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ORIGINAL ARTICLE

Dietary Habits and Prevalence of Allergic Rhinitis in 6 to 7-Year-Old Schoolchildren in Turkey

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ABSTRACT

Background: The prevalence of allergic rhinitis and other allergies has risen worldwide. Dietary habits are considered to be among the potential risk factors. The aim of this study was to evaluate the prevalence of allergic rhinitis and its relationship with dietary habits and other risk factors among 6 to 7-year-old Turkish schoolchildren.

Methods: In this cross-sectional study, a total of 11483 children aged 6-7 years were surveyed. The prevalence of symptoms of allergic rhinitis was assessed using the ISAAC protocol. Dietary information was collected using a food frequency questionnaire.

Results: Of them, 9875 (50.7% M 49.3% F) questionnaires were appropriately completed. The prevalence rates of lifetime rhinitis, current rhinitis, current rhinoconjunctivitis and physician-diagnosed allergic rhinitis, were 44.3%, 29.2%, 8.5% and 8.1%, respectively. Consumption of rice, and cereals ≥3 times per week showed protective effect on physician-diagnosed allergic rhinitis (aOR = 0.53, 95% CI = 0.32-0.87 and aOR = 0.58, 95% CI = 0.36-0.92). Eating pasta, and chocolates ≥3 times per week showed protective effect on current rhinoconjunctivitis (aOR = 0.45, 95% CI = 0.25-0.79 and aOR = 0.50, 95% CI = 0.29-0.86). Eating lollipops, candies and animal fats ≥3 times per week was positively associated with current rhinoconjunctivitis (aOR = 1.47, 95% CI = 1.00-2.17 and aOR = 2.25, 95% CI = 1.11-4.56). Protective effect of the Mediterranean diet was not significant.

Conclusions: Frequent consumption of cereals, rice, pasta and chocolates may have beneficial effect on symptoms of rhinoconjunctivitis. Although dietary habits may affect the prevalence of symptoms of current rhinoconjunctivitis, the Mediterranean diet alone may not be protective against rhinoconjunctivitis.

KEY WORDS

allergic, ISAAC, Mediterranean diet, prevalence, rhinitis

INTRODUCTION

Allergic rhinitis (AR) is a common childhood disorder like other allergic diseases. In recent decades, the prevalence of AR and other allergies has been increasing in developing countries.[1,2] According to worldwide studies, 12-month prevalence of rhinoconjunctivitis reported by the parents in the 6-7 years age group ranged from 2.2% to 24.2%.[3] Reported prevalence rates of AR for Turkish school age children differed from 7.9% to 31%.[4-7] Changes in life-style and environmental factors, and especially dietary habits, are considered to have an important role in the large variations in the worldwide prevalence of symptoms of allergic diseases.[8-15] Most of the developing countries are becoming more urbanized and westernized, and changing their traditional dietary habits. The Western pattern diet is characterized by high intakes of red and processed meats, high-fat dairy products, low levels of vegetables (other than potatoes), fast food, sugar containing foods and drinks, and fruits with the predominant fruit being canned fruit. This diet is rich in polyunsaturated fatty acids (PUFAs) and contains high levels of omega-6 fatty acids compared to

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omega-3, which is considered to be a risk factor for allergic and some chronic diseases.[16,17] Mediterranean diet is a traditional dietary pattern of the countries bordering the Mediterranean Sea. It is characterized by high consumption of vegetables, fruits, pulses and unrefined grains, moderate consumption of milk and dairy products and low consumption of meat.[18,19] Several studies have shown its protective role in some chronic diseases and allergies.[17-21] With modern urban lifestyle, children spend most of their time indoors, watching TV or playing on computer resulting reduced physical activity, and consumption of more junk food. These unhealthy lifestyle behaviors are strongly associated with the presence of allergic diseases such as asthma.[22] The aim of this study was to evaluate the effects of dietary habits and life-style on prevalence of AR among 6 to 7-year-old Turkish schoolchildren, living in Istanbul.

METHODS

STUDY AREA

The survey study was conducted in Istanbul, which is the biggest metropolis, being home to 13,5 million people. The city's population consists of 1/7 of Turkey's population. Two-thirds of the city's population lives in the European part and the rest in the Asian part. Internal immigration towards Istanbul increased after the 1950's and still continues at a great speed, because it is the fastest growing industrial center in Turkey.[23-25]

STUDY POPULATION

The study's population consisted of 11483 primary schoolchildren, attending Grade 1, aged 6 to 7-year-old from all districts of Istanbul without selection by urban or suburban residence or variations in socioeconomic status. Children who did not fulfil age criteria were excluded from the database.

STUDY DESIGN

The standardized 6-item ISAAC Phase I written core questionnaire was used to estimate the prevalence of AR.[26-28] The ISAAC questionnaire was translated into Turkish by a qualified working team, which consisted of fellows of pediatric allergists, and then translated back. An additional questionnaire was used to identify demographic features, and dietary information was collected using a semi-quantitative food frequency questionnaire with 30 food items, asking about the diet of children in the last 12 months. Consumption of protective foods such as potatoes, rice, cereals, pasta, vegetables, tomatoes, broad bean fish and other sea foods, fruits, nuts, olive oil, fish oil, and some traditional foods made from grapes and mulberries, fermented drinks made from millets and various seeds, pickle; aggravating foods including fast-food, potato chips and crackers, chocolates, lollipops and candies, cookies and muffins, margarine; and other foods including eggs, animal fats, milk and dairy products, meat, polyunsaturated fatty acids (butter), sun-flower oil, corn oil, tea, and olive were asked.[29] Analysis of diet variables were determined by frequency of consumption of foods in three groups including: "never or occasionally", "once or twice per week" and "three or more times a week". Questionnaires were completed by parents.

Additionally, a Mediterranean diet score based on the work of García-Marcos *et al.* was used.[30] Fruit, seafood, vegetables, pulses, cereals, pasta, rice, and potatoes were considered Mediterranean foods and scored 0, 1, or 2 points, ranging from the least frequent to the most frequent intake: never or occasionally (0), 1 to 2 times/wk (1), and 3 or more times/wk (2). Meat, milk, and fast food were considered non-Mediterranean foods and scored 0, 1, or 2 points, ranging from the most frequent to the least frequent consumption: 3 or more times/wk (0), 1 to 2 times/wk (1) and never or occasionally (2). In all the analyses, the Mediterranean diet score was the sum of the points of each food, ranging from 0 to 22; the higher the score, the greater the adherence to the Mediterranean diet.

Parents were also asked about the child's gender, parental education, the frequency of vigorous physical activity (never or occasionally, once or twice per week, three or more times per week) and the hours spent on watching TV and/or computer in a day.

STATISTICAL ANALYSIS

Prevalence estimates were calculated by dividing positive responses to the given question by the total number of completed questionnaires while missing or inconsistent responses were excluded from subsequent univariate analyses according to ISAAC recommendations.[26-29] The children who did not respond to a question were excluded from analysis of the relevant variable.

In the present analysis, current rhinoconjunctivitis (CRCJ, the occurrence of any sneezing or a runny or blocked nose apart from common cold or the flue with itchy watery eyes in the past 12 months) and physician diagnosed allergic rhinitis (PDAR, the diagnosis of hay fever ever) were primary outcome variables to be evaluated in relation to diet. The association of dietary habits with lifetime rhinitis (LR, the occurrence of any sneezing or a runny or blocked nose apart from common cold or the flue ever) and current rhinitis (CR, the occurrence of any sneezing or a runny or blocked nose apart from common cold or the flue in the past 12 months) were also evaluated to compare the results. The relationship between the frequency of food intake and each type of rhinitis was evaluated by the chi-square test. A p-value less than 0.05 were considered as significant. The Mediterranean diet score between children with rhinoconjunctivitis and children without rhinoconjunctivitis was

compared using the independent t-test. Risk factors including sex, parental educational level, Mediterranean diet score, exercise frequency, hours spent on watching TV and/or computer and foods with *p*-value less than 0.05 from the univariate analysis were taken into multivariate logistic regression analysis to assess the independent effects of risk factors on rhinoconjunctivitis. Odds ratios for suffering from CRCJ, PDAR, LR and CR when food was consumed never or occasionally (reference category) compared with 1-2 times/week and 3 or more times a week were adjusted by logistic regression. The SPSS software package version 12.0 was used for all statistical analyses.

ETHICAL CONSIDERATION

The study was approved by the Ethics Committee of Istanbul University, Istanbul School of Medicine.

RESULTS

PARTICIPANTS

A total of 10183 questionnaires were completed by parents and returned for an 89% response rate after two visits to schools. Respondents who did not fulfil age criteria were excluded from analysis leaving a sample size of 9875 children. There were 4835 girls (49.3%) and 4972 boys (50.7%), gender was missing in 68 questionnaires.

PREVALENCE

The prevalence rates for rhinitis ever (lifetime rhinitis), current rhinitis (rhinitis in past year), current rhinoconjunctivitis (rhinoconjunctivitis in past year) and physician diagnosed allergic rhinitis (hay fever ever) were 44.6%, 29.3%, 8.5% and 8.2%, respectively.

DIETARY HABITS, EXERCISE AND OBESITY

Table 1 represents the effects of each food item and some confounder factors such as gender, parental educational level, exercise, hours spent on watching TV or computer in a day on lifetime rhinitis, current rhinitis, physician diagnosed allergic rhinitis and current rhinoconjunctivitis. Table 2 represents the independent effects of food items and the confounders on LR, CR, PDAR and CRCJ during last 12 months after tested in logistic regression analysis with adjusted odds.

In the univariate analyses, gender as a confounder was only associated with LR (uOR = 1.12, 95% CI = 0.94-1.24) and lost its significance in the multivariate analysis (aOR = 1.08, 95% CI = 0.94-1.24). Parental education had some significant effects on the prevalence of rhinitis. In the univariate analysis, higher degree of parental education had protective effect on LR (mother's education uOR = 0.63, 95% CI = 0.57-0.70; father's education uOR = 0.66, 95% CI = 0.61-0.73) and CRCJ (mother's education uOR = 0.63, 95% CI = 0.51-0.77; father's education uOR = 0.58, 95% CI = 0.49-0.69), but in the multivariate analysis the significant association with paternal education for LR and CRCJ and maternal education for CRCJ was lost. Higher maternal education was consistently positively associated with CR (uOR = 1.27, 95% CI = 1.06-1.52; aOR = 1.44, 95% CI = 1.13-1.83) and PDAR (uOR = 1.26, 95% CI = 1.06-1.49; aOR = 1.55, 95% CI = 1.18-2.04). There were significant positive associations with exercise and symptoms of rhinitis in the univariate analysis, but significant positive association with exercise was only observed for symptoms of CRCJ in the multivariate analysis (aOR = 1.59, 95% CI = 1.19-2.11). Univariate analysis revealed positive association with time spent on watching TV and/or computer and LR (uOR = 1.21, 95% CI = 1.14-1.33), CR (uOR = 1.14, 95% CI = 0.99-1.31) and PDAR (uOR = 1.18, 95% CI = 1.01-1.37); but multivariate analysis showed no association between time spent on watching TV and/or computer and any type of rhinitis.

In the univariate analysis, rice and cereal consumption once or twice per week and ≥3 times per week in comparison to never or occasionally was protective for LR (uOR = 0.71, 95% CI = 0.61-0.84 and uOR = 0.76, 95% CI = 0.66-0.89 for rice; uOR = 0.72, 95% CI = 0.60-0.87 and uOR = 0.59, 95% CI = 0.51-0.68 for cereal) and CRCJ (uOR = 0.67, 95% CI = 0.54-0.84 and uOR = 0.70, 95% CI = 0.56-0.87 for rice; uOR = 0.68, 95% CI = 0.51-0.91 and uOR = 0.60, 95% CI = 0.48-0.75 for cereal). Eating cereal ≥3 times per week was also protective for PDAR (uOR = 0.60, 95% CI = 0.48-0.76). Protective effect of pasta consumption once or twice a week and ≥3 times per week was significant for LR (uOR = 0.68, 95% CI = 0.59-0.79 and uOR = 0.71, 95% CI = 0.61-0.81) and CRCJ (uOR = 0.62, 95% CI = 0.50-0.77 and uOR = 0.65, 95% CI = 0.53-0.81). Taking vegetable ≥3 times per week was protective for LR (uOR = 0.75, 95% CI = 0.67-0.84) and CRCJ (uOR = 0.81, 95% CI = 0.67-0.99), additionally taking vegetable once or twice a week was also protective for LR (uOR = 0.79, 95% CI = 0.69-0.89). The protective effect of eating tomatoes ≥3 times per week was significant for LR (uOR = 0.86, 95% CI = 0.76-0.97), PDAR (uOR = 0.74, 95% CI = 0.60-0.92) and CRCJ (uOR = 0.70, 95% CI = 0.60-0.90). Broad bean eating once or twice per week had protective effect for LR (uOR = 0.84, 95% CI = 0.75-0.93) and CRCJ (uOR = 0.73, 95% CI = 0.61-0.88). Frequent fruit consumption was protective for LR (uOR = 0.74, 95% CI = 0.63-0.88 for once or twice a week; uOR = 0.64, 95% CI = 0.56-0.75 for ≥3 times per week), PDAR (uOR = 0.78, 95% CI = 0.61-0.99 for ≥3 times per week) and CRCJ (uOR = 0.62, 95% CI = 0.48-0.8 for once or twice a week; uOR = 0.58, 95% CI = 0.46-0.72 for ≥3 times per week). Taking hazelnut once or twice a week was protective for LR (uOR = 0.84, 95% CI = 0.76-0.93) and CR (uOR = 0.85, 95% CI = 0.72-0.99). Although consumption of fish once or twice a week was protective for LR (uOR = 0.82, 95% CI = 0.75-0.91), CR (uOR = 0.83, 95% CI = 0.71-0.96)

Table 1 Effects of food items on lifetime rhinitis, current rhinitis, physician-diagnosed allergic rhinitis and rhinoconjunctivitis during last 12 months

		Lifetime rhinitis		Current rhinitis		Physician-diagnosed allergic rhinitis		Current rhino-conjunctivitis	
		uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value
Gender	boys	**1.12 (1.03-1.21)**	**0.003**	1.07 (0.94-1.22)	0.13	0.91 (0.79-1.05)	0.12	1.01 (0.87-1.16)	0.45
Mother's education	≥high	***0.63 (0.57-0.70)***	***<0.001***	**1.27 (1.06-1.52)**	**0.004**	**1.26 (1.06-1.49)**	**0.005**	***0.63 (0.51-0.77)***	***<0.001***
Father's education	≥high	***0.66 (0.61-0.73)***	***<0.001***	1.02 (0.88-1.18)	0.33	0.98 (0.83-1.14)	0.25	***0.58 (0.49-0.69)***	***<0.001***
Exercise	1 or 2 × wk	1.10 (0.98-1.22)	0.08	**1.30 (1.10-1.55)**	**0.001**	**1.36 (1.14-1.63)**	**<0.001**	**1.42 (1.20-1.69)**	**<0.001**
TV time	≥3 × wk	**1.21 (1.14-1.33)**	**<0.001**	**1.14 (0.99-1.31)**	**0.03**	**1.18 (1.01-1.37)**	**0.01**	1.23 (1.06-1.43)	0.39
Potatoes	1 or 2 × wk	***0.71 (0.61-0.84)***	***<0.001***	1.09 (0.86-1.38)	0.43	0.78 (0.60-1.02)	0.07	***0.73 (0.56-0.93)***	*0.01*
	≥3 × wk	***0.76 (0.66-0.89)***	***0.001***	1.06 (0.84-1.32)	0.59	0.82 (0.64-1.05)	0.13	0.83 (0.66-1.06)	0.14
Rice	1 or 2 × wk	***0.69 (0.60-0.79)***	***<0.001***	0.82 (0.66-1.02)	0.07	***0.66 (0.53-0.84)***	***0.001***	***0.67 (0.54-0.84)***	***<0.001***
	≥3 × wk	***0.75 (0.65-0.86)***	***<0.001***	0.83 (0.67-1.03)	0.10	***0.75 (0.60-0.94)***	***0.01***	***0.7 (0.56-0.87)***	***0.01***
Cereals	1 or 2 × wk	***0.72 (0.60-0.87)***	***0.001***	1.11 (0.84-1.46)	0.44	0.93 (0.70-1.24)	0.64	***0.68 (0.51-0.91)***	***0.011***
	≥3 × wk	***0.59 (0.51-0.68)***	***<0.001***	1.03 (0.83-1.28)	0.73	***0.60 (0.48-0.76)***	***<0.001***	***0.60 (0.48-0.75)***	***<0.001***
Pasta	1 or 2 × wk	***0.68 (0.59-0.79)***	***<0.001***	0.83 (0.67-1.03)	0.09	0.80 (0.63-1.02)	0.07	***0.62 (0.5-0.77)***	***<0.001***
	≥3 × wk	***0.71 (0.61-0.81)***	***<0.001***	0.90 (0.72-1.11)	0.33	0.87 (0.69-1.10)	0.26	***0.65 (0.53-0.81)***	***<0.001***
Vegetable	1 or 2 × wk	**0.79 (0.69-0.89)**	**<0.001**	1.07 (0.88-1.30)	0.49	0.97 (0.78-1.21)	0.82	0.86 (0.7-1.06)	**0.18**
	≥3 × wk	***0.75 (0.67-0.84)***	***<0.001***	0.96 (0.80-1.14)	0.65	0.86 (0.70-1.05)	0.15	***0.81 (0.67-0.99)***	***0.004***
Tomatoes	1 or 2 × wk	0.92 (0.79-1.07)	0.29	1.09 (0.87-1.38)	0.43	0.84 (0.65-1.07)	0.17	0.8 (0.6-1.05)	0.13
	≥3 × wk	***0.86 (0.76-0.97)***	***0.02***	0.96 (0.79-1.16)	0.70	***0.74 (0.60-0.92)***	***0.006***	***0.7 (0.6-0.9)***	***0.004***
Broad bean	1 or 2 × wk	***0.84 (0.75-0.93)***	***0.002***	0.97 (0.82-1.15)	0.78	0.84 (0.70-1.02)	0.09	***0.73 (0.61-0.88)***	***0.001***
	≥3 × wk	0.93 (0.83-1.05)	0.26	1.02 (0.85-1.23)	0.79	0.90 (0.73-1.11)	0.33	0.87 (0.72-1.06)	0.19
Fish and other sea foods	1 or 2 × wk	***0.82 (0.75-0.91)***	***<0.001***	***0.83 (0.71-0.96)***	***0.01***	1.16 (0.98-1.37)	0.08	***0.79 (0.66-0.93)***	***0.007***
	≥3 × wk	1.12 (0.93-1.36)	0.21	0.94 (0.70-1.26)	0.69	**1.55 (1.14-2.09)**	**0.004**	1.05 (0.77-1.43)	0.74
Fruits	1 or 2 × wk	***0.74 (0.63-0.88)***	***0.001***	0.85 (0.66-1.10)	0.23	0.86 (0.65-1.14)	0.29	***0.62 (0.48-0.8)***	***<0.001***
	≥3 × wk	***0.64 (0.56-0.75)***	***<0.001***	0.83 (0.67-1.04)	0.11	***0.78 (0.61-0.99)***	***0.05***	***0.58 (0.46-0.72)***	***<0.001***
Hazelnut	1 or 2 × wk	***0.84 (0.76-0.93)***	***0.001***	***0.85 (0.72-0.99)***	***0.04***	1.02 (0.86-1.22)	0.75	0.93 (0.78-1.11)	0.45
	≥3 × wk	0.96 (0.85-1.08)	0.55	0.88 (0.73-1.06)	0.19	0.86 (0.69-1.07)	0.19	1.1 (0.9-1.3)	0.33
Olive oil	1 or 2 × wk	0.97 (0.86-1.10)	0.69	1.01 (0.83-1.22)	0.92	0.93 (0.75-1.15)	0.51	1.01 (0.8-1.2)	0.87
	≥3 × wk	1.02 (0.92-1.14)	0.62	1.04 (0.88-1.24)	0.59	1.07 (0.88-1.30)	0.45	0.99 (0.81-1.2)	0.94
Fish oil (supplement)	1 or 2 × wk	1.09 (0.81-1.24)	0.94	1.02 (0.73-1.44)	0.87	**1.44 (1.02-2.02)**	**0.03**	1.01 (0.7-1.4)	0.9
	≥3 × wk	1.09 (0.87-1.36)	0.44	0.78 (0.56-1.09)	0.14	**1.79 (1.29-2.48)**	**<0.001**	0.8 (0.5-1.3)	0.5
Grape molasses	1 or 2 × wk	1.01 (0.91-1.12)	0.74	***0.75 (0.63-0.88)***	***0.001***	***0.82 (0.67-0.99)***	***0.04***	0.85 (0.7-1.02)	0.08
	≥3 × wk	**1.18 (1.06-1.33)**	**0.003**	1.07 (0.89-1.27)	0.45	**1.22 (1.01-1.48)**	**0.03**	1.1 (0.9-1.3)	0.28
Boza	1 or 2 × wk	**1.39 (1.02-1.88)**	**0.03**	0.71 (0.46-1.11)	0.13	1.35 (0.83-2.21)	0.22	1.28 (0.79-2.0)	0.31
	≥3 × wk	**2.36 (1.40-3.99)**	**0.001**	1.07 (0.54-2.11)	0.84	**2.06 (1.00-4.27)**	**0.05**	1.6 (0.82-3.3)	0.15
Pickle	1 or 2 × wk	1.11 (0.99-1.24)	0.06	0.94 (0.78-1.12)	0.48	0.90 (0.73-1.10)	0.32	0.96 (0.79-1.17)	0.74
	≥3 × wk	**1.29 (1.06-1.57)**	**0.009**	0.96 (0.72-1.28)	0.81	**1.47 (1.08-1.99)**	**0.01**	1.18 (0.86-1.6)	0.29
Fast-food/ burgers	1 or 2 × wk	0.90 (0.80-1.02)	0.13	0.98 (0.80-1.20)	0.89	1.46 (1.19-1.78)	<0.001	1.01 (0.80-1.25)	0.96
	≥3 × wk	**1.27 (0.99-1.63)**	**0.05**	1.08 (0.73-1.60)	0.67	1.28 (0.85-1.93)	0.23	1.29 (0.87-1.91)	0.2
Potato crisps, crackers	1 or 2 × wk	***0.81 (0.72-0.92)***	***0.001***	1.04 (0.85-1.26)	0.67	0.83 (0.67-1.03)	0.10	***0.76 (0.6-0.95)***	***0.01***
	≥3 × wk	1.00 (0.89-1.12)	0.93	1.05 (0.88-1.25)	0.55	0.86 (0.71-1.04)	0.13	1.03 (0.8-1.24)	0.7
Chocolates	1 or 2 × wk	***0.79 (0.70-0.91)***	***0.001***	0.97 (0.79-1.20)	0.83	0.95 (0.75-1.19)	0.67	***0.63 (0.5-0.78)***	***<0.001***
	≥3 × wk	***0.87 (0.77-1.98)***	***0.02***	0.94 (0.78-1.14)	0.58	0.94 (0.76-1.15)	0.56	***0.72 (0.59-0.87)***	***0.001***
Lollipops, candies	1 or 2 × wk	1.05 (0.94-1.16)	0.36	1.10 (0.92-1.30)	0.26	1.11 (0.92-1.34)	0.26	0.95 (0.78-1.15)	0.6
	≥3 × wk	**1.28 (1.15-1.43)**	**<0.001**	1.04 (0.88-1.23)	0.60	1.17 (0.97-1.41)	0.09	**1.4 (1.2-1.7)**	**<0.001**
Cookies, muffins	1 or 2 × wk	***0.85 (0.76-0.96)***	***0.01***	0.85 (0.71-1.03)	0.11	0.82 (0.66-1.01)	0.06	***0.76 (0.62-0.92)***	***0.007***
	≥3 × wk	0.96 (0.86-1.08)	0.55	0.94 (0.79-1.13)	0.53	0.94 (0.78-1.15)	0.58	0.8 (0.7-1.02)	0.09

(Continued)

Table 1 (Continued)

		Lifetime rhinitis		Current rhinitis		Physician-diagnosed allergic rhinitis		Current rhino-conjunctivitis	
		uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value	uOR† (95% CI)	*P* value
Margarine	1 or 2 × wk	1.05 (0.93-1.18)	0.37	1.12 (0.93-1.34)	0.22	0.94 (0.76-1.15)	0.57	1.0 (0.82-1.23)	0.92
	≥3 × wk	0.98 (0.87-1.10)	0.81	1.11 (0.92-1.33)	0.26	1.01 (0.83-1.24)	0.86	1.11 (0.91-1.35)	0.26
Eggs	1 or 2 × wk	***0.62 (0.53-0.73)***	***<0.001***	1.06 (0.83-1.35)	0.62	0.84 (0.63-1.10)	0.21	***0.6 (0.49-0.81)***	***<0.001***
	≥3 × wk	***0.68 (0.59-0.78)***	***<0.001***	0.91 (0.74-1.13)	0.42	***0.70 (0.56-0.88)***	***0.003***	***0.64 (0.52-0.79)***	***<0.001***
Animal fats	1 or 2 × wk	**1.37 (1.04-1.80)**	**0.02**	***0.63 (0.42-0.93)***	***0.02***	**1.54 (1.01-2.34)**	**0.04**	1.16 (0.74-1.8)	0.5
	≥3 × wk	**1.83 (1.28-2.60)**	**0.001**	0.73 (0.46-1.17)	0.19	1.36 (0.79-2.36)	0.26	**2.06 (1.3-3.2)**	**0.001**
Milk, dairy products	1 or 2 × wk	***0.78 (0.65-0.95)***	***0.01***	1.15 (0.87-1.51)	0.31	***0.58 (0.42-0.80)***	***0.001***	0.79 (0.6-1.0)	0.1
	≥3 × wk	***0.63 (0.54-0.74)***	***<0.001***	1.02 (0.81-1.28)	0.82	***0.69 (0.54-0.89)***	***0.004***	***0.55 (0.44-0.69)***	***<0.001***
Meat	1 or 2 × wk	***0.72 (0.65-0.80)***	***<0.001***	1.01 (0.86-1.18)	0.88	0.91 (0.76-1.09)	0.33	**1.62 (1.31-2.0)**	**<0.001**
	≥3 × wk	***0.69 (0.61-0.78)***	***<0.001***	0.93 (0.77-1.13)	0.50	1.07 (0.87-1.32)	0.50	1.13 (0.92-1.39)	0.21
Butter	1 or 2 × wk	1.03 (0.92-1.16)	0.54	0.97 (0.81-1.17)	0.81	1.09 (0.89-1.34)	0.36	1.07 (0.88-1.3)	0.45
	≥3 × wk	0.96 (0.86-1.09)	0.59	1.08 (0.90-1.31)	0.38	1.11 (0.91-1.37)	0.29	1.07 (0.87-1.32)	0.48
Sunflower oil	1 or 2 × wk	***0.87 (0.76-0.98)***	***0.03***	1.04 (0.85-1.28)	0.64	0.93 (0.74-1.16)	0.52	0.9 (0.7-1.1)	0.37
	≥3 × wk	0.90 (0.81-1.00)	0.06	1.14 (0.96-1.36)	0.11	0.94 (0.78-1.14)	0.58	0.96 (0.8-1.1)	0.71
Corn oil	1 or 2 × wk	0.88 (0.77-1.00)	0.06	0.96 (0.78-1.18)	0.72	0.91 (0.72-1.15)	0.45	0.8 (0.6-1.01)	0.06
	≥3 × wk	0.91 (0.81-1.01)	0.10	0.85 (0.72-1.02)	0.08	1.01 (0.83-1.23)	0.90	***0.74 (0.6-0.91)***	***0.005***
Tea	1 or 2 × wk	0.97 (0.85-1.11)	0.71	1.08 (0.87-1.33)	0.47	1.01 (0.80-1.26)	0.92	1.1 (0.89-1.4)	0.3
	≥3 × wk	1.04 (0.93-1.15)	0.45	0.97 (0.82-1.14)	0.75	0.85 (0.71-1.01)	0.07	**1.3 (1.09-1.5)**	**0.003**
Olive	1 or 2 × wk	0.93 (0.81-1.06)	0.27	1.01 (0.81-1.24)	0.94	***0.70 (0.56-0.89)***	***0.004***	0.8 (0.69-1.08)	0.21
	≥3 × wk	0.93 (0.83-1.04)	0.21	0.95 (0.80-1.13)	0.60	0.83 (0.69-1.01)	0.06	0.8 (0.7-1.07)	0.23
Med. Diet.	-	***0.97 (0.96-0.98)***	***<0.001***	1.0 (0.98-1.01)	0.95	***0.97 (0.94-0.99)***	***0.007***	***0.97 (0.94-0.99)***	***0.01***

Statistically significant inverse associations are identified by bold italic text and statistically significant positive associations are identified by bold text.

† Frequent consumption of foods "once or twice per week" and "≥3 times per week" in relation to "never or occasionally" as the base category.

and CRCJ (uOR = 0.79, 95% CI = 0.66-0.93), its consumption ≥3 times per week was positively correlated with PDAR (uOR = 1.55, 95% CI = 1.14-2.09). Eating frequently traditional foods such as grape molasses, boza and pickle showed positive association with symptoms of LR (grape molasses, ≥3 times per week, uOR = 1.18, 95% CI = 1.06-1.33; boza, ≥3 times per week, uOR = 1.29, 95% CI = 1.06-1.57 and once or twice a week, uOR = 1.39, 95% CI = 1.02-1.88; pickle, ≥3 times per week, uOR = 1.29, 95% CI = 1.06-1.57) and PDAR (grape molasses, ≥3 times per week, uOR = 1.22, 95% CI = 1.01-1.48; boza, ≥3 times per week, uOR = 2.06, 95% CI = 1.00-4.27; pickle, ≥3 times per week, uOR = 1.47, 95% CI = 1.08-1.99). Interestingly, consumption of grape molasses once or twice a week had protective effect for CR (uOR = 0.75, 95% CI = 0.63-0.88) and PDAR (uOR = 0.82, 95% CI = 0.67-0.99). Frequently consuming milk, dairy products and eggs had protective effect on LR (milk, ≥3 times per week, uOR = 0.63, 95% CI = 0.54-0.74 and once or twice a week, uOR = 0.78, 95% CI = 0.65-0.95; eggs, ≥3 times per week, uOR = 0.68, 95% CI = 0.59-0.78 and once or twice a week, uOR = 0.62, 95% CI = 0.53-0.73), PDAR (milk, ≥3 times per week, uOR = 0.69, 95% CI = 0.54-0.89 and once or twice a week, uOR = 0.58, 95% CI = 0.42-0.80; eggs, ≥3 times per week, uOR = 0.70, 95% CI = 0.56-0.88) and CRCJ (milk, ≥3 times per week, uOR = 0.55, 95% CI = 0.44-0.69; eggs, ≥3 times per week, uOR = 0.64, 95% CI = 0.52-0.79 and once or twice a week, uOR = 0.60, 95% CI = 0.49-0.81). Having fast food ≥3 times per week was a risk factor for LR (uOR = 1.27, 95% CI = 0.99-1.63). Taking lollipops and candies ≥3 times per week was also a risk factor for both LR (uOR = 1.28, 95% CI = 1.15-1.43) and CRCJ (uOR = 1.4, 95% CI = 1.2-1.7). Eating potato crisps, crackers and cookies, muffins once or twice a week was protective for LR (uOR = 0.81, 95% CI = 0.72-0.92 and uOR = 0.85, 95% CI = 0.76-0.96) and CRCJ (uOR = 0.76, 95% CI = 0.60-0.95 and uOR = 0.76, 95% CI = 0.62-0.92). Eating chocolates frequently was inversely associated with LR (uOR = 0.87, 95% CI = 0.77-1.98 for ≥3 times per week and uOR = 0.79, 95% CI = 0.70-0.91 for once or twice a week) and CRCJ (uOR = 0.72, 95% CI = 0.59-0.87 for ≥3 times per week and uOR = 0.63, 95% CI = 0.50-0.78 for once or twice a week). While frequent consumption of animal fats was aggravating factor for LR (uOR = 1.83, 95% CI = 1.28-2.60 for ≥3 times per week and uOR = 1.37, 95% CI = 1.04-1.80 for

Table 2 Multiple regression analysis showing the effects of food items on lifetime rhinitis, current rhinitis, physician-diagnosed allergic rhinitis and rhinoconjunctivitis during last 12 months

		Lifetime rhinitis		Current rhinitis		Physician-diagnosed allergic rhinitis		Current rhino-conjunctivitis	
		aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value
Gender	boys	**1.08 (0.94-1.24)**	**0.24**	-	-	-	-	-	-
Mother's education	≥high	***0.77 (0.64-0.92)***	***0.005***	**1.44 (1.13-1.83)**	**0.003**	**1.55 (1.18-2.04)**	**0.001**	**0.80 (0.56-1.15)**	**0.23**
Father's education	≥high	**0.89 (0.75-1.04)**	**0.15**	-	-	-	-	**0.78 (0.58-1.06)**	**0.12**
Exercise	1 or 2 × wk	-	-	**1.01 (0.79-1.27)**	**0.94**	**1.19 (0.89-1.59)**	**0.23**	**1.59 (1.19-2.11)**	**0.001**
TV time	≥3 h	**1.08 (0.93-1.26)**	**0.27**	**1.02 (0.84-1.25)**	**0.78**	**1.19 (0.92-1.54)**	**0.17**	-	-
Potatoes	1 or 2 × wk	**0.81 (0.54-1.22)**	**0.32**	-	-	-	-	**0.98 (0.50-1.89)**	**0.95**
	≥3 × wk	**0.78 (0.46-1.31)**	**0.36**	-	-	-	-	**0.82 (0.40-1.68)**	**0.59**
Rice	1 or 2 × wk	**0.95 (0.68-1.33)**	**0.78**	-	-	***0.46 (0.30-0.73)***	***0.001***	**0.78 (0.47-1.30)**	**0.34**
	≥3 × wk	**1.07 (0.66-1.72)**	**0.76**	-	-	***0.53 (0.32-0.87)***	***0.01***	**0.76 (0.42-1.38)**	**0.37**
Cereals	1 or 2 × wk	***0.67 (0.46-0.98)***	***0.03***	-	-	**0.91 (0.54-1.52)**	**0.72**	**0.83 (0.47-1.45)**	**0.52**
	≥3 × wk	***0.57 (0.36-0.89)***	***0.01***	-	-	***0.58 (0.36-0.92)***	***0.02***	**0.64 (0.38-1.10)**	**0.10**
Pasta	1 or 2 × wk	**0.88 (0.64-1.22)**	**0.46**	-	-	-	-	***0.56 (0.35-0.90)***	***0.01***
	≥3 × wk	**0.93 (0.58-1.49)**	**0.77**	-	-	-	-	***0.45 (0.25-0.79)***	***0.006***
Vegetable	1 or 2 × wk	**0.94 (0.70-1.27)**	**0.72**	-	-	-	-	**0.91 (0.59-1.43)**	**0.70**
	≥3 × wk	**0.95 (0.60-1.49)**	**0.83**	-	-	-	-	**0.74 (0.43-1.26)**	**0.27**
Tomatoes	1 or 2 × wk	**1.44 (1.10-1.87)**	**0.007**	-	-	**0.99 (0.64-1.54)**	**0.98**	**1.01 (0.64-1.59)**	**0.95**
	≥3 × wk	**1.17 (0.92-1.49)**	**0.17**	-	-	**0.8 (0.54-1.24)**	**0.36**	**0.79 (0.52-1.21)**	**0.29**
Broad bean	1 or 2 × wk	**1.08 (0.82-1.40)**	**0.57**	-	-	-	-	**0.73 (0.50-1.07)**	**0.11**
	≥3 × wk	**1.13 (0.71-1.81)**	**0.58**	-	-	-		**0.67 (0.39-1.14)**	**0.14**
Fish and other sea foods	1 or 2 × wk	**0.93 (0.71-1.21)**	**0.60**	**0.91 (0.73-1.13)**	**0.40**	**1.0 (0.76-1.35)**	**0.89**	**0.79 (0.56-1.13)**	**0.20**
	≥3 × wk	**1.11 (0.61-2.02)**	**0.72**	**1.10 (0.71-1.69)**	**0.66**	**1.26 (0.70-2.27)**	**0.42**	**0.70 (0.33-1.46)**	**0.35**
Fruits	1 or 2 × wk	**0.95 (0.65-1.40)**	**0.82**	-	-	**1.11 (0.62-1.98)**	**0.72**	**0.76 (0.42-1.37)**	**0.36**
	≥3 × wk	**0.94 (0.58-1.51)**	**0.80**	-	-	**0.89 (0.50-1.61)**	**0.72**	**0.71 (0.38-1.32)**	**0.29**
Hazelnut	1 or 2 × wk	**0.96 (0.81-1.14)**	**0.65**	**0.87 (0.69-1.10)**	**0.26**	-	-	-	-
	≥3 × wk	**0.93 (0.75-1.16)**	**0.56**	**0.92 (0.70-1.21)**	**0.58**	-	-	-	-
Fish oil (supplement)	1 or 2 × wk	-	-	-	-	**1.92 (1.20-3.07)**	**0.006**	-	-
	≥3 × wk	-	-	-	-	**1.28 (0.75-2.19)**	**0.35**	-	-
	≥3 × wk	-	-	-	-	-	-	-	-
Grape molasses	1 or 2 × wk	**1.27 (1.08-1.50)**	**0.004**	***0.78 (0.63-0.98)***	***0.03***	**0.91 (0.67-1.23)**	**0.56**	-	-
	≥3 × wk	**1.21 (1.07-1.47)**	**0.04**	**1.11 (0.86-1.43)**	**0.42**	**1.35 (0.98-1.86)**	**0.06**	-	-
Boza	1 or 2 × wk	**1.05 (0.63-1.76)**	**0.83**	-	-	**0.71 (0.28-1.81)**	**0.48**	-	-
	≥3 × wk	**3.97 (1.28-1.24)**	**0.01**	-	-	**1.58 (0.44-5.67)**	**0.47**	-	-
Pickle	1 or 2 × wk	**1.13 (0.95-1.35)**	**0.14**	-	-	**0.98 (0.72-1.35)**	**0.94**	-	-
	≥3 × wk	**1.47 (1.05-2.05)**	**0.02**	-	-	**1.36 (0.81-2.29)**	**0.23**	-	-
Fast food/ burgers	1 or 2 × wk	**0.91 (0.68-1.22)**	**0.55**	-	-	**1.43 (1.04-1.98)**	**0.02**	-	-
	≥3 × wk	**0.91 (0.49-1.68)**	**0.76**	-	-	**1.46 (0.78-2.73)**	**0.22**	-	-
Potato crisps, crackers	1 or 2 × wk	**0.98 (0.78-1.24)**	**0.89**	-	-	-	-	**1.00 (0.64-1.56)**	**1.00**
	≥3 × wk	**1.10 (0.85-1.42)**	**0.44**	-	-	-	-	**1.09 (0.67-1.77)**	**0.71**
Chocolates	1 or 2 × wk	**1.16 (0.87-1.56)**	**0.29**	-	-	-	-	**0.61 (0.37-1.002)**	**0.51**
	≥3 × wk	**1.07 (0.78-1.48)**	**0.64**	-	-	-	-	***0.50 (0.29-0.86)***	***0.01***
Lollipops, candies	1 or 2 × wk	**1.22 (1.02-1.46)**	**0.03**	-	-	-	-	**1.26 (0.90-1.78)**	**0.17**
	≥3 × wk	**1.29 (1.04-1.60)**	**0.01**	-	-	-	-	**1.47 (1.00-2.17)**	**0.05**
Cookies, muffins	1 or 2 × wk	**0.91 (0.72-1.15)**	**0.44**	-	-	-	-	**0.93 (0.61-1.42)**	**0.74**
	≥3 × wk	**0.92 (0.72-1.18)**	**0.54**	-	-	-	-	**0.04 (0.66-1.64)**	**0.84**

(Continued)

Table 2 (Continued)

		Lifetime rhinitis		Current rhinitis		Physician-diagnosed allergic rhinitis		Current rhino-conjunctivitis	
		aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value	aOR† (95% CI)	*P* value
Eggs	1 or 2 × wk	**0.72 (0.52-1.01)**	**0.05**	-	-	**0.96 (0.57-1.60)**	**0.87**	**0.75 (0.44-1.28)**	**0.29**
	≥3 × wk	**0.81 (0.59-1.11)**	**0.20**	-	-	**0.70 (0.43-1.14)**	**0.15**	**0.79 (0.47-1.30)**	**0.36**
Animal fats	1 or 2 × wk	**1.02 (0.66-1.58)**	**0.91**	**0.62 (0.37-1.02)**	**0.06**	**1.70 (0.91-3.15)**	**0.09**	**0.96 (0.45-2.05)**	**0.93**
	≥3 × wk	**1.56 (0.81-3.01)**	**0.18**	**0.75 (0.41-1.37)**	**0.36**	**0.93 (0.34-2.52)**	**0.88**	**2.25 (1.11-4.56)**	**0.02**
Milk, dairy products	1 or 2 × wk	**0.74 (0.45-1.20)**	**0.23**	-	-	**0.52 (0.26-1.04)**	**0.06**	**1.23 (0.62-2.44)**	**0.54**
	≥3 × wk	**0.87 (0.49-1.56)**	**0.65**	-	-	**0.98 (0.53-1.8)**	**0.96**	**1.20 (0.58-2.46)**	**0.61**
Meat	1 or 2 × wk	***0.72 (0.55-0.94)***	***0.01***	-	-	-	-	**0.95 (0.65-1.38)**	**0.79**
	≥3 × wk	**0.73 (0.45-1.17)**	**0.20**	-	-	-	-	**0.75 (0.43-1.33)**	**0.33**
Flower oil	1 or 2 × wk	**0.97 (0.81-1.17)**	**0.80**	-	-	-	-	-	-
	≥3 × wk	**0.94 (0.79-1.11)**	**0.47**	-	-	-	-	-	-
Corn oil	1 or 2 × wk	-	-	-	-	-	-	**0.78 (0.55-1.10)**	**0.16**
	≥3 × wk	-	-	-	-	-	-	**0.95 (0.70-1.29)**	**0.76**
Tea	1 or 2 × wk	-	-	-	-	-	-	**2.02 (1.33-3.07)**	**0.001**
	≥3 × wk	-	-	-	-	-	-	**1.77 (1.21-2.60)**	**0.003**
Olive	1 or 2 × wk	-	-	-	-	**0.69 (0.46-1.03)**	**0.07**	-	-
	≥3 × wk	-	-	-	-	**1.08 (0.75-1.55)**	**0.65**	-	-
Med. Diet.	1 or 2 × wk	**0.99 (0.99-1.06)**	**0.78**	-	-	**1.01 (0.99-1.03)**	**0.63**	**1.006 (1.00-1.01)**	**0.06**

Statistically significant inverse associations are identified by bold italic text and statistically significant positive associations are identified by bold text.

† Frequent consumption of foods "once or twice per week" and "≥3 times per week" in relation to "never or occasionally" as the base category.

once or twice a week), PDAR (uOR = 1.54, 95% CI = 1.01-2.34 for once or twice a week) and CRCJ (uOR = 2.06, 95% CI = 1.3-3.32 for once or twice a week), it was protective for CR (uOR = 0.63, 95% CI = 0.42-0.93 for once or twice a week). Although eating meat frequently was protective for LR (uOR = 0.69, 95% CI = 0.61-0.78 for ≥3 times per week and uOR = 0.72, 95% CI = 0.65-0.80 for once or twice a week), eating meat once or twice a week was aggravating factor for CRCJ (uOR = 1.62, 95% CI = 1.31-2). While consumption of sunflower oil once or twice a week was protective for LR (uOR = 0.87, 95% CI = 0.76-0.98), consumption of corn oil ≥3 times per week was protective for CRCJ (uOR = 0.74, 95% CI = 0.6-0.91). Olive consumption once or twice a week was a protective factor for PDAR (uOR = 0.70, 95% CI = 0.56-0.89). Drinking tea ≥3 times per week was a risk factor for CRCJ (uOR = 1.3, 95% CI = 1.09-1.5). Mediterranean diet had protective effect on LR (uOR = 0.97, 95% CI = 0.96-0.98), PDAR (uOR = 0.97, 95% CI = 0.94-0.99) and CRCJ (uOR = 0.97, 95% CI = 0.94-0.99).

In the multivariate analysis frequently eating rice, cereals showed protective effect on PDAR (rice, ≥3 times per week, aOR = 0.53, 95% CI = 0.32-0.87 and once or twice a week, aOR = 0.46, 95% CI = 0.30-0.73; cereals, ≥3 times per week, aOR = 0.58, 95% CI = 0.36-0.92) and frequently eating pasta, and chocolates on CRCJ (pasta, ≥3 times per week, aOR = 0.45, 95% CI = 0.25-0.79 and for once or twice a week, aOR = 0.56, 95% CI = 0.35-0.90; chocolates ≥3 times per week, aOR = 0.50, 95% CI = 0.29-0.86). Taking fish oil supplement once or twice a week was positively associated with PDAR (aOR = 1.92, 95% CI = 1.20-3.07). Taking lollipops, candies and animal fats ≥3 times per week was positively associated with CRCJ (aOR = 1.47, 95% CI = 1.00-2.17 and aOR = 2.25, 95% CI = 1.11-4.56). Frequent drinking tea was also a risk factor for CRCJ (aOR = 1.77, 95% CI = 1.21-2.60 for ≥3 times per week and aOR = 2.02, 95% CI = 1.33-3.07 for once or twice a week). The only food item that had significant effect on CR was grape molasses. Taking grape molasses once or twice was protective for CR (aOR = 0.78, 95% CI = 0.63-0.98). Eating cereals and meat frequently had beneficial effect on LR (cereals, ≥3 times per week, aOR = 0.57, 95% CI = 0.36-0.89 and once or twice a week, aOR = 0.67, 95% CI = 0.46-0.98; meat, once or twice a week, aOR = 0.72, 95% CI = 0.55-0.94). Taking traditional foods such as grape molasses, boza and pickle often was positively associated with LR (grape molasses, ≥3 times per week, aOR = 1.21, 95% CI = 1.07-1.47 and once or twice a week, aOR = 1.27, 95% CI = 1.08-1.50; boza, ≥3 times per week, aOR = 3.97, 95% CI = 1.28-1.24; pickle ≥3 times per week, aOR = 1.47, 95% CI = 1.05-2.05). Taking lollipops, candies and tomatoes often were positively associated with LR (lollipops, candies, ≥3 times per week, aOR =

1.29, 95% CI = 1.04-1.6 and once or twice a week, aOR = 1.22, 95% CI = 1.02-1.46; tomatoes ≥3 times per week, aOR = 1.17, 95% CI = 0.92-1.49 and once or twice a week, aOR = 1.44, 95% CI = 1.10-1.87).

DISCUSSION

This study has shown that dietary habits may have significant effects on prevalence of AR. A protective effect of pasta and chocolates consumption on CRCJ, a protective effect of rice and cereal consumption on PDAR and also a protective effect of cereal consumption on LR were observed after adjusting for potential confounders. Pasta is considered among the pro-Mediterranean foods, and our results are in agreement with previous studies.[20,30,31] ISAAC Phase One study showed a strong negative association between consumption of cereals, rice and nuts and prevalence of allergic diseases.[32] The results for tomatoes consumption were conflicting. Eating tomatoes once or twice a week was only risk factor for LR, but not for other types of rhinitis. This may be due to interactions of the confounders in the analysis.

A protective effect of chocolates has not previously been reported. Cocoa is a food relatively rich in polyphenols, which makes it a potent antioxidant.[33] Furthermore, cocoa influences the immune system, in particular the inflammatory innate response and the systemic and intestinal adaptive immune response. It modifies the functionality of gut-associated lymphoid tissue by means of modulating IgA secretion and intestinal microbiota. Abril-Gil M *et al.* have shown the preventive effect of cocoa-enriched diet on IgE synthesis in a rat allergy model.[34] Further studies are needed to confirm the protective effects of chocolates.

Animal fats are commonly consumed as part of a western diet in their semi-solid form as milk or butter or more commonly as filler in factory produced meat, and fast-food products. The strong positive association between consumption of fast food and allergic diseases is consistent with previous reports.[20,35,36] ISAAC Phase Three study also showed a strong positive association between frequent consumption of fast food and symptoms of wheeze, rhinoconjunctivitis and eczema.[31] In the present study, risk of having rhinoconjunctivitis was three times higher in children who consumed animal fats 3 or more times per week with respect to children who consumed animal fats once or twice week, occasionally or never.

Interestingly, frequent drinking tea was positively associated with symptoms of CRCJ. Children with rhinitis symptoms may be given herbal and regular tea by parents to help the symptoms. In addition, frequent consumption of lollipops and candies was positively associated with outcomes of CRCJ. We reported lollipops and candies as a risk factor for AR in our recent work, and hypothesized that food additives existing in lollipops and candies may act as non-specific adjuvant factors in the development of allergic diseases.[6] In the present study, we reconfirmed our results.

The positive association between fish oil supplementation use and prevalence of PDAR may be due to tendency of physician's prescribing the supplements to the children with AR.

Traditional foods like grape molasses, pickle and boza are generally used for health promoting properties. Among them boza, a fermented millet drink has some probiotic effects. In the present study, prevalence of LR was nearly four times higher in children who consume boza than children who never or occasionally drink. The positive association between boza and other traditional foods with LR may be explained by their frequent use in children who have frequent rhinitis symptoms also including infectious rhinitis.

Dietary patterns have the ability to integrate complex or subtle interactive effects of many dietary exposures.[37] Mediterranean diet, which is plant-based, is rich in antioxidants, unrefined carbohydrates, fibers and monounsaturated fatty acids and omega-3 PUFA (especially as olive oil).[16-21] In several studies performed in Mediterranean countries, a beneficial effect of Mediterranean diet on allergic disease has been reported.[17,20,21,30] In the present study, a slight protective effect of Mediterranean diet on AR was observed in the univariate analysis; but it was lost in the multivariate analysis. It may be due to children with and without AR sharing similar dietary habits in our population. Besides, interaction of different environmental factors together with dietary habits may have an impact on the prevalence of allergic diseases.

In the logistic regression analysis, children with rhinoconjunctivitis were relatively exercising less frequently in comparison to children without rhinoconjunctivitis. This is in agreement with the Spanish study performed in school children.[30] Children with rhinitis symptoms may prefer not to exercise outdoors since pollens, humidity and exercise itself can aggravate their allergy and symptoms.

There are several strengths of this study. First, our data can easily be comparable with other studies using the ISAAC questionnaire, since they share the same standardized methodology. Second, its large sample size and homogenous distribution of children from every district of Istanbul is quite satisfactory to reflect the whole target population of the country. Third, the Mediterranean diet score has been used and validated before.[17-21,30]

A limitation of this study is its cross-sectional design, which is not optimal for the assessment of causal relationships and can only be suggestive. Another limitation is that we used a multivariate regression analysis to adjust several previously known confounding factors, namely gender, parental education level and exercise. Still, there may be many other confounding factors like socioeconomic status and

residential environment. The fact that the data are based on parental reports is another limitation

In conclusion, we found individual protective effects of some pro-Mediterranean foods such as cereal, pasta, and aggravating effects of some other foods such as animal fats, tea, lollipops and candies. We also showed for the first time a positive effect of chocolate on symptoms of rhinoconjunctivitis. We couldn't find significant effect of the Mediterranean diet on the prevalence of allergic rhinitis. Further studies are needed to evaluate the effects of dietary patterns together with other environmental risk factors.

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