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ORIGINAL PAPER

Night Eating Syndrome and Its Relationship with Emotional Eating, Sleep Quality and Nutritional Status Among Adolescents' Boys

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Abstract

Current study was aimed to evaluate the relationship between emotional eating and night eating syndrome (NES) with sleep quality among adolescents in Tabriz-Iran. The current study was conducted among eighty adolescent boys aged 12–16 years old from Tabriz-Iran. Night eating syndrome and Emotional eating were measured by validated specific questionnaires. Pittsburgh Sleep Quality Index questionnaire (PSQI) was used for assessment of sleep quality. Emotional and very emotional eaters had significantly higher protein and fat intake. Among components of PSQI, subjective sleep quality, sleep disturbances and daytime dysfunction scores among emotional and very emotional eaters were significantly higher. Moreover, adolescents with NES, had higher PSQI score and lower carbohydrate intake; whereas, intake of fat among NES group was significantly higher ($P < 0.05$). Our results indicated poor sleep quality and higher dietary fat intake among adolescents with emotional eating disorder and NES. Therefore, it is necessary to consider healthy nutritional pattern including low fat intake in prevention of developing emotional eating and NES among adolescents.

Keywords NES · PSGI · Eating behaviors

Introduction

Sleep is physiologically essential for maintaining overall well-being and sleep quality is an important clinical construct (Buysse et al. 1989). According to clinical evidence, 15–35% of adult population complains of frequent sleep quality disturbance and the prevalence of sleep disorders in children and adolescents is 11–47% (Buysse et al. 1989; Firoozabady et al. 2015). Poor sleep quality is a major symptom of many medical disorders and even can be a major contributing factor of mortality (Buysse et al. 1989). Night eating syndrome (NES) first described by Stunkard et al. (1955) is characterized by a delayed pattern of food intake in which the patients consume at least 25% of their total daily calories after dinner or during nocturnal evening. However the definition has been changed over the years and lack of standard definition of NES made it difficult to achieve exact information about the prevalence, clinical importance and prevention of the disorder (Kucukgoncu et al. 2014). Recently, Allison et al. defined a new diagnostic criterion for NES addressing this limitation (Allison et al. 2008). The prevalence of the NES was described to be 6–16% among obese patients and 1.5% among total population (Kucukgoncu et al. 2014). NES has linked to elevated body mass index (BMI) (Aronoff et al. 2001; Nolan and Geliebter 2016; Poggiogalle et al. 2016), anxiety disorders (Kucukgoncu et al. 2015), depression (Kucukgoncu et al. 2014) and lower mood scores and higher stress (Pawlow et al. 2003). Moreover, recently it has been shown that emotional eating behaviors could be a determinant of night eating syndrome; emotional eating as the practice of consuming large quantities of food -usually "comfort" or junk foods- in response to feelings instead of hunger and is most often defined as (over) eating in response to negative effect, without specificity to particular moods or emotions (Nguyen-Rodriguez et al. 2009). It has been proposed that difference in emotional regulation between individuals could modulate the relationship between night eating syndrome and body mass index or other parameters (Meule et al. 2014).

Adolescence is the most active period of life because of double demand of activity and growth as a result of nutritional needs are very important at this phase. NES appears to be more prevalent among young adults and late adolescences

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(Suri and Pradhan 2010) and males are more likely to experience NES than females (Kucukgoncu et al. 2014); in the National Health and Nutrition Examination Survey III (NHANES III), men were 1.2–1.4 times more likely to exhibit night eating symptoms compared with women (National Center for Health Statistics 1988). Moreover, unhealthy eating behaviors such as omitting main meals and frequent snacking are prevalent among adolescents. Sleep curtailment is very common among adolescents who are involved in many activities such as school-related activities and recreational activities (Corgosinho et al. 2013). Adolescents need more sleep hours than adults and are more likely to encounter with health issues related to inadequate sleep (Corgosinho et al. 2013).

Considering the above, it is important to determine the NES determinants among adolescents to develop preventive strategies against the syndrome, although, there are a few studies evaluating the NES and its determinants in adolescents and the findings are not consistent. Therefore, the present study was aimed to evaluate the NES determinants and its relationship with emotional eating, nutritional parameters and sleep quality among adolescent boys.

Methods and Materials

Subjects

The study was conducted among a sample of eighty adolescent boys aged between 12 and 16 years randomly selected from three high schools of Tabriz in northwest of Iran between December 2015 through March 2016. Three high schools were randomly selected from 10 day-public high schools in the selected sub-county. Proportionate to size sampling was used to sample 107 teenagers. At the school level random sampling was used to select children from each school. Participants were all living in Tabriz city, were from middle-class families and all have Iranian eating habits. Sample size calculation according to the previous reports of the gender-specific prevalence of night eating syndrome among non-obese individuals (Aronoff et al. 2001) and considering 95% power and 5% α-error, 80 adolescents had been determined.

Measurements and Classifications

Weight was measured with a balanced beam scale to the nearest 0.5 kg and height to the nearest 0.5 cm with a wall scale while subjects wearing light clothes and no shoes. BMI was calculated as weight (kg) divided by height $(m)^2$. Obesity was defined as having BMI more than 30 kg/m^2 (Farhangi et al. 2013).

Emotional Eating Measurement

Emotional eating was measured using a ten item Eating Questionnaire (EEQ) developed by Garaulet et al. (2012) to assess to what extent emotions affect eating behavior. All the questions had four possible replies 1, never; 2, sometimes; 3, generally and 4, always. Each replay was given a score of 1 to 4, the lower the score, the healthier behavior. The subjects were classified into four groups: scores between 0 and 5 as non-emotional eaters, scores between 6 and 10 as low emotional eaters, scores between 11 and 20 as emotional eaters and scores between 21 and 30 as very emotional eaters. Due to low number of individuals in very emotional eaters, the latter two groups were merged together in reporting the results. We validated the EEQ and the Cronbach's alpha was 0.71.

Quality of Sleep Measurement

Sleep quality was measured with Persian version of Pittsburgh Sleep Quality Index questionnaire (PSQI) (Farrahi Moghaddam et al. 2012). The PSQI consisted of 19 self-rated questions and five questions rated by bed-partner or roommate (Buysse et al. 1989). The questionnaire assesses sleep quality and disturbances over a 1 month time interval. The latter five questions are used for clinical information only and are not included in the scoring of the questionnaire. The 19 self-rated questions are grouped into seven component scores, each weighted equally on a 0–3 scale. The seven component scores are then summed to yield a global PSQI score ranging from 0 to 21. Higher scores indicate worse sleep quality. The seven components included subjective sleep quality, sleep latency, sleep duration, habitual seep efficiency, sleep disturbances, use of sleeping medications and daytime dysfunction. The questionnaire had been validated previously for use in Iran and achieved a Cronbach's alpha of 0.78 for healthy individuals (Farrahi Moghaddam et al. 2012). Based on previous literature, the scores of greater than 5 are scored as poor sleepers. Those with a score of 5 or less were classified as good sleepers (Lohsoonthorn et al. 2013). Sleep quality components were categorized to specific subscales including long sleep latency (≥ 30 vs. <30 min), poor sleep efficiency (<85 vs. $\geq 85\%$), day-time dysfunction due to sleep (less than once a week vs. once per week or more) and use of sleep medication during the past month (less than

once a week vs. once per week or more) (Lohsoonthorn et al. 2013).

Night Eating Syndrome Measurement

Night eating syndrome (NES) was measured by Night Eating Questionnaire (NEQ) generated by Allison et al. (2008). The questionnaire included 14 items assessing morning hunger and timing of the first food consumption (2 items), food craving and control over eating behaviour both before bedtime (2 items) and during night-times awakenings (2 items), percentage of food consumed after dinner (1 item), initial insomnia (1 item), frequency of nocturnal awakening and ingestion of food (3 items) and mood disturbance (2 items) and awareness of nocturnal eating episodes (1 item). Items are scored on a 0–4 Likert scale with the exception of item 7. The NEQ total score was calculated by reverse coding items 1, 4, and 14 and summing all items, except item 13. The NEQ total score provides a range from 0 to 52 points. We validated the NEQ and the Cronbach's alpha for total score was 0.73. The cut-score for screening patients with NES is 25.

Dietary Intake

Dietary intakes were assessed using a semi-quantitative food-frequency questionnaire (FFQ) adapted to the Iranian society (Mirmiran et al. 2009). Since the efficiency of a FFQ is related to the culture and ethnic background of study population, the validity and reliability should be conducted in different population. The FFQ included 168 food items with specified serving sizes commonly consumed by Iranians. Participants reported their average frequency intake of each food item in terms of the number of specified serving sizes consumed per day/ week/ month/ year, or never. The reported frequency of consumed foods and portion sizes for each food item were converted to a daily intake.

Statistics

Statistical analysis was performed with Statistical Package for Social Science (SPSS 18 for windows, SPSS Inc® headquarter, Chicago, USA). Normality of data was analyzed by Kolmogorov–Smirnov test. Chi square and independent sample *t* test were performed for comparison of discrete and continuous variables between two groups respectively. Analysis of variance (ANOVA) followed by Tukey's post hoc test and analysis of covariance (ANCOVA) with adjustment for confounder variables were performed for comparison of continuous variables between more than two groups. P values less than 0.05 were regarded as statistically significant.

Results

Table 1 presents the comparison of BMI and nutritional intakes in different categorizes of EEQ. As shown in this Table, emotional eaters and very emotional eaters had significantly higher protein and fat intake compared with non and low emotional eaters. Among components of Pittsburg Sleep Quality Index (PSQI), subjective sleep quality score, sleep disturbances score and daytime dysfunction among

Table 1 The comparison of BMI and nutritional intakes in different categorizes of EEQ

Variable	Non- emotional eaters (N = 9)	Low emotional eaters (N = 32)	Emotional and very emotional eaters (N = 44)	P* value
EEQ score (mean ± SD)	3.55 ± 1.23	7.84 ± 1.22	14.79 ± 2.82	< **0.001**
Age (years)	13.75 ± 1.48	13.91 ± 1.05	14.25 ± 2.82	0.29
BMI (kg/m^2)	23.88 ± 1.95	24.17 ± 2.71	24.50 ± 2.58	0.82
Energy (kcal/day)	1922.57 ± 278.94	1740.20 ± 129.19	2063.00 ± 140.14	0.25
Protein (g/day)	70.32 ± 13.69	67.80 ± 5.04	91.12 ± 16.78	**0.025**
Carbohydrate (g/day)	326.80 ± 42.21	251.58 ± 21.03	270.92 ± 19.76	0.66
Fat (g/day)	66.50 ± 9.40	51.82 ± 4.13	75.16 ± 35.73	**0.008**
Grains/cereals (serving/week)	35.25 ± 17.70	35.88 ± 19.19	45.26 ± 25.92	0.17
Milk/dairy products (serving/week)	9.15 ± 5.94	8.99 ± 5.97	8.84 ± 6.41	0.98
Meat/fish/legumes (serving/week)	39.94 ± 25.74	30.26 ± 26.60	45.28 ± 34.75	0.09
Fruits (serving/week)	22.68 ± 9.89	16.33 ± 12.47	17.73 ± 12.99	0.41
Vegetables (serving/week)	15.98 ± 8.08	12.07 ± 9.39	18.05 ± 9.42	**0.026**

The bold values are statistically significant

EEQ emotional eating questionnaire, *BMI* body mass index

*P values from ANOVA followed by Tukey's post hoc analysis

Table 2 Pittsburg Sleep Quality Index (PSQI) components in different categorizes of EEQ

Variable	Non- emotional eaters (N = 9)	Low emotional eaters (N = 32)	Emotional and very emotional eaters (N = 44)	P* value
Subjective sleep quality	1.22 ± 0.97	1.94 ± 1.16	1.41 ± 0.84	**0.04**
Sleep latency	0.77 ± 0.97	1.09 ± 0.85	0.97 ± 0.11	0.55
Sleep duration	1.33 ± 1.32	0.62 ± 0.18	0.54 ± 0.92	0.33
Habitual sleep efficiency	1.33 ± 1.47	0.65 ± 0.19	0.86 ± 1.13	0.29
Sleep disturbances	1.22 ± 0.66	0.96 ± 0.59	1.31 ± 0.56	**0.04**
Use of sleeping medications	0.33 ± 0.50	0.28 ± 0.68	0.52 ± 0.12	0.35
Daytime dysfunction	1.44 ± 0.88	1.06 ± 0.77	1.63 ± 0.68	**0.006**
PSQI global score (mean ± SD)	7.66 ± 3.50	6.61 ± 2.38	7.27 ± 2.65	0.44

The bold values are statistically significant

PSQI Pittsburg sleep quality index

*P values from ANOVA followed by Tukey's post hoc analysis

emotional eaters and very emotional eaters were significantly higher (Table 2, $P < 0.05$). The comparison of BMI and nutritional intakes in adolescents with and without night eating syndrome are presented in Table 3. As shown in this Table, adolescents with NES, had higher PSQI score and lower carbohydrate intake ($P < 0.05$); whereas, intake of fat among NES group was significantly higher ($P = 0.05$). Among PSQI components (Table 4), habitual sleep efficiency score, daytime dysfunction score and sleep disturbances score among NES group were significantly higher compared with non-NES group. Interestingly, the prevalence of night eating syndrome in poor sleepers was substantially higher compared with good sleepers ($P = 0.03$, Fig. 1) (Table 5).

Discussion

In the current investigation, we demonstrated that emotional eater adolescents had poor sleep quality and higher protein and fat intakes. Moreover, adolescents with night eating syndrome had poor sleep quality scores and were eating higher fat and lower carbohydrate in their usual dietary intakes. The prevalence of night eating syndrome among patients with NES was also higher compared with patients without NES. It has been proposed that individual food choices are an important factor in emotional eating behavior and that stress-induced eating is associated with unhealthy dietary practices (Nguyen-Michel et al. 2007). For example, in the study by Cartwright and colleagues (Cartwright et al. 2003), higher stress was associated with more fatty food consumption in adolescents. In another study by Michaud et al. (1990) among high school students, stressful conditions were associated with higher total energy intakes in women and higher fat intake in boys. Interestingly, in our study low emotional eaters, emotional eaters and very emotional eaters had poor sleep quality as shown by higher subjective sleep quality scores. Moreover, emotional and very emotional eaters had high scores of sleep disturbances and daytime dysfunction compared with other groups. Same as our result, (Dweck et al. 2014) reported that the relationship between short sleep time and poor sleep quality with elevated food consumption exists in those who are prone to emotional eating. In their study, emotional eating scores were significantly higher in those who reported poor sleep quality. Indicators of stress such as activation of hypothalamic-pituitary- adrenal (HPA) axis and increased cortisol secretion are associated with sleep deprivation and poor sleep quality (Balbo et al. 2010). Additionally, low sleep quality and short sleep time may affect orexigenic and anorexigenic hormones, thus altering satiety and appetite and lead to obesity (Lombardo 2016; Cleator et al. 2012). In the previous study by Spidgel et al. (2004), reported that sleep deprivation reduced by 18% and increased by 28% the concentrations of leptin and ghrelin respectively. Although in the current study we did not observe any significant difference between dietary intakes of macronutrients in different categorizes of sleep quality components, we reported a lower carbohydrate intakes and higher PSQI scores in adolescents with night eating syndrome compared to adolescents without NES. These findings further confirm the above mentioned discussion about the relationship between poor sleep quality and higher fat intake and also our previous study (Alipour et al. 2015) reporting lower night sleep

Table 3 Food group intakes and anthropometric variables according to Pittsburgh Sleep Quality index components categorization

Characteristics	Fat (g/day)	Carbohydrate (g/d)	Protein (g/day)	Energy (kcal/d)	BMI (kg/m^2)
Sleep duration (h)					
≤6.0	24.54 ± 2.72	1965.69 ± 110.39	78.51 ± 4.62	256.21 ± 131.74	64.25 ± 34.11
6.1–7.0	23.43 ± 2.52	2284.44 ± 196.63	102.01 ± 11.81	316.71 ± 61.03	77.03 ± 31.68
7.1–8.0	23.67 ± 2.08	1748.20 ± 283.00	83.70 ± 17.99	245.96 ± 103.27	71.45 ± 36.91
≥ 8	23.97 ± 1.63	1557.91 ± 280.47	64.53 ± 8.18	251.66 ± 123.52	53.74 ± 11.88
P	0.55	0.29	0.26	0.58	0.48
Sleep latency (min)					
≥ 15	23.78 ± 2.55	1853.90 ± 864.12	74.63 ± 36.35	261.55 ± 126.17	61.08 ± 29.27
16–30	24.25 ± 2.41	1961.04 ± 860.86	87.51 ± 42.53	260.35 ± 119.20	69.67 ± 36.49
31–60	25.41 ± 2.72	2074.35 ± 736.80	71.07 ± 29.83	266.62 ± 138.15	65.01 ± 25.97
≥ 60	22.49 ± 1.79	1422.03 ± 770.65	59.24 ± 34.87	224.90 ± 113.13	44.18 ± 28.62
P	0.16	0.55	0.27	0.94	0.42
Daytime dysfunction (%)					
Never	24.30 ± 2.69	2063.58 ± 821.84	34.26 ± 5.55	282.25 ± 124.21	69.67 ± 34.57
Less than once a week	24.02 ± 2.66	2012.61 ± 865.68	48.85 ± 9.77	251.30 ± 137.59	64.64 ± 30.38
1–2 times/week	24.75 ± 2.06	1655.84 ± 834.31	34.74 ± 8.42	238.05 ± 98.51	63.76 ± 35.72
≥ 3 times/week	23.03 ± 1.84	1376.25 ± 460.67	24.76 ± 11.07	209.43 ± 85.79	43.61 ± 15.21
P	0.69	0.15	0.26	0.43	0.41
Sleep efficiency (%)					
≥85	24.27 ± 2.30	1939.45 ± 760.29	75.18 ± 33.10	269.25 ± 126.95	59.01 ± 27.97
75–84	24.10 ± 3.90	2181.70 ± 918.17	84.41 ± 39.74	258.42 ± 150.86	77.89 ± 44.16
65–74	24.03 ± 2.47	1825.17 ± 983.66	94.18 ± 31.52	255.97 ± 64.13	75.96 ± 25.80
< 65	24.45 ± 1.47	1646.38 ± 928.95	87.10 ± 56.74	232.96 ± 86.54	69.89 ± 33.82
P	0.98	0.35	0.56	0.80	0.17
Sleep medicine during past month					
Never	24.34 ± 2.66	1938.53 ± 110.48	267.25 ± 127.52	75.93 ± 33.98	66.19 ± 33.79
Less than once a week	24.48 ± 2.02	2094.71 ± 199.24	264.87 ± 114.89	99.00 ± 56.63	69.27 ± 35.35
1–2 min/week	23.92 ± 2.45	1652.66 ± 126.62	231.61 ± 35.19	72.72 ± 16.50	52.77 ± 18.75
≥ 3 times/week	21.05 ± 0.42	961.85 ± 814.85	87.66 ± 83.91	68.43 ± 5.424	50.15 ± 2.75
P	0.33	0.26	0.16	0.21	0.67
Sleep quality					
Good	24.58 ± 2.37	1993.54 ± 724.31	76.09 ± 30.16	276.96 ± 109.98	64.46 ± 5.69
Poor	24.13 ± 2.62	1901.77 ± 896.88	82.47 ± 43.50	250.29 ± 128.91	66.68 ± 4.60
P	0.44	0.61	0.43	0.32	0.76

PSQI Pittsburg sleep quality index

*P values from ANCOVA followed by Tukey's post hoc analysis

hours and higher dietary fat intake among college students who had body image distortion and dissatisfaction. One can hypothesize that night eating syndrome might lead to higher fat intake via inducing poor sleep quality. The unhealthy eating behaviors, skipping of meals and frequent snacking are prevalent among adolescents and could lead to development of serious health problems including night eating syndrome (Suri and Pradhan 2010). Same as our results, in the study by Gluck ME patients with NES had tendency to more fat consumption in their daily dietary intakes (Gluck et al. 2008).

Our study had also several limitations; first of all, the cross sectional design of the study cannot clarify the cause and effect relationship between variables. We did not evaluate physical activity level in our study as a major confounder of our studied parameters. We also did not evaluate the relationship between night eating syndrome and traumatic life events and psychiatric co morbidity. However, this study can

Table 4 The comparison of BMI and nutritional intakes in adolescents with and without NES

Variable	NES (N = 11)	Non-NES (N = 73)	P-value
NEQ score (mean ± SD)	28.11 ± 2.20	16.62 ± 5.03	**< 0.001**
EEQ score (mean ± SD)	13.18 ± 4.66	10.66 ± 4.64	0.11
PSQI score (mean ± SD)	9.00 ± 2.56	6.78 ± 2.52	**0.02**
Age (year)	13.73 ± 1.10	14.12 ± 1.11	0.27
BMI (kg/m^2)	24.31 ± 2.18	24.25 ± 2.59	0.94
Energy (kcal/day)	1844.50 ± 270.52	1938.8 ± 96.67	0.74
Protein (g/day)	83.63 ± 12.48	79.62 ± 4.53	0.76
Carbohydrate (g/day)	201.28 ± 96.88	268.76 ± 123.54	**0.042**
Fat (g/day)	84.66 ± 10.29	62.63 ± 3.71	**0.049**
Grains/cereals (serving/week)	35.32 ± 18.07	41.41 ± 23.70	0.33
Milk/dairy products (serving/week)	10.75 ± 8.60	8.66 ± 5.69	0.45
Meat/fish/legumes (serving/week)	39.89 ± 30.08	38.85 ± 29.88	0.91
Fruits (serving/week)	15.10 ± 8.78	18.12 ± 12.89	0.33
Vegetables (serving/week)	14.96 ± 9.83	19.51 ± 6.95	0.07

The bold values are statistically significant

NES nigh eating syndrome, *EEQ* emotional eating questionnaire, *NEQ* night eating questionnaire, *PSQI* Pittsburg sleep quality index, *BMI* body mass index

*P values from ANOVA followed by Tukey's post hoc analysis

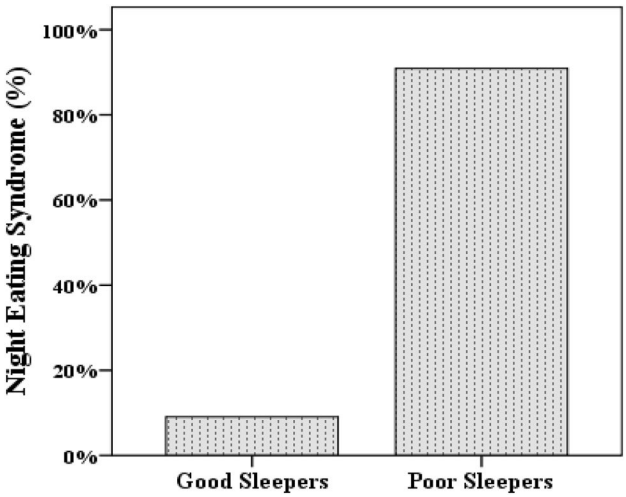

Fig. 1 The prevalence of Night eating syndrome in adolescents according to sleep quality (P = 0.03)

give good information about poor sleep quality determinants and their association with night eating syndrome and emotional eating behaviours to health professionals to develop preventive strategies against these health life-threatening problems.

In conclusion, the results of the current study suggest that emotional eating and night eating syndromes are in association with nutrient intakes and sleep quality in adolescents. Healthy nutritional habits including high fruits and vegetable intake and low fat intake could be considered as appropriate therapeutic approaches to prevent emotional eating and night eating syndrome among adolescents. Although because of the cross-sectional design of the study, the exact causal relationship between nutrient intake and emotional or night eating syndrome could not be inferred. Therefore, further studies with interventional designs are recommended to better elucidate the

Table 5 Pittsburg Sleep Quality Index (PSQI) components in adolescents with and without NES

P value	Non- NES (N = 73)	NES (N = 11)	Variable
Subjective sleep quality	1.18 ± 0.87	1.65 ± 0.02	0.12
Sleep latency	1.27 ± 0.78	0.95 ± 0.78	0.24
Sleep duration	1.09 ± 0.34	0.59 ± 0.11	0.19
Habitual sleep efficiency	1.54 ± 1.12	0.72 ± 0.13	**0.04**
Sleep disturbances	1.54 ± 0.52	1.12 ± 0.59	**0.02**
Use of sleeping medications	0.45 ± 0.15	0.41 ± 0.08	0.78
Daytime dysfunction	1.90 ± 0.70	1.32 ± 0.76	**0.02**

The bold values are statistically significant

NES night eating syndrome, *PSQI* pittsburg sleep quality index

*P values obtained from independent sample t-test

physiological determinants of emotional eating and night eating syndromes.

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