

## Original article

## The impact of food hypersensitivity reported in 9-year-old children by their parents on health-related quality of life

**Background:** There are only a few studies on the impact of food hypersensitivity (FHS) in children on health-related quality of life (HRQL). The present study was designed to examine this impact in a population-based birth cohort (BAMSE).

**Methods:** A nested case–control study was performed within the cohort. The parents of 1378 nine-year-old children filled out a generic questionnaire with 13 subscales (Child Health Questionnaire Parental Form 28 – CHQ-PF28) supplemented with disease-specific questions concerning FHS. There were 212 children with report of FHS. Another 221 children with allergic diseases but not FHS were examined for comparison. Furthermore, the impact of pronounced symptoms of FHS and of increasing levels of food-specific IgE antibodies on HRQL was also analysed.

**Results:** The children with FHS exhibited significantly lower scores on the subscales physical functioning, role/social limitations – physical and general health in the generic instrument. Furthermore, children with food-related symptoms from the lower airways were scored lower on Self Esteem, Parental Impact – time and Family Cohesion. Sensitization *per se* did not alter these patterns, but high levels of food-specific IgE-antibodies affected mental health and general health negatively. A physician's diagnosis of food allergy did not affect any of the subscales negatively.

**Conclusions:** Parents reported that FHS exerts a negative impact on the HRQL of 9-year-old children, in particular in children with symptoms from the lower airways or if the FHS is associated with high levels of food-specific IgE-antibodies. Healthcare-givers must put major effort into improving and maintaining the HRQL of these children.

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Although health-related quality of life (HRQL) in children with allergic diseases has attracted increasing attention recently, the research focus has been limited primarily to asthma, rhinitis and atopic eczema (1–4). To date, only a few such studies on young children with food allergy or food hypersensitivity (FHS) based on hospital records have been reported (5–8). One of these investigations found that children allergic to peanuts experience disruption of their daily activities that is more extensive than that for children with rheumatoid disease (6). Moreover, allergy to peanuts results in a lower

HRQL in children than insulin-dependent diabetes (7). In addition, Sicherer and co-workers have reported that parents of children with food allergies perceive that the HRQL of their children is lower than do parents of nonallergic children (8). It has also been shown that food allergy in children may enhance parental anxiety (9).

Recently a food-allergy-specific questionnaire designed to measure parental burden was developed by Cohen et al. (10) and applied on a group of patients and their families. However, to our knowledge, no population-based study of the HRQL of young children with FHS has yet been conducted. Therefore, the present investigation was designed to examine the impact of reported FHS in 9-year-old children on parental perception of the HRQL of the child, as well as of the family. We used a validated generic instrument, Child Health Questionnaire Parental Form 28 (CHQ-PF28) which was combined with disease-specific questions that we, in the absence of a validated disease-specific instrument for FHS, have developed. The children involved were all recruited from

**Abbreviations:** BAMSE, Children, Allergy and Milieu in Stockholm, an Epidemiological Study; BE, general behaviour; BP, bodily pain; CH, changes in health; CI, confidence interval; FA, family activities; FC, family cohesion; FHS, food hypersensitivity; GH, general health; HRQL, health-related quality of life; MH, mental health; PE, parental impact – emotional; PF, physical functioning; PT, parental impact – time; REB, role/emotional behaviour; RP, role/social-physical; SE, self esteem.

a population-based birth cohort that is being continuously monitored (BAMSE: Children, Allergy and Milieu in Stockholm, an Epidemiological Study), employing a nested case-control design.

## Methods

The Swedish birth cohort project BAMSE from which our subjects were recruited has been described in detail elsewhere (11–13). In brief, background data on 4089 infants born in specific areas of the Stockholm region between 1994 and 1996 were collected by having their parents fill out questionnaires when these infants were approximately 2 months old. Subsequently, these same parents filled out repeated questionnaires concerning symptoms of allergic disease during the period when their children were between 1 and 4 years of age.

The present study employed a nested case-control design based on data from the questionnaire filled out at 4 years of age, from which we could identify 689 children who, according to their parents, demonstrated symptoms of FHS. Six-hundred and eighty-nine (689) children whose parents reported no such symptoms were randomly selected for inclusion as well (Fig. 1). In 2004, when these 1378 children were 9 years old, their parents were sent a questionnaire composed of a generic HRQL instrument and disease-specific questions. The response rate was 76%, with a complete response being obtained from 1014 families (74%). At this point, 212 of the children now fulfilled the criteria for FHS (see below). The remaining 802 children with no parentally reported symptoms of FHS were divided into two groups, i.e. 'children with allergic disease such as asthma, eczema or rhinitis, but with no reported symptom of FHS' ( $N = 221$ ), and those 'with no reported symptoms of any allergic disease' ( $N = 581$ ) (Fig. 1).

### Criteria for FHS

Food hypersensitivity was considered to be present in children where the parents reported that wheezing, a prolonged cough (symptoms from lower airways), a runny or stuffy nose in the absence of a common cold, itchy or watery eyes, eczema, urticaria, vomiting/diarrhoea or symptoms to be described freely by the parents following ingestion of a specific food had occurred on at

least one occasion during the past 12 months. Moreover, children who had previously demonstrated such food-related symptoms but not during the past 12 months because they had avoided the food in question were also considered to have FHS, since such dietary restrictions might also exert a negative influence on HRQL.

Pronounced FHS was considered to be present in children reported as having symptoms from the lower airways, symptoms at least once a month or more than one symptom. Children with 'any other allergic disease' were defined as those with asthma, eczema and/or rhinitis and with no reported FHS. These same criteria have all been employed in previous studies on allergic disease involving the BAMSE cohort (14–16).

### Food-specific IgE

Blood samples were analysed for IgE antibodies against a mixture of six common food allergens, i.e. cow's milk, hen's egg, peanut, soy bean, wheat and cod fish (fx5<sup>®</sup>, Immuno-CAP<sup>TM</sup>, Phadia AB, Uppsala, Sweden). An IgE-antibody level  $\geq 0.35$  kU<sub>A</sub>/l (of a maximal 100 kU<sub>A</sub>/l) was considered positive.

### The HRQL questionnaire

The parental form of the CHQ containing 28 items, was utilized to explore parental perception of their child's HRQL. By using a generic instrument we could detect differences in overall HRQL in different groups.

Validation of this CHQ-PF28 in several countries has consistently indicated that the scores obtained are psychometrically reliable with an acceptable level of internal consistency, discriminant validity, convergent validity and factor structure (17). The Swedish version of CHQ-PF28 has been shown to be valid for Swedish children 9–16 years of age (18, 19). The 28 different items in this questionnaire can be aggregated into 13 subscales (Table 1), the interpretation of which is simplified by converting the raw scores obtained to a value between 0 and 100 scale with higher values indicating better HRQL.

To provide measures of parental perceptions of limitations in daily life as well as of the consequences and/or emotional impact which the child's FHS may have on the child itself and on the parents, this questionnaire was supplemented with disease-specific questions. These questions could be answered with either a 'no,

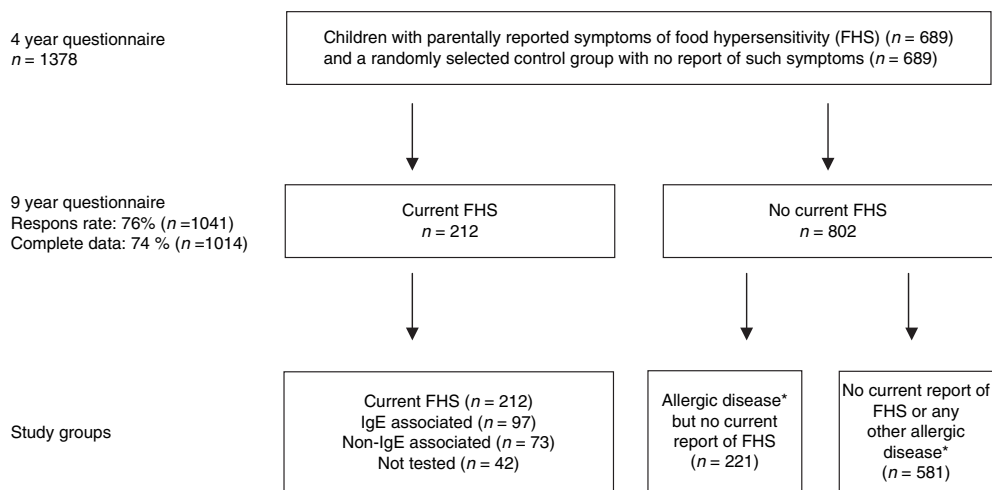


Figure 1. Flow-chart illustrating our recruitment of children from a birth cohort study of 4089 children, employing a nested case-control design. \*Allergic disease: presence of asthma, allergic rhinitis or eczema.

Table 1. Definition of the subscales covered by the CHQ-PF28 and their definitions

| Subscale                                        | No. of items | Definition                                                                                                                   |
|-------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------|
| Physical functioning                            | 3            | Limitations in physical activities                                                                                           |
| Role/social limitations – emotional/behavioural | 1            | Limitations in school or social activities due to emotional or behavioral problems                                           |
| Role/social limitations – physical              | 1            | Limitations in school or social activities due to physical problems                                                          |
| Bodily pain/discomfort                          | 1            | Intensity/frequency of pain/discomfort                                                                                       |
| Behaviour                                       | 4            | Ability to get along with others, behavioral problems including aggression, delinquency, impulsiveness and social withdrawal |
| Mental health                                   | 3            | Positive and negative states, including anxiety, depression and positive affect                                              |
| Self esteem                                     | 3            | Satisfaction with school, athletic ability, appearance, ability to get along with others                                     |
| General health perceptions                      | 4            | Perception of overall health and illness                                                                                     |
| Parental impact – emotional                     | 2            | Distress and worry experienced by parents or guardians concerning the child's condition                                      |
| Parental impact – time                          | 2            | Limitations on personal time experienced by parents as a result of the child's condition                                     |
| Family activities                               | 2            | Limitations in and interruption of normal family activities and family tension as a result of the child's condition          |
| Family cohesion                                 | 1            | Ability of family-members to get along with one another                                                                      |
| Change in health                                | 1            | Changes in health compared to 1 year ago                                                                                     |

never' or 'yes, sometimes/often/always' alternatively 'does not agree at all/does not agree very well' or 'agrees partly/completely'. The disease-specific questions were based on clinical experience, the scientific literature and interviews with both children with reported symptoms of FHS and their parents. Identical questions concerning children with reported reactions to furry pets have also been developed and will be described elsewhere. Following the interviews, the disease-specific questions were tested on the parents of 8- to 9-year-old children with a food and/or pet allergy, but who were not participants in the BAMSE-project, and their comments prompted only minor revisions. The disease-specific questions that were answered with a 'yes, sometimes/often/always' or 'agrees partly/completely' by at least 5% of the parents and with an internal missing of maximum 5% were analysed (Table 3).

### Statistical analyses

The descriptive data are presented as numbers, percentages, geometric mean or 95% confidence intervals (CI). To test for significant proportional differences between the groups, the chi-squared procedure was employed. The scores of the CHQ-PF28 were calculated in accordance with the user's manual and subjected to two-group comparisons utilizing the Kruskal-Wallis test (17). The internal consistency of the CHQ-PF28 subscales and summary scales, ranged from 0.86 and 0.88 as determined by Cronbach's alpha. All analyses were performed using the STATA 8.0 software (Stata, College Station, TX, USA), and a *P*-value of  $\leq 0.05$  was considered to be statistically significant.

Ethical approval for the follow-up of the BAMSE cohort at 9 years of age was obtained from the Ethics Committee at Karolinska Institutet in Stockholm. Informed consent was obtained from the parents in all families participating in the study.

### Results

Among the 212 children with FHS, the following food-related symptoms of FHS were reported: symptoms from the lower airways (15%), rhinitis and/or conjunctivitis (34%), eczema (44%), urticaria (25%), vomiting/diarrhoea (22%), and 'other symptoms', i.e. oral allergy syndrome, colic or rash (23%). For 18 of these children were such 'other symptoms' reported as the only sign of FHS. There were 42% (CI 35–49%) girls and 58% (CI 51–65%) boys among the children with FHS, as compared to 50% (CI 44–47%) girls and 50% (CI 43–46%) boys in the control group ( $P = 0.08$ ). Moreover, there were no statistically significant differences with respect to common background factors such as gender, parental allergic disease or socio-economic variables between the children who remained in our study and nonresponders.

#### The CHQ-PF28

As depicted in Fig. 2, the mean CHQ-PF28 scores for children with FHS were significantly lower than those for children with allergic disease other than FHS on the subscales physical functioning (PF), role/social limitations – physical (RP) and general Health (GH). We also compared children with FHS with children without any allergic disease, and statistically significant differences were found in the subscales PF, RP and GH, but also on role/social limitations – emotional/behavioural (REB), bodily pain (BP), mental health (MH) and parental impact – emotional (PE).

The scores for children with pronounced FHS are presented separately (Table 2). Children with food-related symptoms involving the lower airways ( $n = 32$ ) or that occurred at least once each month ( $n = 70$ ) received scores, on six of the 13 subscales, that were significantly lower than those of children with allergic disease other than FHS, while children demonstrating two or more symptoms of FHS scored lower on seven subscales. The specific subscales are presented in Table 2. Children with FHS, reported to be caused by two or more different food items, scored significantly lower on the GH subscale (71.4) as compared to children who reported reactions to fewer food items (79.9,  $P = 0.02$ ).

The impact of sensitization to food (fx5<sup>®</sup> IgE-antibody level  $\geq 0.35$  kU/Al) on the HRQL in children with FHS was also analysed. In those cases where data on the antibody level were available, i.e. for 170 of the 212 children, 97 (57%) were sensitized to food. There was a significant difference between these two groups only for the subscale BP, where children who were *not* sensitized had a significantly lower score, 74.9 as compared to 86.5 ( $P < 0.001$ ) for the children who were sensitized. This difference was not related to gastro-intestinal symptoms, including colic.

We also examined the quantitative levels of food-specific IgE antibody levels in relation to the subscales scores. Children with FHS and sensitized to food

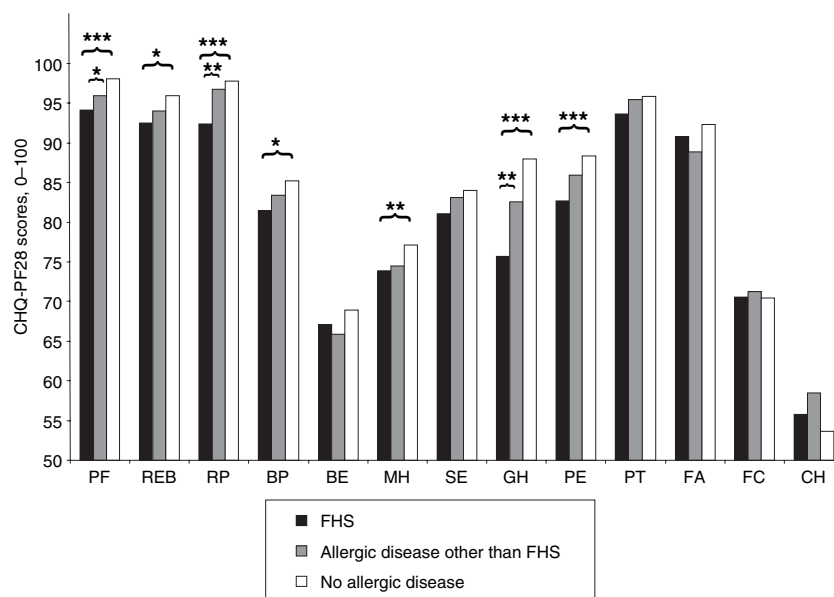


Figure 2. CHQ-PF28 scores obtained for children with reported food hypersensitivity (FHS), allergic disease other than FHS or no reported allergy. \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

(fx5<sup>®</sup>  $\geq 0.35$  kU<sub>A</sub>/l) among whom the IgE-antibody level was higher than the geometric mean ( $> 5.34$  kU<sub>A</sub>/l), scored significantly lower in the subscales MH as compared to those with an IgE-antibody level below the geometric mean, 72.2 and 76.0 respectively ( $P < 0.05$ ). The corresponding figures for the subscale GH was 67.5 and 78.8,  $P < 0.01$ . No such difference was observed for any of the other scales (data not shown).

Among the 212 cases, 62% had a physician-diagnosed food allergy. This did not affect the mean scores negatively in any of the subscales. However, the mean REB subscale score was 94.2 for children with a diagnosis of FA as compared to 89.6 among children without such a diagnosis ( $P = 0.01$ ).

#### Disease-specific questions

In Table 3, the answers to the disease-specific questions are compared between children reported to have pronounced symptoms of FHS and children with mild symptoms. The proportion of children sensitized to food in these two groups was the same (data not shown). Pondering over her/his FHS and feelings of sadness due to FHS were the most frequently reported disease-specific phenomena. It is also noteworthy that 51% (42–60%) of children with pronounced FHS and 41% (30–52%) of children with mild FHS received special meals at school. Furthermore, 50% (41–58%) and 31% (21–41%) of these same groups, respectively, had special meals prepared for them at home, an observation that highlights the problems experienced by the child and her/his family.

With respect to several of these disease-specific questions, the differences between children with pronounced

and mild symptoms of FHS were statistically significant (Table 3). Feelings of sadness and restriction in every day life and conflicts within the family due to the child's FHS were more common in families where the child had a pronounced FHS. For more detailed information on disease-specific questions, see Table 3.

#### Discussion

In the present investigation, we demonstrate for the first time that children from a population-based cohort who were reported by their parents to have FHS displayed significantly lower scores, on certain subscales in the HRQL instrument employed, than did children with asthma, eczema or rhinitis, but not FHS. Thus, it can be tentatively concluded that our findings reflect the situation for children with FHS and not for allergic children in general. This conclusion is strengthened by the observation that in the case of pronounced FHS, the differences were even greater and that high levels of IgE antibodies towards common foods were associated with significant reductions in the scores for the MH and GH subscales. The differences in the mean scores for children with FHS and with other allergic disease were particularly large in the case of the PF, GH and RP subscales of the generic CHQ-PF28 instrument. The clinical importance of these findings requires further investigations in order to improve treatment of children with FHS.

In this context, our observations that the subscales concerning behaviour (BE), self esteem (SE), parental impact - time (PT) and family activities (FA) were not influenced by FHS are encouraging, as is the absence of

Table 2. Comparison of the mean scores on the Child Health Questionnaire Parental Form 28 sub-scales for 9-year-old children with pronounced symptoms of FHS (B, C, D) and children with allergic disease (asthma, eczema or rhinitis), but with no FHS (A)

| Subscale                                        | Mean score (n)                                                              |                                                                        |                                                                          |                                                                     | P-values |        |
|-------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------|----------|--------|
|                                                 | A. Children without FHS, but with at least one other allergic disease (221) | B. FHS children with food-related symptoms from the lower airways (32) | C. FHS children with food-related symptoms at least once each month (70) | D. FHS children with at least two different reported symptoms (101) | A vs B   | A vs C |
| Physical functioning                            | 96.0                                                                        | 88.1                                                                   | 91.0                                                                     | 90.0                                                                | <0.001   | 0.002  |
| Role/social limitations – emotional/behavioural | 94.0                                                                        | 83.3                                                                   | 89.2                                                                     | 87.8                                                                | 0.07     | 0.08   |
| Role/social limitations – physical              | 96.8                                                                        | 81.2                                                                   | 86.8                                                                     | 86.5                                                                | <0.001   | <0.001 |
| Bodily pain/discomfort                          | 83.4                                                                        | 78.8                                                                   | 72.1                                                                     | 77.7                                                                | 0.1      | 0.001  |
| Behaviour                                       | 65.9                                                                        | 64.3                                                                   | 65.3                                                                     | 64.8                                                                | 0.8      | 0.8    |
| Mental health                                   | 74.5                                                                        | 69.8                                                                   | 71.1                                                                     | 68.2                                                                | 0.2      | 0.1    |
| Self esteem                                     | 83.1                                                                        | 75.8                                                                   | 79.0                                                                     | 77.6                                                                | 0.03     | 0.1    |
| General health perceptions                      | 82.6                                                                        | 62.3                                                                   | 72.8                                                                     | 67.5                                                                | <0.001   | 0.002  |
| Parental impact – emotional                     | 85.9                                                                        | 77.3                                                                   | 78.3                                                                     | 75.6                                                                | 0.2      | 0.02   |
| Parental impact – time                          | 95.4                                                                        | 85.3                                                                   | 88.9                                                                     | 90.2                                                                | 0.004    | 0.04   |
| Family activities                               | 88.9                                                                        | 88.7                                                                   | 86.8                                                                     | 88.8                                                                | 0.7      | 0.4    |
| Family cohesion                                 | 71.3                                                                        | 58.4                                                                   | 73.1                                                                     | 67.1                                                                | 0.001    | 0.7    |
| Change in health                                | 58.5                                                                        | 58.6                                                                   | 56.7                                                                     | 56.4                                                                | 1.0      | 0.5    |

FHS, food hypersensitivity.

any difference between children with FHS and other allergic disease in the score for MH. Furthermore, by 9 years of age, the family should have adjusted more-or-less to the child's FHS, which might explain why the FA subscale was not affected. However, since CHQ-PF28 is a generic instrument, specific areas that might be of importance for HRQL in children with FHS can not be captured.

Even though the children reported to show symptoms of FHS had a poorer HRQL than our control children, many of these former children nonetheless had relatively high CHQ-PF28 scores. This situation can probably be explained by the population-based design of our study, which meant that a number of children were likely to have had a relatively mild form of FHS. In contrast, Sicherer et al. (8) have reported that children with confirmed food allergy and recruited from hospital patients, rather than from a general population, exhibit a HRQL that was below the norm for the USA. Moreover, children allergic to peanuts and also recruited among hospital patients have been found to have a HRQL that is as poor as or even poorer than that of children suffering from rheumatoid disease or diabetes (6, 7).

Although we are well aware that there may be a discrepancy between perceived and actual FHS, we have chosen to study perception of this condition, since such a perception itself may exert an influence on daily life and the HRQL. In attempt to minimize the possibility that this choice might make it harder to reveal certain associations, we divided our children into phenotypes with report of pronounced or mild symptoms of FHS and, in addition, analysed the HRQL outcome in relationship to the levels of food-specific IgE antibodies. Furthermore, adding a physician's diagnosis of food allergy into the analysis did not have a negative impact on any of the subscales. In our opinion this observation strengthens our hypothesis that the perception of FHS in the child, in combination with parental anxiety, has an impact on HRQL irrespective of diagnosis of food allergy.

For both logistic and ethical reasons, we did not perform any oral provocation in this cohort. A procedure of oral provocation among those 9-year-olds including both cases and controls might have hampered coming follow-ups. Whether the parents are right or wrong in their perception of their child, objective diagnosis on the basis of an oral challenge does not always appear to result in changes in behaviour or avoidance of food (20, 21). This fact supports the idea that parental perception may actually have greater impact than the word of a physician. To meet the needs of confirmed diagnosis we analysed the results by dividing the children into children above or below the geometric mean of IgE to foods or to physician-diagnosed food allergy or not. This had all very little impact on the results.

To our knowledge, this is the first population-based study concerning the impact of FHS on the HRQL

Table 3. Comparison of children with report of pronounced (A) or mild (B) FHS with respect to limitations in the daily activities, emotional impact and consequences for both the child and the family

|                                                                                                                             | N    | A. Children with symptoms from the lower airways, symptoms occurring at least once each month and/or at least two different symptoms (n = 126) % | B. Children with FHS but no symptoms from the lower airways, symptoms less than once a month and <2 different symptoms (n = 82) % | A vs B, P-value† |
|-----------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------|
| <i>Items concerning the child‡</i>                                                                                          |      |                                                                                                                                                  |                                                                                                                                   |                  |
| Ponders over her/his food hypersensitivity                                                                                  | 202  | 76                                                                                                                                               | 61                                                                                                                                | 0.02             |
| Feels sad about being food-hypersensitive                                                                                   | 203  | 56                                                                                                                                               | 36                                                                                                                                | 0.006            |
| Receives special meals at school                                                                                            | 205  | 51                                                                                                                                               | 41                                                                                                                                | 0.2              |
| Experience anxiety about developing acute symptoms                                                                          | 203  | 41                                                                                                                                               | 34                                                                                                                                | 0.3              |
| Feels restricted in everyday life                                                                                           | 201  | 18                                                                                                                                               | 8                                                                                                                                 | 0.04             |
| Feels that she/he is different from other children                                                                          | 202  | 18                                                                                                                                               | 10                                                                                                                                | 0.1              |
| Does not eat out at restaurants                                                                                             | 206  | 12                                                                                                                                               | 6                                                                                                                                 | 0.2              |
| Cannot eat meals at the homes of friends                                                                                    | 205  | 10                                                                                                                                               | 2                                                                                                                                 | 0.05             |
| Cannot spend the night at the homes of friends                                                                              | 206  | 8                                                                                                                                                | 0                                                                                                                                 | 0.01             |
| Cannot participate in school outings                                                                                        | 206  | 6                                                                                                                                                | 6                                                                                                                                 | 0.8              |
| <i>Items concerning the parents or entire family‡</i>                                                                       |      |                                                                                                                                                  |                                                                                                                                   |                  |
| Experience difficulties in interpreting the list of ingredients on food items                                               | 179‡ | 68                                                                                                                                               | 61                                                                                                                                | 0.3              |
| Prepare different meals for the child and for the rest of the family                                                        | 206  | 50                                                                                                                                               | 31                                                                                                                                | 0.008            |
| Adjust the diet of the entire family to be suitable for the child with FHS                                                  | 205  | 32                                                                                                                                               | 32                                                                                                                                | 0.9              |
| Feel anxious about the child developing acute symptoms                                                                      | 208  | 30                                                                                                                                               | 34                                                                                                                                | 0.5              |
| Experience conflicts within the family over how to deal with the child's FHS                                                | 201  | 25                                                                                                                                               | 6                                                                                                                                 | 0.001            |
| Feel concerned about the future health of the child being affected negatively                                               | 203  | 17                                                                                                                                               | 11                                                                                                                                | 0.2              |
| Feel concerned about the child not receiving all the nourishment she/he needs                                               | 203  | 17                                                                                                                                               | 6                                                                                                                                 | 0.02             |
| Often abandons/changes plans and/or activities/vacations                                                                    | 208  | 17                                                                                                                                               | 6                                                                                                                                 | 0.02             |
| Do not feel secure that school personnel can care for the child properly if she/he should develop symptoms of FHS at school | 205  | 10                                                                                                                                               | 19                                                                                                                                | 0.09             |
| Feel reluctant to leave the child with another care-taker/baby-sitter                                                       | 203  | 10                                                                                                                                               | 9                                                                                                                                 | 0.8              |
| Experience limitations in relationships to friends                                                                          | 204  | 9                                                                                                                                                | 0                                                                                                                                 | 0.007            |
| Feel anxious about being overprotective                                                                                     | 202  | 7                                                                                                                                                | 11                                                                                                                                | 0.3              |
| Express concerns about how to teach the child what food she/he should avoid                                                 | 203  | 7                                                                                                                                                | 10                                                                                                                                | 0.4              |

The figures are presented as percentages of answers that were positive. †0–5% internal missing in the disease-specific questions; ‡this question was only asked of those who have answered that they actually read the lists of ingredients. FHS, food hypersensitivity.

of 9-year-old children and their parents/families to be reported. An additional strength of our present investigation is the relatively large number of children involved, which allowed us to compare children with different phenotypes of reported FHS including IgE-associated FHS. The more detailed findings thus obtained supported our hypothesis. Furthermore, by combining a generic HRQL instrument such as CHQ-PF28 with disease-specific questions (22), we were able to make other comparisons that helped us identify factors associated with FHS that exerts a significant impact on HRQL. We are aware that the disease-specific questions are not yet validated, and the results on these questions should therefore be interpreted with caution. Nevertheless we feel our disease-specific data provide interesting information.

We are also cognizant of the fact that it can be difficult to disentangle the impact of FHS on HRQL from the impact of atopic disease in general. In attempt to minimize this difficulty we compared our children with FHS not only to a group of healthy children, but also to children with an allergic disease (i.e. asthma, eczema and/or rhinitis) other than FHS. In addition, our population-based design as well as our relatively large number of subjects makes it reasonable to generalize our findings.

In the present study, we cannot separate completely parental perception of the child's HRQL from the HRQL of the family as a whole, since certain of the subscales of the CHQ-PF28 also encompass the HRQL of the parents and family. Accordingly, our interpretation of the findings is that FHS in children leads to limitations, restrictions, anxiety and frustration which presumably exert an impact on the HRQL of not only the child her/himself, but of the entire family, especially if the child suffers from pronounced FHS. Our hope is that the observations

described here will contribute to a better understanding of the impact of FHS on daily life and of both the patient's and family's perception of FHS and, thus, help improve healthcare for this group of children. Our future goal is to pinpoint central factors that influence the HRQL of children with FHS and of their families.

## Conclusions

Food hypersensitivity reported to be present in 9-year-old children by their parents exerts a negative impact on the parents' perception of the child's HRQL. This impact appears to be most pronounced in the case of children with reported symptoms from the lower airways, frequent symptoms and/or multiple symptoms of FHS. Furthermore, increasing levels of food-specific IgE is also related to a more serious impairment of HRQL. It is important for healthcare-givers to acknowledge that FHS in a child is likely to affect not only the child her/himself, but the HRQL of the entire family as well, and accordingly support these children and their families in order to enable them to improve and maintain a good HRQL.

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