

Excessive daytime sleepiness in the elderly: association with cardiovascular risk, obesity and depression

Sonolência diurna excessiva em idosos: associação com risco de disfunção cardiovascular, depressão e obesidade

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Conflict of interests: nothing to declare.

Abstract

Objective: To observe the relationship between Excessive Daytime Sleepiness (EDS) and the presence of risk factors for cardiovascular dysfunction, depression and obesity in the elderly. **Methods:** We interviewed 168 elderly from the community of Campina Grande, Paraíba. They were selected according to health districts in the period of 2010. We used the Epworth Sleepiness Scale to diagnose excessive daytime sleepiness (> 10 points); waist circumference for the risk of cardiovascular dysfunction (> 94 or > 80 cm); Geriatric Depression Scale for depression (>10 points) and body mass index for obesity (> 25 kg/m²). Association analysis was performed by the Chi-square test adjusted for sex and age group, adopting $\alpha \leq 0.05$. **Results:** One hundred and sixty eight elderly individuals with mean age of 72.34 ± 7.8 years old participated in this study, being 122 (72.6%) women. EDS was identified in 53 (31.5%) of them; depression, in 72 (42.9%); overweight/obesity, in 95 (64.46%); and risk of cardiovascular dysfunction, in 129 (79.6%). Depressed men (78.6%, $p = 0.0005$) and risk of cardiovascular dysfunction (57.1%, $p = 0.02$) were more prone to EDS. In women, only obesity was related to sleepiness (42.1%, $p = 0.01$). Only those aged between 70 – 79 years old showed association between sleepiness and obesity. **Conclusion:** It was found that obesity for women, and depression and cardiovascular dysfunction risking for men were associated with EDS in the elderly. The variable sex is a confusion condition for the association with sleepiness.

Keywords: Sleep. Disorders of excessive somnolence. Aged. Obesity. Cardiovascular diseases. Depression.

Objetivo: Observar a relação entre a Sonolência Diurna Excessiva (SDE) e a presença de fatores de risco de disfunção cardiovascular, depressão e obesidade em idosos. **Métodos:** Foram entrevistados 168 idosos comunitários em Campina Grande, Paraíba. Eles foram selecionados aleatoriamente de acordo com os distritos sanitários no ano de 2010. O diagnóstico da sonolência diurna excessiva era dado pela Escala de Sonolência de Epworth (> 10 pontos), risco de disfunção cardiovascular pela circunferência da cintura (> 94 ou > 80 cm), a depressão pela Escala de Depressão Geriátrica (> 10 pontos) e a obesidade através do índice de massa corpórea (> 25 kg/m²). Foi realizada análise de associação por meio do Teste do χ^2 com ajustamento para o sexo e a faixa etária, adotando-se um $\alpha \leq 0,05$. **Resultados:** Participaram 168 idosos com média de idade de 72,34 ± 7,8 anos, sendo 122 (72,6%) mulheres. A SDE foi identificada em 53 (31,5%) idosos, depressão em 72 (42,9%), sobrepeso/obesidade em 95 (64,46%) e risco de disfunção cardiovascular em 129 (79,6%). Homens depressivos (78,6%; $p = 0,0005$) e com risco de disfunção cardiovascular (57,1%; $p = 0,02$) estavam mais propensos a apresentar SDE. Nas mulheres, apenas a obesidade mostrou-se relacionada com a sonolência (42,1%; $p = 0,01$). Somente idosas entre 70 - 79 anos apresentaram associação entre sonolência e obesidade. **Conclusão:** Verificou-se que a obesidade em mulheres, depressão e risco de disfunção cardiovascular em homens revelaram associação com a SDE em idosos. A variável sexo é uma condição de confundimento para as associações com a sonolência.

Palavras-chave: Sono. Distúrbios do sono por sonolência excessiva. Idoso. Obesidade. Doenças cardiovasculares. Depressão.

Excessive daytime sleepiness (EDS) is characterized by the increased need to take naps during the day at times when the individual should be alert and active¹. It is subjacent to sleep fragmentation and its reduced efficiency^{2,3}, composing the scope of symptoms of sleep respiratory disorders, such as the Obstructive Sleep Apnea Syndrome (OSAS). However, there is evidence that EDS is not only a result of OSAS, since it can be an independent variable of this disease⁴. For these cases, it is possible that obesity⁴⁻⁶, the metabolic syndrome^{4,7}, heart diseases⁸⁻¹⁰, and depression¹¹⁻¹³ can be related to EDS.

There is an association between EDS and the changes in the autonomic cardiovascular control, which could predispose to heart disease¹⁴. Empana et al.⁹ observed that EDS influenced the 33% increase in the risk of death for heart disease among the elderly, thus indicating to be an independent cardiovascular risk factor. Studies show that the reduced sleep duration can also be involved in the increased mortality due to cardiovascular dysfunction^{2,8,10}. The risk for this condition can be indirectly estimated by waist circumference¹⁵.

Psychiatric disorders also presented association with EDS, especially depression^{11,16}, since this condition is considered to be a major public health issue among the elderly¹⁷. Jaussent et al.¹⁸ observed that the EDS is an independent risk factor for the occurrence of depression. Chellapa and Araújo¹² found a strong association between EDS and severe depression. Lessov-Schlagga et al.¹¹ verified a relationship between depression symptoms and EDS among men. On the other hand, Calati et al.¹³ did not find any association between depression and EDS among women.

There seems to be an association between obesity and EDS^{4-7,19}. Vorona⁶ observed that individuals with overweight/obesity slept less than people with BMI lower to that established by the World Health Organization. Carmelli et al.²⁰ verified the correlation between obesity and EDS among twins. Other researchers observed that, regardless of sleep duration, male elderly with increased BMI presented decreased slow-wave sleep²¹.

Several studies have shown that EDS is an independent risk factor for accidents² and mortality for heart disease⁹, and, when associated to respiratory sleep disorders it increases general mortality among the elderly²³. Therefore, it is necessary to observe to what point the presence of EDS is affected by or affects variables such as obesity^{6,7}, depression¹¹ and cardiovascular morbidity⁸⁻¹⁰; this theme is widely discussed in literature, and there is disagreement among specialists.

We conducted this study with an elderly population with the objective of assessing possible associations between EDS and obesity, depression and risk of cardiovascular dysfunction, and also to find out if these relations are different among men and women or in relation to aging.

Methods

Study design and variables

It is a cross-sectional population-based study carried out in the city of Campina Grande, Paraíba, in 2010, including elderly inhabitants of the urban zone. Individuals from the community aged more than 60 years old with mental and physical skills to perform the assigned tests were included. Elderly in institutional environment and unskilled to answer to the methodologies of the study were excluded from the research.

EDS was diagnosed by the Epworth Sleepiness Scale. EDS was diagnosed by more than 10 points in that scale²⁴. The depression diagnosis was determined by the Geriatric Depression Scale, which classified as medium depression scores from 11 to 20, and moderate/severe depression scores higher than 21 points²⁵. BMI was an indicator of nutritional status: values lower than 18.4 kg/m² are considered as low weight; between 18.5 and 24.9 kg/m², eutrophy; between 25 and 29.9 kg/m², overweight; and 30 kg/m² or higher, obesity^{26,27}.

The risk of cardiovascular dysfunction was estimated by waist circumference, in which for men values between 94 and 101 were classified as increased, and values higher than 102 cm were substantially increased;

for women, values from 80 and 87 cm were considered as increased and those higher than 88 cm were considered as substantially increased^{27,28}. Gender and age of the participants were also collected as identification.

Height was measured in centimeters by a wall-mounted stadiometer from WISO[®], with 0.1 cm precision, while the mass of the elderly participants was measured by a GEOM[®] digital scale, with 150 kg capacity and 100 g precision. Finally, waist circumference was measured by a non-elastic metric tape in the mid-region between the last rib and the iliac crest²⁸. All of the anthropometric measures and the application of the instruments were conducted by trained students of the Physical Therapy and Psychology courses, and the concordance of measurements was estimated.

Population and Sample

This study was part of a larger project that aimed at estimating the prevalence of EDS; therefore, the obtainment of an ideal sample was based on the following equation: $\{[\mu^2 \times p(1-p)] \times c\} / \varepsilon^2$, where μ is the confidence limit for a 5% probability error ($\mu = 1.96$), p is the estimated outcome prevalence ($p = 20\%$), c is the correction coefficient of the sample ($c = 1.2$), considering that it is a conglomerate sample, and ε is the margin of error of the estimates for estimated prevalence ($\varepsilon = 6\%$). Therefore, the estimated sample is comprised of 205 participants. Besides, the elderly population of the city of Campina Grande, Paraíba, was considered to be infinite.

The sample was proportional to the population of elderly individuals of each health district of the urban zone of the city of Campina Grande, Paraíba. Elderly participants were randomly selected in the four health districts. In each district, one Basic Family Health Unit was sorted out. The streets of these selected units were analyzed from one end to another, in both sides, skipping nine houses from the corner chosen to be the starting point, similarly to the method used by the Brazilian Institute of Geography and Statistics (IBGE) for random distribution. Such alternation is given by the ratio between the total number

of households in the neighborhood and the number of elderly people to be visited. In case there were no elderly people in the selected household, the next house should be verified and, if necessary, the previous one. If there was more than one elderly person in the house, data collection was conducted with all of them.

Statistical Analysis

In order to analyze the relationship between EDS and depression, overweight/obesity and risk factor for cardiovascular dysfunction, the Pearson chi-square Test was used in 2x2 contingency situations and linear association, when contingency presented an ordinal characteristic. There was also adjustment for gender and age group (60 - 69 years old, 70 - 79 years old, and 80 years old or more), in the attempt to verify any influence of these variables on the relationship between EDS and overweight/obesity, depression and increased and substantially increased waist circumference. Therefore, a 5% significance level was adopted in order to avoid the type I error. The Statistical Package for the Social Sciences (SPSS), version 17.0, was used.

Ethical Procedures

The study was approved by the Ethics Committee of Universidade Estadual da Paraíba, based on Resolution n. 196/96 of the National Health Council, with protocol 0299.0.133.000-09. The participants signed duplicates of the Informed Consent Form, which explicated the objectives of the research and those in charge of it. The authors declared there was no conflict of interests.

Results

EDS was prevalent in 53 cases (31.5%; 95%CI; 27.9 - 35.0) among the 168 analyzed elderly people, which represent 81.9% of the estimated sample. The obtained loss is a result of refusals to participate in the study. Age ranged from 60 to 98 years old, mean of 72.34 ± 7.8 years, and 122 (72.6%) were women. Depression affected 72 participants (42.9%; 95%CI; 39.1 - 46.7). BMI was higher than 25 kg/m² in 95 patients (64.6%; 95%CI; 60.9-68.3). Waist circumference was increased in 129 members of the sample (79.6%; 95%CI; 76.4 - 82.7) (Table 1).

Table 2 presents the crude association between study variables and EDS. There was no difference in the frequency of depression

Table 1 - Prevalence of Excessive Daytime Sleepiness, depression, obesity and increased waist circumference in the elderly.

Tabela 1 - Prevalência de Sonolência Diurna Excessiva, depressão, obesidade e circunferência da cintura aumentada em idosos.

Variables	n (%)	95%CI
Excessive Daytime Sleepiness		
Absent	115 (68.5)	75.5 - 61.4
Medium	36 (21.4)	18.2 - 24.5
Moderate/Severe	17 (10.1)	7.7 - 12.4
Depression		
Absent	72 (57.1)	64.5 - 49.6
Light	64 (38.1)	34.4 - 41.8
Moderate/Severe	8 (4.8)	3.3 - 6.3
BMI		
Low weight	4 (2.3)	4.56 - 0.01
Eutrophy	48 (28.5)	35.3 - 21.6
Overweight	49 (33.3)	29.7 - 36.9
Obesity	43 (31.3)	27.8 - 34.8
Waist circumference		
No risk	39 (20.4)	23.5 - 17.3
Increased risk	30 (18.5)	15.5 - 21.4
Substantially increased risk	99 (61.1)	57.4 - 64.8

BMI: Body mass index; 95%CI: Confidence interval 95%.

BMI: índice de massa corpórea; 95%CI: Intervalo de confiança de 95%.

among the elderly with EDS (50.1%) and without EDS (39.1%). Elderly with BMI higher than 30 kg/m² presented more prevalence of EDS than those with BMI below this threshold ($p = 0.03$), being 42.6% of obese people, which means 2.5 times more risk of developing EDS. The increased or substantially increased cardiovascular dysfunction was associated with the occurrence of EDS: elderly with EDS had 2.07 times more chances of having cardiovascular risk.

After gender adjustment, it was observed that depression is a variable associated with EDS only among men [11 (78.6%) and 9

(21.4%); $p = 0.005$], being depression 3.6 times more prevalent among the elderly with EDS (Table 3). Women presented relationship between obesity and occurrence of EDS [16 (42.1%); $p = 0.01$]. The increased or substantially increased waist circumference was associated with EDS only among male participants [16 (57.1%); $p = 0.02$] (Tabela 3).

Age group adjustment (data not shown) revealed association between overweight [7 (41.2%)] and obesity [10 (62.5%)] and EDS among the elderly women aged from 70 to 79 years old ($p = 0.02$); age group had no influence on the other found associations.

Table 2 - Association of Excessive Daytime Sleepiness with depression, body mass index and waist circumference in the elderly.
Tabela 2 - Associação da Sonolência Diurna Excessiva com a depressão, índice de massa corpórea e circunferência da cintura em idosos.

Variables	Excessive Daytime Sleepiness		χ^2 (df)	p-value
	Without (%)	With (%)		
Depression			4.83 (2)	0.08
Absent	70 (60.9)	26 (49.1)		
Medium	38 (33)	26 (49.1)		
Moderate/Severe	7 (6.1)	1 (1.9)		
BMI			4.34 (1)	0.03
Low weight	4 (4)	0		
Eutrophy	35 (35)	13 (27.7)		
Overweight	35 (35)	14 (29.8)		
Obesity	26 (26)	20 (42.6)		
Waist circumference			3.98 (1)	0.04
Increased/substantially increased risk	83 (75.5)	46 (88.5)		
No risk	27 (24.5)	6 (11.5)		

df:degree of freedom; BMI: body mass index.

df: grau de liberdade; BMI: índice de massa corpórea.

Table 3 - Association of Excessive Daytime Sleepiness with depression, body mass index and waist circumference in elderly sex adjusted.

Tabela 3 - Associação da Sonolência Diurna Excessiva com a depressão, índice de massa corpórea e circunferência da cintura em idosos ajustado de acordo com o sexo.

Variables	Excessive Daytime Sleepiness							
	Male				Female			
	Without (%)	With (%)	χ^2 (df)	p-value	Without (%)	With (%)	χ^2 (df)	p-value
Depression			10.41 (2)	0.005			0.82 (2)	0.66
Absent	22 (71.0)	9 (29.0)			48 (73.8)	17 (26.2)		
Medium	3 (21.4)	11 (78.6)			35 (70.0)	15 (30)		
Moderate/Severe	1 (100.0)	0			6 (85.0)	1 (14.3)		
BMI			0.12 (2)	0.93			6.7 (3)	0.01
Low weight	0	0			4 (100.0)	0		
Eutrophy	8 (57.1)	6 (42.9)			27 (79.4)	7 (20.6)		
Overweight	8 (57.1)	6 (42.9)			27 (77.1)	8 (22.9)		
Obesity	4 (50.0)	4 (50.0)			22 (57.9)	16 (42.1)		
Waist circumference			4.84 (1)	0.02			2.05 (1)	0.15
Increased/substantially increased risk	12 (42.9)	16 (57.1)			71 (70.3)	30 (29.7)		
No risk	13 (76.5)	4 (23.4)			14 (87.5)	2 (12.5)		

df:degree of freedom; BMI: body mass index.

df: grau de liberdade; BMI: índice de massa corpórea.

Discussion

In this study, male elderly participants with depression and increased waist circumference had more prevalence of EDS. Elderly obese women were associated with EDS only for the age group of 70 – 79 years old. In this population study with elderly people living in a country city of Northeast Brazil, it was possible to find: high prevalence of depression, overweight/obesity and increased waist circumference, which are known as a risk factor for cardiovascular disease¹⁵.

EDS is a public health issue. This condition is an independent risk factor for morbidity and mortality resulting from cardiovascular disease⁹, as well as general mortality²³. There are reports that both the reduction and the excessive sleep can increase the risk of mortality due to cardiovascular disease^{8,10}. In this study, the increased circumference, which is an indirect measurement of the risk for cardiovascular dysfunction, was associated with EDS, and was observed only among male participants.

Depression was considered as the main public health problem among the elderly¹⁷. Duarte and Rego³⁰ found a 23.4% prevalence of depression among the interviewed elderly, while Oliveira, Gomes and Oliveira³¹ observed the occurrence of depression in 31% of the elderly attending community centers. The association between depression and EDs has been previously reported^{12,18}, even though Calati et al.¹³ did not observe significant frequency of depression among women with EDS. However, in their study, the analyzed women had mean age of 34.17 ± 11.37 years old. Bixler et al.⁴ investigated a general population sample and concluded that depression is the main factor associated with EDS. Lessov-Schlaggar et al.¹¹ studied elderly twins in the United States and observed an association between depression and EDS only among men. The authors believe that this superposition is owed to genes that determine both dysfunctions. The authors in this study do not entirely agree with this explanation, since there is great interaction between genes and

environmental factors; many times, genes are only active in specific circumstances of the environment, which is called norms of reaction, in genetics³¹.

Depression is the most frequent mood disorder among the elderly, affecting especially women²⁹, considering the negligence in self-care, lack of self-esteem and worsening of pre-existing conditions. One of the most prominent symptoms of depression is insomnia, which can lead to EDS. However, Jaussent et al.¹⁸ considered EDS and insomnia as independent risk factors for depression.

Some authors report that obesity and EDS can be a result of the reduced quantity and efficiency of sleep^{6,19}, and such variables are not analyzed in this study. Watson et al.³² studied twins with different lifestyles and observed that obesity was secondary to decreasing sleeping hours. Sleep restriction can lead to the decreased metabolism of sugars, and also change the sensation of satiety, causing obesity³². This is a possible explanation for the increased prevalence of obesity and increased abdominal circumference in people with EDS.

In this study, the increased BMI linearly followed the increased proportion of EDs cases, especially among obese people (Table 2). This association occurred in women with obesity (Table 3). These data are in accordance with the results by Bixler et al.⁴, who state that depression and obesity are usually present in cases of EDS when adjusted to gender, educational level and income. Carmelli et al.²⁰ concluded there is genetic relationship between obesity and EDS among women. On the contrary, Ng and Tan³⁴ show that the increased BMI does not increase the chances of EDS, even with odds ratio of 1.43 (0.99 – 2.04).

The relationship between EDS and the variables depression, obesity and risk of cardiovascular disease still seems to be unknown in literature, and some researchers treat them as predictive factors^{5,7} of EDs, while others see them as consequences of EDS^{6,9}. Due to the type of sectional design adopted in this study, the relationship of causality between EDS and obesity, risk for

cardiovascular disease and depression cannot be confirmed yet. However, it is possible to observe there is an association between EDS and the aforementioned variables, being the gender of the individual a possible confusion variable of the studied relationships, which is not verified for the age group variable.

Conclusion

In the studied sample of elderly people, an association between EDS and depression

was found only among men, and such a fact was also verified between EDS and risk for cardiovascular disease. On the other hand, EDs and obesity showed to be related only among women aged from 70 to 79 years old. It was also observed that the gender of the studied elderly was a confusion variable, which was not true for the age group variable. Therefore, the relationship between EDS and depression, obesity and risk for cardiovascular disease is not the same for elderly men and women.

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Received on: 08/29/12

Final version presented on: 07/31/13

Accepted on: 08/12/13