



Association between seasonal affective disorder and subjective quality of the sleep/wake cycle in adolescents



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ABSTRACT

The relationship between seasonal affective disorder (SAD) and subjective quality of sleep/wake cycle in adolescents was explored. The Seasonal Pattern Assessment Questionnaire for Children and Adolescents (SPAQ-CA) and Mini Sleep Questionnaire (MSQ) were administered to 345 adolescents living in the city of Cesena (Emilia-Romagna region, Italy) (299 females; age range: 14–18 years), to determine SAD and perceived quality of the sleep/wake cycle. The response rate was 92% for females and 90.2% for males. The MSQ includes two factors, sleep and wake, with lower scores corresponding to a lower quality of sleep and wake. The MSQ includes cut-off criteria to detect a good or bad sleep and wake quality. Adolescents with SAD (16 ± 5.7) scored significantly lower than those not affected on wake factor (19.5 ± 4.3), while no effect has been observed on sleep factor. SAD was the only one significant predictor of good/bad wake quality, while it did not reach significant level with reference to good/bad sleep quality. Present results are indications of a possible influence of SAD on wake quality and further studies are necessary to confirm them.

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1. Introduction

The relationship between sleep and depression has been deeply explored in the last decades, as reported in three reviews (Riemann et al., 2001; Ivanenko et al., 2005; Tsuno et al., 2005), showing a bi-directional relationship between them. Specifically, some sleep markers of depression are early morning awakening and shorten REM sleep latency (Srinivasan et al., 2009). On the contrary, hypersomnia is related to some sub-types of depression, as the seasonal affective disorder (SAD) (Thompson and Isaacs, 1988; Allen et al., 1993; Tam et al., 1997), which is characterized by recurrent depressive episodes that occur annually in the fall and winter (Rosenthal et al., 1984), with a summer variant of SAD characterized by periodic depressive episodes in this season (Wehr et al., 1987). SAD patients also present awakening difficulties (Avery et al., 2002).

It is well known that the prevalence of SAD changes with age. In particular, during adolescence, the frequency of SAD raises compared to childhood (Swedo et al., 1995; Tonetti et al., 2007). This increase has been linked to the strong hormonal changes, occurring during this period (Swedo et al., 1995). To date only two studies (Swedo et al., 1995; Tonetti et al., 2007) have been carried

out on the features of SAD during adolescence and the relationship between this disorder and the features of the sleep/wake cycle in this age stage has been neglected.

Our study aimed to fill this lack of knowledge, investigating the association between SAD and the perceived quality of the sleep–wake cycle in adolescents. Since adult SAD patients mainly present hypersomnia and awakening difficulties (Thompson and Isaacs, 1988; Allen et al., 1993; Tam et al., 1997; Avery et al., 2002), we could expect a lower wake quality in SAD adolescents compared to those not affected by this disorder.

2. Methods

2.1. Participants

Overall 325 females and 51 males were invited to participate. The final sample was composed of 345 participants (299 females), with a response rate of the 92% for females and 90.2% for males. The mean age of the overall sample was 16.88 ± 1.03 (median 17 years and mode 18 years), with age ranging between 14 and 18 years. The males (17.02 ± 1.13) and females (16.86 ± 1.02) mean ages were not significantly different ($p=0.33$).

All participants attended the same high school in the city of Cesena (Emilia-Romagna region, Italy) and were tested during a school meeting in April 2010, aimed to increase students' knowledge about sleep and well-being. The attending of the school meeting was not mandatory but students received a school credit for their participation. The difference in the number of females and males is due to the fact the investigated high school is mainly attended by females. The time of compilation of both questionnaires was about 15 min. If 18-years-old, participants

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provided written informed consent prior to their participation in the school meeting; if they were underage, the written informed consent was given by parents. The local ethic committee approved the protocol and the study complied with the tenets of the Declaration of Helsinki.

2.2. Measures

2.2.1. Seasonal Pattern Assessment Questionnaire for Children and Adolescents (SPAQ-CA)

The Italian version (Tonetti et al., 2008) of the SPAQ-CA (Swedo et al., 1995) which is a self-reporting questionnaire for normal and clinical seasonal mood variations, was administered. Eleven items on a 5-point Likert scale (no change=0, slight change=1, moderate change=2, marked change=3, and extremely marked change=4) evaluate the seasonal changes in the following areas: sleep length, mood, abuse of stimulants (e.g., alcohol, nicotine, and drugs), social activity, weight, energy, appetite, school performance (troubles and marks), irritability and conduct problems. Adding up the scores of those items, we obtain the Global Seasonality Score (GSS), with higher values corresponding to higher mood seasonality (total range score: 0–44). Another question evaluates the extent to which seasonal changes are felt as a problem. If they are not felt as a problem, the corresponding scoring was 0; on the contrary, if they are felt as a problem, participants indicated if it was no relevant (1), moderate (2), marked (3) or disabling (4). These two scales are used together to classify whether the person suffers from Seasonal Affective Disorder (SAD) or not (NO-SAD). SPAQ-CA criteria (Swedo et al., 1995) for a possible diagnosis of SAD include a GSS of 18 or more with the assessment that these seasonal changes represent at least a moderate problem. The Cronbach Alfa coefficient was 0.75.

2.2.2. Mini Sleep Questionnaire

Participants also completed the Italian version (Fabbri et al., 2006) of the MSQ (Zomer et al., 1985) to subjectively evaluate the quality of the sleep/wake cycle. This questionnaire is composed of 10 items on a 7-point Likert scale (1 means always, 7 means never), referring to the past week. MSQ comprises two main factors: sleep and wake. The MSQ sleep factor includes six items, with score ranging from 6 to 42, which investigate the following features: trouble getting asleep, too early morning awakening, use of sleeping pills, snoring during the night, nighttime awakening and unresting sleep. The MSQ wake factor comprises four items, with score ranging from 4 to 28, that cover the following areas: daily sleepiness, feeling tired at

the morning awakening, headache at the morning awakening, and extended tiredness without a specific reason. Higher scores on these two factors correspond to a higher quality of sleep and wake. Moreover the Italian version of the MSQ includes the following cut-off criteria to discriminate a good sleep quality from a bad sleep quality on one hand and a good wake quality from a bad wake quality on the other: scores higher than 27 indicate a good sleep quality, while scores higher than 14 show a good wake quality.

The Cronbach Alfa coefficient was 0.65 for the MSQ sleep factor and 0.75 for the MSQ wake factor. When the Kolmogorov–Smirnov test was performed, the distribution of the MSQ sleep factor scores resulted normal ($d=0.05$; $p > 0.05$) (kurtosis = -0.12 ; skewness = -0.55), as well as that of the MSQ wake factor scores ($d=0.03$; $p > 0.05$) (kurtosis = -0.15 ; skewness = $0 - 0.39$).

2.3. Data analysis

We performed an ANCOVA, with gender (males and females) and SAD category (SAD and NO-SAD) as independent variables, and age as a covariate, to separately analyze their effects on the sleep and wake MSQ factors. If ANCOVA gave significant results, Tukey's post-hoc test for unequal samples was performed. The results of the ANCOVAs were explored through a set of independent sample *t* tests aiming to compare the scores reported by SAD and healthy adolescents to the single items of the sleep and wake MSQ factors. Furthermore we performed a multiple regression analysis with the forward stepwise method separately for the sleep and wake MSQ scores, with the following independent variables: gender, age and SAD category. Finally we carried out two separate logistic regression analyses with gender, age and SAD category as independent variables and sleep quality (good and bad) or wake quality (good and bad) categories as dependent variable. Since multiple comparisons were performed, the Bonferroni correction was applied, considering as significant a *p* value less than 0.003.

3. Results

On the basis of SPAQ-CA cut-off criteria, our study included 83 adolescents (of which 73 were females) with possible SAD (24.06%) and 262 (of which 226 were females) with no SAD (75.94%).

With reference to the sleep MSQ factor, at the ANCOVA we did not observe any significant effects of gender ($p=0.87$), SAD category ($p=0.17$) and interaction between them ($p=0.47$) (Table 1).

As regards the wake MSQ factor, at the ANCOVA, SAD category showed a significant effect ($F_{1,339}=15.28$; $p < 0.001$) (Table 1). Performing post-hoc comparisons, adolescents with SAD scored lower than those not affected ($p < 0.001$). Gender ($p=0.90$) and interaction between the two factors ($p=0.49$) were not significant (Table 1).

Table 2 shows the scores reported by SAD and healthy adolescents to the single items of the sleep and wake MSQ factors, compared through a set of independent sample *t* tests. With reference to the sleep factor, no significant differences were observed, with only one tendency to significance. As regards the wake factor, the scores of three items on four were significantly lower in SAD compared to healthy adolescents.

Table 1

Actual values (means \pm S.D.) of the sleep and wake MSQ (Mini Sleep Questionnaire) factors by gender and SAD (Seasonal Affective Disorder) category. Higher scores on these two factors correspond to a higher quality of sleep and wake.

	SAD (N=83)	NO-SAD (N=262)	Mean value for total sample
MSQ sleep factor			
Males (N=46)	31.9 \pm 6.7	32.6 \pm 5.5	32.3 \pm 6.1
Females (N=299)	31.0 \pm 5.8	33.2 \pm 5.5	32.1 \pm 5.7
Mean value for total sample	31.5 \pm 6.3	32.9 \pm 5.5	
MSQ Wake factor			
Males (N=46)	15.7 \pm 6.3	19.8 \pm 4.0	17.8 \pm 5.2
Females (N=299)	16.3 \pm 5.1	19.2 \pm 4.6	17.8 \pm 4.9
Mean value for total sample	16.0 \pm 5.7	19.5 \pm 4.3	

Table 2

Actual values (means \pm S.D.) of the replies to the items of the MSQ (Mini Sleep Questionnaire) sleep and wake factors, reported by SAD (Seasonal Affective Disorder) and NO-SAD adolescents. Statistics of the independent sample *t* tests are also shown. The Bonferroni correction was applied, considering as significant a *p* value less than 0.003.

	Item	SAD N=83	NO-SAD N=262	Statistics
Sleep MSQ factor	Number 1_ trouble getting asleep	4.3 \pm 1.8	4.8 \pm 1.7	$p=0.04$
	Number 2_ too early morning awakening	5.1 \pm 1.7	5.4 \pm 1.6	$p=0.22$
	Number 3_ use of sleeping pills	6.6 \pm 1.3	6.8 \pm 0.9	$p=0.19$
	Number 6_ snoring during the night	6.0 \pm 1.6	6.1 \pm 1.4	$p=0.57$
	Number 7_ nighttime awakening	4.6 \pm 1.8	4.9 \pm 1.6	$p=0.12$
	Number 10_ unresting sleep	4.5 \pm 1.8	5.1 \pm 1.7	$p=0.004$
Wake MSQ factor	Number 4_ daily sleepiness	3.5 \pm 1.5	4.2 \pm 1.5	$t_{343}=3.74$; $p < 0.001$
	Number 5_ feeling tired at the morning awakening	3.1 \pm 1.4	3.9 \pm 1.5	$t_{343}=3.75$; $p < 0.001$
	Number 8_ headache at the morning awakening	5.2 \pm 1.9	5.7 \pm 1.6	$p=0.007$
	Number 9_ extended tiredness without a specific reason	4.4 \pm 2.0	5.5 \pm 1.5	$t_{343}=5.32$; $p < 0.001$

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