Vol. 10: 245-250, December 2005

ORIGINAL RESEARCH PAPER

An examination of the association between eating problems, negative mood, weight and sleeping quality in young women and men

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ABSTRACT. *The aim of this study was to determine if low mood influenced the association between eating problem symptoms and self report sleeping quality in a large group of young women and men. A group of 381 female and male undergraduate students completed a set of self-report inventories in order to test a model developed for this study observing the association between eating problems, low mood, restricted dieting, weight and self-reported sleeping quality using a path analysis model. The model that best fit the data indicated that eating problem symptoms were associated with low mood and low mood was related to sleeping quality. There was also a direct association between eating problems and sleeping quality but this was reduced by the presence of low mood in the equation. There were no other direct relationships with sleeping quality but there was an association between low mood and low weight. There were also differences reported between men and women on sleeping quality suggesting that women in this sample reported more sleeping difficulties than men. In all this research demonstrates with a large non-clinical sample the links between eating problems, mood and sleeping difficulties.*

(Eating Weight Disord. 10: 245-250, 2005). *©2005, Editrice Kurtis*

INTRODUCTION

Examination of eating disorders [including both anorexia nervosa (AN) and bulimia nervosa (BN)] and sleeping difficulties have yielded results that suggest that self report of sleeping difficulties, as opposed to objective measures of sleep, in participants with eating problems distinguish them from normal control groups. In this study we sought to examine whether mood mediated between eating problems symptoms and self-reported sleeping quality in a large sample of young women and men.

As early as the 1960's and 1970's, Crisp et al. reported associations between sleeping difficulties and AN. Anorexic patients were described as frequently restless during the night, sleeping 'badly', and suffering from early morning and middle of the night awakenings (1, 2). Observations in an outpatient clinical setting identified that 35% of cases of women with BN reported sleep disturbances (3). In another study (4) women with anorexic symptoms reported frequent disturbed sleep and in a self-report study, college students with high scores on the Eating Attitudes Test (EAT), suggesting sub-clinical eating disorder symptoms, reported sleeping for briefer periods than those with lower EAT scores (5). These observational studies have not translated into clear research findings in sleep laboratory settings.

In studies conducted on the sleep architecture of women with eating problems (AN and BN) recordings on EEG's were reported to be similar in both groups and similar to normal control groups (6-9). Laboratory investigations relying on polysomnographic recordings measuring REM and slow wave sleep (SWS) patterns between women with AN, BN have shown that anorexic patients (10, 11) and patients with BN have differences on aspects of REM sleep (9). However researchers conducting these studies report inconclusive differences on EEG or REM measures of sleep between women with eating problems and normal controls and suggest the differences do not hold clinical significance (12).

Two investigations to date where sleep-

Key words:
Eating problems, low mood, sleeping quality.

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Received: *August 4, 2004*
Accepted: *April 19, 2005*

Eating Weight Disord. 10: 245-250, 2005
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wake patterns of women with BN were monitored both subjectively and objectively, in contrast to normal controls, suggested that women with BN reported a delay in sleep onset and offset (13) and women with eating problems had more frequent arousal during sleep than normal controls (12). The sleep onset and the frequent wakings described in both studies are similar to the descriptions of sleep onset and frequent wakings experienced by individuals with low mood or depression.

Eating problems and sleeping difficulties may possibly be associated through negative or low mood. However it should be noted that studies conducted with EEG and REM sleep tests with a control group of clinically depressed individuals comparing them to both women with eating problems and normal healthy controls has shown that the depressed groups differed from the eating and control groups in both cases (7, 14). The limited number of studies and the low participant numbers lead to the inevitable conclusion that at present it remains unclear whether depression or low mood are associated with and interfere with sleep for individuals with eating disorders. It is certainly well established that women with eating problems experience significant levels of clinical depression (15, 16) or low mood (17). Individuals with low mood, or depressive symptoms and no eating problems also experience difficulties with sleep (18-20). Pieters et al. (21) reported in their study that self-reported measures of mood reduced from Time 1, prior to weight restoration, to Time 2, after weight restoration in AN patients. A premise of this current study is that self-reported negative mood may be a significant variable in self-reported sleep quality of individuals with eating problem symptoms. In Pieters et al.'s study it may have been the restoration of mood that resulted in the change in sleep in this study, although the authors were focused on the change in weight as a contributor to improved sleep.

Apart from mood, weight, weight loss or gain, and bingeing have also been associated with self-reported quality of sleep. Restricting food, or dieting (e.g., low calorie intake) has been related to sleeping problems (22). Previous research has shown that semi-starvation (4, 10, 23, 24) or in fact merely reducing food intake, or reducing weight in overweight individuals (22, 25), results in changes in sleep patterns. Food restriction only needs to be sufficient to lose weight, before the metabolic rate and core body temperatures are lowered which in turn has been associated with later sleep latency and lower levels of slow wave sleep (22). Weight gain resulted in improved self-reported mood and sleep in underweight anorexics (21) however in this study there was no control group so it is difficult to attribute the improvement in self-reported quality of sleep, or mood purely to weight gain. Finally, bingeing in women with BN which is particularly related to bingeing in the evening may be associated with sleeping difficulties (13). The bingeing in the evening is distinct from the range of sleeping and eating disorders associated with Night Eating Syndromes and Nocturnal Sleep Related Eating Disorders (26).

Given that the research to date highlights the importance of a number of aspects of eating and weight in relation to sleeping quality a model was developed and tested in this study that comprised eating problem symptoms (bulimic symptoms and drive for thinness), negative mood, weight and sleeping quality in a sample of young men and women. Men were included in the sample because men have been increasingly identified as having body image concerns and eating disorders (27, 28) and males have been reported to binge eat as often as females (29). It was predicted that eating problems (both bulimic symptoms and drive for thinness) would be related to poor sleep quality and that eating problems would also be related to negative mood and weight. It was expected that negative mood and weight would be associated with poor sleep quality and that negative mood would partially explain the association between eating problems and poor sleep quality.

METHOD

Participants

Participants were 381 female and male undergraduate university students. Participation in the study was voluntary and students were requested to complete the questionnaire. In the final analyses 82 male and 291 female undergraduates participated in the study with a mean age of 22.81 (SD=6.9) years for females and 23.79 (SD=5.4) years for males. University students were approached in classes and asked to complete the questionnaire package.

Measures

Eating problems

Bulimic symptoms were measured with the Bulimia Test Revised (BULIT-R) (30) which is a reliable and valid self-report measure of bulimic behavior designed to distinguish bulimic from control groups. Numerous studies have used it for this purpose (31, 32). Restricting Diet Symptoms were measured with the Eating Disorders Inventory Drive for Thinness Scale

[EDI, DT (33)]. The Drive for Thinness Scale includes items that request the respondent to identify the extent to which staying thin is a priority e.g. 'I think about dieting.' and 'I am terrified of gaining weight.' All items in both scales are responded to on a 6 point likert scale from always to never. The scales are scored by assigning a value of 3 to the highest score (6) and then 2 to 5 and 1 to 4 finally the three lowest scores are scored 0. The sub-scale value is derived by summing all the items together. The reliability value for the DT has been reported to be 0.85 (33).

Weight

Body mass index (BMI): Participants were asked to indicate their height and current weight and BMI (kg/m^2) was calculated.

Mood

The Profile of Mood States (POMS) (34) consists of 65 statements about emotional and mood states. The statements include both positive and negative emotions (e.g., cheerful and sad). Normative data suggest that the POMS is a reliable and valid measure of transitory mood states (34) and is often used in studies relating to mood and sleep (35), eating (36) and exercise (37). Participants were asked to rate the degree to which they had experienced each of the 65 emotions during the previous week on a scale from zero, not at all to four, extremely. The POMS incorporates six sub-scales a score was derived for all of the sub-scales but in this study only three of the sub-scales (tension-anxiety, depression-dejection and anger-hostility) were used. The three sub-scales correlated highly in this study (Pearsons r = 0.78 to 0.84) and were therefore collapsed into one measure of negative mood.

Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) (38) is a self-rated questionnaire designed to assess sleep quality. Items include information about hours of sleep per night etc., and there is a section on sleeping patterns with questions such as 'have to use the bathroom', 'cough or snore loudly' and daytime functioning rated on a 4 point likert scale from not during the past month to three or more times a week. There are seven sub-scale scores and a global score calculated for the PSQI. The scale has good reliability with a Chronbach's alpha of 0.83. High scores indicate greater sleep difficulties.

Data analysis

The model described was tested using path analysis. As the data in this study were collected through a cross-sectional design no assumptions of causality were implied in determining the likely associations between variables. Nevertheless the statistical program and the theoretical use of path analysis implies causality to some extent because of the direction of the arrows in the proposed model (26, 39). There are a number of fit indices traditionally used in the estimation of the fit of the model. The Chi-square goodness of fit for the model, the Non-Normed Fit Index (NNFI), and the root mean square error of approximation (RMSEA) were used to test the goodness of fit of the model. If the chi-square test for the overall model fit is non-significant this indicates a good fit to the data. A root mean square error of approximation RMSEA of 0.05 or less and a value above 0.95 on the NNFI indicates a good fit.

RESULTS

Sample characteristics

Means and standard deviations for measures used in analyses are shown in Table 1. Preparation of the data involved transformations on the BULIT-R and the negative mood from the POMS scores. Logarithmic and square root transformations were used to correct the skew of the distributions of the above variables respectively.

ANOVA's were conducted in order to determine if there were any differences between males and females on age, BMI, BULIT-R, the Drive for Thinness scale, the negative mood scales on the POMS and the PSQI. There were no significant differences on age, the BULIT-R or the negative mood scale. There were significant differences on the Drive for Thinness, the

TABLE 1
Means and standard deviations for participants on age, BMI, BULIT-R, Drive for Thinness from the EDI, the POMS and the PSQI for men and women.

	Female		Male	
	Mean	(SD)	Mean	(SD)
Age	22.81	6.90	23.79	5.40
BMI	22.25[a]	3.06	24.08	3.55
BULIT-R	56.73	21.50	52.69	15.91
Drive for thinness	6.39[b]	5.73	2.43	2.89
POMS	13.52	9.91	13.07	9.17
PSQI	6.13[c]	2.97	4.63	2.49

[a]=F (1,380)=18.32, p<0.001 [b]=F (1,380)=38.26, p<0.001. [c]=F (1,380)=18.27, p<0.001. BMI=body mass index, BULIT-R=Bulimia Test Revised, POMS=Profile of Mood States, PSQI= Pittsburgh Quality Sleep Index.

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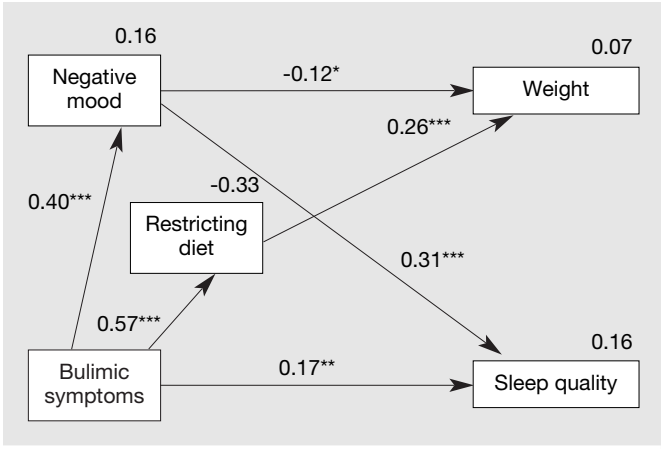

FIGURE 1
Model of bulimic symptoms, negative mood, BMI, Drive for Thinness and Global PSQI scores.
*p<0.05, **p<0.01, ***p<0.001

PSQI scale and BMI (Table 1). Non-parametric t-tests were used to compare women and men on the seven sub-scales of the PSQI. Women reported poorer subjective sleep quality t (381)=3.24, p<0.01, longer sleep latency t (381)= 3.93, p<0.001, less effective sleep efficiency t (381)=2.73, p<0.01, more sleep disturbances t (381)= 2.95, p<0.01 and problematic daytime dysfunction t (381)=2.93, p<0.01 in comparison to men. In order to determine whether the differences on the sleeping measures were due to women reporting more bulimic symptoms participants with BULIT-R scores above 60 were then removed from the sample and men and women were again compared on age, BMI, BULIT-R scores, drive for thinness, negative mood and the PSQI sub-scales. ANOVAs indicated that there were no significant differences for females and males on age, BULIT-R, negative mood, women reported lower BMI F (1,258)= 24.56, p<0.001 and higher Drive for Thinness F (1,258)=18.01, p<0 .001. Non-parametric t tests on the PSQI indicated that women reported poorer sleep quality t (259)=1.98, p<0.05, longer sleep latency t (259)=2.44, p<0.05, less sleep t (381)=1.95, p<0.05, poorer sleep efficiency t (381)=3.37, p<0.001, more sleep disturbances t (381)=2.08, p<0.05 and problematic daytime dysfunction t (381)= 2.73, p<0.01 than men.

Women were more likely than men to report severe bulimic symptoms, 5.4% of the sample of women scored in the clinic range (over 102) on the BULIT-R, 6.6% were in a sub-clinical range (between 85-102) and 70% scored in the low range (under 60). In contrast 1.2% of men scored in the clinical range, 3.5% scored in the sub-clinical range and 72.9% scored in the low range.

Main analyses

The BULIT-R and the PSQI were initially correlated. The Pearsons r correlations were r = 0.30, p <0.001. The path analysis was then conducted with the program AMOS. All hypotheses were tested by placing the variables of interest into the model and the predicted relationships between variables suggested by the arrows in the model. The first analysis indicated that there were no significant associations between weight (BMI) and sleep quality (PSQI), restricting diet (DT) and negative mood, and restricting diet (DT) and sleep quality (PSQI) and no significant associations between bulimic symptoms (BULIT-R) and weight (BMI). The model was adjusted by removing non-significant paths and the analysis was re-run. The final model illustrated in Figure 1 demonstrates that there were significant associations between bulimic symptoms and restricting diet, negative mood and sleep quality. There were also significant associations between negative mood and weight (-ve.) and negative mood and sleep quality. The final model was a good fit to the data with a Chi-square of 7.62, p=0.12, NNFI of 0.99, and an RMSEA of 0.05.

DISCUSSION

Prior to the analysis of the model developed for this study it was shown that self report bulimic symptoms and subjective sleep quality were significantly correlated. This is in line with earlier work that has observed this link. The association between bulimic symptoms and self report sleeping quality however was reduced when negative mood was placed in the model. Then a significant but reduced relationship remained between bulimic symptoms and sleeping quality. There were also significant relationships demonstrated in the model tested in this study between negative mood and low weight although weight was not associated with poor sleep quality in the model. In addition restrictive dieting was related to bulimic symptoms and weight but not to negative mood or sleep quality. The model tested in this study suggested therefore that negative mood experienced in the past few days was an important contributor to subjective sleep quality experienced by individuals with eating problems in addition to the contribution made by the bulimic symptoms. The restricting dieting (DT) measure was not linked to sleeping difficulties in this study, nor was low weight (BMI), chronically restricting food in this sample did not contribute to poor sleep quality.

In addition, in this study gender issues in relation to all variables were assessed. It appears that women in general, in contrast to men, report poorer sleep, longer to get to sleep, sleep disturbances and daytime dysfunction regardless of eating problem symptoms. Women in this group also reported lower weights and higher restricting diet symptoms. Lower weight and a tendency to have a restricting diet may possibly be related to sleep latency and daytime dysfunction independently of bulimic symptoms and negative mood. These findings raise the issue however that gender may confound research into eating problems and sleep if women habitually report more problems with sleep than men.

This paper has contributed to the literature on eating problems and sleeping quality by relying on a large sample and by being able to test more than one variable at once. Self report mood is an important factor to consider in observing the relationship between eating problems and sleeping difficulties. A number of limitations are evident in this study. One of the main limitations with the model tested was that despite the good fit to the data indicated by all fit indices the variance of the PSQI explained by the model was very modest. This of course may be a reflection of the sample that consisted of university students with relatively low numbers of participants with severe sleep or eating problems. Sleeping difficulties may also have in this sample been explained by other variables that were not measured. The circular nature of the findings on eating, sleep, weight and low mood and how they relate to one another has been a limitation in all studies to date, including this study. The use of The Drive for Thinness scale that measures a stable trait tendency to dieting or restricting food with attempts to keep weight low is another limitation. This measure does not identify a change in current dieting practices. The literature to date is not clear in this area but it may be that a change in weight, not stable low weight is what interrupts sleeping quality. Development of measures need to be considered in future studies in order that temporal associations between restricting food, bingeing, negative mood and sleeping quality can be recorded.

In summary, the current study tested a model that provided a useful explanation of how negative mood was associated with sleeping quality for individuals with eating problem symptoms. The self report negative mood influenced reporting of subjective sleep quality. This may explain why in laboratory settings objective sleep quality has not been shown to be different between women with eating problems and normal control groups and yet subjectively women with eating problems report sleeping difficulties. There was also a reduced but significant direct relationship between bulimic symptoms and sleeping quality that was not explained by weight or drive for thinness. Bingeing may be the likely cause of this association (13). Finally women in general, as opposed to men, or women with low weights and tendency to restrict food may be prone to sleeping difficulties. Further investigations will need to explore these factors in both clinical samples and community samples with more extensive prospective studies.

A final word, for clinical practice stated many years ago by Crisp (2) who recommended that a sleep assessment should occur routinely in clients with eating disorders, since clients may not spontaneously mention their sleep problems to therapists. It is hoped that this paper leads to future investigations of the relationship between eating disordered behaviors, weight, negative mood and sleeping difficulties both in clinical work and research.

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ACKNOWLEDGMENTS

The authors would also like to acknowledge the contribution of Natalie De Bono for her help with this study.

REFERENCES

1. Crisp A.H., Stonehill E., Fenton G.W.: The possible significance of some behavioral correlates of weight and carbohydrate intake. J. Psychosom. Res., 11, 117-131, 1971.
2. Crisp A.H.: Clinical and therapeutic aspects of anorexia nervosa- A study of 30 cases. J. Psychosom. Res., 9, 67-78, 1965.
3. Fairburn C.G., Cooper P.J.: The clinical features of bulimia nervosa. Br. J. Psychiatry, 144: 238-246, 1984.
4. Garfinkel P.E., Kaplan A.: Starvation based perpetuating mechanisms in anorexia nervosa and bulimia. Int. J. Eat. Disord., 4, 651-665, 1985,
5. Hicks R.A., Rozette E.: Habitual sleep duration and eating disorders in college students. Perceptual and Motor Skills 62, 209-210, 1986.
6. Mitchell J.E., Hosfield W., Pyle R.L.: EEG findings in patients with the bulimia syndrome. Int. J. Eat. Disord. 2, 17-23, 1983
7. Waller D.A., Hardy B.W., Pole R., Giles D., Gullion C.M., Rush A.J., Roffwarg H.P.: Sleep EEG in bulimic, depressed, and normal subjects. Biol. Psychiatry, 25, 661-664, 1989.
8. Walsh B., Goetz R., Roose S.P., Fingeroth S., Glassman A.H.: EEG-monitored sleep in anorexia nervosa and bulimia. Biol. Psychiatry, 20, 947-956, 1985.
9. Hudson J.I., Pope H.G., Jonas J.M., Stakes J.W., Grochocinski V., Lipinski J.F., Kupfer D.J.: Sleep EEG in bulimia. Biol. Psychiatry, 22, 820-828, 1987.

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©2005, Editrice Kurtis

10. Crisp A.H., Stonehill E.: Aspects of the relationship between sleep and nutrition: A study of 375 psychiatric out-patients. Br. J. Psychiatry, 122, 379-394, 1973.
11. Levy A.B., Dixon K.N., Schmidt H.: REM and delta sleep in anorexia nervosa and bulimia. Psychiatry Res., 20, 189-197, 1987.
12. Marca G., Farina B., Mennuni G., Mazza S., Di Giannantonio M., Spadini V., De Risio S., Ciocca A., Mazza M.: Microstructure of sleep in eating disorders: Preliminary results. Eat. Weight Disord., 9, 77-80, 2004.
13. Latzer Y., Tzischinsky O., Epstein R., Klein E., Peretz L.: Naturalistic sleep monitoring in women suffering from bulimia nervosa. Int. J. Eat. Disord., 26, 315-321, 1999.
14. Dippel B., Lauer C.J., Riemann D., Majer-Trendel K., Kreig J.C., Berger M.: Sleep and dreams in eating disorders. Psychother. Psyhcosom., 48, 165-169, 1987.
15. Hinz L.D., Williamson D.A.: Bulimia and depression: A review of the affective variant hypothesis. Psychol. Bull., 102, 150-158, 1987.
16. Swift W.J., Andrews D., Barklage N.E.: The relationship between affective disorders and eating disorders: A review of the literature. Am. J. Psychiatry, 143, 290-299, 1986.
17. Lewinsohn P.M., Streigel-Moore R.H., Seeley J.R.: Epidemiology and natural course of eating disorders in young women from adolesence to young adulthood. J. Am. Acad. Child Adolesc. Psychiatry, 39, 1284-1292, 2000.
18. Naughton M., Mulrooney J.B., Leonard B.E.: A review of the role of serotonin receptors in psychiatric disorders. Hum. Psychopharmacol., 15, 397-415, 2000.
19. Thase M.E.: Treatment issues related to sleep and depression. J. Clin. Psychiatry, 61, 45-60, 2000.
20. Waters W.F., Adams S.G., Binks A.P., Varnado P.: Attention, stress and negative emotion in persistent sleep-onset and sleep maintenance insomnia. Sleep, 16, 128-136, 1993.
21. Pieters G., Theys P., Vandereycken W., Leroy B., Peuskens J.: Sleep variables in anorexia nervosa: Evolution with weight restoration. Int. J. Eat. Disord., 35, 342-347, 2004.
22. Karklin A., Driver H.S., Buffenstein R.: Restricted energy intake affects nocturnal body temperature and sleep patterns. Am. J. Clin. Nutr., 59, 346-349, 1994.
23. Keys A., Brozek J., Henschel A.I., Mickleson O., Taylor H.L.: The biology of human starvation. Minneapolis, University of Minnesota Press, 1950.
24. Lacey J.H., Crisp A.H., Kalucy R.S., Hartmann M.K., Chen C.N.: Weight gain and the sleep electroencephalogram: Study of 10 patients with anorexia nervosa. Br. Med. J., 4, 556-558, 1975.
25. Crisp A.H., Stonehill E.: Sleep patterns, daytime activity, weight changes and psychiatric status: A study of three obese patients. J. Psychosom. Res., 14, 353-358, 1970.
26. deZwann M., Burgard M.A., Schenck C.H., Mitchell J.E.: Night time eating: A review of the literature. Eur. Eat. Disord. Rev., 11, 7-24, 2003.
27. Braun D.L., Sunday S.R., Huang A., Halmi K.A.: More males seek treatment for eating disorders. Int. J. Eat. Disord., 25, 415-424, 1999.
28. Boroughs M., Thompson J.: Exercise status and sexual orientation as moderators of body image disturbance and eating disorders in males. Int. J. Eat. Disord., 31, 307-311, 2002.
29. LaPorte D.: Gender differences in perceptions and consequences of an eating binge. Sex Roles, 36, 479-489, 1997.
30. Thelen M.H., Farmer J., Wonderlich S., Smith M.: A revision of the bulimia test: The BULIT-R. J. Consult. Clin. Psychol., 1, 119-124, 1991.
31. Kreig J.C., Sargent R., Forand K.J., Ureda J.R., Saunders R.P., Durstine L.J.: Psychological and behavioral differences among females classified as bulimic, obligatory exercisers and normal control. Psychiatry, 55, 185-193, 1992.
32. Ruderman A.J., Besbeas M.: Psychological characteristics of dieters and bulimics. J. Abnorm. Psychol., 101, 383-390, 1992.
33. Garner D., Olmstead M., Polivy J.: The eating disorder inventory: A measure of cognitive-behavioral dimensions of anorexia nervosa and bulimia. Int. J. Eat. Disord., 2, 15-34, 1983.
34. McNair D.M., Lorr M., Dropplemann L.P.: Profile of Mood States Manual. San Diego, CA, Educational and Industrial Testing Service, 1981.
35. Yu B.H., Ancoli I.S., Dimsdale J.E.: Effect of CPAP treatment on mood states in patients with sleep apnea. J. Psychiatr. Res., 33, 427-432, 1999.
36. Pinhas L., Toner B.B., Ali A., Garfinkel P.E., Stuckless N.: The effects of the ideal of female beauty on mood and body satisfaction. Int. J. Eat. Disord., 25, 223-226, 1999.
37. Motl R.W., Berger B.G., Leuschen P.S.: The role of enjoyment in the exercise-mood relationship. Int. J. Sport Psychol., 31, 347-363, 2000.
38. Buysse D.J., Reynolds (III) C.F., Mark T.H., Berman S.R., Kupfer D.J.: The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatr. Res., 28, 193-213, 1989.
39. Grimm L.G., Yarnold P.R.: Reading and understanding multivariate statistics. Washington, American Psychological Association, 1995.

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