

Exploring Quality of Life and Parental Anxiety in Children with Tree Nut Allergies

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Abstract

Background: Food allergies, particularly their severe and persistent forms, have a significant impact on children's quality of life (QoL). Understanding and enhancing QoL is a crucial component of food allergy management. This study aimed to evaluate the QoL of Turkish children aged 0-12 years with IgE-mediated tree nut allergies (TNA) and explore influential factors, including parental anxiety. **Methods:** Primary caregiver-parents of children diagnosed with TNA completed the valid and reliable Food Allergy Quality of Life Questionnaire-Parent Form (FAQLQ-PF) and State-Trait Anxiety Inventory (STAI) to assess QoL and parental anxiety, respectively. **Results:** The study included 88 parents, predominantly mothers (83%). The children had a median age of 12 months (IQR 7.25-19.5). The mean FAQLQ-PF score was 3.55 ± 1.34 without a statistical significance between age groups (0-3 years 3.15 ± 1.28 ; 4-6 years 3.76 ± 1.42 ; 7-12 years 3.73 ± 1.19). Parents reported significantly worse FAQLQ-PF scores for children with hazelnut allergy, with a history of anaphylaxis, and who had to use an adrenaline autoinjector. State and trait anxiety scores were strongly correlated ($r=0.584$, $p<0.001$). There was significant but weak correlations between FAQLQ-PF and STAI domains. The multivariate linear regression analysis revealed that having a hazelnut allergy, a history of anaphylaxis, and higher parental state anxiety were all associated with poorer FAQLQ-PF scores, but, fathers tended to report better level of QoL. **Conclusions:** The QoL of Turkish children with TNA, as reported by parents, is influenced by various factors. Understanding and addressing these factors are crucial for a deeper understanding of how to enhance the accuracy of QoL assessment.

Exploring Quality of Life and Parental Anxiety in Children with Tree Nut Allergies

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iii. ABSTRACT AND KEYWORDS

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Conclusions: The QoL of Turkish children with TNA, as reported by parents, is influenced by various factors. Understanding and addressing these factors are crucial for a deeper understanding of how to enhance the accuracy of QoL assessment.

Key Words: Anxiety; children; food allergy; tree nut; parent; quality of life.

ABBREVIATIONS

AAI- Adrenaline auto-injector

FA- Food allergy

FARQL- Food allergy related quality of life

FAQLQ-PF- Food allergy quality of life questionnaire parent form

TNA- Tree nut allergy

QoL- Quality of life

IV. MAIN TEXT

INTRODUCTION

Tree nut allergy (TNA) is the most common form of IgE-mediated food allergy (FA) in Turkey, and it is distinguished by its persistence and potential for life-threatening reactions.¹ This allergy is highly prevalent

in Turkey due to the widespread use of tree nuts in Turkish cuisine and the country's Mediterranean climate, which is ideal for tree nut cultivation.²⁻⁵

Tree nut allergies can have a significant impact on quality of life (QoL), extending beyond mere dietary considerations. Affected individuals may encounter challenges in fully participating in social and daily activities, potentially resulting in heightened anxiety and a compromised QoL. QoL is a comprehensive assessment of an individual's overall well-being and satisfaction across diverse dimensions, encompassing physical, psychological, social, and environmental aspects.^{6,7} The Food Allergy Quality of Life Questionnaire for Parents of Children with Food Allergy (FAQLQ-PF) is an internationally recognized instrument renowned for its validity and reliability.⁸ It is designed to gauge the quality of life related to FAs in children from the parental perspective. Given the significance of both TNA and QoL, there is a compelling need for well-informed and inclusive approaches aimed at enhancing the health and happiness of individuals, both within and beyond Turkey.

Our study endeavors to measure the FA related QoL (FARQL) of children impacted by TNAs, as perceived by their parents, and to explore the factors, including parental anxiety, that influence this assessment and its accuracy.

MATERIALS and METHODS

Study population

This study was carried out in the primary caregivers (mothers/fathers) of patients aged 12 years and younger who were diagnosed with TNA in Hacettepe University Faculty of Medicine, Department of Pediatric Allergy between January 1, 2018 and December 31, 2020. For primary parenting, parents were given the autonomy to determine the primary caregiver, with the understanding that the primary parent is the one primarily responsible for the child's care and upbringing. In cases where there was uncertainty, the preference was given to the parent who prioritized the child's health, especially in the context of FAs. All patients were required to have sensitization to the relevant tree nut by skin prick test, extract-specific IgE and allergen molecule specific IgE (Ana o 3/Pis v 1 for cashew/pistachio, Cor a 14/Cor a 9/Cor a 11 for hazelnut, Jug r 1/Jug r 2 for walnut).² The diagnosis of TNA was required to be made at least 6 months ago by the presence of a consistent history or positive outcome at the oral food challenge (OFC) or high level of sensitivity as described previously.^{3,4} Parents who could not be contacted, who did not give informed consent, and whose child was older than 12 years of age were not included into the study. The study protocol was reviewed and approved by the Institutional Review Board of Hacettepe University (21/745) and those who gave informed consent for the study completed the questionnaire. Those who participated during the routine outpatient visit, filled out the questionnaire via computer, while those who were contacted by phone called filled out the questionnaire via their mobile devices.

Questionnaires

With the questionnaire, information such as sociodemographic characteristics, comorbid diseases, adrenaline auto-injector (AAI), tree nut and other FAs, healthcare utilizations such as unscheduled healthcare use/emergency and hospital admissions due to TNA were collected. The data obtained from the questionnaires were cross-checked with the information in the hospital electronic database and inconsistencies were resolved through interviews. "Food Allergy Quality of Life Questionnaire-Parent Form" and "State-Trait Anxiety Inventory" (STAI) were used to determine children's FARQL from parent's perspective and parents anxiety, respectively.

Food Allergy Quality of Life Questionnaires-Parent Form: To summarize briefly, the FAQLQ-PF has a scale of 30 questions, and its Turkish translation has previously been shown to be valid and reliable.^{8,9} Each question in the scale is answered with a 6-point Likert type variable (0-none to 6-extreme). All questions are used in the evaluation of children aged 7-12. The first 26 questions pertain to the evaluation of the 4-6 age group, while the first 14 questions are applied in the evaluation of the 0-3 age group. The scale has a total of 3 sub-dimensions: emotional impact, food anxiety, social and nutritional restrictions. The total score of

the scale ranges from 0 to 6, and a low score indicates a high quality of life as detailed previously.⁸

State-Trait Anxiety Scale: To summarize briefly, state-Trait Anxiety Scale has a total of 40 statements in the scale and its Turkish translation has previously been shown to be valid and reliable.¹⁰ The first twenty items measure the level of anxiety related to the situation (state), and items 21 to 40 measure the trait anxiety (T-STAI).^{10,11} Accordingly, 0-19 points obtained from the scale do not mean anxiety, 20-39 points mean mild, 40-59 points mean moderate, 60-79 points mean severe anxiety, and individuals with a score of 60 and above need professional help.¹⁰

Statistical analyses

Descriptive analysis were presented with frequency and percentage for categorical variables, and mean±standard deviation for continuous variables. Conformity of continuous variables to normal distribution was examined by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Independent group comparisons for categorical variables were made with Chi-Square (χ^2) or Fisher tests. Student's t-test was used in comparison of two independent groups for continuous variables, and One-Way Analysis of Variance (ANOVA) method was used in comparisons of three or more groups. The relationship between STAI and FAQLQ-PF scores was investigated by correlation analysis such as Pearson test in parametric and Spearman test in non-parametric correlation analyses. The independent factors predicting the FAQLQ-PF total score were analysed by multivariate linear regression model using possible factors detected in univariate analyses. Statistical significance, the type-1 error level was determined as 5%.

RESULTS

Study group characteristics

There were 120 eligible patients diagnosed with TNA during the study period and 88 patients were included in the study, resulting an inclusion rate of 73.3% (Figure 1). Of the questionnaires 73 (83%) were filled by mothers and 15 (17%) by fathers.

From the children, 31 (35.2%) were female and 57 (64.8%) were male. There were 29 (33%) children aged 0-3 years, 37 (42%) children aged 4-6 years, and 22 (25%) children aged 7-12 years. The median age at diagnosis was 12 (IQR 7.25-19.5) months and median months of follow-up was 40 months (10.25–65.75). The most common TNA was hazelnut (72.7%), followed by cashew, pistachio, walnut and almond. From these, 68 (77.3%) had two or more TNAs. In the context of life time, 42 (47.7%) and 5 (5.7%) patients admitted to the emergency department, and required hospitalization due to TNA, respectively. A total of 42 (47.7%) patients had exposed to the food they were allergic to in the last year. A total of 49 (55.7%) and 16 (18.2%) patients had a lifetime and current history of anaphylaxis. The prevalence of ever anaphylaxis was 34.5% in the 0-3 age group, 67.6% in the 4-6 age group, and 63.6% in the 7-12 age group ($p=0.019$). (Table 1)

Although all patients were prescribed AAIs, only 84.1% of the patients had AAIs. The highest rate of having AAIs among age groups was 97.3% in the 4-6 age group, followed by the 7-12 age group with 81.8% and the 0-3 age group with 69%. A total of 13 (14.8%) patients had to use AAI at least once in their lives due to tree nut allergy (Table 1).

Food Allergy Related Quality of Life

The mean FAQLQ-PF score of the study group was 3.55 ± 1.34 , and there was no statistically significant difference between age groups (0-3 years: 3.15 ± 1.28 ; 4-6 years: 3.76 ± 1.42 ; 7-12 years: 3.73 ± 1.19) (Table 2) and parents' gender (3.61 ± 1.33 for mothers vs 3.23 ± 1.42 for fathers; $p=0.32$).

Considering the effect of individual TNA on FAQLQ-PF scores, while the presence of pistachio, walnut, almond and cashew allergy was not different from those without allergies, the scores for children with hazelnut allergy were significantly higher than those without ($p=0.049$) (Table 2). The FAQLQ-PF scores was significantly higher in those with a previous history of tree nut-induced anaphylaxis ($p=0.008$, Table 2)

compared to those without. Likewise, the scores of the children who had to use an AAI were significantly higher than those who did not ($p=0.005$, Table 2).

State-Trait Anxiety Inventory

The STAI inventory scores, categorized by the child's age groups, are presented in the Table 3. Specifically, 55.6% reported mild state anxiety, 38.6% reported moderate state anxiety, and 5.6% reported severe state anxiety. In addition, 38.6% reported mild trait anxiety, 57.9% reported moderate trait anxiety, and 3.4% reported severe trait anxiety. Mean STAI-S and STAI-T scores in fathers (36.40 ± 11.54 and 40.07 ± 8.43 , respectively) were numerically lower than in mothers (38.66 ± 13.77 and 43.15 ± 10.31 , respectively), but the difference was not statistically significant ($p=0.545$, $p=0.281$, respectively). In numerical terms, trait anxiety consistently exceeded state anxiety, but statistically significant differences were observed in certain subgroups, such as among mothers who were primary caregivers ($p=0.001$) (Figure 2).

When the relationships between anxiety scores and baseline demographic and clinical characteristics of the patients were investigated using bivariate tables, there was higher STAI-S score for the parents who needed to use AAI ($p<0.001$) and higher STAI-T score of the parents whose child was hospitalized due to TNA ($p=0.031$) (Table 3). There was a strong positive correlation between STAI-S and STAI-T scores ($r=0.584$; $p<0.001$).

The relationship between food allergy related quality of life and parental anxiety

When we analyzed the association between STAI inventory scores and the total/subscales of FAQLQ-PF scores using correlations, we found overall significant but weak positive correlations between maternal anxiety and QoL, as well as its subscales (supplementary, Table 1). These findings suggest that a higher level of anxiety in parents is associated with a decrease in the child's QoL from parents perspective. Furthermore, when the association between STAI and total FAQLQ scores was analyzed using univariate tables, the increase in STAI-S ($B=0.032$; 95% CI: 0.011- 0.053; $p=0.003$) and STAI-T scores ($B=0.037$; 95% CI: 0.001 - 0.065; $p=0.009$) was associated with an increase in total FAQLQ-PF scores (a decrease in QoL). Association between STAI and FAQLQ scores was demonstrated as scatter-dot graphs (Figure 3).

Multivariate linear regression analysis was performed to model the relationship between FAQLQ-PF (dependent variable) and independent variables by assuming a linear relationship between the variables. In the model where STAI-S was included, fathers as primary caregiver ($B= -1.035$; 95% CI: -1.761 / -0.310; $p=0.006$), having hazelnut allergy ($B =0.717$; 95% CI: 0.058 / 1.376; $p=0.033$), having ever history of anaphylaxis ($B=0.707$; 95% CI: 0.171 / 1.244; $p=0.010$), and STAI-S scores ($B=0.024$; 95% CI: 0.004 / 0.044; $p=0.019$) were significant predictors (supplementary, Table 2). When analysis repeated by including STAI-T but not STAI-S, similar predictors were depicted except borderline insignificance achieved for STAI-T (supplementary, Table 2). Our findings indicate that considering fathers' viewpoints may yield more favorable assessments of children's QoL. Parents of children with hazelnut allergies and with a history of anaphylaxis tend to report lower QoL for their children. Notably, higher parental state anxiety, as opposed to trait anxiety, is significantly linked to a lower perceived QoL in the child.

DISCUSSION

This study, one of the few to assess QoL in children with TNA^{12,13}, differs from previous studies by including parental anxiety in two domains: state and trait anxiety. While our findings are consistent with previous research in showing the detrimental impact of negative experiences on QoL¹², they also offer new insights in three key areas. First, our study suggests that assessing QoL from the father's perspective may yield better results. Second, it highlights the potential impact of parental state anxiety on reported QoL. Third, it suggests that local traits such as certain nut allergies may also contribute to the reported QoL.

Limited data are available concerning FARQL in children under 12 years old. When comparing the total scores of our group with those from previous studies employing the same scales, our FARQL scores appear on the negative spectrum (0-3 years: 3.15 ± 1.28 ; 4-6 years: 3.76 ± 1.42 ; 7-12 years: 3.73 ± 1.19) of the previous reports¹⁴. In accordance with the validation study of Turkish version of FAQLQ-PF and a recently

conducted one in another region of the country, our scores still remain on the negative side^{9,15}. However, our study's findings align with those from Dunn-Galvin's sample^{8,16}, which included scores from Irish and American children, as well as Limpitkul's sample of Thai children¹⁷, indicating consistency across these diverse populations.¹⁸ This discrepancy might be attributed to tree nut allergies inducing persistent and severe reactions, as well as the particularities of the study group.

Research on parental anxiety and mental health in the context of children's FAs has been subject of extensive research with mixed results¹⁹⁻²⁴. Some studies have found that mothers of children with FAs experience negative effects on their mental well-being, reporting higher levels of stress and anxiety than mothers of children without food allergies. Other studies have found no significant differences in anxiety or depression levels between parents of children with and without FAs²⁵. Parents play a crucial role in shaping a child's emotional development and well-being.²⁶ Children often learn by observing and imitating their parents' behaviors. This phenomenon is often referred to as "emotional contagion" or "emotional mirroring." Young children are particularly susceptible to this because they are still developing their emotional regulation skills and rely heavily on their caregivers for emotional guidance and support.

To our knowledge, only two previous studies have explored the connection between FARQL in children and parental anxiety levels²⁷. DunGalvin's study reported a significant link between parental general anxiety levels and Russian children/adolescents' FARQL by using Generalized Anxiety Disorder 7 (GAD-7) questionnaire. The other study on this subject, Acaster's study, used Hospital Anxiety and Depression Scale (HADS) and reported parental anxiety significantly predicted higher levels of burden for the peanut allergic child. While one could argue that our study reaffirms the connection between parental anxiety and QoL, our findings offer a nuanced perspective that focuses specifically on the state domain of anxiety. Although we showed a significant correlation between state and trait domains of anxiety, the difference in predictive capacity related to state anxiety contributes to a deeper understanding of how to enhance the accuracy of QoL assessment within the context of FAs. The STAI, HADS and GAD-7, though both designed to measure aspects of anxiety, serve different purposes and focus on different dimensions of this emotional state. The STAI is designed to assess both state anxiety, which reflects an individual's immediate emotional state, and trait anxiety, which gauges their enduring predisposition to anxiety. It provides a more comprehensive assessment of anxiety levels overall. In contrast, the GAD-7 is specifically designed to identify and assess symptoms of generalized anxiety disorder, making it a more specialized tool for clinical diagnosis and screening. HADS is often used for quick screening of anxiety and depression in medical settings without distinguishing between transient emotional states and enduring traits. Given these differences in assessment tools, as well as the specific characteristics of the populations and study groups, it is plausible that the observed disparities in results are a consequence of these differences.

We showed that assessing QoL from the father's perspective may yield better results. Whether parental anxiety differs between mothers and fathers is a multifaceted question that has been explored by various researchers^{26,28}, yielding mixed results. Some studies suggest that mothers are more prone to experiencing anxiety compared to fathers, particularly concerning aspects like their children's health and safety.²⁹ The fear of losing a child is a profound and universal concern among parents, particularly mothers, rooted in the deep emotional bond and attachment formed with their child. In the context of food allergies, it is crucial to recognize that parental fears may be further exacerbated due to self/non-self negative experiences, healthcare messages emphasizing the persistent/severe nature of these allergies, and the necessity to carry an AAI for life. Mothers and fathers may experience distinct types of anxiety at various stages in their children's lives. For example, a mother might be more inclined to feel anxious about her child's health if the child has a chronic illness, while a father could be more prone to anxiety regarding the child's social development if the child is shy or introverted.²⁹

We demonstrated that the presence of hazelnut allergy exerts a negative impact on FARQL, implying that local factors may also play a role in the reported QoL. In this context, it is not surprising that hazelnut takes center stage among other tree nuts in our study, given that Turkey leads the world in hazelnut production and ranks third in per capita consumption.³⁰ Furthermore, in contrast to peanuts in the Western world,

hazelnut stands as the primary cause of IgE-mediated food allergies and anaphylaxis.^{3,31,32} The widespread production and consumption of hazelnuts could be indicative of a heightened perception of the risk of unintentional exposure among parents.

Nevertheless, it is important to acknowledge the limitations of our study. These limitations encompass the absence of a prospective aspect to document the evolving impact of state anxiety on FARQLQ-PF scores over time, as well as the relatively modest sample size of the patient group, which could introduce the possibility of type 2 errors for other predictors. Nevertheless, our study boasts several strengths, including being the sole study exclusively dedicated to TNA in the pediatric population. It represents a pioneering effort in the Eastern Mediterranean region and stands as the first and only study to explore various domains of anxiety within this context.

In conclusion, the QoL of children with TNA, as perceived by their parents, is influenced by a variety of factors. Among these factors, some are universal, such as adverse life experiences; some are influenced by local context, such as culinary culture; some are situational, such as state anxiety; and some are parent-specific, such as gender. Comprehending and addressing these multifaceted factors is crucial for the accuracy of FARQL assessment in children.

V. ACKNOWLEDGMENTS

None.

VI. KEY MESSAGE

The quality of life (QoL) for children with tree nut allergies, as reported by their parents, is influenced by various factors. These include universal factors like adverse life experiences, local influences such as culinary culture, situational elements like state anxiety, and parent-specific aspects such as gender. Understanding and addressing these diverse factors is essential for accurate QoL assessment in children.

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VIII. TABLES

	Entire group (n:88)	Age groups	Age groups	Age groups	p
		0-3 years (n:29)	4-6 years (n:37)	7-12 years (n:22)	
Female gender	31 (35.2)	12 (41.4)	10 (27)	9 (40.9)	NS
Age of diagnosis (months)	14.51±12.63	16.03±13.09	12.51±8.78	15.86±16.9	NS
+ Multiple TN allergy	78 (88.6)	27 (93.1)	33 (89.2)	18 (81.8)	NS
Current TN allergy	64 (%72.7) 56 (%63.6) 51	20 (%69) 18 (%62.1) 17	27 (%73) 24 (%64.9) 22	17 (%77.3) 14 (%63.6) 12	NS NS NS NS
-Hazelnut	(%58) 49	(%58.6) 19	(%59.5) 19	(%54.5) 11	
-Cashew	(%55.7) 25	(%65.5) 12	(%51.4) 7	(%50) 6	
-Pistachio	(%28.4)	(%41.4)	(%18.9)	(%27.3)	
-Walnut					
-Almond					
Multiple TN allergy	68 (%77.3)	22 (%75.9)	30 (%81.1)	16 (%72.7)	NS
Concomitant all. disease -Allergic rhinitis -Atopic dermatitis	15 (%17) 12 (%13.6) 3 (%3.4) 15 (%17)	1 (%3.4) 5 (%17.2) 0 7 (%24.1)	8 (%21.6) 5 (%13.5) 2 (%5.4) 2 (%5.4)	6 (%27.3) 2 (%9.1) 1 (%4.5) 6 (%27.3)	NS
-Other food allergy -Asthma					

	Entire group (n:88)	Age groups	Age groups	Age groups	p
Having an AAI	74 (%84.1)	20 (%69)	36 (%97.3)	18 (%81.8)	0.007
Ever use AAI	13 (%14.8)	2 (%9.1)	8 (%21.6)	3 (%16.7)	NS
Exposure to TN (last year)	42 (%47.7)	12 (%41.4)	18 (%48.6)	12 (%54.5)	NS
Anaphylaxis due TN -Ever	49 (%55.7) 16 (%18.2)	10 (%34.5) 4 (%36.4)	25 (%67.6) 6 (%24)	14 (%63.6) 6 (%42.9)	0.019 NS
-Current Ever emergency dept. use	42 (%47.7)	11 (%37.9)	19 (%51.4)	12 (%54.5)	NS
Ever hosp. due to TN all	5 (%5.7)	1 (%3.4)	2 (%5.4)	2 (%9.1)	NS
Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups	Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups	Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups	Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups	Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups	Values are presented as number (%) ; +: mean ± standard deviation; TN: Tree nut; AAI: Adrenaline oto-injector; NS:non-significant Table 1. Clinical characteristics of patients according to the age groups

	Total score (mean±SD)	p	Emotional impact (mean±SD)	p	Food anxiety (mean±SD)	p	Social&dietary limitation (mean±SD)	p
Sex - Male	3.70±1.39	0.153	2.78±1.12	0.057	3.97±1.33	0.58	3.06±1.74	0.169
- Female	3.27±1.20		3.37±1.47		4.15±1.59		3.59±1.65	
Age groups	3.15±1.28	0.148*	2.67±1.26	0.056*	3.22±1.66	0.001*	3.56±1.61	0.700*
- 0-3 yr -	3.76±1.42		3.34±1.48		4.50±1.27		3.42±1.86	
4-6 yr -	3.37±1.19		3.51±1.21		4.52±1.16		3.16±1.54	
7-12 yr								
TN allergy	3.57±1.37	0.833	3.19±1.41	0.686	4.14±1.53	0.557	3.37±1.75	0.728
- Multiple - Single	3.49±1.24		3.05±1.28		3.91±1.42		3.52±1.52	

	Total score (mean±SD) p		Emotional impact (mean±SD) p		Food anxiety (mean±SD) p		Social&dietary limitation (mean±SD) p	
TN	3.72±1.32/3.09±0.49	0.001	3.34±1.38/2.68±0.43	0.003	4.25±1.48/3.63±0.84	0.047	3.57±1.67	0.140
allergy -	3.37±1.30/3.85±1.07	0.036	3.01±1.33/3.43±1.14	0.174	3.95±1.55/4.32±1.63	0.269	/	0.085
Hazel-	3.35±1.31/3.83±0.99	0.095	3.01±1.36/3.37±1.20	0.209	3.96±1.49/4.26±1.61	0.365	2.96±1.71	0.035
nut	3.74±1.39/3.31±1.38	0.134	3.35±1.43/2.92±1.53	0.150	4.15±1.57/4.00±1.71	0.624	3.17±1.75	0.051
(+/-) -	3.19±1.17/3.69±1.19	0.119	2.75±1.08	0.079	3.62±1.57/4.27±0.84	0.014	/	0.530
Cashew			/3.32±1.46				3.82±1.54	
(+/-) -							3.08±1.79	
Pista-							/	
chio							3.85±1.46	
(+/-) -							3.71±1.75	
Walnut							/	
(+/-) -							3.01±1.56	
Almond							3.22±1.75	
(+/-)							/	
Ever	3.88±1.34	0.008	3.53±1.36	0.05	4.46±1.45	0.008	3.66±1.71	0.114
anaphylaxis	3.13±1.23		2.70±1.27		3.61±1.44		3.08±1.64	
- Yes - No								
Having	3.58±1.39	0.633	3.17±1.44	0.923	4.16±1.55	0.285	3.41±1.69	0.911
AAI - Yes -	3.39±1.04		3.13±1.05		3.69±1.13		3.36±1.77	
No								
Use AAI -	4.30±0.83	0.005	3.72±0.77	0.023	4.99±0.86	0.025	4.21±1.18	0.023
Yes - No	3.41±1.41		3.04±1.50		3.95±1.58		3.25±1.73	
ED	3.29±1.39	0.087	3.00±1.32	0.308	3.95±1.64	0.433	2.93±1.74	0.012
admission -	3.78±1.25		3.31±1.43		4.21±1.36		3.84±1.54	
Yes - No								
Hospit. due	4.08±1.44	0.362	3.66±1.39	0.413	4.75±1.09	0.230	3.84±1.95	0.626
TN - Yes -	3.52±1.33		3.13±1.38		4.04±1.51		3.38±1.69	
No								
Asthma -	3.22±1.41	0.297	2.91±1.48	0.449	3.52±1.75	0.111	3.22±1.41	0.654
Yes - No	3.62±1.32		3.21±1.36		4.20±1.43		3.44±1.75	
Allergic	4.38±0.90	0.008	3.86±0.91	0.030	5.10±0.79	0.003	4.17±1.28	0.055
rhinitis -	3.38±1.35		3.02±1.42		3.88±1.53		3.24±1.73	
Yes - No								
Atopic	3.21±1.09	0.345	2.76±1.28	0.288	3.99±1.31	0.818	2.87±1.88	0.243
dermatitis -	3.60±1.37		3.22±1.39		4.10±1.53		3.49±1.66	
Yes - No								
Sibling	4.07±1.00	0.065	3.78±1.13	0.032	4.48±1.40	0.211	3.95±0.97	0.129
allergy -	3.42±1.38		3.00±1.40		3.98±1.51		3.26±1.81	
Yes - No								
Mother's	3.71±1.20	0.480	3.26±1.27	0.687	4.33±1.17	0.332	3.54±1.63	0.624
educ.	3.49±1.39		3.12±1.43		3.99±1.61		3.35±1.73	
<Univer-								
sity								
[?]University								

	Total score (mean±SD) p		Emotional impact (mean±SD) p		Food anxiety (mean±SD) p		Social&dietary limitation (mean±SD) p	
*ANOVA	*ANOVA	*ANOVA	*ANOVA	*ANOVA	*ANOVA	*ANOVA	*ANOVA	*ANOVA
test;	test;	test;	test;	test;	test;	test;	test;	test;
TN:	TN:	TN:	TN:	TN:	TN:	TN:	TN:	TN:
Tree	Tree	Tree	Tree	Tree	Tree	Tree	Tree	Tree
nut;	nut;	nut;	nut;	nut;	nut;	nut;	nut;	nut;
AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin	AAI:Adrenalin
autoin-	autoin-	autoin-	autoin-	autoin-	autoin-	autoin-	autoin-	autoin-
jector;	jector;	jector;	jector;	jector;	jector;	jector;	jector;	jector;
Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency	Ed:Emergency
depart-	depart-	depart-	depart-	depart-	depart-	depart-	depart-	depart-
ment;	ment;	ment;	ment;	ment;	ment;	ment;	ment;	ment;
SD:	SD:	SD:	SD:	SD:	SD:	SD:	SD:	SD:
stan-	stan-	stan-	stan-	stan-	stan-	stan-	stan-	stan-
dard	dard	dard	dard	dard	dard	dard	dard	dard
devia-	devia-	devia-	devia-	devia-	devia-	devia-	devia-	devia-
tion	tion	tion	tion	tion	tion	tion	tion	tion
Table	Table	Table	Table	Table	Table	Table	Table	Table
2.Total	2.Total	2.Total	2.Total	2.Total	2.Total	2.Total	2.Total	2.Total
and	and	and	and	and	and	and	and	and
subscale	subscale	subscale	subscale	subscale	subscale	subscale	subscale	subscale
scores of	scores of	scores of	scores of	scores of	scores of	scores of	scores of	scores of
T-	T-	T-	T-	T-	T-	T-	T-	T-
FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-	FAQLQ-
PF	PF	PF	PF	PF	PF	PF	PF	PF
accord-	accord-	accord-	accord-	accord-	accord-	accord-	accord-	accord-
ing to	ing to	ing to	ing to	ing to	ing to	ing to	ing to	ing to
the	the	the	the	the	the	the	the	the
variable	variable	variable	variable	variable	variable	variable	variable	variable
parameters	parameters	parameters	parameters	parameters	parameters	parameters	parameters	parameters

	STAI-S scores	p	STAI-T scores	p
Sex Male Female	36.79±12.51 41.00±13.75	0.149	43.02±10.67 41.90±8.89	0.622
Age groups 0-3 yr 4-6 yr 7-12 yr	36.52±10.30 41.24±15.33 35.59±11.52	0.186*	41.86±10.02 43.14±10.45 42.77±9.77	0.877*
TN allergy - Multiple - Single	38.81±12.77 36.45±14.09	0.801	43.31±10.56 40.30±7.83	0.241

	STAI-S scores	p	STAI-T scores	p
TN allergy -	38.36±11.61 /	0.920 0.720 0.946	42.53±10.32 /	0.887 0.430 0.581
Hazelnut (+/-) -	38.04±16.55	0.904 0.057	42.88±9.46	0.368 0.245
Cashew (+/-) -	37.89±13.10 /		41.98±10.20 /	
Pistachio (+/-) -	38.94±13.11		43.75±9.81	
Walnut (+/-) -	38.35±13.22 /		42.12±10.49 /	
Almond (+/-)	38.16±12.96		43.32±9.49	
	38.12±11.95 /		43.49±10.74 /	
	38.46±14.44		41.54±9.11	
	34.08±10.84 /		40.64±10.40 /	
	39.94±13.53		43.41±9.87	
Ever anaphylaxis -	39.33±14.20	0.399	42.92±10.73	0.761
Yes - No	36.95±11.45		42.26±9.22	
Having AAI - Yes -	38.77±13.33	0.414	42.30±10.10	0.485
No	35.64±11.42		44.36±9.91	
Use AAI - Yes - No	51.77±14.76	<0.001	44.69±11.91	0.318
	35.59±11.22		41.64±9.57	
ED admition Yes	38.33±12.76	0.967	42.76±10.15	0.904
No	38.22±13.43		42.50±10.05	
Hospitalization -	41.60±10.99	0.560	52.00±5.91	0.031
Yes - No	38.07±13.18		42.06±9.98	
Asthma Yes No	36.40±14.10	0.545	41.67±9.61	0.687
	38.66±12.88		42.82±10.18	
Allergic rhinitis Yes	38.67±15.64	0.899	40.07±8.86	0.281
No	38.19±12.56		43.15±10.24	
A.dermatitis - Yes -	41.50±11.77	0.359	42.33±7.78	0.915
No	37.76±13.23		42.67±10.39	
Sibling allergy - Yes	40.72±10.05	0.375	46.22±9.29	0.089
- No	37.64±13.69		41.70±10.08	
Mother's educ.	35.92±10.44	0.289	41.32±9.72	0.446
<University	39.21±13.90		43.14±10.20	
[?]University				

*ANOVA test; STAI:State-Trait anxiety inventory; TN: Tree nut; AAI:Adrenaline autoinjector; Ed:Emergency department

Table 3. STAI-S and STAI-T scores according to the potential predictors

IX. FIGURE LEGENDS

Figure 1. Flowchart of the study

Figure 2. State-Trait Anxiety Inventory scores according to age groups and primary parents.

Figure 3. Correlations between Food Allergy Quality of Life Questionnaires-Parent Form and State-Trait Anxiety Inventory

X. APPENDICES

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FIGURES 15.10.23.docx available at <https://authorea.com/users/357594/articles/672437-exploring-quality-of-life-and-parental-anxiety-in-children-with-tree-nut-allergies>