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Atopic conditions are associated with food addiction in U.S. women

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To the editor

Atopic conditions, particularly atopic dermatitis (AD) and asthma, are associated with obesity.¹ In epidemiologic studies, obesity is associated with higher risk of developing AD² and asthma.³ It is possible, though, that the association is bidirectional. A possible mediator

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between obesity and atopy that has not been explored is obesogenic eating behavior. The psychological burden of atopic conditions, including decreased quality of life and increased rates of depression,^{4, 5} may lead to over-eating, and promote obesity. Food addiction is a form of obesogenic eating behavior analogous to substance dependence⁶ and is associated with depression⁷ and obesity.⁸

In this study we examined the association between atopic conditions (AD, food allergy, hayfever and asthma) and food addiction in the Nurses' Health Study 2 (NHS2), a cohort of US female nurses. NHS2 began in 1989 with 116,609 participants. Race/ethnicity was reported at cohort baseline. Information on body weight, physical activity, alcohol intake and smoking status were comprehensively collected and updated during the cohort follow-up and data from 2009 were used in this analysis. History of AD, food allergy and hayfever was assessed in 2009 and history of asthma was assessed biennially from 1989, with data up to 2009 included in this analysis; questions used to define cases of atopic conditions are presented in the online repository (table E1). Food addiction was assessed in 2009 using a modified version of the Yale Food Addiction Scale (mYFAS).⁹ The mYFAS shows good construct validity and sensitivity (79%), providing a conservative assessment of food addiction.⁹ Participants' completion and return of the self-administered questionnaire is considered informed consent. The study was approved by the institutional review board of Brigham and Women's Hospital.

A total of 90,482 participants had valid questionnaire data for 2009. We excluded participants who did not answer the question regarding a diagnosis of eczema, food allergy and hayfever (n=10,391) or who did not sufficiently answer the food addiction questions (n=3,766). There were no important differences between the excluded and included participants with regards to age, BMI, physical activity, alcohol consumption, smoking status or history of asthma.

We used logistic regression models to calculate age- and multivariate-adjusted odds ratios (OR) and 95% confidence intervals (CIs) for the association between each atopic condition and food addiction. Multivariate-adjusted analysis was conducted adjusting for age, race/ethnicity, physical activity, alcohol intake, and smoking status. In a second analysis, BMI was added as a covariate. In additional analyses, focused on each atopic condition, we further adjusted for the other 3 atopic conditions (eg. the analysis of the association between AD and food addiction was adjusted for food allergy, hayfever and asthma). An indicator variable was created for missing data of a variable. All statistical analysis was performed with SAS, version 9.2 (SAS Institute, Inc., Cary, NC). All tests were 2-tailed, with P<0.05 considered statistically significant.

A total of 76,325 subjects were included in our analysis. Among them, 6,339 (8.3%) met criteria for food addiction (Table I). Age- and multivariate-adjusted analyses of the association between atopic conditions and food addiction are presented in Table II. Each condition was associated with increased odds of food addiction after adjusting for demographic and lifestyle confounders. Adding BMI (in 7 categories) to the regression models attenuated the ORs, but the associations were still significant – AD (OR 1.14, 95% CI 1.05–1.24), food allergy (OR 1.16, 95% CI 1.06–1.27), hayfever (OR 1.16, 95% CI 1.10–

1.23) and asthma (OR 1.22, 95% CI 1.15–1.30). Similar results were obtained when adjusting for BMI as a continuous variable (data not shown). In the final model adjusting for all atopic conditions, the ORs did not change materially; however, only associations of hayfever and asthma with food addiction remained significant.

Our study is limited by its reliance on self-report of atopic conditions and cross-sectional design, which does not allow us to infer causality. Additionally, our study population consists only of female nurses, which limits generalizability but also increases the accuracy of self-reports.

In summary, AD, food allergy, hayfever and asthma were each associated with increased odds of food addiction, a specific form of obesogenic eating behavior with specific symptomatology and accompanying impairment.⁶ These associations are independent of increased BMI, which is associated with both atopy and food addiction.^{1–3, 8} However, only the associations of hayfever and asthma with food addiction remained significant when simultaneously adjusting for all atopic conditions, indicating that these two conditions may underlie the overall association of atopy with food addiction.

Atopic conditions are known to be associated with depressive disorders, and food addiction is known to be associated with depression.^{4, 5, 7} While our cross-sectional design does not allow us to assess the temporal nature of this association, it is possible that the psychological burden of atopic conditions leads to food addiction. Given how common atopic conditions are in the population, even the small effect sizes found in this study have important public health implications. Prospective studies assessing the direction of the association between atopic conditions and obesogenic eating behaviors are needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

AD	atopic dermatitis
OR	odds ratio
CI	confidence interval
mYFAS	modified Yale Food Addiction Scale

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Clinical Implications

Atopic conditions are known to be associated with obesity. In this study of US female nurses, we found atopic dermatitis, food allergy, hayfever and asthma to be associated with food addiction, an obesogenic eating behavior.

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Table I

Demographic and physical characteristics and atopic conditions among participants in the Nurses' Health Study 2 in 2009, by diagnosis of food addiction

	No Food Addiction (n=69,986)	Food Addiction (n=6,339)
Age in 2009 *	54.5 (4.6)	54.5 (4.5)
Race/ethnicity (%)		
White	94.9	96.4
Hispanic	1.6	1.4
Black	1.4	1.0
Asian	1.6	0.5
Body mass index (mean (SD), kg/m ²)	27.1 (6.0)	33.8 (7.5)
Alcohol intake (mean (SD), g/day)	6.5 (10.3)	4.7 (9.1)
Physical activity (mean (SD), MET/wk)	24.3 (30.3)	16.2 (24.1)
Smoking (%)		
Past smokers	28.0	35.2
Current smokers	6.3	4.5
Atopic dermatitis (%)	10.0	11.9
Food Allergy (%)	8.3	10.7
Hayfever (%)	26.2	31.7
Asthma (%)	17.7	26.0

Values are standardized to the age distribution of the study population.

* Value is not age adjusted

Table II

Age- and multivariate-adjusted models of the association between atopic diseases and food addiction

Atopic condition	n/n participants with specific atopic condition	n/n participants without specific atopic condition	Age-adjusted model	MV Model 1 ^a	MV model 2 ^b	MV model 3 ^c
Atopic dermatitis	751/7,021	5,588/62,965	1.21 (1.11, 1.31)	1.20 (1.11, 1.30)	1.14 (1.05, 1.24)	1.08 (0.99, 1.18)
Food allergy	679/5,833	5,660/64,153	1.32 (1.21, 1.44)	1.27 (1.17, 1.38)	1.16 (1.06, 1.27)	1.07 (0.97, 1.17)
Hayfever	2,011/18,360	4,328/51,626	1.31 (1.24, 1.38)	1.28 (1.21, 1.36)	1.16 (1.10, 1.23)	1.09 (1.02, 1.16)
Asthma	1,653/12,392	4,686/57,594	1.64 (1.55, 1.74)	1.53 (1.44, 1.62)	1.22 (1.15, 1.30)	1.17 (1.09, 1.25)

Results are expressed as odds ratios (95% CI). Bolded ORs are statistically significant.

n/n: number with food addiction/number without food addiction. MV: multivariate

^a adjusted for age (per 5 years), race/ethnicity (White, Hispanic, Asian, or Black), physical activity (by quintile in metabolic equivalent hours [MET]/week), alcohol intake (0, 1–4, 5–9, 10–14, 15–29, 30+ g/day) and smoking status (never, past or current in cigarettes/day [15, 15–24, 25+])^b Adjusted for BMI (<20, 20–22.9, 23–24.9, 25–26.9, 27–29.9, 30–34.9, or ≥ 35 kg/m²) in addition to the covariates in (a)^c The analysis for each atopic condition is adjusted for the other 3 atopic conditions, in addition to the covariates in (b)