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Original Article

Is long sleep duratıon a new risk factor for obesity?

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Abstract: Sleep is an important modulator for neuroendocrine functions and glucose metabolism. However the data about the relation between long sleep duration and obesity is scarce and unclear, so herein we evaluated both long and short sleep durations either with high or poor quality: within different age and obesity groups to define the interaction between obesity and sleep. Here in our group most of the patients (79.6%) sleeping longer than 8 hours -long sleepers- were either obese (49%) or morbid obese (30.6%) and long sleep duration was significantly common compared to control group (79.5% *vs.* 6%; and $P < 0.001$). We can conclude that as well as short sleep duration; long sleep duration has to be taken into concern as a cause or result of obesity.

Keywords: Obesity, sleep duration, sleep quality

Introduction

The relationship between obesity and sleep disturbances are well documented in last years. The parallelism with the increased prevalence of obesity and shortening night sleeps is the interesting theme. Either with numerous studies on patients or with epidemiological data, this negative correlation has been proved.

On the other hand the poor quality of sleep which can be defined as two or more awakenings during a night sleep is the other factor correlated to obesity which defined as a new risk factor for the issue [1, 2].

Sleep is an important modulator for neuroendocrine functions and glucose metabolism. Glucose intolerance, increased ghrelin and decreased leptin levels with increased hunger and appetite, with an abnormal increment of night cortisol levels are the direct and indirect manifestations of both obesity and cardiometabolic risk related to obesity and sleep duration [1, 3-6].

However the data about the relation between long sleep duration and obesity is scarce and unclear [7-10], so herein we evaluated both long and short sleep durations either with high or poor quality; within different age and obesity groups to define the interaction between obesity and sleep.

Methods

The study was conducted through our Internal Medicine- Obesity Outpatient Clinic. All the patients applied for obesity were referred to fill a unique questionnaire; which included an exhaustive data about the patients' eating habits, daily physical activity, medical history, family history, medications and anthropometric measurement. As all these data is not beyond the scope of this article, we did not mention.

The subjects with day time sleeping habit, and/or taking any medication and/or any disease that effects sleep were excluded.

Body mass index (BMI) was calculated [BMI= weight (kg)/height (m^2)].

The subjects with a $24.9 \leq BMI \leq 29.9$ kg/m^2 were defined as overweight, $30 \leq BMI \leq 39.9$ kg/m^2 as obese, and $BMI \geq 40$ kg/m^2 as morbid obese. The patients with a $BMI \geq 24.9$ kg/m^2 were also evaluated for sleeping duration considering age.

The subjects were divided into three groups according to their sleeping duration; shorter

Table 1. The documentation of patients according to body mass indices and sleeping duration

Sleep duration	< 6 ours			6-8 hours			> 8 hours			Tota		
BMI kg/m^2	M	W	*T*	M	W	*T*	M	W	*T*	M	W	*T*
18.5-24.9	1	2	*3*	35	56	*91*	2	4	*6*	38	62	*100*
25-29.9	-	-	-	14	70	*84*	5	15	*20*	19	85	*104*
30-39.9	8	10	*18*	65	110	*175*	13	35	*48*	86	155	*241*
> 40	8	11	*19*	25	31	*56*	10	20	*30*	43	62	*105*
Total	*17*	*23*	*40*	*139*	*267*	*406*	*30*	*74*	*104*	*186*	*364*	550

M: Men, W: Women, T: Total number of patients.

Table 2. The documentation of patients with number and percentage of cases according to body mass indices and sleeping duration

Duration of sleep (hours)	< 6 hours		6-8 hours		> 8 hours	
	n	%	n	%	n	%
BMI < 24.9 kg/m^2	3	3	91	91	6	6
BMI ≥ 24.9 kg/m^2	37	8.2	315	70	98	21,7
24.9 ≥ BMI > 29.9 kg/m^2	-	0	84	26.7	20	20.4
29.9 ≥ BMI > 39.9 kg/m^2	18	7.5	175	55.6	48	49
40 kg/m^2 ≥ BMI	19	18.1	56	17.7	30	30.6

than 6 hours, 6-8 hours and longer than 8 hours [11-16].

Quality of sleep was defined according to the criteria of two or more awakenings during a night sleep [17, 18]. The subjects were assessed for quality of sleep; and the relationship with body mass indices was evaluated.

Statistical analysis

Pearson's Chi-squared test and Bonferroni corrected Chi square tests were used for categorical data. Student t test was used for parametric data. Spearman's and Pearson's Correlation tests were used for correlations. Significance was defined with a *p value < 0.05.* Statistical analysis was performed using the SPSS for Windows software package (version 19.0, SPSS Inc., Chicago, IL, USA).

Results

Five hundred and fifty subjects were recruited into the study. One hundred subjects (62 women, 38 men; mean age 27±8 yrs, minimum 18, maximum 65 years) with normal BMI (18.5 < BMI < 24.9 kg/m^2) were served as the control group. Four hundred and fifty (302 women, 148 men; mean age 35±7 yrs, minimum 15, maximum 75 years) obese subjects (BMI ≥ 24.9 kg/m^2) were evaluated. The number of subjects and their gender with sleeping duration in hours (h) are documented on **Table 1**.

The subjects with normal (18.5 < BMI < 24.9 kg/m^2) BMI

Three (3%) subjects of the normal BMI group were sleeping less than 6 hours, 91 (91%) were 6-8 hours, and 6 (6%) were sleeping longer than 8 hours. There was no correlation between BMI and sleeping duration within this group (P=0.802 r=0.034). The data is documented on **Table 2**.

The obese subjects (BMI ≥ 24.9 kg/m^2)

Thirty seven (8.2%) of the obese patients were sleeping less than 6 hours, 315 (70%) were 6-8 hours and 98 (21.7%) were sleeping longer than 8 hours. The data is documented on **Table 2**.

All the patients sleeping less than 6 hours were either obese (48.6%) or morbid obese (51.4%). The differences between these two groups (obese *vs.* overweight and morbid obese *vs.* overweight) were significant (P < 0.001).

A normal sleeping duration -6 to 8 hours- was significantly less in the morbid obese group compared to control subjects (53.3% *vs.* 91%; P < 0.001). They were sleeping either longer or shorter compared to normal BMI group (28.5% *vs.* 6%; and 18% *vs.* 3%; respectively; P < 0.001 for both).

Most of the patients (79.6%) sleeping longer than 8 hours were either obese (49%) or morbid obese (30.6%). Long sleep duration was significantly common compared to control group (79.5% *vs.* 6%; and P < 0.001).

The data of obese subjects (BMI ≥ 24.9 kg/m^2) beyond their age

Most of the obese subjects sleeping longer than 8 hours were either young or middle aged (79.5%). The patients were dominantly within 36-65 years of age (n=42, 42.9%), while between 15-35 years old obese were the second (n=36, 36.7%), and the third was the oldest group (n=20, 20.4%). The data is documented

Table 3. The documentation of patients with BMI ≥ 24.9 kg/m^2 according to age, gender and sleeping duration

Age	15-35 years			36-65 years			> 65 years			Total		
Gender	W	M	*T*	W	M	*T*	W	M	*T*	W	M	*T*
< 6 hours	2	1	*3*	7	3	*10*	13	11	*24*	22	15	*37*
6-8 hours	50	20	*70*	150	61	*211*	20	14	*34*	220	95	*315*
> 8 hours	26	10	*36*	23	19	*42*	11	9	*20*	60	38	*98*
Total	*78*	*31*	*109*	*180*	*83*	*263*	*44*	*34*	78	302	148	450

M: Men, W: Women, T: Total number of patients.

Table 4. The percentage of subjects according to sleeping interval in age spesific obese (BMI ≥ 24.9 kg/m^2) group

	15-35 yrs	36-65 yrs	> 65 yrs
Short (< 6 hours) sleepers %	2.7	3.8	30.8
6-8 hours sleepers %	64.2	80.2	43.6
Long (> 8 hours) sleepers %	33.0	15.9	25.6

Table 5. The documentation of patients for sleep quality

BMI (kg/m^2)	Poor sleepers (n)	Good sleepers (n)	Total (n)
< 24.9	-	100	100
24.9-29.9	50	36	86
29.9-39.9	205	40	245
≥ 40	110	9	119
Total	365	285	550

on **Table 3**. Seventy eight subject older than 65 years old were evaluated for sleep duration. The data is documented on **Table 4**. Short sleep duration (< 6 hours) was significant within the morbid obese group. The rate of long sleepers (> 8 h) was 25.6%, short sleepers (< 6 h) was 30.8% and subjects with a normal sleeeping period (6-8 h) was 43.6%. The short sleeper geriatric group was found to be significantly obese compared to the other short sleeper groups (P < 0.001). The rate of long sleeeper geriatric subjects were 25.6%, which were more obese compared to middle-aged long sleepers (P < 0.01).

The data about sleep quality

Where as none of the subjects from control group had complaint for poor sleep quality; most of the obese (BMI ≥ 24.9 kg/m^2) subjects (n=365, 81.2%) had. The data is documented on **Table 5**. The rate of poor sleep quality was 92.4% in morbid obese group; 83.6% in obese group and 58.1% in overweight group. Obesity and morbid obesity was 10.8% in good quality sleepers. Sleep quality was significantly different both between obese and morbid obese groups compared to control subjects and overweight groups (P < 0.001 for both). Poor sleep quality was found to be positively correlated with higher BMI (r=0.277; P < 0.001).

Discussion

The optimal night sleep duration for an adult which is also recommended by the U.S. Centers for Disease Control and Prevention is 7-8 hours. Numerous epidemiological studies documented that both reduced sleep quantity and quality increase the risk of weight gain and type 2 diabetes mellitus (T2DM) [11, 12-16, 19-21]. Here in this study we also have defined that all the short sleepers were either obese or morbid obese. The causative mechanisms relating to sleep problems and metabolic disturbances as well as obesity are mostly revealed. In early studies prolonged wakefulness found to impair insulin sensitivity in humans without diabetes [22, 23]. Even just a single night of restricted sleep (4.5 h instead of 8.5 h) is able to impair glucose metabolism [24]. Increased appetite as a result of increased hunger-promoting hormone ghrelin and decreased satiety-promoting hormone leptin concentrations are just two of the mentioned causative factors in this process [25-27]. Both daily food intake and snack consumption was stated to increase with the recurrence of short sleep [27]. Even though these data; some researches notified that food intake did not increase under time-deprived laboratory conditions in healthy men [28]. As our study is the documentation of a kind of survey for the special outpatient clinic we did not study any of these obesity related molecules; but the overwhelming majority of obesity in short sleeper group is remarkable as supporting the literature. On the other hand sleep quality is the other factor effecting metabolism as well as sleep duration. Poor quality is defined as two or more awakenings during a night sleep.

Herein our survey; 70% of the poor quality sleepers were either obese or morbid obese

where as obesity ratio was significantly low (10.8%) in good quality sleeper group. The obstructive sleep apnea syndrome (OSAS) is strongly associated with obesity and its prevalence is likely increasing in parallel with the epidemic of obesity [29]. The syndrome even can be supposed to be evaluated in whole obese population at least in poor quality sleeper group. But it must be kept in mind that the condition is also increasingly identified in the less obese even lean persons. Only about 50% of patients diagnosed at a large sleep clinic in Edinburgh were obese and additionally the lack of common presenting complaints, excessive daytime sleepiness, loud snoring and morning headaches in means of the syndrome; were our reasons not to evaluate the patients for OSAS routinely [14, 30].

Besides abundant studies and declarations about the negative relationship between sleep duration and obesity; the data about long sleep and obesity is confusing and scarce (7). The meta-analysis conducted by Wu et all [8] documented the relationship between obesity and sleep duration in 197,906 short sleepers and 164,016 long sleepers. Whereas short sleep duration was related to obesity, and long sleep duration was not (OR, 1.06; 95% CI, 0.98-1.15). The other meta-analysis reported by Zhang et all [9] was the documentation of 285,452 adults; in which short sleep duration (< 6 hours) was related to obesity but long (> 8 hours) was not.

Here in our group, most of the patients (79.6 %) sleeping longer than 8 hours -long sleepers- were either obese (49%) or morbid obese (30.6%) and long sleep duration was significantly common compared to control group (79.5% *vs.* 6%; and P < 0.001). Lopez-Garcia et all [10] reported the data of 3576 geriatric (> 60 years old) subjects which shorter than 5 hours and longer than 8-9 hours sleep were both related to obesity. Both night sleep duration and sleep quality decreases with age as a result of hormonal changes physiologically [31]. We evaluated our patients within different age groups to banish this physiological effect; and established three groups; 15-35; 36-65 and > 65 years old. In contravention of physiological sleep decrement in geriatric group; the obese old subjects were found to have a tendency to long sleeping with a significant difference from adult obese group similar with the younger (15-35 yrs old) obese subjects. Though the sleeping disturbances in geriatric group including lower sleep efficiency, longer sleep latency, greater night time wakefulness, and higher number of long wake episodes have been reported in population-based cohorts of the older. Most of these results depends on self reports and -at least to our knowledge- there is no data about a sleep duration peculiar to geriatric age [32, 33]. Moreover some of these studies work on the intrinsic frailty status of the subjects [34]. Herein we defined that nearly 60% of the obese old subjects were either short sleeper or long sleeper. As shown on **Table 4**, different than the older group; long sleepers were significantly common in both young and adult obese groups.

We can conclude that as well as short sleep duration; long sleep duration has to be taken into concern as a cause or result of obesity. We cannot conclude weather it is a cause or result because lack of knowledge on the subject. But all these data lead us to suggest that a regular good night's sleep may help people to maintain metabolic health with healthy body mass.

Disclosure of conflict of interest

None.

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