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Relationship of Sleep Duration with Obesity and Dietary Intake

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Abstract**—**Background: There is a mutual relationship between sleep duration and obesity. We studied the relationship between sleep duration with obesity and dietary Intake. Methods: This cross-sectional study was conducted on 444 male students in Ahvaz Jundishapur University of Medical Science. Dietary intake was analyzed by food frequency questionnaire (FFQ). Anthropometric indices were analyzed. Participants were being asked about their sleep duration and they were categorized into three groups according to their responses (less than six hours, between six and eight hours, and more than eight hours). Results: Macronutrient, micronutrient, and antioxidant intake did not show significant difference between three groups. Moreover, we did not observe any significant difference between anthropometric indices (weight, body mass index, waist circumference, and percentage body fat). Conclusions: Our study results show no significant relationship between sleep duration, nutrition pattern, and obesity. Further study is recommended.

Keywords**—**Sleep duration, obesity, dietary intake, cross-sectional.

I. Introduction

OBESITY is a global problem that many developed and developing countries suffer from. In recent years, obesity prevalence has spread among a lot of university and school students in many countries including Iran [1], [2]. There are many risk factors in incidence of obesity. One of these factors is dietary pattern [3]. Dietary pattern is associated with obesity and many diseases [4]-[6]. That is why many nutritional strategies have been presented for the prevention and treatment of metabolic diseases such as obesity [7]-[10].

Recent studies show that sleep duration is another important factor in incidence of obesity [11]. Sleep is an important factor in physical and mental health. However, lack of sleep has spread in contemporary societies [12]. Now, compared to the previous decades, children and adolescents devote less time to sleep [13]. Several factors including artificial light, caffeine consumption, obesity, food intake, and late-night screen time are effective in reducing sleep time [14]. Some of studies conducted in Iran show that more than half of the students in medical universities (Qazvin university of medical science, and Qom university of medical science, 57.5% and 61.7%, respectively) do not have a good sleep quality [15], [16].

Studies indicate that reduction in sleep duration could have different consequences on health of the people including depression, cardiovascular diseases, diabetes, and obesity [17], [18]. The relationship between sleep duration and obesity in children and adults has been studied in many countries [19], [20]. Although there is a belief that sleep is important for brain health, but it has been suggested that reduction in sleep duration during youth period can be regulate appetite and energy expenditure by manipulating hypothalamic mechanisms. This manipulation moves toward increasing appetite by reducing sleep duration [21]. Some studies focused on hormonal changes role. It is reported that reduction in sleep duration causes appetite increase by reducing leptin level and increasing ghrelin level [22], [23]. Despite this, one of effective factors and mechanisms related to the effect of sleep duration on obesity is the dietary intake factor that could result differently in each society regarding different dietary pattern. Hence, regarding to different dietary patterns in different societies and novelty of studies conducted on the relationship between sleep duration and obesity in Iran; this study was designed and carried out in Ahvaz Jundishapur University of medical science on male students to analyze the relationship between sleep duration and obesity regarding the dietary intake.

II. Material and Methods

The study population consisted of 444 male students who were studying in the Ahvaz Jundishapur University of medical science (Ahvaz, Iran), forming a cross-sectional study.

Participants were randomly selected and entered to study voluntarily. A 168-item semiquantitative food frequency questionnaire (sq-FFQ) consisting of a list of foods with a standard serving size was used for assessing the dietary intakes. Body weight was measured without shoes and light clothing by using a seca scale with the precision of 0.1 kg. Heights and waist circumference were also measured using a stadiometer without shoes with precision of 0.1 cm. Body mass index (BMI) was calculated by weight (kg) divided by height squared (m). Body fat percentage was earned by in body and physical activity was analyzed by using metabolic equivalent. Sleep duration was registered by asking participants. The examinees were divided into three categories based on the duration of sleep: less than six hour (n=72),

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between six and eight hours (n=292) and more than eight hours (n=80). The study protocol was approved by the Ethics Committee of Jundishapur University of Medical Sciences. (Ethical code. IR.AJUMS.REC.1394.143)

The data were analyzed by SPSS software (version 19). The normality of the distribution of variables was determined by the Kolmogorov-Smirnov test. To compare quantitative variables between three groups, ANOVA and Kruskal–Wallis tests were used for normal and non-normal distribution variables, respectively. All variables were expressed as mean± standard deviation (Mean ± SD). P values <0.05 were considered to be statistically significant.

TABLE I
CHARACTERISTICS OF MALE STUDENTS IN AHVAZ UNIVERSITY OF MEDICAL SCIENCES ACROSS THE TERTILES OF SLEEP DURATION

Variables	Tertiles of sleep duration			P value
	First	Second	Third	
	<6 h	6-8 h	>8	
N	72	292	80	-
Age (y)	21.8± 1.8	21.2± 1.5	20.7± 1.6	0.12
Weight (kg)	70.94±12.09	72.79± 13.76	78.07±12.07	0.53
Height (cm)	174.11± 7.41	177.60± 7.14	178.60± 8.23	0.13
BMI (kg/m^2)	23.73± 3.39	23.14± 3.88	24.47± 2.56	0.32
WC (cm)	90.11± 15.24	87.78± 12.89	91.35± 15.32	0.53
Physical activity (Met-h/w)	60.28± 24.84	55.31± 38.52	41.27± 19.72	0.11
Body fat (%)	25.91± 4.46	28.03± 6.45	28.87± 6.42	0.30
Sleep duration	5.11± 0.40	7.06± 0.75	9.50± 0.68	0.01

BMI: Body mass index, WC: Waist circumference; Data are presented as mean ± SD *P<0.05 is significant.

TABLE II
DIETARY INTAKE OF MALE STUDENTS IN AHVAZ UNIVERSITY OF MEDICAL SCIENCES ACROSS THE TERTILES OF SLEEP DURATION

Variables	Tertiles of sleep duration			P value
	First	Second	Third	
	<6 h	6-8 h	>8	
Energy (kcal/d)	2231.36± 959.79	2978.56± 2109.06	2164.51± 1483.70	0.11
Protein (g)	86.23± 44.94	106.09± 80.92	76.90± 55.85	0.21
Carbohydrate (g)	339.62± 140.08	463.79± 327.48	331.77± 258.27	0.09
Fat (g)	59.92± 32.97	80.05± 74.03	60.08± 35.61	0.28
Cholestrol (mg)	164.05± 148.00	182.07± 306.23	151.06± 160.26	0.88
SFT (g)	15.48± 8.71	19.68± 14.09	14.75± 7.96	0.18
Mufa (g)	19.31± 11.41	22.48± 14.18	16.78± 10.43	0.28
Pufa (g)	15.99± 8.83	19.69± 13.35	14.72± 10.65	0.20
Oleic acid (g)	17.23± 10.35	20.16± 12.93	15.26± 9.59	0.23
Linoleic acid (g)	13.67± 7.96	17.06± 11.32	12.69± 9.32	0.17
Linolenic acid (g)	1.02± 0.65	1.30± 1.05	1.01± 0.75	0.34
Calcium (mg)	966.50± 507.46	1305.53± 882.44	994.75± 799.27	0.57
Iron (mg)	14.69± 6.26	15.58± 12.42	10.90± 9.09	0.11
Zinc (mg)	9.98± 5.34	12.71± 10.25	8.55± 5.54	0.14
Magnesium (mg)	626.86± 368.55	852.23± 720.50	532.68± 358.64	0.08
Copper (mg)	4.04± 1.78	5.82± 4.90	3.93± 3.15	0.10
Selenium (µg)	277.82± 146.73	348.37± 254.59	236.38± 173.89	0.11
Manganese (mg)	11.30± 6.91	15.45± 13.09	8.67± 6.41	0.06
Chromium (mg)	0.15± 0.25	0.20± 0.38	0.03± 0.06	0.14
Sodium (mg)	3955.51± 1811.07	5915.11± 9155.48	4711.41± 3591.12	0.13
Phosphor (mg)	2535.19± 1334.56	3271.90± 2575.82	2168.95± 1485.37	0.11
Potassium (mg)	4557.82± 2783.63	5911.22± 5217.58	4140.58± 2695.91	0.22
Vitamin D (µg)	2.37± 2.88	2.68± 2.47	1.62± 1.65	0.23
Vitamin E (mg)	16.65± 10.62	19.90± 10.96	14.21± 11.42	0.09
Vitamin K (µg)	117.18± 101.82	174.07± 173.55	94.34± 70.89	0.07
Vitamin A (µg)	373.61± 298.35	554.12± 824.76	347.69± 159.68	0.37
Beta-Carotene (mg)	1520.30± 884.21	2393.74± 2853.79	1445.28± 1021.51	0.16
Vitamin C (mg)	76.29± 54.34	95.67± 98.30	95.68± 70.80	0.69
Lycopene (mg)	2313.68± 1735.11	3590.48± 5467.94	3527.47± 2752.57	0.57
Lutein (mg)	1282.08± 877.87	1633.46± 1245.55	1193.34± 797.19	0.20
Vitamin B1(mg)	1.13± 0.48	1.50± 1.12	1.13± 0.94	0.17
Vitamin B2 (mg)	3.77± 1.94	5.13± 3.61	3.78± 3.00	0.12
Niacin (mgNE)	59.98± 28.11	73.83± 55.62	54.26± 42.63	0.23
Vitamin B6 (mg)	2.83± 1.45	3.42± 2.60	2.28± 1.44	0.12
Vitamin B12 (µg)	5.57± 4.56	5.65± 9.60	4.02± 2.75	0.72
Biotin (µg)	32.12± 27.12	45.25± 45.68	23.24± 15.26	0.06
Caffeine (mg)	96.89± 84.59	103.26± 107.44	94.71± 94.86	0.93

BMI: Body mass index, WC: Waist circumference; Data are presented as mean ± SD *P<0.05 is significant

III. Results

444 male students of Ahvaz Jundishapur University of medical science (18-30 years old) were studied. Table I shows general characteristics of participants including age, anthropometric indices, physical activity, and sleep duration in this study. There was no significant difference in variables such as weight, height, BMI, waist circumference, and percentage body fat ($P<0.05$). Dietary intake of three groups based on sleep duration is shown in Table II. Analysis of the data showed no significant difference in calorie, protein, carbohydrate, and fat intake between the three groups ($P> 0.05$). Moreover, we observed no significant difference in vitamins and minerals intake between three groups ($P>0.05$). We also observed no significant difference in caffeine consumption and antioxidants intake (Lutein, Beta-Carotene and Lycopene) among three groups ($P>0.05$).

IV. Discussion

Results of the present study showed no relationship between sleep duration, obesity, and dietary intake among male students in Ahvaz University of medical science. Our study results were different from the other studies carried out on this topic.

Najafian et al. [24] analyzed the relationship between sleep duration and metabolic syndrome in Esfahan. Women and men older than 19 years were analyzed and studied in this experiment. Their result showed the people who sleep less than five hours per day are more vulnerable to metabolic syndrome than people who sleep seven to eight hours per day. This significant relationship was shown after sex and age adjustment (OR: 1.52; 95%CI: 1.33-1.74). Moreover, in the mentioned study, sleeping for 9 hours and more was introduced as a protective factor (OR: 0.79; 95%CI: 0.68-0.94) against metabolic syndrome. Participants were categorized into four groups according to their sleep duration (less than five hours, six hours, six to eight hours, and more than nine hours) that could be one of the factors for having contradictory results with our study. Haghighatdoost et al. [25] studied the relationship between sleep duration and dietary quality and obesity through a cross-sectional study on female students of Isfahan University of Medical Science. Results show that the people who sleep less than six hours per day encounter more chance to get overweighed and fat. Moreover, their study showed that people who sleep less use more calories and carbohydrates and less fiber, fruits, whole grains and legumes compared to others. Low scores of diet quality indices were reported in subjects with short sleep duration. Gender difference could be one of the reasons for contradictory results with the findings of our study.

Khan et al. [26] studied the relationship between quality and quantity of sleep with diet quality, physical activity, and weight in Canadian children. Results showed more sleep duration significantly reduce the risk of overweight and obesity (OR = 0.82, 95% CI: 0.73, 0.91). Moreover, longer sleep duration has been associated with better diet quality and higher physical activity level.

Kazem et al. showed that sleeping less than six hours per day can cause increasing BMI, insulin resistance, serum visfatin level, and reducing cognitive performance [27]. Wu et al. [28] examined relationship between the sleep duration with obesity through a meta-analyAtic study on children. Their results showed that reduction in sleep duration significantly increases the risk of obesity in children. Moreover, adequate sleep per day has been introduced as a potentially important factor in the prevention of obesity in children.

Most carried out studies in this area have emphasized the relationship between sleep duration with obesity and dietary intake. There were some limitations in the study such as small sample size, lack of female participants in study, lack of exact methods and tools for determining sleep duration and physical activity, and lack of sleep quality analysis.

V. Conclusion

We did not observe any relationship between sleep duration, obesity (weight, BMI, waist circumference, and percentage body fat) and dietary pattern in this study. Regarding study limits and inconsistency in the results of previous studies, we recommend a more comprehensive study with larger sample size.

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