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Letter to the Editor

Dietary patterns and allergy in children aged 5–12 years in Australia: Findings from the mothers and their Children's health study

Dear Editor,

Allergic diseases are an increasing public health concern, especially in industrialized countries.¹ Up to 40% of Australian and New Zealand children experience some kind of allergic condition, a rate that has been steadily increasing in the last 30 years alongside the severity of allergies related to hospitalization for anaphylaxis.² Asthma, eczema and rhinoconjunctivitis are the most common non-communicable diseases (NCDs) during childhood in Australia.³ The escalation of the issue suggests that environmental factors and lifestyle changes must play a greater role in increasing the burden of allergic diseases than genetic predisposition.^{1,4}

Diet is an important determinant of health and recent shifts on dietary consumption towards a less healthy diet have been linked to the increase of many NCDs.¹ Previous studies have correlated the excessive consumption of snacks and fast foods with atopic diseases in children.^{4–6} Others have reported a potential protective effect from the increased intake of healthy foods, such as fruits, vegetables, cereals, nuts, vegetable oils, milk and fish.^{1,4} However, the analysis of isolated foods might fail to account for nutrient or food interactions in multi-component dietary patterns.⁴ Thus, we conducted a cross-sectional cohort study to investigate the association between dietary patterns and allergies in a population-based sample of Australian children aged 5–12 years, who participated in the Mothers and their Children's Health (MatCH) study.

Maternal data were from the 1973–78 cohort of the Australian Longitudinal Study on Women's Health (ALSWH), who have completed surveys approximately every 3 years between 1996 and 2015. In 2015/2016, ALSWH mothers provided information on the health and development of their three youngest children aged 0–12 years as part of MatCH.⁷ Both studies were approved University of Newcastle's Human Research Ethics Committee and the Human Research Ethics Committee of the University of Queensland and mothers provided informed written consent for themselves and their children.⁷

The presence of allergies was reported by mothers answering the following question 'Does your child have any of these long-standing problems or symptoms': i) respiratory allergy (including hay fever); ii) non-food allergy; iii) food or digestive allergy; iv) eczema, dermatitis or any kind of skin allergy; and v) asthma. Answers were dichotomized as no versus mild or moderate/severe and each allergic condition was analysed separately.

Children's daily frequency of intake was reported by mothers using a Children's Dietary Questionnaire adapted from Magarey,

Golley, Spurrier, Goodwin, & Ong⁸ which included 26 items categorized as positive and negative indicators based on their nutritional quality. An exploratory factor analysis with varimax rotation was used to identify dietary patterns among all 5,780 children included in MatCH study. The four factors solution was preferred because of the levelling observed on the scree plot of Eigen-values thereafter. According to the food items they comprised, factors were labelled as 'High-sugar and fast food' pattern, 'Healthy' pattern, 'Sweet and savoury snacks' pattern and 'Reduced fat dairy' pattern. Higher dietary pattern scores indicated higher mean daily frequencies of intake of all food items included in the patterns.

Multinomial logistic regression models were used to test the association between mother-reported allergic conditions and dietary patterns accounting for the clustering of children within mothers. The first model was an assessment between allergies and each dietary pattern. Potential confounders were added in the second model and other dietary patterns in the third model. Potential confounders were chosen following suggestions from Wang *et al.*'s⁵ systematic review and meta-analysis, including socioeconomic status, urban vs. rural residence, maternal smoking and maternal history of atopy. Child's sex, age, and physical activity were additionally included in the confounders list. Dose–response relationships were not evaluated in this study.

From the 5,780 children included in MatCH, a total of 4,400 children were in the age group of interest. Only children with complete data were included in the analysis, totalling a sample of 3,744 children aged 5–12 years (51.2% boys and 48.8% girls; mean age 8.4 years, SD: 2.2; for more details see [Supplementary Table 1](#)). The results ([Supplementary Table 2](#)) showed that children in the 'Sweet and savoury snacks' pattern had approximately 1.2 times higher likelihood of having food allergy compared to those with lower intake of snacks (OR: 1.25, 95%CI: 1.06–1.46, $p = 0.007$; aOR₁: 1.27, 95%CI: 1.07–1.5, $p = 0.005$). The results remained similar after further adjustment for other food patterns (aOR₂: 1.28, 95%CI: 1.08–1.51, $p = 0.004$). Children in this pattern consumed biscuits, chips, processed meats, lollies and spreads, approximately twice a day, which likely exceeds the recommendation of the Australian dietary guidelines of one serve of non-core foods per day.⁹

After adjustments, the 'Reduced fat dairy' pattern was associated with a lower probability of having asthma (aOR₁: 0.90, 95%CI: 0.82–1.00, $p = 0.046$; aOR₂: 0.91, 95%CI: 0.82–1.00, $p = 0.048$). The mean frequency of consumption of reduced fat dairy (milk and yoghurt/custard) in the sample, however, was low – less than once a day – which may have affected the results.

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Nonetheless, other studies found that both regular and low-fat dairy products have anti-inflammatory properties that may benefit children's immune system, hence, protecting against allergies.¹⁰ No other statistically significant relationships between allergies and dietary patterns were observed.

Our findings show that allergic conditions are highly prevalent in Australian children, with 36.9% of the sample having one or more allergies. The elevated burden of allergies may be associated with a higher frequency of consumption of non-core foods, particularly for food allergy. Therefore, promoting healthy food environments may yield significant public health benefits.^{3,6} The results from this study need to be replicated in longitudinal studies to identify causal relationships.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.alit.2020.04.012>.

Conflict of interest

The authors have no conflict of interest to declare.

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Supplementary Table 1. General characteristics of the sample compared with children aged 5 years excluded from the analysis

Variables	Included (n=3,744)		Excluded (n=656)	
	N	%	n	%
Sex			<i>(n missing=3)</i>	
Male	1,916	51.2	330	50.5
Female	1,828	48.8	323	49.5
Physical activity			<i>(n missing=250)</i>	
No	2,318	61.9	238	58.6
Yes	1,426	38.1	168	41.4
Maternal education				
≤High school	493	13.2	111	16.9
Trade/Diploma	874	23.3	154	23.5
University	2,377	63.5	391	59.6
Maternal smoking				
Never smoker	2,469	66	459	70
Ex-smoker	983	26.3	166	25.3
Current smoker	292	7.8	31	4.7
Maternal history of atopy				
No	737	19.7	131	19.9
Yes	3,007	80.3	525	80.1
Difficulty in managing income				
Not difficult	699	18.7	93	14.2
Average	1,461	39	270	41.2
Some difficulties	1,050	28	207	31.5
Many difficulties	534	14.3	86	13.1
Area of residence			<i>(n missing=12)</i>	
Major cities	2,152	57.5	346	53.7
Inner regional	1,022	27.3	185	28.7
Outer regional/ Remote/Very remote	570	15.2	113	17.6

Supplementary Table 2. Association between dietary patterns and allergies using Multinomial logistic regression (N=3,744)

Dietary patterns	OR	Model 1 [†] 95%CI	p-value	aOR1	Model 2 [‡] 95%CI	p-value	aOR2	Model 3 [§] 95%CI	p-value
Asthma (ref: No, n=3,269)									
High-sugar and fast food	0.93	0.85-1.03	0.2	0.99	0.90-1.10	0.9	0.99	0.89-1.10	0.8
Healthy	0.99	0.88-1.10	0.8	0.97	0.87-1.08	0.6	0.98	0.87-1.09	0.7
Sweet and savoury snacks	1.01	0.91-1.13	0.9	1.01	0.90-1.12	0.9	1.01	0.90-1.13	0.9
Reduced fat dairy	0.91	0.82-1.00	0.1	0.90	0.82-1.00	0.046*	0.91	0.82-1.00	0.048*
Eczema (ref: No, n=3,030)									
High-sugar and fast food	1.00	0.91-1.09	1.0	1.02	0.94-1.12	0.6	1.02	0.93-1.12	0.6
Healthy	1.05	0.96-1.15	0.3	1.05	0.96-1.15	0.3	1.06	0.96-1.16	0.2
Sweet and savoury snacks	1.05	0.96-1.14	0.3	1.05	0.96-1.15	0.3	1.05	0.96-1.15	0.3
Reduced fat dairy	0.93	0.86-1.01	0.1	0.93	0.85-1.01	0.1	0.93	0.85-1.01	0.1
Respiratory allergy (ref: No, n=3,094)									
High-sugar and fast food	0.95	0.88-1.04	0.3	1.05	0.96-1.16	0.3	1.05	0.96-1.16	0.3
Healthy	0.96	0.88-1.06	0.4	0.93	0.84-1.02	0.1	0.93	0.84-1.02	0.1
Sweet and savoury snacks	1.01	0.92-1.11	0.9	1.00	0.91-1.10	1.0	1.00	0.91-1.10	1.0
Reduced fat dairy	0.96	0.88-1.06	0.4	0.97	0.88-1.07	0.6	0.97	0.89-1.07	0.6
Food allergy (ref: No, n=3,525)									
High-sugar and fast food	1.01	0.89-1.15	0.8	1.06	0.92-1.22	0.4	1.06	0.92-1.22	0.4
Healthy	1.09	0.95-1.26	0.2	1.08	0.93-1.24	0.3	1.09	0.95-1.26	0.2
Sweet and savoury snacks	1.25	1.06-1.46	0.007**	1.27	1.07-1.50	0.005**	1.28	1.08-1.51	0.004**
Reduced fat dairy	0.89	0.79-1.00	0.05	0.90	0.80-1.01	0.07	0.89	0.79-1.00	0.05
Non-food allergy (ref: No, n=3,365)									
High-sugar and fast food	0.97	0.88-1.08	0.6	1.04	0.93-1.17	0.5	1.05	0.93-1.17	0.4
Healthy	0.99	0.88-1.11	0.9	0.96	0.86-1.08	0.5	0.97	0.86-1.08	0.5
Sweet and savoury snacks	1.04	0.92-1.18	0.5	1.05	0.92-1.19	0.5	1.05	0.92-1.19	0.5
Reduced fat dairy	0.99	0.88-1.11	0.8	1.01	0.90-1.13	0.9	1.01	0.90-1.13	0.9

OR: odds ratio; %95CI: 95% confidence interval; aOR1: odds ratio adjusted for covariates; aOR2: odds ratio adjusted for covariates and other food scores. [†]Model 1: univariate model; [‡]Model 2: covariates (status, urban vs. rural residence, maternal smoking, maternal history of atopy, child's sex, age, and physical activity) added to Model 1; [§]Model 3: other dietary patterns added to Model 2. *p<0.05 (significant); **p<0.01 (very significant)