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Changes in Adiposity and Dietary Intake during Nowruz Holiday in University Students

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study aimed to assess possible alterations in adiposity and dietary intake during holiday periods in healthy subjects.
Study Design: 452 students of medicine faculty of Mashhad University of Medical Sciences were

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participated in this study and announced via internet and campus announcement in Feb 2014.
Methodology: Anthropometric parameters and body composition were measured using standard protocols. Individual nutritional intakes were assessed using the Dietplan6 software. SPSS software version 11.5 was used for statistical analysis.
Results: Of the 452 students who attended the pre-holiday visit, 433 returned for the post-holiday appointments. Of these participants, 82 (18.1%) were men. The mean age was 24.4 years for men and 23.8 years for women (p=0.171). All the adiposity and body composition variables significantly changed over the follow-up except for fat free mass (p=0.074) and truck fat free mass (p=0.935). Mean weight of participants increased from 63.5 kg to 63.9 kg at the end of holiday (absolute change 0.37 kg, p<0.001). Total energy intake increased by 16.4%, carbohydrate by 15.9% and total fat by 25.4%, and significant association were observed between changes in some dietary variables and change in adiposity during follow-up (15 days).
Conclusion: In conclusion, holidays like Nowruz play a significant role in periodical weight gain and obesity in the college students of Mashhad University. Moreover we have found that dietary intake of carbohydrate and total fat increased through Nowruz holiday. Understanding times when people are more likely to gain weight including holidays is important for the development of prevention strategies.

Keywords: Obesity; body composition; body weight; Nowruz holiday; dietary intake.

1. INTRODUCTION

Obesity is a potent predictor of poor health status [1]. Obesity and overweight are leading risk factors for many adverse health outcomes including type 2 diabetes, hypertension, dyslipidaemia, cardiovascular diseases and some types of cancers [2-5]. Although genetic predisposition may play an important role in the occurrence of obesity, high caloric diets and sedentary lifestyles are major contributors [6]. Weight gain during holidays is thought to be a significant determinant of obesity occurrence [7, 8]; with the incidence of a large weight gain during holiday increasing with the starting body mass index (BMI) [9]. It has been indicated that only a few weeks of overeating and reduced physical activity causes many harmful effects on the body including increased fat percentage, waist circumference, body mass index, total cholesterol and triglycerides [10,11]. Studies recommended that a significant percentage of the average annual body weight gain in US adults occurs during the winter holiday quarter and is sustained throughout the following year [12]. Summer vacations have also been a time period of focus. Summer weight gain has been stated in most studies, with the greatest weight gain occurring in overweight children and adolescents [13-15]. These changes in anthropometric indices can be attributed to higher dietary intake and lower physical activity during holidays periods compared to non-holiday days. However, existing evidence is still conflicting. Some studies reported no significant difference in body weight during holiday [8,16,17].

Nowruz indicates the first day of spring, beginning of the year in the Persian calendar. It is celebrated by people from diverse ethnic and religious backgrounds in many other countries including Afghanistan, Albania, Azerbaijan, the Former Yugoslav Republic of Macedonia, India, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey and Turkmenistan as well as Iran (15-day-New Year holiday) [18]. Since during this period (15-day-New Year holiday) people visit each other much more than at other times of the year, and it is traditional custom for people to prepare staple food, snacks, fruits, nuts, candies, and get these ready for the visitors to eat, people tend eat much more than in usual time.

Regarding the long-term negative health consequences of overweight and obesity, and considering that the Nowruz holiday in Iran may contribute to annual body weight gain, it is necessary to understand the factors affecting this body weight gain.. The aim of this study was to evaluate alterations in dietary intake, body weight and body composition in the healthy subjects during Nowruz.

2. MATERIALS AND METHODS

2.1 Study Population

In this observational, longitudinal study, 452 students of medicine faculty of Mashhad

University of Medical Sciences were participated in this study and announced via internet and campus announcement in feb 2014. All the subjects were examined at two phases,before and after nowruz holiday(15 day new year holiday) Eligibility criteria included an age of at least 18 years, being healthy, and willingness to attend all study visits. Subjects were excluded (12 person) if they suffered from any particular diseases affecting body composition or metabolism, were pregnant, were severely underweight (body mass index [BMI] <18.5 kg/m²), were on restriction diets and were using drugs that affect appetite and weight. Sample size were on according to the study conducted by Yanovski et al. with confi¬dence interval of 95%, and power of 80% was calculated [19]. All subjects were participated voluntarily and signed a written consent form. All of these forms were approved by the university ethics committee and all the information remained confidential.

2.2 Protocol

Baseline measurements were obtained two weeks before the Nowruz holiday (pre-holiday and follow-up measurements after the holiday (early post-holiday). Dietary information was collected using a three different days, 24-hour food record questionnaire [20]. Individual nutritional intakes (all macro and micro nutrients intake) were assessed with the use of the Dietplan6 software (Forestfield Software Ltd., UK). All the data collected by one person (A specialist in nutrition, ZG).

Height (to the nearest 0.1 cm) was measured using a portable stadiometer (Seca 213, Seca Corp., Hamburg, Germany) in a participant without shoes, stretching to the maximum height with the head positioned in the Frankfort plane. The weight, BMI, and body composition were measured by a bio-impedance analyzer (BIA) (Tanita BC-418 MA, Tanita Corp.,Japan) and participants were dressed in light clothing (i.e. no shoes, sweaters or jackets, with 0.1Kg accuracy, frequency range 50-60 Hertz) [21]. The BIA was calibrated according to the manufacturer's guidelines before each testing and the participants were informed in advance not to use any substance affecting their body composition (e.g. alcohol and coffee) 24 hours before the test [21] to evaluate the fat percentage, fat mass, fat free mass, trunk fat percentage, trunk fat mass, trunk fat free mass. All evaluations were performed by a single trained nutritionist (ZG). Waist circumference was measured by a flexible anthropometric tape measure, at the narrowest part of the trunk between the last rib and the iliac crest [21].

2.3 Ethical Considerations

The study aims and methods were described to the participant and the signed informed consent obtained from them prior to participation. Moreover, the study protocol was approved by Ethical Committee in Research of Mashhad University of Medical Sciences (No: A545).

2.4 Statistical Analysis

SPSS software (version 11.5, Chicago, IL, USA) was used for statistical analysis. The Kolomogrov-Smirnov test was used to confirm the normal distribution of continuous variables. Data are expressed as the mean and standard deviation (SD) for normally distributed variables and median and 25th-75th percentiles for skewed variables. Change in adiposity markers and dietary intake during follow-up were investigated using the paired t-test and Wilcoxon test in the overall cohort. Linear regression models (adjusted for sex and age) were used to assess the association between change in anthropometric variables and change of dietary intake during holiday. A p-value ≤0.05 was considered statistically significant.

3. RESULTS

3.1 Baseline Characteristics

Of the 452 students who attended the pre-holiday visit, 433 returned for the post-holiday appointments and completed the study (4% drop-out rate). Of these participants, 82 (18.1 %) were men and 370 (81.9%) were women. The mean age of the participants was 23.9 years overall, 24.4 years for men and 23.8 years for women (p=0.171). With respect to adiposity factors, significant men vs. women differences were found for all the factors, except for trunk fat mass (p=0.131). Energy intake was lower in men than women (1618.9 vs. 1639.1; p=0.030), while no significant difference was found for all other dietary variables (Table 1).

3.2 Changes in Adiposity, Body Composition and Dietary Intake during Follow-up

Changes in adiposity and body composition during holiday are described in Table 2. Body weight increased by 0.4 kg (relative change 0.6%), BMI by 0.1 Kg/m2 (0.6%), waist circumference by 0.3 cm (0.4%), fat percentage by 0.6% (relative change 3.3%), total fat by 0.4 kg (3.6%), trunk fat percent by 0.9% (relative change 6.6%) and absolute trunk fat mass by 0.4 kg (14.4%); with all these changes being statistically significant (all p<0.001). Contrariwise, marginal decreased in total fat free mass (absolute change -0.2 kg [relative change -0.4%], p=0.502) and trunk fat free mass (-0.01 kg [7.8%], p=0.499) did not reach statistical significance. When changes in adiposity and body composition during holiday were compared between men and women, the following differences were observed:

> Body weight changes were higher in men than women (0.8±1.3 g vs. 0.2±1.4 g for men and women, respectively) and also for BMI (0.2±0.4 vs. 0.09 ± 0.5 for BMI respectively for men and women).

Changes in dietary intake are also described in Table 2. Significant increased were observed for total energy (relative increased 16.4%, p<0.001), carbohydrate (16%, p=0.011), total fat (25.4%, p<0.001), cholesterol (4%, p<0.001), polyunsaturated fatty acids (5.5%, p=0.034), while fibre intake significantly decreased (-8.2%, p=0.004). Change in protein intake was not significant (p=0.315). The following differences were observed when changes in dietary intakes were compared between men and women: energy intake in men was higher in men than women (244±804 kcal vs. 331±669 g for men and women respectively) and also for sugar intake (24.3±59.7 g vs. 7.2 ± 80 g for sugar intake respectively for men and women).

3.3 Association between Changes in Dietary Intake and Changes in Adiposity during Holiday

The age and sex adjusted regression coefficients for the association between changes in dietary intake and changes in adiposity are described in Table 3. Change in saturated fatty acids, galactose and lactose (all p<0.001) were significantly and positively associated with changes in weight and BMI, while change in monounsaturated fatty acids (p=0.011), cholesterol (p=0.009), fructose, sucrose and lactose (all p<0.01) were significantly associated with change in fat mass.

4. DISCUSSION

The present study investigated the effect of holiday on anthropometric, adiposity and dietary intake among medical students in Iran. We observed that during this relatively short holiday, total and regional adiposity significantly increased, in parallel with increases in energy intake, fat, carbohydrate intake, and a reduction in fibre intake. There was further evidence from regression analysis that changes in adiposity were correlated with changes in dietary intakes. Although the magnitude of changes was inconsiderable, cumulative effect over the successive holiday will likely have a profound effect on obesity development and maintenance.

We observed increased in adiposity during holiday are in line with the findings of Cooper et al. [13], Montero et al. [11], Yanovski et al. [19], Costa et al. [7] and Branscum et al. [22]. Similarly, Payab et al. recently reported significant weight gain during Nowruz holiday among the staff of a hospital in Tehran, Iran [23]. Cooper et al. conducted a prospective study to determine if a 1- to 3-week vacation in adults leads to weight gain and whether that gain persists 6 weeks later. Their results showed that holidays causes important weight gain, and this weight gain persisted at the 6-week follow-up period. In accordance with our findings, they reported that the weight gain seems to be determined by increased energy intake above energy requirements [13].

However, some studies reported no significant difference in body weight during holiday [8,16, 17]. The difference in body weight and BMI following holiday in our study seems inconsiderable. However, the accumulating such small gains over successive holidays across years is likely to translate into sizable gains, which in turn can explain some of the rise in obesity among adults [19].

Table 1. Participants' characteristics at baseline

Variables	Overall (n=433)	Male (n=96)	Female (n=357)	P-value
Age, years	23.9±4.2	24.4±4.7	23.8±4.0	0.171
Education status, n (%)				0.863
Freshman	146 (32.2)	32 (33.3)	114 (31.8)	
Sophomore	88 (19.4)	19 (19.8)	69 (19.3)	
Junior	79 (17.4)	16 (16.7)	63 (17.6)	
Senior	71 (15.6)	12 (12.5)	59 (16.5)	
Graduate	70 (15.4)	17 (17.7)	53 (14.8)	
Marital status, n (%)				0.352
Single	368 (81.1)	81 (84.4)	287 (80.2)	
Married	86 (18.9)	15 (15.6)	71 (19.8)	
Residence, n (%)				0.175
Dormitory	204 (44.9)	49 (51.2)	155 (43.3)	
Own room	250 (55.1)	47 (49.3)	203 (56.7)	
Height (cm)	166.4±8.6	177.3±5.9	163.4±6.6	<0.001
Weight (Kg)	63.5±12.2	78.9±12.3	59.5±8.3	<0.001
Waist circumference (cm)	76.8 ±10.2	89.4±10.8	73.4±6.4	<0.001
Body mass index (kg/m2)	22.8±3.2	25.0±3.3	22.2±2.9	<0.001
Fat percentage (%)	24.5±6.6	17.8±6.2	26.3±5.5	<0.001
Fat mass(kg)	15.7±5.6	14.5±6.2	16.0±5.3	0.023
Fat free mass (kg)	47.7±10.0	64.4±7.9	43.2±4.0	<0.001
Trunk fat percentage (%)	21.6±7.1	17.8±6.4	22.6±6.9	<0.001
Trunk fat mass (kg)	7.5±3.2	7.9±3.4	7.3±3.2	0.131
Trunk fat free mass (kg)	26.5±5.6	35.0±4.5	24.2±3.1	<0.001
Energy (Kcal)	1639.1 (1400.9-1803.3)	1618.9 (1462.5-1838.0)	1639.1 (1382.7-1787.2)	0.030
Protein (g)	201.2 (156.9-227.9)	216.4 (183.3-231.4)	191.7 (152.9-227.6)	0.808
Carbohydrates (g)	229.2 (191.2-257.6)	240.1 (191.5-255.4)	218.2 (187.6-259.4)	0.549
Fat total (g)	50.1 (42.3-64.8)	50.1 (45.9-63.7)	50.1 (41.5-64.8)	0.353
Cholesterol (mg)	175.8 (139.8-255.6)	201.4 (147.9-270.3)	160.7 (131.3-247.3)	0.021
Saturated fatty acids (g)	15.7 (12.8-18.0)	16.1 (12.7-20.9)	15.7 (12.8-17.8)	0.194
Monounsaturated fatty acids (g)	17.0 (13.8-19.6)	18.2 (16.2-21.4)	16.1 (13.5-19.5)	0.262
Polyunsaturated fatty acids (g)	10.1 (7.6-13.8)	10.8 (8.6-14.3)	10.07 (7.51-13.5)	0.211
Fiber total (g)	21.0 (13.8-27.9)	21.2 (16.6-25.2)	20.8 (13.5-28.1)	0.211
Sugar (g)	72.3 (51.5-88.2)	60.9 (45.4-102.3)	72.3 (51.7-88.2)	0.149
Glucose (g)	8.7 (5.3-14.1)	10.2 (6.4-14.2)	8.6 (5.2-14.1)	0.160
Galactose (g)	1.4 (1.0-2.7)	1.4 (1.1-3.3)	1.4 (1.0-2.5)	0.175
Fructose (g)	11.2 (7.2-17.6)	14.1 (7.0-18.0)	10.2 (7.2-17.1)	0.165

Variables	Overall (n=433)	Male (n=96)	Female (n=357)	P-value
Sucrose (g)	14.5 (8.6-20.8)	15.9 (7.9-18.5)	14.4 (9.3-20.9)	0.183
Lactose (g)	9.6 (5.6-16.2)	8.5 (6.3-11.3)	9.6 (5.6-16.2)	0.125
Maltose (g)	0.7 (0.4-1.2)	0.8 (0.4-1.3)	0.7 (0.4-1.1)	0.164

Table 2. Anthropometric, adiposity and dietary intake baseline

Variables		Absolute change (immediate post-holiday – baseline)	Relative change (immediate post-holiday – baseline)	p-value	P effect of gender
Anthropometric factors	Weight (kg)	0.32±1.44	0.62±2.63	<0.001	<0.001
	Waist circumference (cm)	0.32±0.01	0.31±0.02	<0.001	<0.001
	Body mass index (kg/m2)	0.1±0.5	0.6±2.6	<0.001	0.005
Adiposity factors	Fat percentage (%)	0.5±1.6	3.3±9.0	<0.001	0.234
	Fat mass (kg)	0.3±1.1	3.6±9.9	<0.001	0.002
	Fat free mass (kg)	-0.2±2.5	-0.3±7.3	0.074	0.502
	Trunk fat percentage (%)	0.9±2.3	6.6±16.7	<0.001	0.159
	Trunk fat mass (kg)	0.4±1.4	14.4±80.4	<0.001	0.129
	Trunk fat free mass (kg)	-0.01±2.5	7.8±92.2	0.935	0.499
Dietary factors	Energy (Kcal)	246.4 (-169.7 to 6 5.8)	16.4 (-11.7 to 45.9)	<0.001	0.310
	Protein (g)	19.5 (-37.0 to 80.6)	11.1 (-16.2 to 47.3)	0.315	0.244
	Carbohydrates (g)	29.1 (-49.3 to 71.0)	15.9 (-23.5 to 40.7)	0.011	0.938
	fat total (g)	13.8 (-3.5 to 36.5)	25.4 (-6.6 to 81.9)	<0.001	0.331
	Cholesterol (mg)	6.2 (-61.8 to 142.4)	3.9 (-26.8 to 81.8)	<0.001	0.222
	Saturated fatty acids (g)	6.5 (-0.6 to 12.9)	37.9 (-3.9 to 85.0)	0.342	0.150
	Monounsaturated fatty acids (g)	3.8 (-2.1 to 11.6)	22.7 (-12.9 to 67.8)	0.598	0.230
	Polyunsaturated fatty acids (g)	0.4 (-2.2 to 6.4)	5.4 (-18.1 to 60.5)	0.034	0.219
	Fiber total (g)	-1.3 (-12.2 to 8.6)	-8.1 (-45.2 to 63.9)	0.004	0.124
	Sugar (g)	15.8 (-13.3 to 47.6)	22.9 (-16.9 to 75.1)	0.005	0.073
	Glucose (g)	5.5 (-2.7 to 10.4)	61.3 (-21.4 to 168.0)	0.137	0.123
	Galactose (g)	0.9 (-1.1 to 2.5)	55.6 (-73.5 to 208.6)	0.009	0.124
	Fructose (g)	4.6 (-5.3 to 11.5)	43.0 (-32.5 to 149.0)	0.100	0.124
	Sucrose (g)	-1.4 (-8.4 to 8.9)	-8.3 (-48.6 to 86.0)	0.007	0.220
	Lactose (g)	0.2 (-7.5 to 6.5)	1.2 (-59.4 to 99.8)	0.006	0.058
	Maltose (g)	0.1 (-0.3 to 0.7)	23.0 (-38.5 to 146.5)	0.006	0.163

P-values are from paired sample t-test and Wilcoxon test. Data expressed as a mean ± standard deviation for anthropometric and adiposity factors, for dietary factors data are based on mean and confidence interval

Table 3. Change in anthropometric, adiposity and dietary intake factors during follow-up

Variables (absolute change)	Weight (absolute change)		Body mass index (absolute change)		Fat mass (kg) (absolute change)		Trunk Fat mass (Kg) (absolute change)	
	β	p-value	β	p-value	β	p-value	β	p-value
Energy (Kcal)	0.29	0.842	0.14	0.920	0.33	0.824	1.78	0.235
Protein (g)	-1.29	0.045	-1.29	0.045	-0.60	0.359	-1.77	0.007
Carbohydrates (g)	-0.22	0.795	-0.10	0.903	-0.19	0.829	-1.07	0.227
fat total (g)	-0.52	0.740	-0.47	0.766	-0.90	0.577	-1.95	0.222
Cholesterol (mg)	0.10	0.127	0.11	0.089	-0.18	0.009	-0.19	0.006
Saturated fatty acids (g)	1.64	0.038	1.64	0.037	0.84	0.293	2.30	0.004
Monounsaturated fatty acids (g)	2.05	0.085	2.07	0.080	3.07	0.011	3.13	0.009
Polyunsaturated fatty acids (g)	1.24	0.275	1.26	0.265	-0.17	0.879	-2.45	0.033
Fiber total (g)	-0.03	0.894	-0.04	0.865	-0.50	0.084	-0.22	0.451
Sugar (g)	0.31	0.228	0.35	0.184	0.26	0.321	-0.19	0.475
Glucose (g)	-0.57	0.661	-0.80	0.537	-0.86	0.516	1.49	0.256
Galactose (g)	-6.98	<0.001	-7.08	<0.001	-2.13	0.214	-2.62	0.125
Fructose (g)	1.18	0.214	1.29	0.173	2.49	0.010	0.50	0.603
Sucrose (g)	-0.77	0.081	-0.82	0.064	-1.31	0.004	-0.07	0.874
Lactose (g)	2.36	<0.001	2.41	<0.001	1.67	<0.001	2.00	<0.001
Maltose (g)	1.43	0.677	1.44	0.674	-1.63	0.642	0.55	0.874

Models were adjusted for sex and age

Other body composition variables including fat mass and fat percent were significantly different between pre- and post-holiday visits in the present study which is in accordance with Hull et al. [8] and Cristi-Montero et al. [11]. Significant increase in trunk fat mass of the participants during holiday in this study is in line with the findings of Costa et al. and Hull et al. [7,8]. In contrast, Wagner et al. found no significant difference in fat percent [17], while Payab et al. [23] observed a significant decrease in fat percent, as well as a significant increase in fat free mass among the hospital staff during Nowruz holiday.

The present study, for the first time, analysed the macro and micro nutrient intake before and after holiday. Our findings suggest that holiday had a significant effect on the components of food intake including total calories, carbohydrates and fat intakes. Grimes et al. carried out a national investigation in Australia to compare the dietary component of the student on non-school days with school days [24]. In line with our findings, they reported that intakes of total fat, sugars, saturated fat and the energy density of foods consumed is higher during holiday's days. In addition, the absolute intake of sodium was higher on non-school days. In accordance with our findings, Shahar et al. observed an increase in fat and calorie intake during winter holidays [25]. Moreover, Ma et al. [26] demonstrated that daily calorie intake was higher during autumn holiday compared to spring and showed a slight seasonal variation with a peak for carbohydrate intake in spring and for total fat in fall in overweight/obese participants. Our regression analysis also revealed some associations in the causal direction between changes in dietary intake and change in adiposity during holiday.

5. STRENGTHS AND LIMITATIONS

Follow-up the participants after holiday and assessing macro-micro nutrient intake in the mentioned times are the strengths of this study. Moreover, we collected no data for regular times (one- or two-weeks (post – pre) holiday) to figure out if college student are increasing their weight constantly. However, one limitation of the study was that the participants were informed of the aim of the study, which might possibly have biased our findings. Secondly, physical activity, which might be a confounding factor, was not assessed in our study. Lack of a third visit showing the change in weight and body composition a few months later was another limitation of the study. Generally, limiting the intake of high-calorie foods and having regular physical activity during the Nowruz holiday is strongly recommended.

6. CONCLUSION

Our study findings suggest that Nowruz holiday could play a significant role in periodical weight gain and obesity in this population of medical students, which can be contribute to weight gain and maintenance in later age. Considering the health consequences of overweight and obesity, understanding times when people are more likely to gain weight including holidays is important for the development of prevention and control strategies.

CONSENT

All subjects were participated voluntarily and signed a written consent form.

ETHICAL APPROVAL

All of these forms were approved by the university ethics committee and all the information remained confidential.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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