ORIGINAL REPORT

Dietary Intakes in Asthmatic and Non-Asthmatic Female Pupils of Tehran

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Abstract- Dietary factors are suggested to be involved in recent increases in the prevalence of asthma. The differences in dietary intake of 23 asthmatic and 317 non-asthmatic students were investigated, who were chosen by multistage stratified cluster sampling. The dietary data were assessed by food frequency questionnaire and a 24-h recall form. Total calorie and fat intake were similar. Daily intake of Saturated and poly-unsaturated fatty acids, and calcium and sodium were significantly higher in asthmatics. There was no significant difference between dietary antioxidant intake of asthmatic and non asthmatics. It seems that in this age, the type of consumed fat may be more important than the amount of fat intake in inducing asthma. For accurate results, n-6 and n-3 fatty acid intake must be assessed. Higher sodium and calcium intake may also be associated with asthma. Randomized controlled trials with restricting diets can help to elucidate the results.

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Introduction

Asthma is a significant public health problem worldwide, with high and increasing prevalence in many countries, especially in children (1). The exact cause of this increasing prevalence is not clear; however it seems that some factors such as dietary factors may contribute to such increase (2). The important changes in modern diet have suggested that the epidemiological changes of asthma are related to the changes in food consumption. Excess in sodium intake, low intake of dietary antioxidants, and changes in dietary balance between omega-3 polyunsaturated fatty acid (PUFA) and omega-6 PUFA have been proposed as possible causes (3).

The aim of this study was to evaluate the differences in dietary intake between a female population with and without asthma.

Materials and Methods

The students in this study were a subset of students of the Tehran Adolescent Obesity Study (2004-05), the detailed information of which has been published previously (4).

The study was a cross-sectional study conducted in Tehran. To get an even distribution of children according to socio-economic status, a multistage stratified cluster sampling was done, according to the information obtained from municipality and ministry of education, in each area the life conditions and socioeconomic status was almost the same. Twenty secondary and high schools (6^{th} to 11^{th} grades) were randomly selected from 5 different zones in Tehran, and totally 400 female students, 11-17 year old, were chosen randomly.

All enrolled participants were questioned about asthma history and symptoms. Asthma was defined as physician diagnosed asthma and confirmed by symptoms. The students were divided in 2 groups: asthmatics and non-asthmatics. The weight, height and waist circumference of all students were recorded. The body mass index (BMI; in kg/m^2) was calculated.

Dietary intakes were assessed by an extensive standard food frequency questionnaire (FFQ) and a 24-h recall form. This food frequency questionnaire asked about the usual frequency of consumption and portion size of 120 different food groups, as well as other dietary patterns (Willett format).

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Table 1. Characteristic of asthmatic and non-asthmatic subjects

	Asthmatics (n=23)		Non-asthmatics (n= 317)		*P* value
	Mean ± SD	95% CI	Mean ± SD	95% CI	
Age [a]	14.22 ± 1.73	13.47 -14.97	13.88 ± 1.77	13.68 – 14.08	0.393
BMI[bc]	21.65 ± 3.24	20.25 – 23.05	20.68 ± 3.71	20.28 -21.09	0.333
Weight [b]	55.11 ± 10.45	50.59 – 59.63	52.89 ± 11.63	51.60 -54.15	0.588
Waist circumference [b]	70.08 ± 9.48	65.99 – 74.19	67.77 ± 9.18	66.87 – 68.91	0.349

In statistical analysis, $P<0.05$ was considered as significant.

[a] Independent-samples T test.

[b] After adjustment, using ANCOVA

[c] Body Mass Index (Kg/m^2)

The analysis of diet questionnaires was performed by Food Processor 2 software. All of the collected information was compared in two groups.

SPSS 13.0 for windows software was used for statistical analysis. Variables were analyzed with one sample *t* test and Independent-samples T test. If there was need to adjust the effect of age, analysis of Covariance was used. A *P* value of less than 0.05 was considered as significant.

This study was approved by the Ethics Board of Tehran University of Medical Sciences and Iranian Ministry of Education and Training.

Results

Of 400 students studied, 60 were excluded due to uncertain responses or other medical conditions. Twenty-three female students were considered as asthmatic students and the 317 healthy non-asthmatic female students were evaluated as non-asthmatic group.

The characteristics of all subjects are presented in Table 1.

There was no significant difference in BMI, Weight and Waist circumference between the two groups. Dietary intakes of female asthmatic and non-asthmatic students are shown in Tables 2 and 3. No significant difference was detected between subjects' calorie intake. Total calories from fat (% of total calories) in both groups was significantly higher than recommended daily intake of 30% (P=0.009 in asthmatics and p<0.001 in non asthmatics), with no significant difference between the intakes of the two groups. Daily intake of Saturated Fatty Acids (SFAs) and PUFAs were significantly higher in asthmatic students compared to non-asthmatics (P=0.005, P=0.029, respectively) (Table 2).

Table 2. Macronutrient intake of asthmatic and Non-asthmatics subjects

	Content in the diet				
	Asthmatics				*P*-
	Mean ± SD	95% CI	Mean ± SD	95% CI	value
Total calories (Kcal/d)	1807.70 ± 736.16	1489.36-2126.04	1864.50±743.11	1597.46-1763.19	0.427
Total Fat (g/d)	70.38 ± 31.62	56.71-84.05	65.54 ± 41.11	60.36-69.54	0.536
SFA[ab] (g/d)	37.50 ± 61.72	10.81-64.18	23.24 ± 18.85	20.90-25.10	0.005*
PUFA[c] (g/d)	19.77 ± 11.69	14.72-24.83	15.15 ± 9.81	13.96-16.15	0.029*
Total Protein (g/d)	62.01 ± 24.72	51.32-72.70	54.16 ± 22.93	51.29-56.46	0.106
Total CHO [d] (g/d)	243.18 ± 110.21	195.52-290.84	231.11 ± 107.92	217.99-242.21	0.577
Total calories from fat (%energy)	34.26 ± 7.13	31.18-37.34	33.51 ± 9.53	32.36-34.45	0.668
Total calories from protein (% energy)	14.00 ± 4.01	12.27 – 15.73	12.92 ± 3.79	12.47 – 13.32	0.181
Total calories from CHO (% energy)	52.22 ± 8.28	48.63 – 55.80	53.60 ± 10.16	52.53 – 54.81	0.505

A $P<0.05$ was considered as significant (Independent-samples T test)

[a] Saturated Fatty Acid

[b] After adjustment, using ANCOVA

[c] Poly Unsaturated Fatty Acid

[d] Carbohydrates

[*] Significance at <0.05 level

Table 3. Micronutrient intake in asthmatic and Non-asthmatics subjects

	Content in diet				
	Asthmatics		Non-asthmatics		*P*-value
	Mean ± SD	95% CI	Mean ± SD	95% CI	
Vitamin A (μg)	908.35 ± 855.19	538.54-1278.16	763.54 ± 1728.43	553.67-932.52	0.644
β-Carotene (μg)	575.03 ± 760.61	246.11-903.94	387.96 ± 534.37	328.31-447.56	0.117
Vitamin C (mg)	124.49 ± 121.41	71.99-177.00	152.88 ± 154.50	132.38-166.57	0.445
Vitamin E (mg)	7.92 ± 4.37	6.03-9.82	8.84 ± 8.02	7.75-9.52	0.671
Thiamin (mg)	1.22 ± 0.55	0.98-1.46	1.15 ± 0.49	1.09-1.20	0.476
Riboflavin (mg)	1.76 ± 0.79	1.42-2.10	1.45 ± 0.90	1.35-1.55	0.104
Niacin (mg)	13.07 ± 6.30	10.35-15.80	13.00 ± 6.74	12.18-13.69	0.923
Pyridoxine (mg)	1.44 ± 0.66	1.15-1.73	1.84 ± 11.51	0.55-3.11	0.870
Cobalamin-B12 (mg)	2.85 ± 1.68	2.12-3.58	4.01 ± 9.61	2.91-5.06	0.573
Folate (μg)	229.77 ± 128.83	174.06-285.49	228.22 ± 141.80	211.60-243.28	0.939
Pantothenic acid(mg)	4.57 ± 2.28	3.59-5.56	4.22 ± 2.20	3.96-4.45	0.441
Calcium (mg)	974.43 ± 578.87	724.11-1224.76	706.62 ± 449.06	643.13-743.57	0.005*
Phosphorus(mg)	1072.57 ± 488.92	861.14-1283.99	911.80 ± 438.60	847.52-946.17	0.068
Iron(mg)	10.37 ± 4.79	8.29-12.44	10.72 ± 4.75	10.02-11.09	0.852
Magnesium (mg)	254.30 ± 116.67	203.85-304.75	224.20 ± 115.05	207.01-232.76	0.168
Selenium (μg)	104.33 ± 58.98	78.82-129.84	98.85 ± 50.05	89.29-100.54	0.393
Potassium (mg)	2567.52 ± 1277.26	2015.19-3119.85	2176.69±1032.09	2052.21-2283.47	0.080
Sodium(mg) [a]	1592.83 ± 926.39	1192.22-1993.43	1141.98±740.71	1047.49-1235.01	0.009*
Zinc (mg)	9.10 ± 4.16	7.31-10.90	8.82 ± 4.07	8.22-9.13	0.628

A $P<0.05$ was considered as significant (Independent-samples T test)

* Significance at <0.05 level

a After adjustment, using ANCOVA

Regarding the micronutrient intake, calcium and sodium intake were significantly higher in asthmatic subjects in comparison to non-asthmatics (P=0.005 and P=0.009, respectively). There was no significant difference between dietary antioxidant intakes between the two groups (β-carotene, vitamin C and E and selenium) (Table 3).

Discussion

Many dietary factors have been considered to have effect on asthmatic patients' status. Increasing evidence indicates a link between excess calorie intake/obesity and asthma (5,6). However in our study, there was no significant difference in age matched weight, BMI, and calorie intake of the two groups.

Over the last decade, as nutrition transition is occurring in many countries, as well as Iran, significant changes in dietary fat intakes have been observed (7). These changes by generally increasing the cellular susceptibility to inflammatory insults and increasing inflammatory mediators (e.g. prostaglandins and leukotriens) could lead to diseases such as asthma (8). In consistence with literature, we observed significant differences in two groups' PUFA and SFA intake (but not total fat) with higher intakes in asthmatics (Table 2). It seems that the type of consumed fat may be more important than the amount of fat intake in inducing asthma. For accurate results, n-6 and n-3 fatty acid intake must be assessed in detail in further studies, because investigations of asthma and dietary lipids has suggested that asthma and atopy are a consequence of increasing n-6 PUFA intake and decreasing n-3 PUFA consumption which have effects on inflammatory mediators and T helper cell differentiation (9).

Asthmatic students have higher intakes of Calcium, and Sodium than do non-asthmatic subjects (Table 3). Epidemiological studies on the association between salt intake and asthma had controversial results according to the age and gender of study population (with positive association in children and men); and randomized-controlled clinical trails have shown that increased salt intake may exacerbate asthma and airway responsiveness in adults (10). Increased smooth muscle contractions, increased circulating blood volume leading to reduced lung function via lung microcirculation and

sodium influx impacting airway reactivity could be possible mechanisms that salt can predispose to asthma. Although several cross-sectional studies have reported a protective effect of magnesium intake on asthma prevalence (11), the data about the association of calcium intake and asthma are rare, so more studies are needed to investigate the probable effect of calcium on asthma, which may be through its effect on smooth muscle contraction.

Although our study could not confirm any association between dietary antioxidants and asthma, the literature supports the correlation (9,12-14). This could be due to our small sample size, and subjective responses that are prone to error and over and under-reporting. In other hands, there is also a new hypothesis that some antioxidants are found to suppress formation of T helper 1-type cytokines and thereby favor an over-production of T helper 2-type cytokines and increase the susceptibility for allergic reactions and asthma (15), so more studies must be focused on the association between antioxidants and asthma, and the need for antioxidant supplementation in asthmatics.

In conclusion, because of all controversies, our study emphasizes the need for future randomized controlled trials with restricting diets to discover the relation between nutrient intake and asthma, as nutrients may be a triggering factor, as well as an initiating factor.

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