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Correlation of Types of Food and Asthma Diagnosis in Childhood: A Case-Control Study

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ABSTRACT

Background: Studies concerning asthma in Lebanon investigated environmental and personal factors but none of them took into account the effect of nutritional habits. Our objective is to assess the effect of nutritional habits on asthma and allergies in Lebanese children aged between 3--16 years old.

Methods: This is a case-control study, conducted between December 2015 and April 2016. The Food Frequency Questionnaire was composed of 16 semi-quantitative questions covering different food categories.

Results: This study included 1276 children (976 healthy and 300 asthmatic children). Eating dairy products less than twice a week, 3--6 times per week and daily were significantly and inversely associated with asthma, as compared to never eating dairy product ($p = 0.02$, ORa = 0.285, CI 0.099-0.821; $p < 0.001$, ORa = 0.140, CI 0.052-0.378 and $p < 0.001$, ORa = 0.161, CI 0.061-0.422), whereas eating red meat daily compared to never, was associated with asthma significantly ($p = 0.037$, ORa = 2.051, CI 1.046-4.024). Eating nuts less than twice weekly as compared to never, was significantly and inversely associated with asthma ($p = 0.035$, ORa = 0.597, CI 0.369-0.965). The age category 7--10 and 11--13 years were significantly associated with asthma as compared to the 3--6 years category ($p < 0.001$, ORa = 3.359, CI 1.869-6.038 and $p = 0.008$, ORa = 2.191, CI 1.228-3.909 respectively), while male gender was significantly more prone to asthma ($p = 0.014$, ORa = 0.686, CI 0.507-0.926).

Conclusion: Knowing the correlation between nutritional habits and asthma is important to promote healthy eating. Educational programs for parents about healthy food and breastfeeding encouragement is warranted.

Keywords

asthma; children; dairy products; nuts; red meat.

Abbreviations

ISAAC: The International Study of Asthma and Allergies in Childhood

FFQ: Food Frequency Questionnaire

CDC: Center for Disease Control and Prevention

SPSS: Statistical Package for the Social Sciences

OR = unadjusted odds ratio

ORa = adjusted odds ratio

1. INTRODUCTION

Urbanization has been associated with an increase in asthma, leading us to think that the rapidly increasing prevalence of asthma in developed countries suggests an environmental cause such as lifestyle changes, including dietary habits. The Mediterranean diet is considered a healthy diet and has been proven to be a protective factor against allergic diseases in most of the studies performed in children (1). Numerous studies were done to study the effect of the adherence to this diet on asthma. Antonogeorgos et al. found that adherence to the Mediterranean diet was negatively related to asthma symptoms(2).

Although there have been several nutritional studies assessing single nutrients instead of assessing dietary patterns, the single food approach may fail to account for interactions between nutrients. Indeed, people eat meals consisting of a variety of foods with combined nutrients, not just isolated foods. Furthermore, Nagel et al. studied food categories in relation with asthma and wheezing in a multicenter study (The International Study of Asthma and Allergies in Childhood ISAAC phase 2) of more than 50,000 school children aged between 8 and 12 years old. Fruit intake was associated with a low prevalence of current wheezing in both affluent and non-affluent countries while the consumption of fish in affluent countries and of cooked green vegetables in non-affluent countries was associated with a lower prevalence of current wheezing and asthma (1).

Similar results were found with Barror R et al. (3) who concluded that “high fat, sugar and salt” dietary patterns (positively correlated with pastry, chocolate and sweet desserts, candies, salty snacks, chips, fruit juices, soft drinks and alcoholic beverages consumption at snacks) was associated with asthma prevalence and current severe asthma, while “fish, fruit and vegetables” dietary patterns (positively correlated with fish, vegetables and fruit intake at meals) was negatively associated with current medicated asthma, after adjustment for confounders (3).

All studies concerning asthma in Lebanon investigated environmental and personal factors like humidity, child health status, exposure to tobacco smoke and pesticides but none of them took into account the effect of nutritional habits (4, 5), even though numerous studies in other countries showed the importance of the nutritional habits impact on asthma and allergic diseases. In Arabic countries, only one study was done in Saudi Arabia to assess the effect of diet on childhood asthma. Nowadays, the Lebanese population, especially the young one, is now shifting from the Mediterranean diet to a more Western diet with increased intake of fat, sugar and red

meat (6). The objective of this study is to assess the effect of nutritional habits on asthma and allergies in Lebanese children aged between 3--16 years old.

2. METHODS

Ethical aspect

The Institutional Review Board of the University Faculty of Pharmacy waived the need for an approval based on the facts that it was an observational study that respected participants' autonomy and confidentiality and induced minimal harm to them.

Study design

This case-control study was conducted between December 2015 and April 2016. In addition to cases (asthmatic) and controls (healthy), a third group of participants (undiagnosed / probable asthma) was defined as the presence of respiratory symptoms (wheezing, cough, excess bronchial secretions, respiratory distress), but without a physician diagnosis of asthma.

Participants' characteristics

Controls were chosen using a sample of healthy Lebanese students, from schools in all districts of Lebanon, including children from different socioeconomic levels. Directors of the schools were contacted to take the permission to enter classrooms to distribute the questionnaires. Children were then given the questionnaire to be filled at home by their parents after a parental written informed consent. Classification into a control (healthy child) requires a double absence

of a diagnosis of a respiratory disease by a physician and absence of respiratory symptoms (wheezing, cough, dyspnea).

As for cases, they were taken mainly (85%) from a specialized center for the treatment of asthma in children, which provides free services to children with respiratory diseases from all areas of the country. Children came to the center either as new patients or for follow-up visits on their asthma symptoms, and not for any other reason. After the administration's approval, the questionnaire was distributed in the Asthma Center to asthmatic children's parents after a written informed consent was obtained. Classification into the diagnosed asthma group was defined as the child having asthma-related symptoms (chronic wheezing, cough, and dyspnea), as well as an affirmative answer to the question "Have your doctor ever told you that your child has asthma?". We note that some asthmatic children encountered in schools and fulfilling the case criteria were also enrolled in the study as cases (15%); this allowed an increase in the sample size and the power of the study.

A third group of participants that had a state of "probable asthma" was suggested for children in schools, having chronic respiratory symptoms but no physician confirmation of asthma diagnosis. They were neither cases nor controls and were excluded from the study.

Questionnaire and variables

A pretested self-administered questionnaire, adapted to local Arabic language (the native language in Lebanon) from the standardized and validated American Thoracic Society chronic respiratory disease questionnaire was used (7). The same conditions were applied for questionnaires in both cases and controls, to evaluate the diagnosis of asthma and respiratory

symptoms. The standardized ISAAC questionnaire was used, after translation into Arabic and back translation into English to ensure the accuracy of questions (8).

This questionnaire assessed the socio-demographic characteristics, including age, gender, region, number of rooms and the number of persons living in the house, the level of education for both parents, the family history of asthma.

The primary diagnosis of declared asthma was defined as an affirmative answer to the question “Have your doctor ever told you that your child has asthma?” while a classification into a control requires a double absence of diagnosis of a respiratory disease by a physician and of positive answers to the respiratory symptoms’ questions. We removed the group of children with respiratory problems (having symptoms of asthma only) but not diagnosed with asthma by their physician to avoid confusion.

DIETARY INTAKE ASSESSMENT

The self-administered questionnaire used in this study included numerous questions related to the socio-demographic background of our children and a short food frequency questionnaire (FFQ) to assess the usual dietary intake of youth. The FFQ was composed of 16 semi-quantitative questions covering different food categories (including the five basic food categories typically consumed by the Lebanese population) (9). The FFQ used in this study was adapted from the questionnaire earlier administered in the Lebanese population (9) and the Center for Disease Control and Prevention (CDC) Global School Health Survey (10); the finally used items were vegetables, fruits, olive oil, fish and sea food, meats (including cooked meats, poultry, ham, and hotdog), pasta, sweets (cake, ice cream, chocolate), carbonated beverages, fruit, vegetables, fast food (hamburger, pizza, Lebanese pizza (known as Mankouche with thyme or cheese or yogurt

based kechek), and fried potatoes and chips. The questionnaire was distributed in the winter season where some types of foods availability and consumption are lower than usual.

We omitted to ask questions about eggs and dairy products as separate items, because they would have been confusing to the parents to record in the FFQ given that these food items are frequently consumed in Lebanon within composite dishes (eggs, cheese, and yogurt within cooked dishes), fast food meals. The FFQ asked how often each food item, group, or beverage was usually consumed with five possible answers for each of the food categories: (1) never, (2) two times or less per week, (3) three to six times per week, (4) at least one time per day, and (5) at all meals. These five response categories were later merged into four categories for analysis purposes, namely: (1) never, (2) once or twice per week (3) three to six times per week, and (4) consumption on daily basis.

Sample size calculation

Using the Gpower 3.1.9.2 program for the calculation of the minimal sample size needed for our study, with a $1-\beta = 0.8$, a proportion $p_2 = 0.05$ (5% reflects the percentage of the mothers that smoked during pregnancy in the healthy children group) according to the pilot study that was done last year and considering a ratio of 4 controls for every case and an odds ratio $OR = 2$, the results showed that we need 296 cases versus 1184 controls (11).

Statistical analysis

Data analysis was performed on SPSS software, version 22. Two sided statistical tests were used; Chi-2 test for dichotomous or multinomial qualitative variables, Student's t test for quantitative variables of normal distribution and homogeneous variances. Regarding multivariable analysis, an ascending stepwise logistic regression was performed, taking into account the variables in the

bivariate analysis that showed a p-value < 0.2 . (12, 13); potential confounders may be eliminated only if $p > 0.2$, in order to protect against residual confounding (14). Furthermore, we used the SPSS option in the logistic regression to disregard all variables that showed a $p > 0.2$ (probability for stepwise in SPSS). Significance was defined as a p-value less than 0.05.

3. RESULTS

Socio demographic and socio economic characteristics

We calculated the reliability of each scale to assess the quality of our data. We obtained high Cronbach alphas for all scales as follows: ISAAC (0.873) and FFQ (0.732). Since we obtained good internal consistency, the results we got from these scales are adequate, solid and reliable.

Out of 1680 questionnaires distributed in schools, 1503 (89.46%) were collected back from parents of the children aged between 3--16 years old. 227 children having chronic respiratory symptoms of asthma (without a physician's diagnosis), were removed from the analysis, leaving us with a total of 1276 children (976 children were totally healthy and 300 having diagnosed asthma). There were missing values in our results since not all questions were answered by all parents. Missing data were not replaced for this analysis due to their low percentage ($< 10\%$).

Table 1 summarizes the sociodemographic and socioeconomic factors. The results showed that our sample included 51.6% boys and 48.4% girls. Twenty two percent of these children were aged between 3--6 years and 7--10 years respectively, whereas 42.6% were aged between 11--13 years old. 55.9% of these children had 1 or 2 person(s) living with them. Parents' university education was 35.8% for fathers and 55.1% for the mothers. The mean height was 139.68 ± 21.01 cm and the mean weight was 38.41 ± 15.37 Kg.

Bivariate analysis of food kinds between healthy and asthmatic children.

The results of the bivariate analysis are summarized in table 2. The results showed there was a significant difference between all kinds of food between asthmatic and healthy children, except for the fast food, milk and chocolate categories ($p < 0.05$ for all variables).

Multivariable Analysis

The results of the multivariable analysis are summarized in table 3. The results showed that Eating dairy products less than twice a week, 3--6 times per week and daily were significantly and inversely associated with asthma, as compared to never eating dairy product ($p = 0.02$, ORa = 0.285, CI 0.099-0.821; $p < 0.001$, ORa = 0.140, CI 0.052-0.378 and $p < 0.001$, ORa = 0.161, CI 0.061-0.422 respectively), whereas eating red meat daily compared to never, was associated with asthma significantly ($p = 0.037$, ORa = 2.051, CI 1.046-4.024). Eating nuts less than twice weekly as compared to never, was significantly and inversely associated with asthma ($p = 0.035$, ORa = 0.597, CI 0.369-0.965). The age category 7--10 and 11--13 years were significantly associated with asthma as compared to the 3--6 years category ($p < 0.001$, ORa = 3.359, CI 1.869-6.038 and $p = 0.008$, ORa = 2.191, CI 1.228-3.909 respectively), while male gender is significantly more prone to asthma ($p = 0.014$, ORa = 0.686, CI 0.507-0.926). Living in North and South Lebanon, as well as the Bekaa region, was significantly associated with asthma, as compared to living in the capital Beirut ($p = 0.007$, ORa = 2.034, CI 1.219-3.395; $p < 0.001$, ORa = 3.046, CI 1.658-5.595 and $p < 0.001$, ORa = 19.905, CI 4.963-79.829 respectively).

4. DISCUSSION

This is a case-control study carried out on Lebanese children to assess potential factors associated with asthma, especially the effect of food habits.

Food Habits

The traditional Mediterranean diet provides food sources rich in antioxidants such as vegetables, legumes, fruits and nuts, cereals, fish, a high monounsaturated-to-saturated fat ratio mostly from olive oil, low-fat dairy products, and a low intake of meat and poultry (15). This diet pattern has been shown to be protective of asthma (16, 17). Adherence to the Mediterranean diet was inversely associated with having asthma among children in Peru (18). Another systematic review showed evidence of a negative association between asthma or wheeze and dietary intake of vitamins C, E and D, as well as intake of fruits and adherence to a Mediterranean diet (19).

Seaton et al. have postulated that increases in the prevalence of asthma may be due to a reduced intake of antioxidant vitamins (beta-carotene, vitamins A, C and E) and mineral cofactors essential for antioxidant defense mechanisms (selenium, zinc and copper) as a result of reduced consumption of meat, fresh fish, fruit and vegetables in Western diets (20), while the results of Hodge et al. showed that children with wheeze only had a significantly higher intake of red meat (21). Our results agree with those of Hodge.

Dairy products were found to be inversely associated with asthma, in line to Hijazi et al. study that suggested that a lower consumption of milk is associated with a higher prevalence of asthma symptoms and allergy (22). On the opposite, no clear association between dairy products and asthma was observed according to Tabak et al. (23).

Nuts consumption less than twice weekly compared to never, was inversely associated with asthma, a finding consistent with the study of Chatzi (24). This is in agreement with the hypothesis that a dietary pattern rich in antioxidants may have a protective effect on the inflammatory response from early childhood to adolescence and thus, have a protective effect on both asthma and allergic diseases development (16, 17).

Our findings showed that fish was not associated with a higher risk of asthma, in opposite to the results of Miyake Y et al (25) and also in opposite to most of the literature where fish consumption is considered a protective factor (21, 26, 27).

No association was found between fruits and vegetables intake in our study in opposite to many studies in the literature that found that the consumption of fruits and vegetables may contribute to optimal respiratory health due to their antioxidant activity. Forastiere et al. concluded that the consumption of fruit rich in vitamin C may reduce wheezing symptoms in childhood (28). This absence of association in our results might be due to the fact that the questionnaire was distributed between December and April, a season where fruits availability and consumption are lower than usual. Therefore, the answers given about the frequency of fruits consumption might not reflect the reality of the usual dietary habits.

Fast food, soft drinks, fried food and salty snacks consumption are widely thought to be unhealthy especially for children, but the results of our study showed no correlation with either asthma or allergy. These findings are in opposite to the results of many studies that showed that respiratory allergic diseases in children such as asthma, have been correlated with the high consumption of fast food, like the frequent consumption of hamburgers, salty-snack eating^(22, 29). High salt, as shown in many studies (3), is a predictor of asthma and allergic disease that might

camouflage the benefits of dairy products. Moreover, the consumption of soft drinks containing preservatives or colorants increased significantly the risk of allergic rhinitis symptoms in children (30), but not in our study. This might be due to the reverse causality concept, where the parents know the food that might increase asthma symptoms in their children and avoid them.

Several studies have shown that polyunsaturated fatty acids containing food such as olive oil significantly improved pulmonary function tests, thus childhood asthma and allergy (26, 27) but this was not found in our results.

Barros R et al found that high sugar intake (like chocolate and pastry) is correlated with severe asthma prevalence. This finding is inconsistent with our results where we did not find any association between pastry or chocolate with asthma and allergy⁽³⁾. One possible explanation is that individuals with asthma or allergies may change their diet after being diagnosed with this disease(31).

These results could be also due to a reverse causal effect (families of children with severe asthma may improve their diet) and residual confounding. Moreover, people's dietary patterns often change over time through the lifespan and because of changes in socioeconomic and/or health status. Most of the studies reviewed were cross-sectional, precluding investigation of a temporal or causal relationship between dietary patterns and asthma (32). Further studies are warranted to confirm these findings.

Age, gender and district

Older age was found to be a significant predictor of asthma considering the cumulative years' effect in asthma which is a chronic disease as shown in the study done by Porsbjerg et al (33), in agreement with our study results.

Living in North and South Lebanon, as well as in the Bekaa region was associated with a higher risk of asthma in children. A previous study conducted by Salameh et al. revealed that Beirut was significantly associated with a higher risk of asthma versus Mount Lebanon. This might be explained by the fact that air pollution is more important in Beirut (34). No study has shown the causes of asthma in different governorates in Lebanon; larger studies are needed to investigate this issue.

Diagnosis of asthma was affected by the male gender in our study, in agreement to the findings of Waked and Salameh⁽³⁴⁾ and other studies in the literature that found that male sex is predominant in asthma population in the first decade (35, 36).

Limitations

Our study has several limitations. The possibility of recall bias might be entertained due to the retrospective nature of our investigation. A selection bias is possible because of the refusal rate for participation. An information bias is also possible since the use of a questionnaire in a young population or for surrogate responders (parents) may not always be accurate: problems in question understanding, recall deficiency and over or under evaluating symptoms may still be possible. The broad age range of the participants (3 to 15 year) may act as a confounding factor given that food consumption may vary substantially among children of different age groups. A self-administered diet history questionnaire was also used to assess children's dietary intakes in our study. This method should be interpreted with caution as it might not reflect long-term intake by children and may underestimate the results, maybe the child has recently changed his dietary habits, than we will have information about the present life style which does not have yet an

effect on asthma and allergy. In the case group, some children are known to have asthma, which might interfere with their nutritional habits, whereas other children are newly diagnosed, which makes them different from the “already-known” ones. This issue might be a source of bias since we don’t know if asthma changes nutritional habits or some patterns in nutritional habits creates a risk scenario to future asthma patients. The heterogeneous results may be partially explained by the notable variation in FFQs used for measuring dietary intakes between us and other studies. Moreover, the FFQ and ISAAC questionnaires are not validated in Lebanon. However, being a case-control study, and considering the big sample size enrolled for all 5 districts of Lebanon make our results representative of the whole population.

5. CONCLUSION

Knowing the correlation between nutritional habits and asthma is important to promote healthy eating. Educational programs for parents about healthy food and breastfeeding encouragement are warranted. Further larger studies are needed though to confirm our findings or discover new ones.

Conflicts of interest

The authors have nothing to disclose and report no conflicts of interest.

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Table 1. Sociodemographic and anthropometric measurements of children in the total sample and by gender (N = 1236).

Disease status/ Factors	Total number of subjects N = 1276	Healthy Subjects N = 976	Diagnosed Asthma N = 300	Chi- square	P-value
Age category				49.63	<0.0001
3-6 years	263 (20.8%)	163 (16.8%)	100 (33.8%)		
7-10 years	281 (22.2%)	208 (21.5%)	73 (24.7%)		
11-13 years	560 (44.3%)	459 (47.4%)	101 (34.1%)		
> 14 years	160 (12.7%)	138 (14.3%)	22 (7.4%)		
Gender				17.03	<0.0001
Male	662 (52%)	476 (48.8%)	186 (62.4%)		
Female	612 (48%)	500 (51.2%)	112 (37.6%)		
District				79.85	<0.0001
Beirut	302 (23.7%)	241 (24.7%)	61 (20.4%)		
Mount Lebanon	537 (42.1%)	416 (42.6%)	121 (40.5%)		
North	156 (12.2%)	98 (10%)	58 (19.4%)		
South	25 (2%)	4 (0.4%)	21 (7%)		
Bekaa	255 (20.0%)	217 (22.2%)	38 (12.7%)		
Height (in cm)		139.68 ± 21.01	141.91 ± 19.82	132.48 ± 23.06	-
Weight (in Kg)		38.41 ± 15.37	39.56 ± 15.09	34.68 ± 15.71	-
Education father				7.03	0.03
Low *	106 (8.4%)	70 (7.2%)	36 (12%)		
Intermediate **	708 (55.9%)	545 (56.3%)	163 (54.5%)		
High ***	453 (35.8%)	353 (36.5%)	100 (33.4%)		
Education mother				9.99	0.007
Low *	79 (6.2%)	49 (5%)	30 (10.1%)		
Intermediate **	496 (39.1%)	383 (39.4%)	113 (38%)		
High ***	693 (54.7%)	539 (55.5%)	154 (51.9%)		
Number of persons per room				0.183	0.913
[0-1]	763 (60.2%)	581 (59.9%)	182 (61.3%)		
[1-2]	465 (36.7%)	359 (37%)	106 (35.7%)		
More than 2	39 (3.1%)	30 (3.1%)	9 (3%)		

*Chi-square test was used to compare between the 2 groups (healthy vs diagnosed children) and the following independent variables: age category, gender, district, paternal and maternal level of education, number of persons per room. The Student t-test was used to compared between the 2 groups and the following independent variables: weight and height.

Table 2. Dietary intake of the Lebanese children as assessed by a food frequency questionnaire, in total study sample and by disease status.

Factor	Total (N = 1276)	Absence of asthma (N = 976)	Presence of asthma (N = 300)	Chi-square	p-value
Fast food				5.07	0.167
Never	238 (18.7%)	178 (18.2%)	60 (20%)		
Less than 2 times per week	967 (75.8%)	750 (76.8%)	217 (72.3%)		
3-6 times per week	54 (4.2%)	38 (3.9%)	16 (5.3%)		
Daily	17 (1.3%)	10 (1%)	7 (2.3%)		
Fish				21.73	<0.0001
Never	186 (14.6%)	140 (14.3%)	46 (15.3%)		
Less than 2 times per week	1050 (82.3%)	817 (83.7%)	233 (77.7%)		
3-6 times per week	36 (2.8%)	16 (1.6%)	20 (6.7%)		
Daily	4 (0.3%)	3 (0.3%)	1 (0.3%)		
Red meat				63.83	<0.0001
Never	109 (8.5%)	84 (8.6%)	25 (8.3%)		
Less than 2 times per week	418 (32.8%)	340 (34.8%)	78 (26%)		
3-6 times per week	624 (48.9%)	492 (50.4%)	132 (44%)		
Daily	125 (9.8%)	60 (6.1%)	65 (21.7%)		
Nuts				25.25	<0.0001
Never	114 (8.9%)	74 (7.6%)	40 (13.3%)		
Less than 2 times per week	886 (69.4%)	701 (71.8%)	185 (61.7%)		
3-6 times per week	207 (16.2%)	161 (16.5%)	46 (15.3%)		
Daily	69 (5.4%)	40 (4.1%)	29 (9.7%)		
Fruits				14.65	0.002
Never	30 (2.4%)	17 (1.7%)	13 (4.3%)		
Less than 2 times per week	123 (9.6%)	89 (9.1%)	34 (11.3%)		
3-6 times per week	325 (25.5%)	268 (27.5%)	57 (19%)		
Daily	798 (62.5%)	602 (61.7%)	196 (65.3%)		
Vegetables				14.66	0.002
Never	38 (3%)	22 (2.3%)	16 (5.3%)		
Less than 2 times per week	121 (9.5%)	89 (9.1%)	32 (10.7%)		
3-6 times per week	352 (27.6%)	289 (29.6%)	63 (21%)		
Daily	765 (60%)	576 (59%)	189 (63%)		

Dairy products				26.63	<0.0001
Never	24 (1.9%)	9 (0.9%)	15 (5%)		
Less than 2 times per week	87 (6.8%)	61 (6.3%)	26 (8.7%)		
3-6 times per week	285 (22.4%)	233 (23.9%)	52 (17.3%)		
Daily	879 (68.9%)	672 (68.9%)	207 (69%)		
Olive oil				34.1	<0.0001
Never	88 (6.9%)	61 (6.3%)	27 (9%)		
Less than 2 times per week	332 (26%)	270 (27.7%)	62 (20.7%)		
3-6 times per week	422 (33.1%)	350 (35.9%)	72 (24%)		
Daily	434 (34%)	295 (30.2%)	139 (46.3%)		
Fried food				17.11	0.001
Never	64 (5%)	41 (4.2%)	23 (7.7%)		
Less than 2 times per week	945 (74.1%)	730 (74.8%)	215 (71.7%)		
3-6 times per week	216 (16.9%)	175 (17.9%)	41 (13.7%)		
Daily	51 (4%)	30 (3.1%)	21 (7%)		
Chips				32.93	<0.0001
Never	85 (6.7%)	55 (5.6%)	30 (10%)		
Less than 2 times per week	788 (61.8%)	617 (63.2%)	171 (57%)		
3-6 times per week	243 (19%)	204 (20.9%)	39 (13%)		
Daily	160 (12.5%)	100 (10.2%)	60 (20%)		
Pastry				33.44	<0.0001
Never	28 (2.2%)	16 (1.6%)	12 (4%)		
Less than 2 times per week	1019 (79.9%)	807 (82.7%)	212 (70.7%)		
3-6 times per week	183 (14.3%)	131 (13.4%)	52 (17.3%)		
Daily	46 (3.6%)	22 (2.3%)	24 (8%)		
Carbonated beverages				15.69	0.001
Never	313 (24.5%)	224 (23%)	89 (29.7%)		
Less than 2 times per week	629 (49.3%)	506 (51.8%)	123 (41%)		
3-6 times per week	194 (15.2%)	151 (15.5%)	43 (14.3%)		
Daily	140 (11%)	95 (9.7%)	45 (15%)		
Milk				5.33	0.149
Never	212 (16.6%)	162 (16.6%)	50 (16.7%)		
Less than 2 times per week	326 (25.5%)	255 (26.1%)	71 (23.7%)		
3-6 times per week	237 (18.6%)	191 (19.6%)	46 (15.3%)		
Daily	501 (39.3%)	368 (37.7%)	133 (44.3%)		

Chocolate				3.44	0.329
Never	20 (1.6%)	13 (1.3%)	7 (2.3%)		
Less than 2 times per week	214 (16.8%)	158 (16.2%)	56 (18.7%)		
3-6 times per week	506 (39.7%)	397 (40.7%)	109 (36.3%)		
Daily	536 (42%)	408 (41.8%)	128 (42.7%)		

*Chi-square test was used to compare between the 2 groups (healthy vs diagnosed children) and all food/drinks category variables.

Table 3. Multivariate analysis with disease status taken as the dependent variable.

Factor	p-value	OR	ORa	Confidence interval	
Red meat category	.001				
Never	-	1	1	-	-
Red meat less than twice a week as compared to never	.342	0.771	.758	.427	1.343
Red meat between 3--6 days per week as compared to never	.767	0.901	.919	.526	1.607
Red meat daily as compared to never	.030	3.64	2.117	1.074	4.176
Nuts category	.056				
Never	-	1	1	-	-
Nuts less than twice a week as compared to never	.039	0.488	.601	.371	.976
Nuts between 3--6 days per week as compared to never	.096	0.529	.597	.325	1.095
Nuts daily as compared to never	.808	1.341	1.096	.523	2.297
Dairy products category	<0.001				
Never	-	1	1	-	-
Dairy products less than twice a week as compared to never	.012	0.256	.251	.085	.740
Dairy products between 3--6 days per week as compared to never	<0.001	0.134	.126	.045	.350
Dairy products daily as compared to never	<0.001	0.185	.142	.053	.381
Olive oil category	.009				
Never	-	1	1	-	-
Olive oil less than twice a week as compared to never	.441	0.519	.785	.424	1.454
Olive oil between 3--6 days per week as compared to never	.448	0.465	.788	.425	1.459
Olive oil daily as compared to never	.269	1.065	1.416	.764	2.626
Chips category	.003				
Never	-	1	1	-	-
Chips less than twice a week as compared to never	.110	0.508	.641	.372	1.106
Chips between 3--6 days per week as compared to never	.146	0.350	.611	.315	1.186
Chips daily as compared to never	.252	1.100	1.504	.748	3.023

Pastry category	.029				
Never	-	1	1	-	-
Pastry less than twice a week as compared to never	.693	0.350	.836	.343	2.036
Pastry between 3--6 days per week as compared to never	.953	0.529	1.030	.388	2.730
Pastry daily as compared to never	.110	1.455	2.568	.809	8.157
Age category	<0.001				
3-6 years	-	1	1	-	-
7-10 years as compared to 3--6 years category	.034	0.572	.628	.408	.966
11-13 years as compared to 3--6 years category	<0.001	0.359	.447	.296	.675
≥ 14 years as compared to 3--6 years category	<0.001	0.260	.274	.151	.495
Gender	.012	0.573	.677	.501	.916
District	<0.001				
Beirut	-	1	1	-	-
Mount Lebanon as compared to Beirut	.254	1.149	1.252	.851	1.841
North Lebanon as compared to Beirut	.015	2.338	1.862	1.129	3.070
South Lebanon as compared to Beirut	<0.001	20.742	11.753	3.066	45.058
Bekaa as compared to Beirut	.058	0.692	.582	.333	1.018

* All kinds of food compared to no intake of that food kind.

** Variables entered in the model: fast food, fish, red meat, nuts, fruits, vegetables, dairy products, olive oil, fried food, chips, pastry, carbonated beverages, milk, educational level of the father, educational level of the mother, age category, gender, district.

*** OR means unadjusted odds ration; ORa means adjusted odds ratio.