

comprise a questionnaire score as well as airway reversibility as these measures address different manifestations of asthma. Our research took into account important potential confounders such as atopy, parental education level, nutritional supplementation, total energy intake, surrounding environment, all of which have been considered relevant when addressing asthma-related outcomes in schoolchildren (33, 34).

The Healthy Eating Indexes have the benefit of being constantly revised and updated to agree with the latest guidelines for Americans (17). Even if the HEI-2015 is not adapted for Portugal nor Portuguese children, this index has the benefit of being scored on a density basis (17, 18), utilizing a less restrictive approach to defining standards for maximum scores, and enabling it to be employed to different groups, including children. The HEI-2015 evaluates quality over quantity (17). This index targets food subgroups that are most frequently low in diets and that have an exceptional nutrient profile, as legumes, dark green vegetables and seafood (17). Additionally, it has the benefit of not requiring any single food to have higher scores, having into regard food intake as a whole to characterize diet quality (17) carrying a more rounded approach to evaluate dietary intake that takes into consideration the potential interactions between the diverse components of the diet.

This study suggests that in non-overweight/obese school-aged children, a higher dietary quality is associated with a lower prevalence of self-reported medical diagnosis of asthma, self-reported medical diagnosis of asthma under asthma treatment, and lower levels of airway inflammation. This work underlines the significance of promoting a diet that is high quality as for example diets that are rich in vegetables, fruits, whole grains, greens and beans, healthy fats, high quality and diverse protein sources and that is low in saturated fats, added sugars, sodium, and refined grains. Understanding the potential effect of food consumption on asthma and airway inflammation might support the introduction of clinical guidelines and public health recommendations. Nevertheless, there are still significant gaps in the interpretation of the types of foods or diets that the population should incorporate in order to improve their respiratory health.

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Table I. Summary of participants characteristics.

	Girls, (49,1%)	n= 324	Boys, (50,9%)	n= 336	Total, n= 660	p-value
Age (years), mean \pm SD	8.68 \pm 0.8		8.69 \pm 0.8		8.68 \pm 0.8	0.907
BMI category						0.864
Non-overweight/obese	242 (74.7%)		249 (74.1%)		491 (74.4%)	
Overweight/obese	82 (25.3%)		87 (25.9%)		169 (25.6%)	
HEI-2015 Score, mean \pm SD	59.6 \pm 11.7		58.8 \pm 11.1		59.2 \pm 11.4	0.387
Carbohydrates, %VET	50.1 \pm 7.1		50.9 \pm 7.4		50.6 \pm 7.3	0.142
Protein, %VET	17.8 \pm 4.2		17.3 \pm 3.8		17.5 \pm 4.0	0.095
Fat %VET	28.8 \pm 6.2		28.6 \pm 6.4		28.7 \pm 6.3	0.679
MUFA %VET	10.2 \pm 3.0		10.2 \pm 3.3		10.2 \pm 3.1	0.815
PUFA %VET	3.8 \pm 1.8		3.7 \pm 1.5		3.8 \pm 1.7	0.500
SFA %VET	9.0 \pm 3.4		8.9 \pm 3.1		9.0 \pm 3.2	0.597
Fiber (g), median (25th – 75th)	17.9 (13.3; 24.3)		18.8 (14.4; 24.3)		18.4 (13.8; 24.3)	0.345
Sodium (mg), median (25th – 75th)	1923 (1441; 2591)		2206 (1689; 3030)		2053 (1513; 2769)	<0.001*
Total energy intake (kcal), median (25th – 75th)	2065 (1760; 2403)		2228 (1966; 2581)		2865 (1868; 2476)	<0.001*
Nutritional Supplementation, n (%)	44 (15.4%)		43 (14.4%)		87 (14.9%)	0.496
+BD (>10%), n%	73 (22.5%)		91 (27.1%)		164 (24.8%)	0.027*
+BD (>12% and >200ml), n (%)	21 (6.5%)		15 (4.5%)		36 (5.5%)	0.041*
Asthma Symptoms, n (%)	45 (13.9%)		44 (13.1%)		89 (13.5%)	0.820
Asthma medication, n (%)	45 (13.9%)		44 (13.1%)		89 (13.5%)	0.820
Increased levels of FeNO (\geq 35ppb), n (%)	36 (11.1%)		50 (14.9%)		86 (13.0%)	0.150
Asthma definitions, n (%)						
Ever	23 (7.1%)		22 (6.5%)		45 (6.8%)	0.759
Medical diagnosis with asthma symptoms or +BD	33 (10.2%)		23 (6.8%)		56 (8.5%)	0.124
Medical diagnosis and under asthma treatment	21(6.5%)		16 (4.8%)		37 (5.6%)	0.337

Atopy, n (%)	106 (33.3%)	121 (36.3%)	227 (34.9%)	0.422
Parental education, n (%)				0.236
<9 years	81 (32.3%)	107 (38.5%)	188 (35.5%)	
10-12 years	84 (33.5%)	77 (27.7%)	161 (30.4%)	
>12 years	86 (34.3%)	94 (33.8%)	180 (34.0%)	

Note: * statically significant differences. Abbreviations: HEI: Healthy Eating Index. FeNO: Fractional exhaled nitric oxide. MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; SFA: Saturated fatty acids. +BD: Positive Bronchodilation; %VET: Percent of Total energy value.

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Table II. Scores of the HEI-2015 components by sex.

	Girls, n= 324 (49,1%)	Boys, (50,9%)	n=336 Total, n= 660	p-value
HEI-2015 Groups, mean ± SD				
Total Fruits, mean ± SD	3.44±1.95	3.23±1.96	3.34 ±1.96	0.171
Whole Fruits, mean ± SD	3.86±1.99	3.71±2.03	3.79±2.01	0.350
Total Vegetables, mean ± SD	1.91±1.46	1.77±1.38	1.84±1.42	0.194
Whole Grains, median (25th – 75th)	0.00 (0.00; 2.43)	0.00 (0.00; 2.06)	0.00 (0.00; 2.21)	0.434
Dairy, mean ± SD	6.90±2.93	6.83±2.81	6.87±2.87	0.729
Total Protein Foods, median (25th – 75th)	5.00 (4.71;5.00)	5.00(4.90;5.00)	5.00 (4.86;5.00)	0.512
Seafood & Plant Proteins, mean ± SD	2.69±2.42	2.96±2.40	2.83±2.41	0.148
Greens & Beans, mean ± SD	3.27±2.02	3.24±2.05	3.26±2.04	0.841
Fatty Acids, mean ± SD	3.86±3.57	3.71±3.40	3.78±3.49	0.564
Refined Grains, mean ± SD	2.63±3.31	2.44±3.12	2.53±3.21	0.454
Sodium, median (25th – 75th)	10.00 (8.31;10.00)	10.00 (8.29;10.00)	10.00 (8.29;10.00)	0.870
Added Sugars, median (25th – 75th)	10.00 (7.99; 10.00)	9.37 (7.64; 10.00)	9.59 (7.86;10.00)	0.098
Saturated fats, mean ± SD	7.79±2.77	7.88±2.59	7.84±2.68	0.644

Note: Abbreviations: HEI: Healthy Eating Index.

Table III. Association between diet quality and airway inflammation and asthma.

	HEI Score: Crude Model OR (95% CI)	HEI Score: aOR (95% CI)	HEI Score Tertiles: Crude Model OR (95% CI)		HEI Score Tertiles: aOR (95% CI)		
	Continuous (n=660)	Continuous (n=660)	>54.53 and ≤ 65.37 (n=220)	>65.37 (n=220)	Reference ≤54.53 (n=220)	>54.53 and ≤65.37 (n=220)	>65.37 (n=220)
Increased levels of eNO (≥ 35ppb)							
All participants	0.98 (0.96;0.99)*	0.98 (0.96;0.99)	0.63 (0.36;1.09)	0.68 (0.4;1.18)	1.0	0.58 (0.29;1.17)	0.74 (0.38;1.45)
Non-overweight/obese	0.97 (0.96;0.99)*	0.97 (0.94; 0.99)	0.52(0.28;0.96)*	0.62 (0.34;1.13)	1.0	0.39 (0.17;0.91)*	0.65 (0.30; 1.40)
Overweight/obese	0.99 (0.948;1.04)	0.999 (0.95; 1.05)	1.23 (0.34;4.52)	0.93 (0.24;3.65)	1.0	1.48 (0.32;6.91)	0.86 (0.17;4.36)
+ BD (>10%)							
All participants	1.00 (0.99;1.02)	1.00 (0.98;1.02)	1.3 (0.78,2.17)	1.3 (0.78,2.17)	1.0	1.37 (0.81,2.32)	1.36 (0.79,2.33)
Non-overweight/obese	0.99 (0.98;1.02)	0.99 (0.97;1.02)	1.85 (0.66,5.14)	1.62 (0.6,4.33)	1.0	1.93 (0.68,5.48)	2.05 (0.7,5.95)
Overweight/obese	1.02 (0.99;1.06)	1.04 (0.99;1.08)	1.2 (0.66,2.17)	1.22 (0.67,2.22)	1.0	1.24 (0.67,2.32)	1.27 (0.67,2.43)
Asthma							
Ever							
All participants	0.97 (0.95;0.99)*	0.98 (0.95; 1.01)	0.61 (0.29;1.28)	0.63 (0.31;1.31)	1.0	0.45 (0.18;1.15)	0.71 (0.31;1.62)
Non-overweight/obese	0.96 (0.94;0.99)	0.96 (0.93;0.999)	0.43 (0.17;1.08)	0.55 (0.23;1.29)	1.0	0.14 (0.03;0.69)*	0.53 (0.19;1.49)
Overweight/obese	0.99 (0.95;1.04)	0.999 (0.95;1.05)	1.38 (0.38,5.08)	0.93 (0.24;3.65)	1.0	1.62 (0.41;6.44)	1.19 (0.27;5.23)
Medical diagnosis w/asthma symptoms or +BD							
All participants	0.99 (0.97;1.02)	0.99 (0.97;1.02)	0.74 (0.38;1.47)	0.9 (0.47;1.72)	1.0	0.61 (0.27;1.41)	0.94 (0.44;2.01)
Non-overweight/obese	0.99 (0.96;1.02)	0.99 (0.96;1.02)	0.56 (0.25;1.27)	0.81 (0.38;1.72)	1.0	0.41 (0.14;1.24)	0.94 (0.38;2.32)

Overweight/obese	1.01 (0.96;1.06)	1.01 (0.96; 1.07)	1.51 (0.43;5.27)	1.18 (0.32;4.33)	1.0	2.09 (0.47;9.24)	1.6 (0.35;7.25)
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Medical diagnosis and under asthma treatments

All participants	0.98 (0.95;1.00)	0.98 (0.95;1.01)	0.45 (0.19,1.07)	0.69 (0.32;1.48)	1.0	0.30 (0.09;0.94)*	0.76 (0.32;1.84)
Non-overweight/obese	0.97 (0.94;1.00)	0.97 (0.93;1.01)	0.37 (0.13,1.08)	0.61 (0.24;1.54)	1.0	0.09 (0.01;0.78)*	0.62 (0.2;1.87)
Overweight/obese	0.99 (0.94;1.05)	0.92 (0.83;1.02)	0.71 (0.16,3.12)	0.93 (0.24;3.65)	1.0	0.82 (0.17;3.95)	1.08 (0.24;4.78)

Note: * statically significant differences. Abbreviations: aOR: Adjusted odds ratio; HEI: Healthy Eating Index; FeNO: Fractional exhaled nitric oxide. +BD: Positive Bronchodilation. Logistic regression was adjusted to age, sex, parental education, atopy, school, total energy intake, and nutritional supplementation use. Significant differences were defined with an α -value of less than 5%, 95% confidence interval, ($p < 0.05$)

Figure 1. Representation of the interaction between potential risk factors (as environmental pollution, education and socioeconomic status, weight and genetics) for asthma and airway inflammation and diet quality as a potential protector.

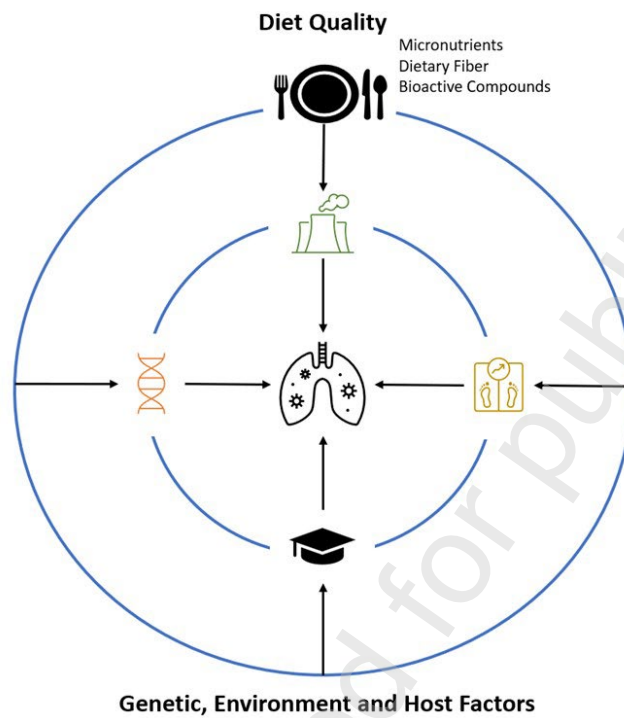


Figure 2: Flow chart of the included participants.

