangerous non-perishable	176	51.5
Dangerous non-perishable	49	13.3
Work Shift		
Night shift predominantly	54	15.3
Day and night equally	79	22.4
Day shift predominantly	219	62.3
Driving for more than six uninterrupted hours		
Never/rarely	203	57.7
Sometimes	52	14.7
Almost every time/Every time	97	27.6
Traffic accidents over the last twelve months		
Yes	16	4.5
No	326	95.5

transported cargo was classified with not dangerous non-perishable (50.0%) (Table 2).

Regarding the SFI, it was noted that 89.5% of the truck drivers do not consume nuts with frequency, 66.5% eat more than four types of meat and 43.8% eat cereals and legumes frequently. About the bread and energetic drinks self-reported intake, 58.5% of the truck drivers referred eat one type of bread and 63.5% consume, at least, one type of energetic drink frequently. Among the fruits and vegetables intake, 42.6% of truck drivers referred to eat, at least, two types of fruits frequently, while 25.3% did not consume vegetables (Supplement 2). The food group with the highest daily consumption of portions was meat (3.5 ± 0.8), followed by cereals and legumes (3.2 ± 0.8) and vegetables (2.0 ± 1.5) (Table 3).

In the adjusted linear regression, the consumption of dairy products and fruits was associated with better sleep quality (lower PSQI score), with *Badj* -0.614 (p-value 0.004) and *Badj* -0.342 (p-value 0.034), respectively. The intake of energetic drinks was associated with worsening sleep quality (higher PSQI score), with *Badj* 0.923 (p-value <0.001) (Table 4). Candies and sugar beverages were associated with higher PSQI score in simple model. When adjusted, the data lost significance. Consumption of tryptophan-rich foods was not associated with sleep quality (Table 4).

4. Discussion

The profile of truck drivers was predominantly male, white, with partners and with a varied food consumption. The consumption of dairy products and fruits was associated with better sleep quality, while the consumption of energetic drinks was associated with worsening sleep quality. Consumption of tryptophan-rich foods was not associated with sleep quality.

The sociodemographic profile of the analyzed population was similar to that reported in other studies with truck drivers in Brazil [29,30] especially in relation to the predominance of males, with average age above 40 years, low education and overweight [29]. However, other studies have reported

Table 3

Characterization of self-reported intake by truck drivers interviewed in a medium size city of Paraná state, southern Brazil, 2021 (n = 352).

Self-reported Food Intake variables	Mean of daily portions	Standart deviation
Nuts	0.1	± 0.4
Meats	3.5	± 0.8
Dairy	1.0	± 0.8
Vegetables	2.0	± 1.5
Fruits	1.9	± 1.0
Cereals and legumes	3.2	± 0.8
Candies and sugar beverages	1.0	± 0.8
Bread	1.1	± 0.7
Energetic drinks	1.4	± 0.6

Table 4

Association between self-reported food intake and subjective sleep quality using the Pittsburgh Sleep Quality Index in continuous score, in truck drivers interviewed in a medium size city of Paraná State, southern Brazil, 2021. Bold highlights analyzes with statistical significance.

Self-reported food intake	Beta (CI 95%. p-value)	Beta adjusted* (CI 95%. p-value)
Nuts	-0.586 (-1.396; 0.223. 0.156)	-0.340 (-1.093; 0.413. 0.376)
Meat	-0.013 (-0.449; 0.422. 0.953)	-0.076 (-0.476; 0.323. 0.708)
Dairy	-0.813 (-1.255; -0.371. <0.001)	-0.614 (-1.034; -0.194. 0.004)
Vegetables	-0.206 (-0.439; 0.027. 0.083)	-0.077 (-0.296; 0.142. 0.492)
Fruits	-0.456 (-0.799; -0.112. 0.009)	-0.342 (-0.658; -0.025. 0.034)
Cereals and legumes	-0.057 (-0.516; 0.402. 0.807)	0.019 (-0.403; 0.441. 0.929)
Candies/Sugar Beverage	0.732 (0.295; 1.169. 0.001)	0.402 (-0.041; 0.846. 0.076)
Bread	-0.176 (-0.697; 0.346. 0.509)	-0.165 (-0.643; 0.313. 0.498)
Energetic drinks	1.039 (0.488; 1.590. <0.001)	0.923 (0.404; 1.442. <0.001)
Number of types of food rich in tryptophan consumed frequently		
Foods rich in tryptophan**	-0.262 (-0.529; 0.005. 0.054)	-0.193 (-0.437; 0.051. 0.122)

* Adjusted by age (continuous), gender, Body Mass Index (continuous), monthly family income chronotype, practice of physical activity and work Shift.

** Meats, eggs, milk, cheese, potato, rice, wheat, oat, beans and soybeans.

a work pattern with a higher percentage of truck drivers who drive for a longer time uninterruptedly and at night [30,31]. About the food consumption, truck drivers, in general, eat three or more types of meat, cereals and legumes regularly. The consumption of nuts was scarce, frequency similar in Brazilian population, in general [32]. Most of truck drivers did not consume variable fruits and vegetables. In the presented group of participants, it was observed high prevalence of meat, candies, sugar beverages and energetics drink intake, approaching the food pattern considered as Western Diet [33], which is characterized for a high intake of industrialized food, [16,34] rich in sugars and fat, and red meat, especially processed food [12,35].

The western diet, based on processed food, and, consequently, rich in sugar, may be associated, with a high intake of carbohydrates, to a worse sleep quality [36]. In this paper, there was no association with candies and sugar beverages and the sleep quality, using an adjusted analysis. Perhaps the absence of association in the participants is due to the work variables, which can attenuate the effects of this difference in food consumption and the meal timing, which can affect the sleep quality, as observed in some studies [37–39].

The time of food intake and sleep, therefore it was not observed, in the present study, statistical significance, may be a factor that can be negative associated with sleep regulation [40,41]. In general population, it was observed that people who, usually, consume food after 9 p.m. can have a worse sleep quality compared with those who consume their meals before 9 p.m. [28]. Changes in the food pattern, associated with higher intake of industrialized meals and lower intake of fruits and vegetables can be associated with a worse sleep quality. Associated with strenuous and stressful work conditions, like higher workloads (>12 hours/day) and shift work can be associated with worse sleep quality in general population [42]. In shift nurses, it was observed a higher intake of sweetened drinks and shorter period to have meals associated with worse sleep quality [43].

The SFI assessment showed a frequent intake of tryptophan, through the rich foods (meats, eggs, milk, cheese, potato, rice, wheat, oat, beans and soybean). In the present research, it was not found an association between the sleep quality and the SFI of food rich in tryptophan. However, there is evidence of a direct association of intake [44] (or supplementation) with sleep quality in adults (non-truck drivers) [45,46].

Indeed, this study showed an association between dairy and fruits consumptions and lower PSQI score in adjusted model. Even if it is impossible to elucidate the mechanisms of action of foods in sleep using the SFI, the literature indicates that, in non-truck drivers, a variable and diverse food intake may provide the adequate ingestion of vitamins and tryptophan, and, by then, corroborate with a better sleep quality. In the present population, once the consumption of foods rich in tryptophan was not associated with sleep quality, it is possible to speculate that the effects are mainly from other actions, such as, perhaps, the modulation of the intestinal microbiota [39], as promoted by the consumption of fruits [47], which is associated with smaller latency time (evaluated by PSQI) and the use of sleep medication [47–49].

In elderly people, the dairy consumption was associated with a better sleep quality (evaluated by PSQI), especially when the intake occurred at night [48]. In this research, the regular intake of dairy products was associated with better sleep quality, despite the period of the day of intake was not collected.

Meanwhile, the ingestion of energetic drinks was associated with higher PSQI score. In literature, the energetic drink effect in sleep is a bidirectional pathway because of caffeine [49]. Caffeine is a stimulant substance, that can act as an antagonist in the adenosine receptors in brain [18].

Therefore, it is impossible to know if the associations can be extrapolated to other populations, because of the labor conditions those population is exposed. It is known that shift workers can present a similar pattern of sleep and food intake [40,50,51], with a higher intake of energetic and sweetened drinks, even high-processed foods [41,43,52]. In this present research, it was not observed interactions between sweetened drinks and worse pattern of sleep.

As exposed, it is possible to refer that food can be an important *zeitberg*. It was observed that the food composition and the time the meal is consumed, can be important factors which interfere in sleep hygiene [53]. Aminoacids and high carbohydrate foods are associated with better and worse, respectively, sleep quality [41], so, if the sleep quality can be affected in general population, the result can be extrapolated for specific population, who suffered with other *zeitbergs* like shift work, stress and high caffeine intake [43,45,47,52].

The main limitation of the present research, since it is a thirty-day record, is the interviewee's memory bias. The convenience sample may also be limiting factors in this research. Nevertheless, the data collection was performed during a pandemic period, factors that can modify the intake behaviors of the participants [50,54]. Other limitation is the possibility of a bidirectional association between the study variables (food consumption and sleep quality). In addition, may have occurred interaction with other factors not observed in the study, such as the origin of the food (purchased or homemade), food availability in the places where the hikers ate, time of consumption of each food and the general conditions (luminosity, noise, comfort, etc.) for sleeping in the thirty days prior to the research. Among the study strengths are the broad investigation of foods consumed and the linear regression analysis adjusted by confounding variables, which reduce biases during the investigation. Therefore, it is perceived, that this research agrees with others studies conducted, regarding the self-reported food intake by truck drivers.

5. Conclusion

Truck drivers tend to have similar patterns of food intake as to shift workers, and it can be observed in this research that fruit and dairies intake was associated with better sleep quality, although the energetic drink consumption was associated with worse sleep quality. The tryptophan dietary intake was not associated with subjective sleep quality.

CRedit authorship contribution statement

Leticia Paviani: Conceptualization, data curation, Formal analysis, Investigation, writing–original draft, and Writing - review & editing. **Edmarlon Giroto:** Writing–review & editing. **Anne Cristine Rumiato:**

writing–review & editing. **Renne Rodrigues:** Conceptualization, Methodology, Formal analysis, writing–original draft, Writing - review & editing, and Supervision. **Alberto Durán González:** Conceptualization, Methodology, Formal analysis, Writing–original draft, Writing - review a& editing, and Supervision.

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dialog.2023.100098>.

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