

ORIGINAL ARTICLE

Parent perceived quality of life is age-dependent in children with food allergy

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Keywords

anaphylaxis; child; food allergy; quality of life; specific questionnaire.

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Abstract

Background: Food allergy in children significantly affects their quality of life. Its impact can be analyzed by quality of life questionnaires.

Objectives: The aim of our study was to validate the French version of disease-specific questionnaires and to evaluate the quality of life in children with IgE-mediated food allergy.

Methods: Two validated food allergy-specific questionnaires for quality of life, the parent's and children's forms (FAQLQ-PF and FAQLQ-CF), were translated from English to French and submitted to children with food allergy and their parents. Questionnaires were analyzed in terms of emotional impact, food anxiety, and social and food limitations. NCT 01480427.

Results: Sixty-two parents of children aged 0–12 yrs answered the FAQLQ-PF, and 32 children aged 8–12 yrs the FAQLQ-CF. Construct validity of both questionnaires was assessed by correlation between the FAQLQs and FAIM ($r = 0.85$ and 0.84 , respectively). Both FAQLQs had good internal consistency (Cronbach's $\alpha = 0.748$ and 0.67 , respectively). Young children (0–3 yrs old) showed better quality of life scores than older children (FAQLQ-PF global score: $p = 0.02$). Worse scores were also shown among children with previous severe systemic reactions (FAQLQ-PF global score: $p = 0.039$), the ones with an allergic mother (FAQLQ-PF global score: $p = 0.002$), or allergic siblings (FAQLQ-PF emotional impact score: $p = 0.034$), the ones with multiple food allergy (more than 1 food) (FAQLQ-PF anxiety score: $p = 0.04$) and among the girls (FAQLQ-CF global score: $p = 0.031$).

Conclusion: Older children, the ones with severe systemic reactions, or with mothers or siblings also affected by allergies, as well as girls, and children with multiple food allergies show worse quality of life scores.

The overall burden of food allergy in children is of growing concern, as the disease affects up to 3–7% of school-aged children (1, 2). The rate of severe systemic reactions, that is, anaphylaxis, has also increased with a doubling of the number of hospitalizations over a 5-yr period (3), in particular among children and teenagers with food allergy (4). There is no cure or preventive treatment for food allergy available

yet. Therefore, the management is restricted to avoidance of the offending food, and to emergency treatment plans for accidental reactions. The quality of life of children with food allergy and their parents can often be affected by elimination diets, as well as by the fear of potentially severe allergic reactions in case of accidental ingestions. This results in a change in behavior in the whole family, for example, during social

activities such as dining out, and can lead to limited social integration and in more severe cases to a clear psychological impact.

Quality of life has been investigated by generic questionnaires comparing food allergy with other chronic conditions, such as insulin-dependent diabetes and digestive and rheumatologic diseases and with other atopic diseases (5–9). These have shown a greater negative impact for food allergy. Other questionnaires highlighted also a significant impact on parents' quality of life (10–12). More recently, food allergy-specific quality of life questionnaires, based on the parental perception of the impact on children's life and on the children's direct perception, have been recently developed and validated in English (13) and in Dutch (14). The aim of this study was first to validate the French version of those disease-specific questionnaires and then to evaluate the impact of food allergy on the quality of life of Swiss children, of different age groups, with IgE-mediated food allergy, as perceived by the parents and the children themselves.

Methods

This was a cross-sectional questionnaire-based study, measuring quality of life of children with IgE-mediated food allergy. Ethical approval was obtained from the University of Lausanne and Geneva Hospitals research ethical committees. Written parental and child (in older subjects) consent was obtained. NCT 01480427.

Participants

Children and their parents were recruited among the outpatient allergy clinics of the Paediatric Departments of the University Medical Centers of Lausanne and Geneva. Children were 0–12 yrs old, and all had been diagnosed previously with IgE-mediated food allergy by a pediatric allergy consultant by the following criteria: a positive open food challenge with a positive skin test and/or positive specific IgE; or a convincing history of severe allergic reaction supported by evidence of sensitization to the triggering food according to current guidelines (15, 16). The severity of the initial reaction was graded for severity according to the anaphylaxis grades proposed by Sampson (17). To avoid an impact of associated chronic diseases on quality of life, patients with severe chronic conditions such as uncontrolled asthma [as defined by expert guidelines (18)] or atopic dermatitis requiring the regular use of topical or oral corticosteroids were excluded. Parents and children who were eligible and gave their consent completed the questionnaires during a scheduled follow-up clinical visit with the assistance of the investigator when needed.

Questionnaires

Questionnaires were translated, following guidelines of the World Health Organization (19) from English to French separately by two bilingual physicians, whose native language

was French. To ensure an accurate translation from the original English questionnaire, a summary of the translation was made by a third person and back-translated to English by a bilingual medical expert whose native language was English.

Two disease-specific questionnaires were used – for the parents, the Food Allergy Quality of Life Questionnaire – Parent Form (FAQLQ-PF). The FAQLQ-PF is divided into three sub-scores evaluating the emotional impact, the food anxiety, and the social and dietary limitations. The questionnaires were divided into three age groups and address a different number of questions according to the children's age (some questions, as the ones touching peers social activities, are not applicable to younger children): group 1 from 0 to 3 yrs, group 2 from 4 to 6 yrs, and group 3 from 7 up to 12 yrs.

In children aged 8–12 yrs, we applied the Food Allergy Quality of Life Questionnaire – Children Form (FAQLQ-CF). The FAQLQ-CF is divided into four sub-scores studying allergen avoidance, risk of accidental exposure, emotional impact, and dietary restrictions. Items were scored on a seven-point scale ranging from 'not troubled' to 'extremely troubled'. The total FAQLQ score is the sum of all the items divided by the number of items and ranges from 1 (minimal impairment in HRQL) to 7 (maximal impairment in HRQL).

In addition, the Food Allergy Independent Measure (PF and CF) – which are disease-specific questionnaires and consist of four questions each that assess the parent's and child's expectations of the child's food allergy's outcome – was administered to evaluate the construct validity of the FAQLQ-PF and -CF (20).

Statistical analyses

To achieve adequate power for the validation of the questionnaire translation, with the minimum effect size of 0.5 and an alpha error probability of 0.05, the minimum sample size required was calculated prior the study to be 27 participants. Cross-sectional validation of the French version of the questionnaires was evaluated by the calculation of the correlation between the FAQLQs and FAIMs. Internal consistency of the FAQLQs was investigated by calculating the Cronbach's α as previously described (13, 14). We required a correlation score of > 65%.

Mean scores of the FAQLQ-PF were compared between the three different age groups with analyses of variance (ANOVA). Scheffé tests were used for pair-wise comparisons of means after statistically significant ANOVA. Mean scores of the FAQLQ-PF and FAQLQ-CF were compared between binary epidemiological variables using two-sided *t*-tests. The eight epidemiological variables tested were sex, father suffering of any allergy (yes or no), mother suffering of any allergy, siblings suffering of any allergy, child's allergy severity [according to the reaction severity grades proposed by Sampson grade 1 or 2 vs. 3 (17, 21)], number of involved allergens (1, 2 or 3), presence of peanut among the allergens (yes or no). Finally, all variables with a *p*-value < 0.1 in the analyses above were tested together in multiple OLS regressions to adjust for the effect of each other. The Pearson

correlation coefficient between the total FAQLQ-PF score by parents and total FAQLQ-CF score by children was calculated. Statistical analyses were performed with Stata version 11 (StataCorp LP, College Station, TX, USA) and PASW 18.0 (IBM Corp, Chicago, IL, USA).

Results

Sixty-two children and one parent per child were enrolled in the study, 42% were girls and 58% were boys, with a median age of 7.8 yrs. Thirty-two children (aged 8–12 yrs) of the 39 patients from age group 3 (7–12 yrs) answered themselves the FAQLQ-CF. Fifty percent also suffered from or had a history of eczema (well controlled at the time of the study), 40% suffered from rhino-conjunctivitis and 29% from well-controlled asthma. 87% had been provided a self-injectable epinephrin device. 58% were known to be allergic to one food, 18% to two foods, 24% to 3 or more foods. 30 children (48%) underwent a standardized oral food challenge to confirm their allergy. The reference food for entering the study was peanuts (71% of children), hazelnuts (29%), walnuts (23%), in addition 21% of the patients were allergic to eggs as the most frequent other concomitant food allergy. Sixty-one percent of children had had previously a mild systemic reaction because of food allergy (grades 1 and 2), 37% a severe systemic reaction (grade 3), with slightly less severe reactions (not significant) among older children (Table 1).

Questionnaire validation

For the FAQLQ-PF, 27 (of the 62 parents included in the study) subsequent fully completed questionnaires were used for the cross-sectional validation. The strong positive correlation between the FAQLQ-PF and FAIM-PF was found

($r = 0.85$), supporting the construct validity of the FAQLQ-PF. Good internal consistency was shown by a Cronbach's α of 0.748.

For the FAQLQ-CF, 32 questionnaires were available for validation analysis. The correlation between the FAQLQ-CF and FAIM-CF was also good ($r = 0.84$), supporting the construct validity of the FAQLQ-CF. Good internal consistency was shown by a Cronbach's α of 0.67.

Indices of quality of life

Age-related quality of life

Parent's perception: for all FAQLQ-PF scores (total score and the three domains), children with the lowest age (0–3 yrs old) had the best mean quality of life values, that is, lowest scores, while the means of the other two age classes differed only slightly from each other. However, the null hypothesis of no difference could not be rejected for the limitations score in the unadjusted analysis (see p-value) (Table 2).

Gender-related quality of life

Children's perception: There was a significant difference in the quality of life between girls and boys with a higher impact for the girls for the global score, the emotional and the dietary eviction scores of the FAQLQ-CF. We could not find the same difference in the FAQLQ-PF (Tables 2 and 3).

Other family members with allergies and quality of life

Parent's perception: for all four scores (total score and the three domains) of the FAQLQ-PF, children whose mothers (but not fathers) suffer from any allergy had higher mean scores than those whose mothers have no allergies. Furthermore, children with allergic siblings had a higher emotional impact score than children with no allergic siblings (Table 2).

Table 1 Epidemiological characteristics of the study subjects, divided into three age groups – according to the Food Allergy Quality of Life Questionnaire – Parent Form construction (0–3 yrs, 4–6 yrs, and 7–12 yrs), presented in numbers and frequencies (%)

	0–12 yrs (n = 62)	0–3 yrs (n = 7)	4–6 yrs (n = 16)	7–12 yrs (n = 39)
Female	26 (42)	3 (43)	7 (44)	16 (41)
Presence of atopic dermatitis*	31 (50)	3 (43)	10 (62)	18 (46)
Presence of allergic rhino-conjunctivitis	25 (40)	0	3 (19)	22 (56)
Presence of controlled asthma	18 (29)	1 (14)	6 (37)	11 (28)
Peanut allergy	36 (58)	3 (43)	3 (19)	30 (80)
Hazelnut allergy	10 (16)	0	0	10 (26)
Walnut allergy	2 (3)	0	0	2 (5)
Egg allergy	12 (19)	3 (43)	5 (31)	4 (10)
Multiple food allergies†	25 (40)	4 (57)	6 (37)	15 (38)
Oral food challenge	30 (48)	2 (29)	5 (31)	23 (59)
Atopic mother‡	37 (60)	2 (29)	10 (62)	25 (64)
Atopic siblings‡	17 (27)	0	4 (25)	13 (33)
Atopic father‡	34 (54)	4 (57)	11 (69)	19 (49)
Previous severe systemic reactions§	23 (37)	2 (29)	7 (44)	14 (36)
Equipped with self-injectable epinephrin	54 (87)	6 (86)	12 (75)	36 (92)

*Defined as concomitant, well-controlled eczema, or a history of previous lesions.

†Defined as more than food one allergy.

‡Defined as having physician diagnosed food allergy, allergic asthma, allergic rhinitis or severe atopic dermatitis.

§Defined as grade 3 anaphylaxis following Sampson criteria (13).

Table 2 Non-adjusted comparisons between quality of life scores and epidemiological variables for the Food Allergy Quality of Life Questionnaire – Parent Form questionnaire. p-values for binary variables were obtained from two-sided t-tests (na, non-applicable)

Variable	Category	N	Global score		Emotional impact		Anxiety		Limitations	
			Raw mean	p	Raw mean	p	Raw mean	p	Raw mean	p
All groups	na	62	2.84	na	2.66	na	3.11	na	2.79	na
Age (yrs)	0–3	7	1.67	anova 0.014	1.21	anova <0.001	1.76	anova 0.045	2.02	anova 0.158
	4–6	16	3.13	Pair-wise	3.03	Pair-wise	3.31	Pair-wise	3.05	
	7–12	39	2.94	0.020*	2.78	<0.001*	3.27	0.077*	2.81	
				0.027**		0.001**		0.054**		
Sex				0.845***		0.661***		0.993***		
	Female	26	2.88	0.839	2.69	0.875	3.17	0.809	2.80	0.960
	Male	36	2.82		2.64		3.07		2.78	
Father with allergies	Yes	34	2.96	0.469	2.65	0.800	3.29	0.392	2.99	0.176
	No	25	2.73		2.72		2.93		2.56	
Mother with allergies	Yes	37	3.22	0.002	3.06	<0.001	3.56	0.004	3.04	0.037
	No	25	2.30		2.08		2.45		2.41	
Siblings with allergies	Yes	17	3.21	0.139	3.13	0.034	3.51	0.203	3.06	0.314
	No	24	2.64		2.38		2.90		2.66	
Anaphylaxis grade	1–2	37	2.47	0.004	2.36	0.014	2.64	0.004	2.43	0.006
	3	24	3.33		3.03		3.75		3.24	
Number of allergens	1	36	2.60	0.071	2.46	0.118	2.77	0.049	2.61	0.206
	2–3	25	3.15		2.90		3.55		3.00	
Peanut among the allergens	Yes	36	2.91	0.507	2.70	0.602	3.25	0.336	2.82	0.721
	No	25	2.70		2.55		2.86		2.70	
Peanut or tree nuts among the allergens	Yes	49	2.89	0.359	2.75	0.127	3.19	0.326	2.78	0.876
	No	12	2.54		2.21		2.70		2.72	

*Two-sided p-value for 0–3 yrs vs. 4–6 yrs groups.

**Two-sided p-value for 0–3 yrs vs. 7–12 yrs groups.

***Two-sided p-value for 4–6 yrs vs. 7–12 yrs groups.

Children's perception: the FAQLQ-CF (total score and the four domains) showed the same tendency, but the difference was not significant among the children with or without allergic family members (Table 3).

Severity of reactions, number of allergens, and quality of life

Parent's perception: similar results were found in children with a history of previous severe allergic reactions (including respiratory or cardiovascular symptoms) compared to those with milder systemic reactions and those with two or more food allergies had higher global and anxiety scores compared to those with one allergy (Table 2). All the above variables were retained in the multiple regressions. For the remaining associations presented in Table 2, associations are inconclusive.

Children's perception: the quality of life questionnaires – child form – showed the same results, but the difference was not significant among the children with or without severe reactions. There were no differences for the children having one or multiple food allergies (Table 3).

Mutual adjustment of the age, familial allergies, severity of the reactions, and number of allergens (parent's perception)

Associations similar to the above-described results were found between age groups, mothers with allergy or disease severity and emotional impact. The association between

allergy among siblings and emotional impact was weak and not conclusive (confidence interval: –0.30 to 0.98). Finally, mean predicted limitations scores were higher in children with mothers with allergies compared to those without mothers with allergies and for those with severe reactions compared to those with milder reactions (Fig. 1).

Comparison between child and parent quality of life scores (children aged 8–12 yrs)

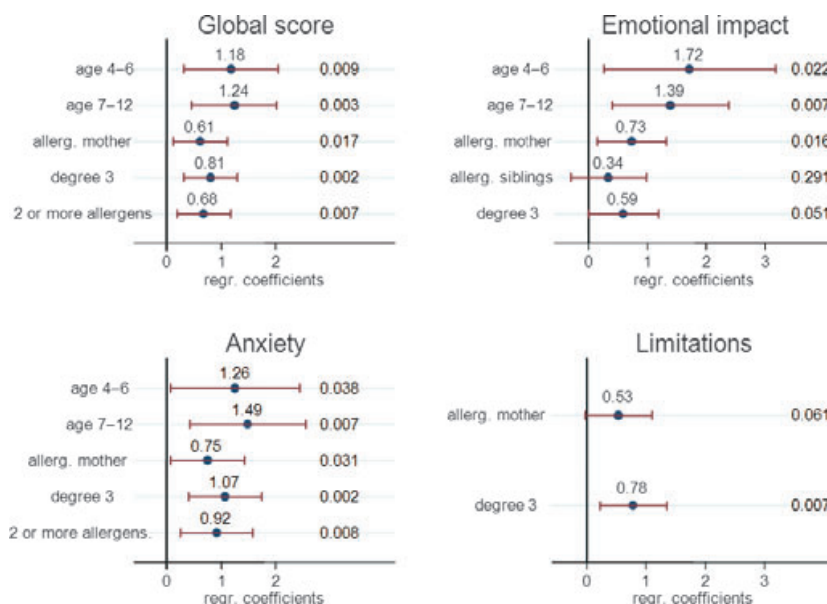
The total FAQLQ-CF mean score was significantly higher (indicating a more severe impact on the quality of life) than the total FAQLQ-PF mean score (3.71 vs. 2.84; two-tailed t-test; $p = 0.002$), as were all the domain scores of the FAQLQ-CF comparing to the FAQLQ-PF. The Pearson correlation coefficient between the total FAQLQ-PF and FAQLQ-CF score was 0.61 (95% CI: 0.33–0.79) (Fig. 2).

Discussion

Our study investigated the quality of life of food allergic children by using questionnaires allowing comparison between three age groups. We observed a clear difference of perception of quality of life (by the parents on their children perspective) between young children and school-aged

Table 3 Non-adjusted comparisons between quality of life scores and epidemiological variables for the Food Allergy Quality of Life Questionnaire – Parent Form questionnaire. p-values were obtained from two-sided *t*-tests (na, non-applicable)

Variable	Category	N	Global score		Emotional impact		Allergen avoidance		Risk of accidental exposure		Dietary restrictions	
			Raw mean	p	Raw mean	p	Raw mean	p	Raw mean	p	Raw mean	p
All groups	na	32	3.71	na	4.21	na	3.31	na	3.81	na	3.58	na
Sex	Female	12	4.40	0.031	4.96	0.021	3.93	0.076	4.45	0.107	4.36	0.043
	Male	20	3.29		3.77		2.93		3.42		3.12	
Father with allergies	Yes	15	3.78	0.783	4.21	0.991	3.36	0.841	3.85	0.883	3.74	0.575
	No	17	3.63		4.21		3.25		3.76		3.40	
Mother with allergies	Yes	20	3.85	0.463	4.26	0.808	3.66	0.092	3.96	0.536	3.58	0.982
	No	12	3.46		4.13		2.71		3.56		3.59	
Siblings with allergies	Yes	13	4.02	0.306	4.18	0.916	3.69	0.251	4.19	0.310	4.10	0.160
	No	19	3.49		4.23		3.05		3.55		3.23	
Anaphylaxis grade	1–2	21	3.61	0.588	4.06	0.431	3.39	0.667	3.48	0.142	3.50	0.719
	3–4	11	3.90		4.49		3.14		4.44		3.74	
Number of allergens	1	20	3.69	0.925	4.39	0.379	3.26	0.840	3.72	0.714	3.47	0.630
	2–3	12	3.74		3.91		3.38		3.96		3.78	
Peanut among the allergens	Yes	28	3.78	0.426	4.22	0.949	3.40	0.365	3.89	0.500	3.71	0.278
	No	4	3.16		4.16		2.64		3.25		2.70	

**Figure 1** Adjusted coefficients for the Food Allergy Quality of Life Questionnaire – Parent Form questionnaire from the multiple regressions, with 95% confidence intervals and p-values. Coefficients represent predicted mean differences from a variable's reference category. Reference categories are, respectively: age 0–3; no allergy in mother; no allergy in siblings; severity of a previous reaction grade 1–2(11); and 1 allergen.

children, the later reporting a greater impact on their quality of life, as well as for the presence of an allergic sibling. In addition, having a previous history of severe reaction to a food clearly diminished the quality of life of the family.

Not previously reported by others, we found in this study that older children (the 7–12 yrs old) had a score indicating a lower quality of life than younger children (the 0–3 yrs old

and 4–6 yrs old). This was revealed by comparing age-related quality of life questionnaires used in this study and has not been possible to be demonstrated in earlier studies using only one age-group questionnaire. Studying younger children for the first time in terms of their own quality of life (perceived by their parents) offers the picture of quality of life evolution with the age. Clearly, our findings meet the general impres-

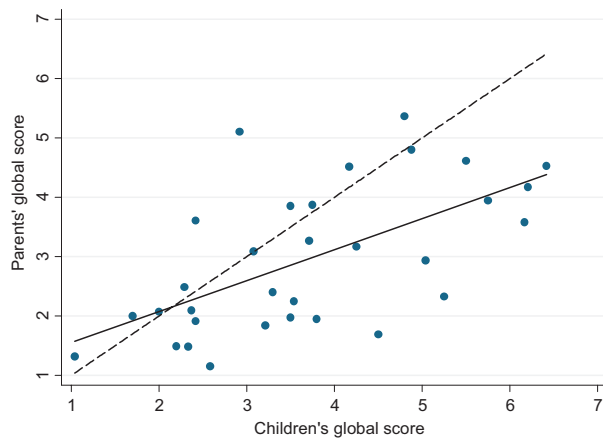


Figure 2 Correlation between Food Allergy Quality of Life Questionnaire – Parent Form (FAQLQ-PF) and Food Allergy Quality of Life Questionnaire – Children Form (FAQLQ-CF) global score. Pearson correlation coefficient: 0.61 (95% CI: 0.33–0.79). Solid line: regression line. Dashed line: concordance (FAQLQ-PF = FAQLQ-CF).

sions by physicians taking care of children with food allergy that pre-adolescents and adolescents are age groups at risk (21). This age group indicated by their responses to the questionnaire that they are well aware that, in relation to their age, an increasing involvement in social life, away from the familial nucleus, represents a higher risk of accidental reactions. It is therefore of importance that the caregivers provide them with all needed information, particularly at vulnerable transition points (22) in relation to their evolving social life (23).

When analyzing other variables, and similarly to our study, Ostblom et al. reported earlier that severe reactions are associated with scores indicating a lower quality of life (8, 14). These results are in opposition with those by Cummings et al. (24) reported in a study with a different population in terms of food allergy diagnosis. This study included also children with positive skin tests and primary food evictions, without evidence of systemic reactions after accidental food ingestion, while in our study all children had an IgE-mediated food allergy with a previous history of systemic reactions. We could not find any difference between children having encountered oral food challenges in comparison with the ones included in the study on the basis of a convincing history of previous severe allergic reaction, in opposition to the study of Kemp et al. (25) which found a positive impact on quality of life of children after having had a food challenge, independently of its result; this difference can be explained by the high level of heterogeneity of the period between the food challenge and the completion of the questionnaire in our study. In relation to previous reactions reported, we also wanted to exclude the period of time between the previous reaction and the questionnaire as a potential confounding factor; however, the limited sample size hampered this additional analysis.

For the first time, we show that children with an allergic mother or allergic siblings also had a greater impact on qual-

ity of life, based on the FAQLQ-PF questionnaire, which can be partially explained by the fact that the questionnaires in our study were >90% completed by the mothers and that, in our population, the mothers were predominantly involved in their children's food allergy management; therefore, being themselves food allergic or having another child with this condition may have an impact on the quality of life of the whole family. There was no impact in cases with allergic fathers.

We found a higher impact on quality of life among girls, based on their own perception, in the general score and in the emotional impact and dietary restrictions scores. This is similar to the findings of Marklund among Swedish adolescents (26) but opposite to the results of Flokstra-de Blok et al. (14). We could not find a difference in quality of life between genders on the parents' questionnaire, similarly to the results of Dunn Galvin et al. (13). We hypothesize that these different findings might be related to the study populations.

Previous studies (8, 12, 27) have shown that having more than one food allergy increases the impact on quality of life. These observations were independent from the type of food (27). Our population was mostly affected by tree nuts and/or peanut allergy and our recruitment criteria did not allow comparing the impact on the quality of life of multiple food allergies.

A good correlation between parents and children scores was shown, which means that parents and their children had concordant judgements concerning the child's quality of life. As previously shown, children reported greater impact of food allergy on their quality of life than their parents (28). Van der Velde et al. have also shown that the children aged 11–12 yrs had a better quality of life than the ones of 8–10 yrs which could indicate an improvement of quality of life in older children which is in contradiction with the results of our study that compared very different age groups.

Finally, the quality of life – children forms – did not show any significant differences between age, familial allergies, and reactions severity – due possibly to the smaller population sample and more homogenous clinical situation of the children (nuts and peanut systemic reactions). However, we notice big differences in FAQLQ-CF scores between children with and without peanut allergy on the total score and the domains (except for the domain emotional impact); assuming that the minimal clinical important difference (MCID) is 0.5 and the difference on the domain dietary restrictions is even two times the MCID. Our study had limitations and strength to comment on. We used a sample of limited size, and no control group of healthy children, which is, however, not applicable to our study as these are not used in disease-specific questionnaires. A clear strength of the study is the homogeneity of the study population, recruited in tertiary pediatric allergy clinics after a confirmed IgE-mediated systemic food allergy. However, this referral population had previously received education and support, possibly improving scores of quality of life.

To confirm the impression that the impact of food allergy on quality of life increases with age, it would be very interest-

ing to conduct the same analysis with teenagers with the teenager's FAQLQ (29): however, as this questionnaire, which is not validated in French yet, is quite different from the children's one, only indirect comparison will be possible.

Larger studies with specific and generic validated questionnaires should be conducted to confirm these results and compare them with other populations. Follow-up and intervention trials to evaluate the long-term evolution of the quality of life of food allergic patients could also prove to be very useful. The validation in French of the questionnaires used here will increase the population in Europe available for studies examining quality of life.

In conclusion, we showed that food allergy has a significant impact on the quality of life of Swiss children as reported by the parents and by the children themselves, similarly to previously studied populations. According to the parents, certain subgroups of patients suffer from a higher impact on their quality of life: school-aged children and those with severe reactions or with multiple food allergies. These groups should therefore benefit from a more important medical, dietary, social, and psychological support. Educating

parents and children to empower them should increase their self-confidence in their ability to manage the food allergy. Community awareness of the food allergy burden should be also increased, such as school personnel training and political implication to develop adapted regulation on labeling and school restaurants rules.

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Conflict of interests

The authors declare no conflict of interests in relation to this study.

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