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Food allergy: Children's symptom levels are associated with mothers' psycho-socio-economic variables

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ABSTRACT

Background: Allergies affect children's health as well as their quality of life, stress levels, and family budget. The available literature suggests that family, social and psychological factors are affected by allergic pathologies such as rhinitis, asthma and atopic dermatitis. However, few studies have focused on quantifying such association in child food allergy. This study aims to enhance the understanding of the associations between caregiver variables and children's Food Allergy (FA).

Methods: The study involved 206 participants: 103 mothers plus 103 children with IgE mediated FA. The analyses excluded two outliers comprising 101 subjects. For statistical analyses, each dyad –mother/child- was considered to be one subject unity. A between-subjects one-way ANOVA determined the association of children's *cutaneous*, *gastric* and *respiratory* symptoms with *anxiety*, *depression*, *perceived social support* and socioeconomic factors in the mothers.

Results: There are significant associations between children's allergic symptoms (*gastric* and *cutaneous*) and mothers' psychological state (*anxiety* and *depression*); family *budget*; social interactions (with *friends*, *family* and *partner*); *understanding* of health care required by their child; and *sleep disorders*. *Respiratory* symptoms did not show any significant associations with the dependent variables.

Conclusion: FA is a process in which children's symptoms are significantly associated with socioeconomic and psychological variables of the mothers. The presence or absence of some specific symptoms is directly associated with specific impacts on the mothers. An understanding of such dynamics supports the consideration of a comprehensive and multidisciplinary therapeutic approach to offer more ecological healthcare for "families living with FA."

1. Introduction

Child food allergy (CFA) is a growing phenomenon [1] with epidemic features [2], especially in developed countries [3]. However, developing countries have shown similar patterns [4]. Although numbers may vary, child food allergy reportedly affects 6% to 10% of the pediatric population [2,4]. Several nutritional and health problems that may be fatal after an anaphylactic reaction [5] are everyday issues among allergic people. However, physical and mental health are not the only areas affected by CFA; it also affects the quality of life [6–8], financial aspects [9] and social interactions [10–13] of patients and their families or caregivers [6–8,10–14].

Food allergy (FA) it is a growing public health problem given the high medical costs it entails [15,16]. Because of the latter, the economic factor has been proposed as a critical element in assessing the effectiveness of interventions aiming at improving patients' quality of life [17,18]. In 2007, the total cost of FA in Australia amounted to AUD $29.4 billion [19], and in 2012 the cost of FA in the United States totalled US$24.8 billion, US$20.5 billion of which accounted for costs to families [20]. The estimated annual price per person with FA in Europe averaged US$2.016, twice as much as the cost for controls [21]. Several variables, such as the special diets required, allergen-free foods, medical appointments, medication, hospitalisation and lost workdays explain such high cost to families.

A patient's socioeconomic status seems to have a significant impact on allergic pathologies, for instance, the impact on quality of life is lower among individuals with a better economic status [18,22]. Thus, a better economic situation might enable access to better therapies and

Abbreviations: FA, Food allergy; DV, Dependent variable; IV, Independent variable; IgE, Immunoglobulin E

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Table 1
Dependent variables included in the study.

No	Dependent variables	Question/scale
1	Anxiety	Hospital Anxiety and Depression Scale (HADS), Scale: 0–21 points.
2	Depression	Hospital Anxiety and Depression Scale (HADS), Scale: 0–21 points.
3	Perceived social support	The Scale of Perceived Social Support (PSS)/12–60 points.
4	Budget	Do you feel your child's food allergy has affected your family budget?/Likert scale: 1–5 points. 1: not at all/2: a little/3: mildly/4: quite a bit/5: very much
5	Understanding	Have you felt not understood due to your child's food restrictions and care needed?/Likert: 1–5 points. 1: not at all/2: a little/3: mildly/4: quite a bit/5: very much
6	Social interactions	Do you feel your child's symptoms have affected your social interactions with a) Friends; b) Family; c) Partner?/Likert: 1–5 points. 1: not at all/2: a little/3: mildly/4: quite a bit/5: very much
7	Irritability	Due to your child's food allergy, have you developed higher irritability?/Likert: 1–5 points. 1: never/2: uncommonly/3: sometimes/4: often/5: always
8	Sleep disorders	Due to your child's food allergy, have you developed sleep disorders?/Likert: 1–5 points. 1: never/2: uncommonly/3: sometimes/4: often/5: always

would result in a lower perceived impact on the family budget. Accordingly, economic impact becomes an additional stress factor for families of children suffering from FA.

Caregiving is a challenging task [23], and most of the time it is performed by the mother as the primary caregiver [10]. There is substantial evidence about the detrimental effects of such activity, including higher anxiety, fear, disappointment, physical distress and reduced quality of life [24]. Mothers of children with atopic dermatitis tend to describe themselves as more depressive, anxious, overprotective and less hopeful than mothers of children without allergies [25,26].

Several studies have reported a relationship between parental psychological state and child allergy symptoms. Parental anxiety is a critical factor for children's perceived risk of their allergy [27], which supports interventions for parents to improve how children perceive their disease. Studies suggest that an adverse family climate predicts asthma severity and correlates with depression in children even after controlling for the degree of treatment adherence [28]. Likewise, a low level of family support is related to higher asthma symptoms and reduced pulmonary function among youngsters [29]. Thus, the relative risk of maintaining the atopic disease in children in dysfunctional family interactions [30] increases to 1.99 ($1.18 < RR < 3.37$, $p = 0.01$). On the contrary, recovery is four times more likely (74% versus 20%, $p = 0.01$) in families with functional interactions and adequate support networks, as compared to families with dysfunctional social interaction [31]. Therefore, psychological, social, environmental and biological factors influence both patients and parents.

Available literature supports the hypothesis that family, social and psychological factors have an impact on allergic pathologies [32], such as asthma [28–30], rhinitis [22] and atopic dermatitis [25]. Thus, family [29] and social support networks [31] become crucial elements in the "process of having" an allergy or an allergic child. Such studies suggest that psychological variables must be considered in addition to a conventional biomedical and pharmacological approach to guarantee success in preventing and managing atopic pathologies.

Nevertheless, few studies have focused on CFA; therefore, little is known about the relationship, if any, between maternal psychological state and CFA. Additionally, the relationship between the type or level of allergic symptoms in children and the psycho-socio-economic statuses of caregivers is a poorly explored dynamic. Could there be an association between the type or level of allergy symptoms in children and mothers' psychological, social, and economic experiences? The present study aims to shed light on this question.

2. Methods

This study involved 103 subjects: 103 mothers and 103 children with milk, egg, peanut and soybean FA. Each mother/child dyad was considered to be one study unit; comprising 206 participants. Using Mahalanobis distance, two outliers were detected and removed from the analyses. All statistical analyses were run using an N of 101 since children's allergy symptoms and their mothers' psychosocial characteristics made up one unit of analysis. Recruitment took place over a six-month period; consecutive outpatients seeking care at the clinical Allergy Centre were invited to take part in the study. All of them, by their own will or by GP indication, were previously evaluated by a specialist immunologist due to allergic-like symptoms and allergy tests were conducted where indicated. A trained healthcare explained the study's objectives and evaluations to all participants. After the allergy diagnosis was confirmed (through tests and immunologist evaluation) and mothers agreed to be part of the study, participants were interviewed, and the children's results were added to the database. A total of 157 patients were invited to take part in the study. Regarding inclusion/exclusion criteria:

- 24 (15%) children had lactose intolerance-like symptoms;
- 11 (7%) cases needed further analyses to ensure diagnosis;
- 19 (12%) had already been diagnosed and came only for a second opinion, and continued treatment at a different centre.
- 103 (66%) of the mothers of children with a confirmed diagnosis of food allergy decided to answer the scales and interview.

Every mother signed an informed consent for themselves, and their children enrolled in the study. The Ethical Committee of the Hospital Clinico Universidad de Chile approved this protocol.

Mothers' evaluations included demographic data, socioeconomic factors, assessment of anxiety, depression [33] and perceived social support [34]. A survey addressing children's demographic factors and allergic symptoms was also applied.

Table 1 describes socioeconomic and psychological dependent variables (DVs) included in the study and the strategy to evaluate these DVs.

Instruments and interview (see details in Table 1)

- *The Hospital Anxiety and Depression Scale*, HADS [35] was used to assess anxiety and depression. This 14-item questionnaire has two sub-scales, and it is widely used as a valid instrument in a hospital care setting to detect states of anxiety (7 items) and depression (7 items) of patients without psychiatric disorders. Each item is scored on a scale of 0 to 3, with a maximum score of 21 points for both subscales. Scores follow reference cut-off values given by the authors: up to 7 points indicate an "*unlikely*" diagnosis of anxiety or depression; a score of 8 to 10 describes the diagnosis as "*doubtful*." A score equal to or higher than 11 indicates a clinical diagnosis of anxiety or depression [33,35].
- The *Perceived Social Support Questionnaire* (PSSQ). This scale measures the perception of support given by fraternal and institutional networks with which the subject interacts. PSSQ consists of 12items and contains three subscales: *Belonging* (2 questions), *Esteem* (4

questions) and *Self-development* (6 questions). Each question is scored on a scale of 1 to 5. The final score (range: 12–60) becomes a factor that indicates perceived social support. Scores equal to or lower than 47 points on the PSSQ indicate decreased social support. Reliability is reportedly excellent (Cronbach's α = 0.89) [34].

- Interview: In 1:1 interviews with mothers, interviewers ask four types of questions related to the mother's psycho-social experiences of caring for a food allergic child. The exact questions are reported in Table 1.
  - o *Budget:* This question focused on whether the family budget has been affected by their child's allergy symptoms.
  - o *Understanding*: This question focused on to what extent mothers felt understood (i.e., had empathy from others) in regards to their role as a caregiver for a food allergic child.
  - o *Social Interactions*: This question focused on whether the mother's social encounters with friends, family or a partner have been affected by their child's allergy symptoms.
  - o *Irritability*: This question focused on the mother's self-perceived general irritability due to the psychological stressors of caring for a food allergic child.
  - o *Sleep disorders*: This question focused on whether the mother's sleep habits have been affected by their child's allergy symptoms.

The food allergy diagnosis was based on clinical evaluation and in-vivo or in-vitro tests (skin prick test or specific IgE) depending on the clinical criteria of a trained immunologist.

The interview included scales, direct questions (described in detail in Table 1) and a checklist of allergic symptoms; and the Independent Variables (IVs). Within the first two hours after intaking, inhaling or having dermic contact with allergens, the onset of early symptoms characterise immediate atopic reactions [36,37]. Based on literature [38,39] review and expert criteria (immunologist from the HCUCH Allergy Centre) a set of prevalent allergic symptoms was defined. Divided by type, the 18 symptoms selected comprised three categories; gastric (six), respiratory (six) and cutaneous (six). Mothers answered whether their child had (or did not have) the listed symptoms (Table 2). Symptoms were grouped into categories (by type of organ affected) to study possible differences in the impact these may have on maternal variables. The mother responded to whether or not the child had experienced any of the listed symptoms during the previous month.

Analyses included associations between the type and number of symptoms (gastric, cutaneous and respiratory) and mother's psychosocial variables. Additional information from medical records included the type of food allergy, previous diagnostic processes and medication prescribed (if any). Statistical analysis used the Pearson's correlation coefficient and ANOVA. A one-way between-subjects ANOVA was performed to evaluate the association between the level of allergy symptoms in the child (IV) and the socioeconomic and psychological variables in their mothers (DV). To perform the ANOVA, IVs (number of gastric, cutaneous and respiratory symptoms) needed to be categorical; therefore, they were divided into 1) *none*, 2) *low* and 3) *high* levels according to the number of symptoms reported by the mother (details in Table 2). All tests were two-tailed, and the significance level was 0.05. All analyses were performed using the statistic package *SPSS V.20* [40].

Table 2
Level of allergy symptoms (Sx) and symptoms included.

Levels		
Level 1 = None (0 Sx)	Level 2 = Low (1–2 Sx)	Level 3 = High (3–6 Sx)
Symptoms		
Gastric	Cutaneous	Respiratory
Bloating	Skin rash	Cough or sneeze
Abdominal pain	Urticaria	Runny nose
Gastroesophageal reflux	Dry skin	Nasal irritation or itching
Vomiting	Eczema	Nasal congestion
Diarrhoea	Swelling of face, eyes or lips	Wheezing
Blood in stool	Wheals on neck, arms	Breathing difficulties

Table 3
Sample characteristics (N 101).

Children's gender: n (%)	
Male:Female	61(60.4):40(39.6)
Children's age in months:	
Mean [SD]	26.8[20.1]
Mothers' age in years:	
Mean [SD]	31.4[4.6]
Mothers' educational level: n(%)	
Primary	2(2)
Secondary	16(15.8)
Technical	17(16.8)
University	24(23.8)
Missing	42(41.6)
Reported allergy on parents: n(%)	
None	39(38.6)
Mother (only)	25(24.8)
Father (only)	28(27.7)
Both parents	6(5.9)
Missing	3(3)
Children's age in months when symptoms began:	
Mode/media [*SD*]range	0/3[7.8]0–56
Severe reaction - anaphylactic shock: n(%)	
Yes	22(21.8)
No	79(78.2)

3. Results

According to sample distribution analyses, there were two outliers for children's age. Mahalanobis distance for cases 32 and 39, was 20.3 (p = 0.00001) and 19.8 (p = 0.00001) respectively. Therefore, these subjects were removed from further analyses, resulting in a final sample of 101.

The mean age of the children was 26 months, 60% were male, and the mean age of the mothers was 31 years (SD = 4.6). Almost 40% of the mothers reported not having any allergic symptoms. By the age of 6 months, 86% of the children had experienced their first allergic symptom, and 92% of them began showing symptoms during their first year of life. Table 3 provides details on these demographic data. Regarding the DVs distribution, 42.6% of all the mothers in the study had anxiety, and 21.8% of them had depression (HADS). Most of them (58%) scored high on social support (score higher than 48). Half of the sample (49.2%) perceived their family income as "good" or "very good"; nevertheless, 85.1% perceived the impact of their child's FA on their budget as "*quite a bit*" or "*very much*." Over half of the sample (56.3%) reported they have felt "*quite a bit*" or "*very much*" not understood due to the care required by their allergic children. See more details in Table 4.

Regarding IVs; 21.8% of the sample (N = 22) had a clinical history compatible with anaphylactic shock. Out of the total sample, 71 children had multiple food allergies, 15 had cow's milk protein allergy, and 15 of them had an allergy to only one identified food. Most of the children were allergic to egg (yolk 32, white 31), milk (40), soya (15) and meat –beef– (14). Table 5 shows the distribution of allergic symptoms in the children.

The correlations between the IVs versus the DVs highlighted direct correlations between the number of *gastric symptoms* in children and: a) maternal *anxiety* (r = 0.20; p < 0.05); b) *depression* (r = 0.22; p < 0.05); c) *Budget*: Perceived economic impact of the child's condition on the family budget (r = 0.35; p < 0.01); d) *Understanding*: Maternal perception of not being understood because of the care required by their child (r = 0.40; p < 0.01); and d) *Social Interaction*:

Table 4
Dependent variables distribution (N = 101).

Variables			
HADS: %	Anxiety	Unlikely/doubtful/ definite	32.7/24.8/42.6
	Depression		56.4/21.8/21.8
Social support: n(%)		Scores from 12 to 14 (Quartile 1)	1(1.0)
		Scores from 15 to 36 (Quartile 2)	11(10.9)
		Scores from 37 to 48 (Quartile 3)	30(30.7)
		Scores from 49 to 60 (Quartile 4)	59(58.3)
Income perception: n(%)		Very bad	2(2.0)
		Bad	12(11.9)
		Regular	17(16.8)
		Good	26(25.7)
		Very good	4(4.0)
Budget: n(%)		Not at all	4(4.0)
		A little	7(6.9)
		Mildly	4(4.0)
		Quite a bit	18(17.8)
		Very much	68(67.3)
Understanding: n(%)		Not at all	26(25.7)
		A little	10(9.9)
		Mildly	8(7.9)
		Quite a bit	14(13.9)
		Very much	43(42.6)
Social interactions: n(%) friends/ Family		Not at all	13(12.9)/ 27(26.7)
		A little	8(7.9)/14(13.9)
		Mildly	11(10.9)/ 19(18.8)
		Quite a bit	28(27.7)/ 12(11.9)
		Very much	37(36.6)/ 28(27.7)
		I don't have	3(3.0)/0(0.0)
Irritability: n(%)		Never	8(7.9)
		Uncommonly	17(16.8)
		Sometimes	12(11.9)
		Often	24(23.8)
		Always	40(39.6)
Sleep disorders: n(%)		Never	8(7.9)
		Uncommonly	13(12.9)
		Sometimes	15(14.9)
		Often	19(18.8)
		Always	46(45.5)

Table 5
Independent variables. Number of children with a specific symptom and percentage it represents over the total sample (N = 101).

Allergic symptoms			
Type	Symptom	N	%
Gastric	Bloating	72	71,3
	Abdominal pain	75	74,3
	Gastroesophageal reflux	61	60,4
	Vomiting	61	60,4
	Diarrhoea	74	73,3
	Blood in stool	55	54,5
Cutaneous	Skin rash	77	76,2
	Urticaria	61	60,4
	Dry skin	75	74,3
	Eczema	36	35,6
	Swelling of face, eyes or lips	43	42,6
	Wheals on neck, arm	36	35,6
Respiratory	Cough or sneeze	70	69,3
	Runny nose	71	70,3
	Nasal irritation or itching	34	33,7
	Nasal Congestion	73	72,3
	Wheezing	31	30,7
	Breathing difficulties	34	33,7

Table 6
Pearson's correlation: dependent (DVs) versus independent variables (IVs).

N		IVs		
	DVs	Gastric symptoms	Cutaneous symptoms	Respiratory symptoms
	HADS			
1	Anxiety	0.204[a]	0.133	0.107
2	Depression	0.219[a]	0.245[a]	0.088
3	Perceived social support	− 0.050	− 0.183	− 0.153
	Esteem	− 0.048	− 0.185	− 0.025
	Self development	− 0.016	− 0.152	− 0.195
	Belonging	− 0.080	− 0.065	− 0.016
4	Impact on budget	0.349[b]	0.202[a]	0.112
5	Understanding	0.396[b]	0.128	0.064
6	Social Interactions			
	With friends	0.333[b]	0.101	0.095
	With family	0.399[b]	0.14	0.044
	With partner	0.173	0.166	− 0.019
7	Sleep disorders	0.319[b]	0.065	0.118
8	Irritability	0.206[a]	0.039	0.031

[a] Correlation is significant at the 0.05 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).

Perceived impact of children's symptoms on family interactions (r = 0.40; $p < 0.01$) and interactions with friends ($r = 0.33$; $p < 0.01$). *Cutaneous symptoms* correlated with a) *depression* ($r = 0.25$; $p < 0.05$) and; b) *Budget* (r = 0.20; $p < 0.05$). No correlations were observed for *respiratory symptoms*. See details in Table 6.

Statistically significant correlations were observed within the studied DVs. Inverse correlations were found between perceived social support and anxiety ($r = -0.485$; $p < 0.01$) and depression ($r = -0.528$; $p < 0.01$). The level of *anxiety* was directly correlated to the level of *irritability* due to the child allergic condition ($r = 0.578$; $p < 0.01$) and with the presence of *sleep disorders* ($r = 0.416$; $p < 0.01$). The level of *depression* also correlated directly with *irritability* levels ($r = 0.488$; $p < 0.01$), with sleep *disorders* ($r = 0.345$; $p < 0.01$) and with *understanding* ($r = 0.372$; $p < 0.01$).

Such relationships were confirmed by ANOVA, which found significant effects of the IVs in children (number of *gastric*, *cutaneous* and *respiratory symptoms*) on the DVs in mothers (*Anxiety*, *depression*, *perceived social support*, *budget*, *understanding*, *social interactions*, *irritability* and *sleep disorders*). Table 7 summarises the associations (ANOVA and Tukey test) of *gastric*, *cutaneous* and *respiratory symptoms* with the studied variables. See Table 1 for a description of variables and Likert codes.

The ANOVA showed significant associations between the quantity of allergic symptoms (*gastric* and *cutaneous*) in children, but not *respiratory symptoms, and* socioeconomic and psychological variables in mothers.

The post hoc (Tukey) test confirmed that *gastric symptoms* affect the studied variables:

1) *Depression*: In the model, *depression* was significantly associated with *gastric symptoms* ($p = 0.022$). The level of *depression* among mothers of children with *low gastric symptom* levels was significantly lower (Mean = 4.3; unlikely depression) than that seen among mothers of children with *high* symptom levels (M = 7.6. Cut off point for "doubtful anxiety" = 8); $p = 0.037$.
2) *Budget*: In the model, the *budget* was significantly associated with *gastric symptoms* ($p = 0.000$). Perceived impact on the family budget was significantly lower (Mean = 2.0; *a little/mildly*) among mothers of children without *gastric symptoms* (*none*) compared with mothers of children with a *low* or *high* level of symptoms (Mean = 4.2 and 4.6 respectively; *quite a bit/very much*).
3) *Understanding*: In the model, *understanding* was significantly

Table 7
Effect of allergic symptoms (categories) on socioeconomic and psychological variables.

	Mean [SD]			ANOVA			Tukey (best fit)	
	None	Low	High	df	F	Sig	Differences in measures	Sig
Gastric symptoms								
Anxiety	8.5 [6.5]	8.3 [4.2]	10.5 [4.3]	2–100	2.68	0.074	Low v/s high	0.070
Depression	4.3 [4.0]	5.4 [3.7]	7.6 [4.2]	2–100	3.99	**0.022**	Low v/s high	**0.037**
Perceived social support	56.3[4.3]	48[9.3]	48[8.7]	2–100	1.62	0.203	Low v/s high	0.188
Budget	2.0 [1.1]	4.2 [1.1]	4.6 [1.0]	2–100	13.16	**0.000**	None v/s low v/s high	**0.000**
Feeling of not being understood	1.0 [0.0]	2.9 [1.7]	3.7 [1.6]	2–100	7.75	**0.001**	None/low v/s high	**0.003/0.039**
Sleep disorders	3.0 [1.6]	3.3 [1.6]	4.1 [1.1]	2–100	4.79	**0.010**	Low v/s high	**0.016**
Irritability	2.8 [1.3]	3.5 [1.6]	3.9 [1.4]	2–100	1.82	0.167	None v/s high	0.252
Social interaction with: friends	1.5 [0.6]	3.5 [1.6]	4.0 [1.3]	2–99	7.32	**0.001**	None v/s low/high	**0.018/0.001**
: Family	1.3 [0.5]	2.5 [1.3]	3.3 [1.6]	2–99	6.08	**0.003**	None/low v/s high	**0.023/0.033**
: Partner	2.8 [2.4]	2.9 [1.6]	3.1 [1.5]	2–98	0.30	0.739	Low v/s high	0.777
Cutaneous symptoms								
Anxiety	6.3 [3.5]	9.9 [4.3]	10.2 [4.5]	2–100	2.98	0.059	None v/s high	**0.050**
Depression	6.12 [4.4]	6.0 [4.0]	7.9 [4.2]	2–100	2.47	0.090	Low v/s high	0.083
Perceived Social Support	49.1[9.7]	50[8.0]	47[9.4]	2–100	1.36	0.261	Low v/s high	0.234
Budget	3.1 [1.6]	4.5 [1.1]	4.5 [0.8]	2–100	6.19	**0.003**	None v/s low/high	**0.004**
Feeling of not being understood	2.6 [1.8]	3.2 [1.7]	3.7 [1.6]	2–100	2.44	0.093	None/low v/s high	0.186
Sleep Disorders	3.6 [1.5]	3.7 [1.5]	4.0 [1.2]	2–100	0.99	0.375	Low v/s high	0.373
Irritability	3.3[1.5]	3.7 [1.4]	3.8 [1.3]	2–100	0.56	0.572	None v/s high	0.544
Social interaction with: friends	3.6 [1.5]	3.5 [1.6]	4.0 [1.3]	2–99	1.53	0.222	Low v/s high	0.202
: Family	3.1 [1.7]	2.6 [1.5]	3.4 [1.5]	2–99	3.52	**0.033**	Low v/s high	**0.026**
: Partner	2.5 [1.7]	2.7 [1.4]	3.5 [1.6]	2–98	3.43	**0.037**	Low v/s high	**0.048**
Respiratory symptoms								
Anxiety	9.9 [4.6]	9.0 [4.3]	10.5 [4.4]	2–100	1.30	0.277	Low v/s high	0.246
Depression	7.2 [4.6]	6.2 [4.3]	7.4 [3.9]	2–100	0.95	0.391	Low v/s high	0.381
Perceived Social Support	49.6[7.8]	49.2[8.4]	47.5[9.6]	2–100	0.55	0.576	Low v/s high	0.622
Budget	4.4 [1.1]	4.3 [1.2]	4.5 [0.9]	2–100	0.365	0.695	low v/s high	0.673
Feeling of not being understood	3.5 [1.6]	3.3 [1.8]	3.4 [1.6]	2–100	0.16	0.848	None v/s low	0.866
Sleep disorders	3.9 [1.5]	3.6 [1.4]	4.0 [1.2]	2–100	1.39	0.255	Low v/s high	0.227
Irritability	3.9[1.5]	3.6 [1.4]	3.7 [1.3]	2–100	0.16	0.851	None v/s low	0.839
Social interaction with: friends	3.9 [1.2]	3.6 [1.5]	3.9 [1.4]	2–99	0.50	0.606	Low v/s high	0.652
: Family	3.6 [1.6]	2.6 [1.5]	3.1 [1.6]	2–99	2.38	0.098	None v/s low	0.109
: Partner	3.3 [1.8]	3.0 [1.6]	3.0 [1.5]	2–98	0.28	0.755	None v/s Low/high	0.765

Bold values highlight statistically significant data.

associated with *gastric symptoms* ($p = 0.001$). Compared with mothers of children with a *high* level of *gastric* symptoms (Mean = 3.7; *often*), the perception of not being understood by others (due to the care needed by their allergic children) was significantly lower (Mean = 1.0; *not at all/a little*) among mothers of children without gastric symptoms (*none*). Likewise, mothers of children with *low* symptom levels perceived significantly more *understanding* (Mean = 2.9; *sometimes*) than mothers of children with *high* symptom levels.

4) *Social interaction*: In the model, *social interactions* with *friends* was significantly associated with *gastric symptoms* (p = 0.001). Perceived impact on interaction with *friends* was significantly lower among mothers of children without gastric symptoms (*none*) (Mean = 1.5; *a little*) when compared with mothers of children with symptoms (*low* and *high levels*) (Mean = 3.5 and 4.0, respectively: *mildly/quite a bit*).
5) *Social interaction*: In the model, *social interactions* with *family* was significantly associated with *gastric symptoms* ($p = 0.003$). Perceived impact on interaction with *family* was significantly lower among mothers of children without gastric symptoms (*none*) (Mean = 1.3; *not at all*) when compared with mothers of children with symptoms (*low* and *high levels*) (Mean = 2.5 and 3.3, respectively; *mildly*).

In the case of *cutaneous symptoms,* the post hoc (Tukey) test showed an effect on economic and psychological variables:

6) *Budget*: In the model, the *budget* was significantly associated with *cutaneous symptoms* (p = 0.003). Perceived impact on the family budget was significantly lower among mothers of children without cutaneous (*none*) symptoms (Mean = 3.1; *mildly*) compared with mothers of children with cutaneous symptoms (*low* and *high levels*; Mean = 4.5 and = 4.5, respectively; *quite a bit/very much*).
7) *Social interaction*: In the model, *social interactions* with *family* was significantly associated with *cutaneous symptoms* ($p = 0.033$). Perceived impact on interaction with *family* was significantly lower among mothers of children with *low* cutaneous symptoms (Mean = 2.6; *a little*) when compared with mothers of children with *high* levels of symptoms (Mean = 3.4; *mildly*).
8) *Social interaction*: In the model, *social interactions* with a *partner* was significantly associated with *cutaneous symptoms* ($p = 0.037$). Perceived impact on interaction with a *partner* was significantly lower among mothers of children with *low* cutaneous symptoms (Mean = 2.7; *a little*) when compared with mothers of children with *high* levels of symptoms (Mean = 3.5; *mildly*).

4. Discussion

Numerous studies and reports from various countries and international institutions have highlighted the high level of psychosocial and economic impact that child food allergy implies for healthcare systems and their families.

The results of the present study show significant associations of presence or absence of *gastric symptoms* in the child with mother's:

a) levels of *depression*
b) perception of its impact on the family *budget*
c) *understanding* about the health care needed by their children
d) impact on *social interactions* with *friends* and *family*
e) *sleeping disorders*

Moreover, the presence of *gastric symptoms* alone in their children (*none* versus *low* or *high* symptoms) showed a direct and significant detrimental association with the impact on the family *budget*, *understanding*, and social interactions with *friends* and *family*, and such associations increase as the number of symptoms increases.

In the case of *cutaneous symptoms,* the presence or absence of these symptoms in the child showed a significant association with the mother's perception of impact on the family *budget* and her *social interactions* with *family* and a *partner*. Moreover, the presence of *cutaneous symptoms* alone in the children showed a direct and significant detrimental association with the impact on the family *budget*, and such associations increase as the number of symptoms increases. Additionally, these results point to a tendency for higher *anxiety* associated with more *cutaneous symptoms*.

Studies have reported higher levels of stress and anxiety among caregivers of children with FA [11], especially on their mothers [13,41,42]. High levels of stress in parents may increase the levels of self-perceived risk among children [27], increase stress levels [43] and decrease their quality of life [44]. Recent studies showed similar results in patients with food allergy; higher food prices, anxiety about safe food, troubles keeping a healthy diet, anxiety related to social encounters, and symptoms increase on days with more allergy issues [45].

Such precedents create a framework to support the results of this study. Consistently, mothers with reduced perceived social support and higher anxious and depressive symptomatology, correlated with more allergy symptoms in their children and with higher emotional impact as a result of child food allergy as compared with those mothers reporting lower symptom levels in their children. The psychological impact on mothers (carers) seems to follow the described pattern [45] for patients; the psychosocial impact increases as the symptoms increases. Thus, the association between high levels of gastric and cutaneous symptoms and a higher psycho-socio-economic impact on mothers of children with FA are sound results in the light of the cited studies.

Since this study based children's symptoms on maternal reports, it is possible to infer that more anxious mothers may inform more or more severe symptoms in their children, in the same way that more or more severe symptoms may increase anxiety on the mothers. As mentioned, anxiety and stress in general increase among mothers of children with food allergies –compared with mothers of children without chronic conditions–, especially after a highly stressful situation such as an anaphylactic shock [46].

Such data reaffirm that, for children with a diagnosis of FA and their families, there is not only an impact on the biomedical aspects but also on family functionality, which is consistent with reports of previous research in rhinitis [22], atopic dermatitis [25] and asthma [28–30]. Based on the significant associations found between socioeconomic and psychological variables and allergic symptoms in the child, it is likely that the psychological and economic impact on the mother (or the caregiver) associates directly with the presence or absence of and the severity of food allergy symptoms in the child.

In fact, the perceived impact on the family *budget* was significantly worse among mothers of children who had experienced an anaphylactic shock (average 2.5 = bad-regular) compared with those who had not (average 3.5 = regular-good). These associations may directly relate to the straight economic impact of FA treatment; for instance, in Chile, there are considerable limitations to acquiring self-injected adrenaline or special milk since these items are not available on the market and parents must import them.

The reported data points to significant associations between psychosocial variables in the mother and allergic symptomatology in the children. Data are coherent with previous literature; nevertheless, the cross-sectional design discourages interpretations of causality.

Further studies might advance beyond these results by including immunological markers to assess the impact of psycho-socio-economic factors on child food allergy with higher accuracy. As previously mentioned, anxious mothers may report more symptoms in their children. Therefore, future research should consider including a secondary (clinical) parameter to corroborate the number of symptoms (in addition to mother's reporting). The study design could also benefit from a larger sample size; and, despite the fact that mothers are the primary caregivers, the inclusion of fathers' data may also improve the design and conclusions. Further analyses based on longitudinal approaches may also help to establish more definitive statements.

5. Conclusions

The present study explored socioeconomic and psychological variables among mothers of children with FA and found significant associations between them.

As stated in other allergic conditions such as rhinitis, asthma and atopic dermatitis, the psychological and social status of mothers of children with FA are profoundly influenced by their child's pathology. In fact, the type and amount of symptoms define the impact on caregivers. In such a scenario, a systemic perspective allows for redefining child FA; it is not only an immune reaction to specific proteins in foods, causing organic and even fatal symptoms, but it is also a family "*process of living with food allergy*." In such processes, both biological and psychosocial factors interact in a relationship of mutual influences.

From such results emerges the need to include psycho-socio-economic variables in child food allergy research, from a multi-causal perspective and with a different role than that already studied. Socioeconomic variables should be included not only as the collateral impact of child food allergy that might affect patient health by restricting access to therapy or care but also as a variable that may directly impact the child's symptomatology. Psychosocial variables should be included not only from the patient's viewpoint but the caregiver's perspective as well.

According to the present results, children's symptoms seem to have different effects on mothers depending on the presence or absence of the symptoms or the organ affected. There appears to be a direct association between children's health and the psychosocial state of caregivers. Likewise, addressing the economic impact of childhood food allergy might have a direct impact on children's health through an association with the stress levels undergone by children (and their caregivers).

Drafting comprehensive and multidisciplinary therapeutic plans of action involving psycho-socio-economic variables will facilitate the timely detection of problems in such areas affected by increasing symptoms. In this way, therapeutic approach and psychological support to caregivers should complement a more ecological approach to help "*families living with food allergy*".

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Conflict of interest

The authors have no potential conflicts of interest to disclose.

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