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ORIGINAL ARTICLE

Correlation between anthropometric indicators and sleep quality among Brazilian university students*

CORRELAÇÃO ENTRE INDICADORES ANTROPOMÉTRICOS E A QUALIDADE DO SONO DE UNIVERSITÁRIOS BRASILEIROS

CORRELACIÓN ENTRE LOS INDICADORES ANTROPOMÉTRICOS Y LA CALIDAD DEL SUEÑO EN UNIVERSITARIOS BRASILEÑOS

Hérica Cristina Alves de Vasconcelos[1], Luciana Vládia Carvalhêdo Fragoso[2], Niciane Bandeira Pessoa Marinho[3], Márcio Flávio Moura de Araújo[4], Roberto Wagner Júnior Freire de Freitas[5], Maria Lúcia Zanetti[6], Marta Maria Coelho Damasceno[7]

ABSTRACT

The current study investigated the correlation between anthropometric indicators and sleep quality among Brazilian university students using the Pittsburgh Sleep Quality Index. A cross-sectional assessment with 702 university students was conducted between March 2010 and June 2011. Results showed that cases of obesity were more frequent among students who were good sleepers. On the other hand, overweight and high cervical and abdominal circumference was most prominent among poor sleepers. Thus, apart from the damage caused by sleep disorders alone, additional risks due to the association between poor sleep quality and being overweight, central obesity, and increased cervical perimeter are highlighted.

DESCRIPTORS

Sleep disorders
Students
Obesity
Adult health

RESUMO

Objetivou-se investigar a correlação existente entre indicadores antropométricos e a qualidade do sono de universitários brasileiros por meio do Índice de Qualidade do Sono de Pittsburgh. Estudo transversal, realizado com 702 universitários entre março de 2010 e junho de 2011. A correlação indicou que os casos de obesidade foram maiores entre os estudantes bons dormidores. Por outro lado, o sobrepeso e os valores elevados das circunferências cervical e abdominal predominaram entre os maus dormidores. Assim, além dos prejuízos ocasionados pelos distúrbios do sono isoladamente, ressaltam-se riscos adicionais devido à associação da má qualidade de sono com o sobrepeso, a obesidade central e a elevação do perímetro cervical.

DESCRITORES

Transtornos do sono
Estudantes
Obesidade
Saúde do adulto

RESUMEN

El objetivo de este estudio fue investigar la correlación que existe entre los índices antropométricos y la calidad del sueño en universitarios brasileños, a través del Índice de Calidad del Sueño de Pittsburgh. Estudio transversal, realizado en 702 estudiantes universitarios entre marzo de 2010 y junio de 2011. La correlación indicó que los casos de obesidad fueron mayores entre los estudiantes que dormían bien. Por otra parte, el sobrepeso y elevados valores de circunferencia cervical y abdominal fueron predominantes entre los que dormían poco. Así, además de los daños causados por los trastornos del sueño, aisladamente, se resaltan los riesgos adicionales debido a la asociación de la mala calidad del sueño con el sobrepeso, la obesidad central y el aumento del perímetro cervical.

DESCRIPTORES

Trastornos del sueño
Estudiantes
Obesidad
Salud del adulto

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[1] Nurse. PhD Student, Post-Graduate Course in Nursing, Federal University of Ceará. Professor of Nursing at the Rainha do Sertão Catholic Faculty. Fortaleza, CE, Brazil. hekinha@hotmail.com [2] Nurse. PhD Student, Post-Graduate Course in Nursing, Federal University of Ceará. Nurse at the Walter Cantídio University Hospital and São José Hospital. Fortaleza, CE, Brazil. luciana.vladia @hotmail.com [3] Nurse. PhD in Nursing. Professor of Nursing, Federal University of Maranhão. Imperatriz, MA, Brazil. marciofma@yahoo.com.br [4] Nurse. PhD Student, Post-Graduate Course in Nursing, Federal University of Ceará. 1st Assistant Professor of Nursing, Federal University of Piauí. Campus Floriano, PI, Brazil. robertowjff@globo.com [5] Nurse. PhD in Nursing. Associate Professor at the Ribeirão Preto Nursing School, University of São Paulo. Ribeirão Preto, SP, Brazil. zanetti@eerp.usp.br [6] Nurse. PhD in Nursing. Professor of the Post-Graduate Course in Nursing, Federal University of Ceará. Fortaleza, CE, Brazil. martadamasceno@terra.com.br [7] Nurse. PhD in Nursing. Professor of the Post-Graduate Course in Nursing, Federal University of Ceará. Fortaleza, CE, Brazil. martadamasceno@terra.com.br

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INTRODUCTION

In recent decades, the introduction of new technologies has transformed cultural habits and lifestyles among university students around the world. However, this has contributed to the development of sleep disorders among these young adults [1]. Although poor sleep quality is common among the elderly[2] and nightshift workers[3], recent research has shown that university students have also been affected, both nationally[4] and internationally[5].

In general, sleep disorders carry various implications including, but not limited to, a loss in quality of life, autonomic dysfunction, decreased academic and professional performance, and increased incidences of psychiatric disorders[4]. Moreover, sleep disorders are strongly associated with the appearance of cardiovascular disease[6], which can lead to early mortality. Further consequences include intolerance to glucose, higher cortisol levels during the night, and changes to sympathetic nervous system activity[7].

The aforementioned evidence suggests that the architecture and physiology of sleep is an active, complex, and necessary process for physical and cognitive health. However, the specific mechanisms involved in the association between sleep duration and mortality are unclear[7]. Thus, studies on the causal relationships between sleep, living conditions, and non-transmissible chronic diseases, especially among young adults, have been encouraged.

Researchers have already observed correlations between sleep disorders and anthropometric indicators, such as body mass index and abdominal and cervical diameter[8-11]. It is known that these indicators, when outside a healthy range, are also considered risk factors for non-transmissible chronic diseases. Therefore, it is important to investigate the association between these risk factors and sleep disorders to better understand the complications that arise.

Nevertheless, the majority of sleep disorder cases are associated with respiratory disorders, such a sleep apnea syndrome. Such disorders indirectly contribute to low quality sleep due to bouts of nighttime awakening and periods of somnolence during the day. However, studies investigating the association between anthropometric measures and direct assessments of sleep quality using specific instruments are scarce[11].

University students do not always develop healthy sleep habits. A large portion of this population has a decompensated lifestyle, replacing hours meant for sleeping with social activities associated with alcohol consumption and smoking[12]. Additionally, students tend to engage in supplementary academic activities, such as extracurricular internships, as well as scientific initiation and monitoring, which further contribute to reduced nighttime sleeping[4].

University students' sleep patterns are differentiated from the rest of the population in that same age group, making it important to identify the presence of irregularities so that health educational activities are promoted. Therefore, the current study was interested in investigating the correlation between anthropometric indicators and sleep quality among Brazilian university students using the Pittsburgh Sleep Quality Index (PSQI-BR).

> University students' sleep patterns are differentiated from the rest of the population in that same age group, making it important to identify the presence of irregularities so that health educational activities are promoted.

METHOD

A cross-sectional study was conducted between March 2010 and June 2011 at a public university in Ceará. At that time, 17, 228 students were enrolled at all campuses within the city of Fortaleza, distributed across six domains of study: humanities, exact sciences, agrarian sciences, health, and science and technology.

From this population, a simple random sample without replacement was calculated based on a formula for infinite populations. A percentage of 50% (P=50% and Q=50%) was adopted, given that this value provides a maximum sample size when a significance level (α=.05) and relative sampling error of 8% (absolute error=4%) are fixed. Thus, the sample size included 600 subjects. An additional 10% sample size increase was added due to the loss of information from some questionnaires. Overall, complete data were obtained from 702 university students.

The above sample was divided within each of the major areas of study at the institution. For participant selection, at least two undergraduate courses were chosen for convenience from each area of study. Within each course, students from different semesters were selected.

The inclusion criteria were age ≥18 years; being duly enrolled in undergraduate courses in a classroom mode; residing in Fortaleza, Brazil; having participated in both stages of data collection; and having a landline, cell phone, or e-mail for contact purposes. Those with any condition that would interfere with the measurement of anthropometric data, and those who were pregnant, were excluded.

Data collection took place between February and June 2011 and was performed by three nurses and three previously trained nursing students. Prior to data collection, meetings with the course coordinators and department heads were held in order to explain the objectives and research methodology. It should be noted that information about the study was advertised via message boards within the selected courses, student emails, and the university website. This was done in order to include students who were not in the classroom at the time of the first recruitment.

Data collection occurred in two phases. First, in the classroom, students answered a questionnaire assessing sociodemographic data and sleep quality. Sociodemographic data concerned students' identification and socioeconomic status. The Brazilian Economic Classification Criterion (CCEB) was used, as prepared by the National Association of Research Companies (ANEP); this measure has been widely disseminated in the literature. This measure aims to determine the purchasing power of individuals and urban families. No claim is made to characterize the population in terms of *social classes* but in terms of economic classes: A1 (30–34 points), A2 (25–29 points), B1 (21–24 points), B2 (17–20 points), C (11–16 points), D (6–10 points), and E (0–5 points)[13].

Sleep quality was assessed based on a translated version of the Pittsburgh Sleep Quality Index (PSQI), which evaluates the quality of sleep over the past month. This measure consists of ten questions that include seven components: subjective quality of sleep, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, daytime sleepiness, and disturbances during the day[14].

The maximum PSQI score is 21 points, determined by the sum of the seven components. Each component is given a score between zero and three points. These scores are then combined to generate an overall PSQI score; the higher the score, the worse the quality of sleep. An overall PSQI score > 5 points indicates that the individual has difficulties in at least two components or moderate difficulties in more than three components. In the end, it is common to classify subjects into two groups: good (PSQI<5) and poor sleepers (PSQI>5)[14].

At a later date, the university students were invited to partake in the second phase of the study, in which the following anthropometric data were measured: weight, height, and abdominal and cervical circumference. Weight was obtained during a single measurement with the students standing barefoot on a scale (capacity of 150 kg with a precision of 0.1 kg) while wearing light clothing. Height, also obtained in a single measurement, was checked with a measuring tape that included a 0.5 cm scale. To ensure accurate height measurements, respondents were asked to stand erect and motionless, hands flat on their thighs, and heads adjusted to the Frankfurt plane.

From the height and weight measurements obtained, body mass index (BMI) was calculated, defined as the ratio between weight (kg) and squared height (m). Students with BMI values ranging from 25.0 to 29.9 kg/m^2 were considered overweight, and those with a BMI≥30 kg/m^2[15] were considered obese.

Abdominal circumference (AC) was measured with an inelastic measuring tape placedover the skin. While students stood upright, circumference was taken at the midpoint between the last rib and the upper edge of the iliac crest at the end of the expiratory movement. Values ≥ 102 cm and ≥ 88 cm among men and women, respectively, were considered to be high[16].

Neck circumference (NC) was also measured using an inelastic measuring tape. Participants were asked to stand erect with their head positioned in the Frankfurt horizontal plane, eyes facing forward. The measuring tape was positioned just below the top edge of the laryngeal prominence, being applied perpendicularly along the axis of the neck and measured at the midpoint[10]. For male participants, the measurement was performed just below the Adam's apple. Cutoff values were set at ≥ 39 cm for men and ≥ 35 cm for women[17].

Data were entered three times in an Excel worksheet and then exported into STATA version 8.0 statistical software. Data analysis consisted of validating the internal consistency of the information entered and calculating measures of central tendency based on a 95% confidence interval. To investigate differences between proportions of characteristics under analysis, Pearson's Chi-squared or Fisher's exact tests were used (when necessary). To examine the relationship between anthropometric variables and sleep quality, Spearman's linear correlation (rs) and the Mann-Whitney tests were used.

The current study was submitted to the Human Research Ethics Committee of the Health Sciences Center, Federal University of Ceará, and approved according to protocol 208/2010. All ethical aspects concerning human research were followed.

RESULTS

702 university students within 24 undergraduate courses at the educational institution participated in the study. Most students were women (62.6%). Subjects' mean age was 21.5 years (SD±4.5 years) with an asymmetrical distribution to the right (Kolmogorov Sminorv with p<.001). 50.6% of respondents reported being of mixed race, and 36.1% reported being Caucasian (Table 1).

The percentage of students within each academic area was equivalent. A predominant number of students were in their third (20.8%) and first semesters (19.5%).

The socioeconomic status was attributed to unmarried university participants (93%) who still lived with their parents (71.2%) and were full-time students without other employment (65.2%). A significant portion of the students' families belonged to income classes C (39.6%) and B (39.7%) and lived with an average monthly income of R$ 3,206 reais (SD ± 376 reais). When taking into account the minimum wage value, this variable showed an asymmetric distribution to the right (Kolmogorov Sminorv with p <.001), with a predominance of individuals living with a monthly family income of six or more minimum wages (39.2%). 15% of the sample did not provide income data (Table 1).

Table 1 – Sociodemographic characteristics of university students by gender - Fortaleza, CE, Brazil, 2011

Characteristics	Total n (%)	Gender				p-value[b]
		Men 262 (37.4)		Women 439 (62.6)		
		n	(%)	n	(%)	
Age group (years) (n=696)						0.506
18 to 20	350 (50.3)	137	52.2	213	49.0	
21 to 25	283 (40.7)	102	38.9	181	41.7	
26 to 30	42 (6.0)	13	4.9	29	6.6	
31 and older	21 (3.0)	10	3.8	11	2.5	
Marital status (n=682)						
Married/Partnership	42 (6.0)	11	4.2	31	7.0	
Single	648 (93.0)	246	95.3	402	91.5	
Widow	2 (0.3)	-	-	2	0.4	
Separated	5 (0.7)	1	0.3	4	0.9	
Color (n=682)						0.883
White	246 (36.1)	8	34.6	158	36.9	
Black	53 (7.8)	21	8.2	32	7.4	
Mixed race	345 (50.6)	132	51.9	213	49.7	
Yellow	38 (5.6)	13	5.1	25	5.8	
Economic classification (n=698)						0.525
A	74 (10.6)	33	12.6	41	9.3	
B	277 (39.7)	105	40.2	172	39.3	
C	277 (39.7)	98	37.5	179	40.9	
D and E	70 (10.0)	25	9.5	45	10.3	
Family income[a] (minimum wage) (n=596)						0.185
Less than 1 MW	24 (4.0)	13	5.8	11	2.9	
1 to 3 MW	198 (33.2)	70	31.6	128	34.1	
4 to 5 MW	140 (23.5)	46	20.8	94	25	
Higher than 5 MW	234 (39.3)	92	41.6	142	37.8	
Work status (n=696)						**0.001**
Only studies	454 (65.2)	149	57.3	305	70	
Studies and works informally	126 (18.1)	60	23	56	12.8	
Studies and works formally	116 (16.7)	51	19.6	75	17.2	
Who the student lives with (n=694)						0.723
Alone	20 (2.9)	183	70.3	311	71.6	
Parents	494 (71.2)	45	17.3	73	16.8	
Relatives (siblings, uncles/aunts, cousins)	118 (17.0)	11	4.2	16	3.6	
Partner	35 (5.0)	11	4.2	24	5.5	
Friends	27 (3.9)	10	3.8	10	2.3	

[a]The minimum wage at the time of the study was R$ 545.00; [b]Pearson's Chi-square test; [c](n=702).

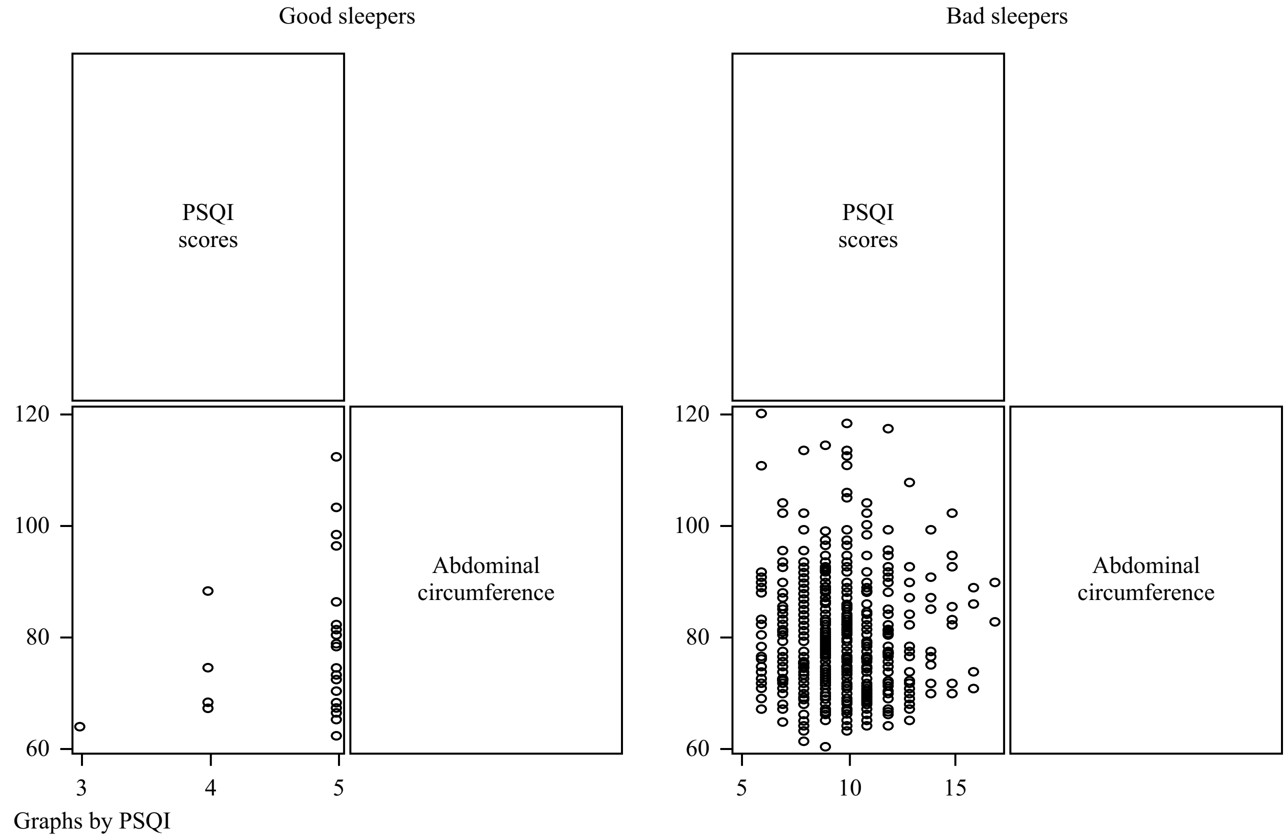

Figure 1 – Correlation between PSQI scores and abdominal circumference - Fortaleza, CE, Brazil, 2011

Stratification of BMI results by gender showed that the groups differed significantly (p<.001); women had higher rates of low (6.2%) and normal weight (74.7%), whereas men had higher percentages of overweight (32.4%) and obese (7.6%).

Regarding anthropometric data, AC, NC, weight, and height averages of 79.1 cm (SD±25.5 cm), 33.7 cm (SD±3.3 cm), 64.1 kg (SD±13.7 kg), and 1.65 cm (SD±0.9 cm) were found, respectively. All anthropometric measurements showed asymmetrical distributions to the right, as follows: weight, BMI, AC, NC (Kolmogorov-Sminorv with p<.000), and height (Kolmogorov-Sminorv with p<.021).

After analysis of the seven PSQI components, we observed that a higher proportion of university students (95.2%) had poor sleep quality (PSQI>5). Overall, the average PSQI score obtained was 9.4 (SD±2.2 points).

The relationship between BMI and the PSQI revealed that the proportion of obese people in the sample was higher among good sleepers (6.1%), while overweight people were more frequent among poor sleepers (22%). On the other hand, the proportion of individuals with normal weight was equal in both groups, and the proportion of individuals of a low weight was twice as high among good sleepers (12.1%) (p=.089).

Comparisons were also made between AC and NC and sleep quality using the Mann-Whitney test. Poor sleepers showed higher a NC (33.8 SD±3.5 cm) than students who slept well. However, this difference was not statistically significant (p=.159). There was also no statistically significant association between quality of sleep and AC (p=.421).

Associations were also assessed between AC and NC and PSQI scores. Figure 1 shows that the relationship between AC and the PSQI among good sleepers was positive and weak (ρ=.209; p=.241) and negative and weak (ρ=-.033; p=.382) among bad sleepers.

As with AC, the relationship between PSQI scores and NC was also positive and weak among good sleepers, (ρ=.026; p=.885) and negative and weak among poor sleepers (ρ=-.070; p=.070) (Figure 2).

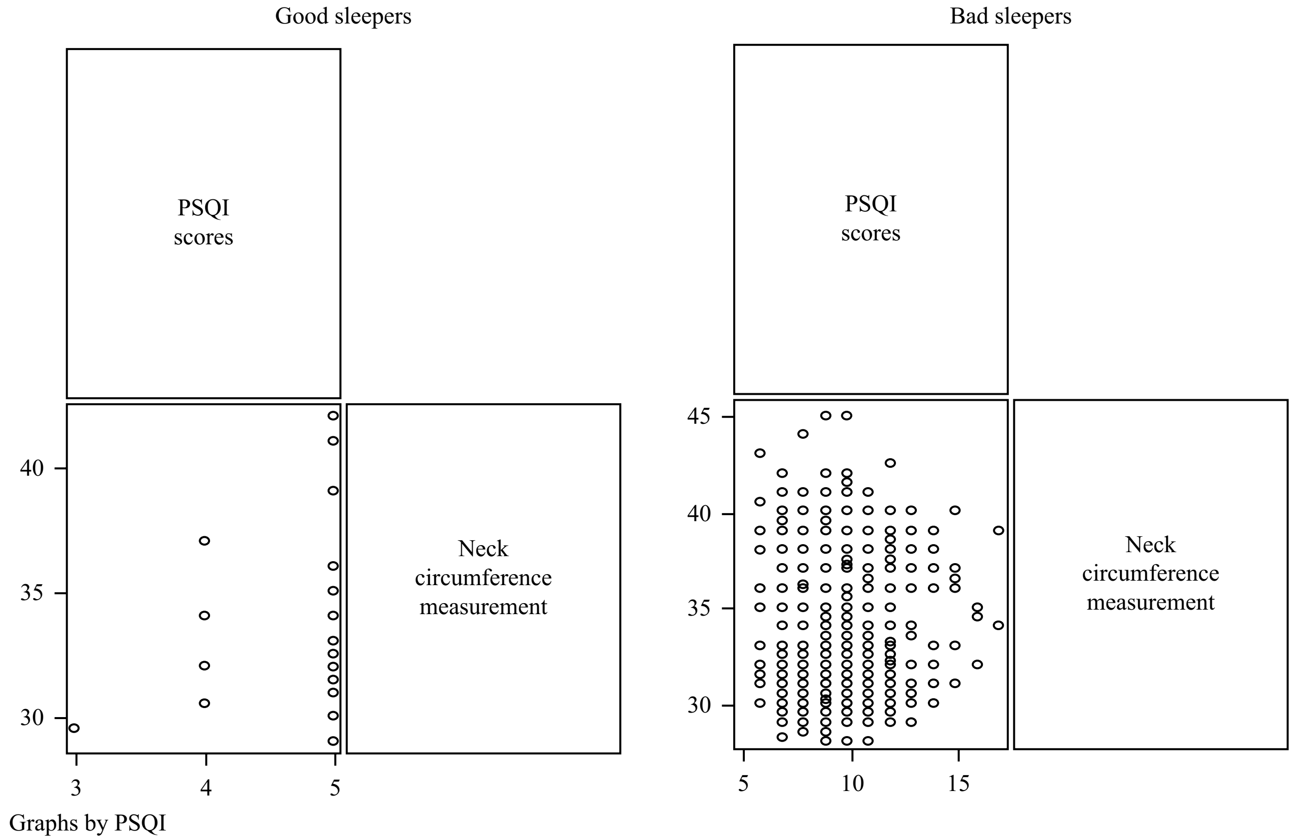

Figure 2 – Correlation between PSQI scores and neck circumference measurement - Fortaleza, CE, Brazil, 2011

DISCUSSION

The current study consisted of a 702-student sample with a mean age of 21.5 years. Similar age ranges have been observed among university samples from other studies[18]. This sample allowed for the assessment of relationships with individuals who were predominantly unmarried, living with their parents, and full-time students.

Regarding the classification of students concerning BMI, a prevalence of excess weight (overweight and obese) was observed among males, while women were classified as underweight and at a normal weight. Most of the participants were female and belonged to income classes B and C. Thus, the low prevalence of overweight women in this study may be related to past research suggesting that the quest for a lean body is very common among women belonging to more favored social classes[19].

In addition to measures of weight and height to calculate BMI, students also had their AC and NC anthropometric data values quantified. The average AC was 79.1 cm. Although differences between genders were not taken into account, the calculated averages suggest that the students were within normal standards[16]. Values not only higher than the ones observed in the current study, but also outside the normal limits for both genders, have been revealed in other studies[10,20].

A study conducted in Rio de Janeiro with 40 university students found that 15% of the students showed increased AC[21]. Meanwhile, a study with 605 students from the Federal University of Piauí detected abdominal obesity in only 2.4% of students[22].

Furthermore, the current sample had an average NC of 33.7, also within a healthy range. Past studies have shown lower[11], similar[17], and higher[8] NC values.

Researchers say that youth is a critical period for the development of cardiovascular risk factors while recommending interventions to avoid unfavorable outcomes in adulthood[23]. The detection of overweight and elevated abdominal and cervical circumferences among university students becomes especially important due to the lifestyle led by this population. These individuals often leave the comfort of their homes and start living alone or with colleagues, begin unhealthy food habits, do not eat during correct times, and work or study at night. This lifestyle leads to eating in a more practical way, with canned and fried foods; this facilitates excess weight and increased adiposity and body perimeters[24].

The evaluation of sleep quality among students was also possible via the PSQI[14]. We found that about 95% of the students were classified as bad sleepers, as found in other studies using the PSQI[11], as well as when other classifications are employed[8].

No statistically significant association between gender and sleep quality among students was found in this study, similar to that of most previous studies [1,4-5].

The neurobiological processes that occur during sleep are necessary for the maintenance of physical and cognitive activity. Disorders associated with poor sleep quality can impair performance in school, work, and with family and social relationships. Sleep disorders are also associated with an increased risk of accidents[25]. Therefore, university students who lack adequate sleep quantity and quality may see learning and academic performance affected as a result. This can predispose this population to cognitive and psychosomatic problems[12].

When assessing associations between anthropometric data and sleep quality among university students, it was apparent that poor sleepers showed higher BMI, AC, and NC values as compared to good sleepers. Nevertheless, when relating AC and NC measurements with PSQI scores, all relationships were negative among individuals classified as bad sleepers. This leads to the conclusion that, as PSQI scores increase (i.e., when there is a worsening in quality of sleep) anthropometric measurement values tend to decrease, with no association or statistically significant correlation with PSQI scores.

Despite this, in a consulted systematic review, there was a consensus that the duration and quality of sleep were independently related to human cardiometabolic risk. This occurs through the development of problems such as obesity, DM 2, hypertension, dyslipidemia, issues associated with Metabolic Syndrome, and vascular failure markers[26].

In addition to the damage caused by sleep disorders alone, additional risks exist due to the association between these disorders and poor sleep quality with obesity, central obesity, and other anthropometric data.

A review of the literature on the relationship between sleep and obesity presented at least eight studies that correlate short duration of sleep time with increased BMI within different populations[27]. Elevated BMI and AC values associated with poor quality of sleep have been found elsewhere[8-9]. Although less significant, associations have also been found between elevated NC and the presence of disorders related to sleep, which can contribute to poor quality[11,17].

CONCLUSION

This study investigated the correlation between anthropometric indicators and sleep quality among Brazilian university students using the PSQI-BR. Most participants were classified as bad sleepers. The relationship between BMI and the PSQI showed that overweight individuals were more frequent among bad sleepers, who also showed NCs larger than those of students who slept well; however, this relationship was not statistically significant. Results were similar when assessing relationships with AC.

Although no statistically significant differences were detected between the anthropometric measurements and the PSQI, healthcare professionals are advised to pay special attention to university students during early clinical stages, considering the high chance of therapeutic success and decreased prevalence of several cardiometabolic problems in the future.

Since this is a relatively new area of study, one limitation of this research is the scarcity of relevant literature on the subject, preventing a more detailed analysis of the results. Therefore, new studies are needed to clarify the real influence of these anthropometric measurements on sleep quality.

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Correspondence addressed to: Hérica Cristina Alves de Vasconcelos
Rua Zuca Acioly, 633 – Apto. 201 Bl H, Dunas
CEP 60191-335 – Fortaleza, CE, Brazil