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Emotional and Behavioral Problems in Adolescents and Young Adults with Food Allergy

(Psychopathology in Young People with Food Allergy)

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ABSTRACT

Background: Adolescents with food allergy have poorer psychosocial outcomes compared to their non-allergic counterparts; however, few studies have prospectively examined the mental health of adolescents and young adults in this vulnerable population. Our objectives were to estimate the prevalence of emotional and behavioral problems in an epidemiological sample of adolescents and young adults with food allergy; determine if food allergy is associated with adolescent and maternal reports of such problems; and, examine patterns of change in emotional and behavioral problems from adolescence to young adulthood among individuals with and without food allergy. **Methods:** Data come from 1303 participants at the 14 and 21-years of age in the Mater University Study of Pregnancy. Emotional and behavioral problems were measured using self and maternally-reported symptoms of depression, anxiety, attention-deficit hyperactivity disorder (ADHD), oppositional defiant, and conduct disorder. **Results:** Maternal, but not self-reports suggested that emotional and behavioral problems were higher among adolescents with food allergy. Food allergy was associated with increased odds of elevated levels of maternal-reported symptoms of depression [OR=4.50 (1.83, 11.07)], anxiety [OR=2.68 (1.12, 6.44)], and ADHD [OR=3.14 (1.07, 9.19)] in adolescence. Food allergy was also associated with depressive symptoms that persisted from adolescence to young adulthood [OR=2.05 (1.04, 4.03)]. **Conclusions:** Emotional and behavioral problems, particularly symptoms of depression, anxiety, and ADHD are common among adolescents with food allergy in the general population, and in the case of elevated levels of depressive symptoms, persist into young adulthood. Health professionals should seek adolescent and parental perspectives when assessing emotional and behavioral problems and monitor mental health during the transition to adulthood.

KEY WORDS

adolescence; behavior; food allergy; mental health; young adulthood

INTRODUCTION

Food allergy affects approximately 5% of children and its prevalence appears to be increasing rapidly in high-income countries (1, 2). The increased prevalence of food allergy is placing considerable burden on the healthcare system with increasing rates of physician consultations, hospitalizations, and emergency department visits (3, 4). Notwithstanding these systemic burdens, pediatric food allergy results in significant distress and compromised quality of life for children and parents concerned with potential anaphylactic reactions in their child (5-7).

Despite the progress made in describing the quality of life of children and adolescents with food allergy, few studies have extended research to examining emotional and behavioral problems in this potentially vulnerable population. Research on psychosocial outcomes using subscales of quality of life measures suggest that children and adolescents with food allergy function more poorly behaviorally and socially relative to their healthy peers and have lower self-esteem (5, 8, 9). A study of 2-17 year olds with food allergy demonstrated that while problem behavior scores were similar to population norms, individuals with food allergy had significantly higher anxious coping and separation anxiety scores (10). The same study also demonstrated informant discrepancies between maternal and child/adolescent reported anxiety problems, whereby maternal reports were significantly higher than child/adolescent self-reports. An epidemiological study of adolescents 10-16 years of age found that food allergy was associated with increased risk for separation and generalized anxiety, and attention-deficit

hyperactivity disorder in cross-sectional assessments (11). Longitudinally, food allergy was associated with increasing symptoms of depression and anxiety between annual assessments, but not with diagnoses of psychiatric disorders.

While these studies are suggestive of associations between food allergy and child anxiety symptoms, they consist generally of affluent families (5, 10) and children whose ages range widely (8, 10, 11), limiting their generalizability. Moreover, estimates of association were either unadjusted or adjusted for a minimal complement of demographic factors (age, sex) and did not consider confounding effects of other important variables including presence of other health conditions, maternal psychopathology, and family socioeconomic status (5, 8-11). Finally, their study designs did not permit a prospective examination of associations from adolescence to adulthood (5, 8-11).

Significant opportunities remain for investigating emotional and behavioral problems in children and adolescents with food allergy. Such investigations can provide further impetus for adopting person and, when appropriate, family-centered care strategies for individuals with food allergy. Second, recognizing children and adolescents who are at elevated risk for emotional and behavioral problems can help reduce health care costs, since individuals with comorbid physical and mental illness use disproportionately more health, yet still experience worse psychiatric outcomes (12). Third, at an etiological level, examining patterns of psychiatric comorbidity in this population can be hypothesis-generating for the next generation of studies that aim to elucidate biological and psychosocial mechanisms that link food allergy and emotional and behavioral problems across the life-course and provide targets for intervention.

Utilizing the strengths of the current study—epidemiological design for broad generalizability; longitudinal assessment to examine changes from adolescence to young

adulthood; maternal and self-reports to identify potential informant discrepancies; and, inclusion of several control variables to obtain unbiased estimates—the aims of this study were to estimate the prevalence of emotional and behavioral problems in a general population sample of adolescents and young adults with food allergy; determine if food allergy is associated with adolescent and maternal reports of emotional and behavioral problems; and, examine patterns of change in emotional and behavioral problems from adolescence to young adulthood.

METHODS

Participants

Data come from the Mater University Study of Pregnancy (MUSP), a representative birth cohort study of mothers and their children designed to examine the factors that influence maternal and offspring development through adulthood (13). Women who received public prenatal care from the Mater Misericordiae Hospital (Australia) between 1981 and 1983 were recruited. Assessments were conducted at 3-5 days, six months, and five, 14, 21, and 30 years after birth. The cohort consists of 7223 (85%) live singleton offspring from whom data were available at hospital discharge. Broad inclusion criteria were used for the current study to maintain representativeness of the sample. The inclusion criteria were: male or female adolescents and their mothers who completed the 14-year follow-up. A single exclusion criterion was used, whereby adolescents who had a health condition other than food allergy (see following section) were excluded. A total of 5171 (72%) mothers and adolescents completed the 14-year follow-up. Of these, $n=3868$ were excluded because they met the exclusion criterion. Thus, $n=1303$ participants were available at 14 years and $n=1087$ at 21 years. With the exception of being approximately three months younger ($p=.012$), the representativeness of our sample was

retained after applying the exclusion criterion. Approval for the MUSP was obtained from the University of Queensland's Behavioural and Social Sciences Ethical Review Committee.

Measures

Food Allergy. Presence of food allergy in adolescents was based on a two-step case identification strategy. The first stage used maternal responses to the question, "Has your child had any of the following...? [food allergies]. The reference group was adolescents whose mothers who did not endorse any of the following conditions: [acne; asthma; epileptic fits; diabetes; food allergies; a head injury with loss of consciousness; broken bones or fractures; burns requiring hospitalization; poisoning requiring hospitalization]. To ensure that participants had active food allergy, the second stage was checking adolescent reports of food allergy against one item from the Youth Self-Report (YSR, at age 14) and Young Adult Self-Report (YASR, at age 21) – "I have an allergy". This case-finding strategy resulted in $n=1035$ adolescents with no food allergy and $n=268$ with food allergy.

Emotional and Behavioral Problems. Emotional and behavioral problems were measured from adolescents using the self-reported YSR at 14 years and YASR at 21 years, and from mothers using the Child Behavior Checklist (CBCL) at 14 years (14). The DSM-oriented depression, anxiety, attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder, and conduct disorder scales derived from these measures were used to increase the clinical utility of the findings (15). The validity and reliability of the CBCL, YSR, and YASR subscales have been documented (13, 14). Higher scores reflect more symptoms of emotional and behavioral problems (0=*rarely/never*; 1=*sometimes*; 2=*often*). As reported (16), items for each psychiatric problem were summed and those scoring above 90th percentile were categorized

as having clinically significant symptoms of depression, anxiety, ADHD, oppositional defiant disorder, or conduct disorder.

Maternal and Family Characteristics. Maternal psychological distress was measured using the anxiety and depression subscales of the Delusions-Symptoms-States Inventory (DSSI) (17). Each subscale consists of seven items which assess recent symptoms (in the past month). Items were originally assessed using a five-point scale: 1=*all of the time*; 2=*most of the time*; 3=*some of the time*; 4=*rarely*; and, 5=*never*. Responses were then recoded by collapsing the *rarely* and *never* options and scores were rescaled and reverse-coded as 0 to 3, reflecting the original DSSI. Total scores can span 0 to 42 and scores ≥ 8 are thought to represent clinically relevant symptoms of anxiety and depression. The DSSI has been shown to be valid and reliable (18). Recognizing the importance of maternal psychopathology on offspring mental health, maternal DSSI score was included as a confounding factor in analyses.

Maternal age at child birth, marital status (*married/unmarried*), employment (*employed/unemployed*), and household income (*range: $\leq \$10,399$ to $\geq \$36,350$ Australian dollars*), as well as adolescent age and sex and whether adolescents with food allergy also had comorbidity (e.g., asthma, diabetes, epilepsy, etc. in addition to food allergy) were also considered as confounding factors.

Analysis

Bivariable analyses compared sociodemographic characteristics between adolescents with and without food allergy. Frequency distributions estimated the proportion of individuals with emotional and behavioral problems at the 14 and 21-year follow-ups. Logistic regression models computed adjusted estimates [odds ratio (OR) and 95% confidence intervals (CI)] of adolescent and mother-reported emotional and behavioral problems in adolescents with food

allergy compared to adolescents without food allergy. To examine patterns of change in emotional and behavioral problems over time, individuals were categorized as follows based on self-reported emotional and behavioral problems: *resolved* (emotional and behavioral problems at 14 years, but not 21 years); *incident* (emotional and behavioral problems at 21 years, but not 14 years); *persistent* (emotional and behavioral problems at 14 and 21 years); and, *none* (no emotional and behavioral problems at 14 and 21 years). Multinomial logistic regression examined the association between food allergy and pattern of change. Data were analyzed using SAS 9.2 (SAS Institute Inc.).

Missing Data

Multiple imputation was used to account for data assumed to be missing at random (19). This assumption is plausible because all variables, including those predicting missingness, were included in the imputation model (20). Twenty datasets were generated. Twelve percent of adolescents and 6% of mothers had missing data for adolescent emotional and behavioral problems at the 14-year follow-up. No sociodemographic factors were associated with missing adolescent response data; however, missing maternal responses were associated with socioeconomic disadvantage: lower household income ($\beta=-0.17$, $p=.004$), unmarried ($\beta=-0.61$, $p=.017$), and unemployed ($\beta=-0.55$, $p=.017$). Seventeen percent of adolescents were lost to follow-up at the 21-year follow-up. Males were more likely to be lost ($\beta=-0.55$, $p<.001$).

RESULTS

Sample Characteristics

Sample characteristics were similar between adolescents with and without food allergy (Table 1), except that mothers of adolescents with food allergy reported more symptoms of psychological distress ($t=2.68$; $p=.007$) and lower household income ($\chi^2=14.14$; $p=.028$). At the 21-year follow-up, 21% of the offspring, now young adults, were married and 79% had completed secondary school. There were no significant differences in marital status ($\chi^2=1.76$, $p=.19$) or educational attainment ($\chi^2=0.01$, $p=.94$) between individuals with and without food allergy.

Emotional and Behavioral Problems in Adolescence

Figure 1 shows the proportion of adolescents with clinically significant symptoms of depression, anxiety, ADHD, oppositional defiant disorder, and conduct disorder according to adolescent (YSR) and maternal reports (CBCL). Whereas the prevalence of emotional and behavioral problems were not significantly different based on adolescent self-reports, the prevalence of maternal-reported clinically significant symptoms of depression, anxiety, ADHD (all $p<.001$) and oppositional defiant disorder ($p<.05$) was significantly higher for adolescents with food allergy.

Based on adolescent reports on the YSR and adjusting for adolescent sex, presence of a coexisting physical condition, maternal psychological distress, and household income, there was no evidence that adolescents with food allergy were at elevated risk for emotional and behavioral problems compared to their healthy counterparts (Table 2). However, maternal reports on the CBCL suggested that adolescents with food allergy were at elevated risk for clinically significant

symptoms of depression, OR=4.50 (1.83, 11.07); anxiety, OR=2.68 (1.12, 6.44); and, ADHD, OR=3.14 (1.07, 9.19).

Having observed these differences in effect estimates, we examined the level of agreement between adolescent and maternal reports of emotional and behavioral problems. Unilaterally, there was evidence of low adolescent-maternal agreement for each emotional and behavioral problem: depression, $\kappa=0.27$; anxiety, $\kappa=0.21$; ADHD, $\kappa=0.28$; oppositional defiant disorder, $\kappa=0.25$; and, conduct disorder, $\kappa=0.39$. In a *post hoc* analysis, we used a series of regression models to examine whether this informant bias was a function of maternal mental health (i.e., depression distortion) (21). In other words, we tested whether maternal psychological distress moderated their reports of adolescent emotional and behavioral problems. Results suggested that levels of maternal psychological distress did not significantly impact their reports of adolescent emotional and behavioral problems (not shown).

Emotional and Behavioral Problems in Young Adulthood

The prevalence of self-reported emotional and behavioral problems in young adulthood is illustrated in Figure 2. There were no significant between-group differences in the prevalence of emotional and behavioral problems in young adulthood.

Patterns of Emotional and Behavioral Problems from Adolescence to Young Adulthood

As shown in Table 3, self-reported emotional and behavioral problems was most commonly limited to adolescence (*resolved*), with fewer individuals reporting problems during young adulthood only (*incident*). A smaller proportion of individuals had *persistent* self-reported problems that remained from adolescence to young adulthood. After adjusting for potential confounding factors (Table 4), individuals with food allergy were found to be at elevated risk for *persistent* self-reported symptoms of depression, OR=2.05 (1.04, 4.03).

DISCUSSION

Summary of Findings

Clinically significant symptoms of emotional and behavioral problems are common among adolescents and young adults with food allergy. Notably, self-reports suggested a non-significant increase in risk for individuals with food allergy, while maternal reports suggested that adolescents with food allergy were up to four-times more likely to have symptoms of depression, anxiety, or ADHD. Typically, emotional and behavioral problems were limited to adolescence and fewer individuals with food allergy had problems that manifested in or persisted to young adulthood. However, individuals with food allergy were at elevated risk for *persistent* symptoms of depression compared to their healthy counterparts.

Comparisons of the prevalence of emotional and behavioral problems in previous samples of adolescents and young adults with food allergy is difficult due to differences in the age distribution of samples, non-specific recruitment of individuals with general “allergies”, different methods of assessment of emotional and behavioral problems, and the predominant focus on symptoms of anxiety and depression in the food allergy literature. One study reported that 43% and 20% of their sample of undergraduate students with food allergy met the cut-off for clinically significant depression and anxiety, respectively (22). This relatively high prevalence is likely attributable to using non-DSM-oriented questionnaires in a highly selected sample. An epidemiological study reported that 7% of food allergic individuals over the age of 15 years had major depressive disorder according to the Composite International Diagnostic Interview (23) which, due to the diagnostic nature of their measure, is lower than the estimate from our study. Separate studies suggest that food allergy is associated with elevated risk for depression (22, 23) and anxiety (22), particularly separation anxiety (5, 10), across childhood and young adulthood

in both clinical and non-clinical populations. While prevalence estimates of other psychiatric problems are virtually non-existent in the food allergy literature, the prevalence of clinically relevant symptoms of ADHD in food allergy found in our study was similar to that of other allergic conditions, specifically asthma (24).

Findings suggest stronger associations between food allergy and internalizing versus externalizing problems. The elevated risk for symptoms of depression among those with food allergy may be the result of stress associated with having a chronic condition, the realization of the permanence of having food allergy, or increased risk of experiencing social exclusion among peers. Adolescents with food allergy often report deficits in social functioning, particularly restrictions in social activities and tenuous social relationships (5, 8) which in turn can negatively influence their mood during this developmental period (25). In addition, the association between food allergy and *persistent* depressive symptoms from adolescence to young adulthood may be attributable to forced dietary restrictions that avoid potential allergens. One study in adults with celiac disease showed that symptoms of anxiety, but not depression were reduced after one-year of adopting a gluten-free diet (26).

The elevated risk for increased levels of symptoms of anxiety among adolescents with food allergy observed in this study is consistent with behavioural learning theories of anxiety (27). Parents of children with food allergy experience high levels of distress, worry, and anxiety (28). Children and adolescents with food allergy may learn modelled cognitive and behavioural patterns that exaggerate risk and associated harm of exacerbations, as well as underestimate their ability to handle potentially threatening situations, leading to elevated levels of anxiety (27). Additionally, anxiety in adolescents with food allergy may be the consequence of negative interactions with peers. One study reported that one-third of adolescents with food allergy were

bullied; often by classmates with threats of food (29). Bullied adolescents also reported significantly more symptoms of anxiety. On the other hand, the increased anxiety may be a normative process for those with food allergy that supports self-management and adaptive coping (6).

Finally, the elevated risk for high levels of symptoms of ADHD appeared to be driven largely by elevated scores on items associated with inattention (pay attention, fail to finish). This inattention may be more a symptom of anxiety rather than a core feature of ADHD. Although heightened vigilance can be viewed as protective (30), such behavior is problematic if it prevents normal functioning.

In addition to these psychosocial pathways involved in the manifestation of emotional and behavioral problems in adolescents with food allergy, there is also some preliminary evidence of shared biological pathways linking food allergy with mental health. Upregulation of pro-inflammatory cytokines, specifically interleukins and tumor necrosis factor- α has been found in individuals with depression and anxiety (31-34), as well as in individuals with food allergy (35-37). These findings support additional evidence implicating inflammatory processes as potential mediators in the association between food allergy and emotional and behavioral problems. Because most studies are cross-sectional, these inferences are speculative and longitudinal research is needed to appropriately assess potential causal pathways.

Implications

As reported in other samples of adolescents with food allergy (10, 38), low adolescent-maternal agreement on emotional and behavioral problems was found. It is unclear whether mothers over-estimate or adolescents under-estimate symptoms of emotional and behavioral problems—an unfortunate limitation in understanding informant discrepancies (39). Nonetheless,

researchers and health professionals should be cognizant of this informant discrepancy when probing for mental health problems, especially for internalizing problems. During adolescence, young people are faced with the challenges of managing a changing relationship with parents from one of dependency to one of autonomy, exploring intimate relationships, and recognizing personal weaknesses (40). Subsequently, adolescents may become less inclined to discuss personal struggles and keep thoughts and feelings, such as sadness or anxiety to themselves. Furthermore, an increasing independence away from the family may provide parents fewer opportunities to observe their child's behavior. Thus, best practice involves gathering reports from both adolescents and parents to assess mental health. Indeed, robust methodological research is needed to expound potential mechanisms resulting in informant discrepancies in this population to ensure unbiased estimates of emotional and behavioral problems are reported. For example, depression distortion is a special case of informant bias whereby mothers with depression overestimate mental health problems in their children (39).

Clinically, findings provide initial support for the importance of awareness among health professionals of emotional and behavioral problems during adolescence and young adulthood within the allergy/immunology setting to help optimize overall health for patients transitioning from pediatric to adult health services. If these findings are replicated, mental health modules could be implemented in transition clinics to help reduce the persistence of emotional and behavioral problems. Early detection of psychosocial difficulties in the pediatric setting for those suspected of having food allergy could also potentially identify individuals at risk for emotional and behavioral problems and lead to the initiation of appropriate intervention(s). Although discussions of mental health can easily be overshadowed during the medical encounter, supporting the mental health of adolescents with food allergy is important to ensuring optimal

food allergy management. Systematically, adolescents and their families should be encouraged to seek additional resources, such as the Food Allergy Research & Education website to obtain relevant resources to promote mental health. For high-risk adolescents where intervention is indicated, evidence suggests that group-based interventions within a family-centered care framework are most effective (41).

Limitations

Notwithstanding its strengths, this study has limitations. First, causality cannot be established given the observational design and we cannot definitively comment on the social or biological mechanisms linking food allergy and emotional and behavioral problems. Second, food allergy and emotional and behavioral problems were based on self and maternal-report and could not be validated with administrative or clinical data (blood testing, diagnostic interviews). Instead, in this secondary data analysis, lifetime food allergy was reaffirmed using the YSR and YASR, and emotional and behavioral problems were scored with DSM-oriented items that have demonstrated reliability and predictive validity (42). Despite this, the sometimes discrepant maternal and adolescent reports of emotional and behavioral problems give rise to some uncertainty to the findings. Although we cannot speculate on the validity of our two-step procedure in assessing food allergy, this limitation is tempered by the fact that most feasibility constraints prevent more robust assessment of food allergy in epidemiological studies (11, 22, 23, 43-45). Third, certain salient variables were not available (number of anaphylactic reactions, severity, type, and number of food allergies); however, associations between these variables and emotional and behavioral problems are mixed (5, 9, 10) and it is unknown what effect these variables would have had on our estimates. Finally, like other longitudinal epidemiological

studies, selective attrition may have impacted our findings. However, multiple imputation was used for missing data and provides unbiased estimates of association.

CONCLUSION

In this prospective epidemiological study, emotional and behavioral problems, particularly symptoms of depression, anxiety, and ADHD were found to be common among adolescents with food allergy. Prospectively, food allergy was associated with depressive symptoms that persisted from adolescence to young adulthood. Agreement between maternal and adolescent self-report was low, indicating that future research and health professionals may benefit from seeking the perspective of both informants. Although replication of these findings is warranted, health professionals should be aware of elevated rates of emotional and behavioral problems in adolescents with food allergy and monitor their mental health during their transition to adult health services.

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AUTHORS' CONTRIBUTIONS

Dr. Ferro conceived the study idea, conducted the analyses, and drafted the manuscript. Drs. Van Lieshout, Ohayon, and Scott contributed to the interpretation of data and critically revising the manuscript for important intellectual content. All authors gave final approval of the manuscript to be published.

CONFLICTS OF INTEREST

Dr. Ferro has no conflicts to disclose.

Dr. Van Lieshout has no conflicts to disclose.

Dr. Scott has no conflicts to disclose.

Dr. Ohayon has no conflicts to disclose.

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Table 1. Characteristics of the Study Sample

	No Food Allergy (n = 1035)	Food Allergy (n = 268)	<i>t</i>/χ^2	<i>P</i>-value
Adolescent				
Age, years	13.9 (0.01)	13.9 (0.02)	0.62	.54
Male, %	52.7	55.2	0.56	.45
Mother				
Age at Child Birth, years	26.4 (0.16)	26.4 (0.31)	0.12	.90
Psychological Distress, DSSI	3.0 (0.14)	3.8 (0.30)	2.68	.007
Married, %	82.8	81.7	0.16	.69
Employed, %	58.8	59.5	0.03	.85
Annual Income, %			14.14	.028
≤ \$10,399	2.6	4.6		
\$10,400 - \$15,599	5.4	9.7		
\$15,600 - \$20,799	11.4	13.2		
\$20,800 - \$25,999	12.1	10.9		
\$26,000 - \$31,148	15.9	11.1		
\$31,149 - \$36,349	15.4	12.4		
≥ \$36,350	37.2	38.1		

Adolescent age, maternal age at child birth, and maternal psychological distress are reported as mean (standard error). Income is reported in Australian dollars. DSSI, Delusions-Symptoms-States Inventory.

Table 2. Logistic Regression Models Examining the Association between Food Allergy and Emotional and Behavioral Problems in Adolescence

Informant	Depression	Anxiety	ADHD	Oppositional Defiant	Conduct Disorder
YSR–	0.56	1.38	1.69	1.47	1.14
Adolescent	(0.13, 2.42)	(0.55, 3.50)	(0.60, 4.75)	(0.54, 4.00)	(0.33, 3.97)
CBCL–	4.50	2.68	3.14	1.78	1.58
Mother	(1.83, 11.07)	(1.12, 6.44)	(1.07, 9.19)	(0.63, 5.03)	(0.50, 5.00)
ΔOR	3.94	1.30	1.45	0.31	0.44
	(0.69, 10.52)	(-1.33, 5.15)	(-2.24, 7.60)	(-2.47, 3.69)	(-2.59, 3.96)

Results are reported as the odds ratio (OR) and 95% confidence interval (bolded values are statistically significant). Models adjusted for adolescent sex, presence of comorbidity, maternal psychological distress, and household income. CBCL, Child Behavior Checklist; YASR, Young Adult Self-Report; YSR, Youth Self-Report.

Table 3. Emotional and Behavioral Problems during the Follow-up from Adolescence to Young Adulthood

	Resolved		Incident		Persistent	
	FA	No FA	FA	No FA	FA	No FA
Depression	12.5	11.0	10.7	9.5	6.3	3.1
Anxiety	17.7	16.0	9.9	9.2	4.5	2.1
ADHD	9.9	8.2	13.3	10.9	5.1	3.1

Oppositional	14.8	12.1	8.4	8.5	2.0	2.1
Defiant						
Conduct	11.9	8.4	11.0	9.3	3.4	3.1
Disorder						

Results are reported as percentages. *Resolved* refers to individuals meeting the threshold for emotional and behavioral problems at 14 years, but not 21 years; *Incident* refers to meeting the threshold at 21 years, but not 14 years; and, *Persistent* refers to meeting the threshold at both 14 and 21 years. FA, food allergy.

Table 4. Multinomial Logistic Regression Models Examining Persistence and Resolution of Emotional and Behavioral Problems

	No Problems	Resolved	Incident	Persistent
Depression	1.00	1.20 (0.76, 1.90)	1.17 (0.61, 2.24)	2.05 (1.04, 4.03)
Anxiety	1.00	1.17 (0.80, 1.72)	1.12 (0.64, 1.95)	2.03 (0.91, 4.49)
ADHD	1.00	1.30 (0.81, 2.08)	1.30 (0.81, 2.06)	1.76 (0.91, 3.42)
Oppositional Defiant	1.00	1.16 (0.78, 1.74)	1.02 (0.60, 1.74)	0.94 (0.32, 2.75)
Conduct Disorder	1.00	1.42 (0.91, 2.22)	1.21 (0.68, 2.17)	1.09 (0.47, 2.52)

Results are reported as the odds ratio and 95% confidence interval for the association between food allergy and *resolved*, *incident*, and *persistent* emotional and behavioral problems (bolded values are statistically significant). Models adjusted for adolescent sex, presence of comorbidity, maternal psychological distress, and household income.

Figure 1. Prevalence of Emotional and Behavioral Problems among Adolescents with and without Food Allergies. Estimates show the proportion of adolescents with (grey bars) and without food allergy (white bars) classified as having emotional and behavioral problems according to adolescent (YSR) and maternal (CBCL) reports. Error bars denote the 95% confidence intervals. CBCL, Child Behavior Checklist; YSR, Youth Self-Report. * $p < .05$, ** $p < .001$

Figure 2. Prevalence of Emotional and Behavioral Problems among Young Adults with and without Food Allergies. Estimates show the proportion of young adults with and without food allergy classified as having emotional and behavioral problems according to self-reports. Error bars denote the 95% confidence intervals.



