

Online version of the food allergy quality of life questionnaire–adult form: validity, feasibility and cross-cultural comparison

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Clinical & Experimental Allergy

Summary

Background Food-allergic reactions occur in 3–4% of the adult population in Western countries. It has been shown that food allergy may impair health-related quality of life (HRQL). Food allergy quality of life questionnaires (FAQLQs) have been developed and validated, including an adult form (FAQLQ-AF). These questionnaires may be particularly useful for cross-cultural comparisons.

Objectives The aims of this study were to translate the FAQLQ-AF from Dutch into English and validate an online version in the United States. Additionally, HRQL of American and Dutch food-allergic adults was compared.

Methods The Dutch FAQLQ-AF was translated into English as set out by the World Health Organization and converted to an electronic online format. Participants (food allergic American adults) were recruited through the 'Food Allergy and Anaphylaxis Network' website and completed the questionnaire online. Construct validity, internal consistency, discriminative ability and feasibility were analysed. A cross-cultural comparison was made using the Dutch FAQLQ-AF scores.

Results Data from 180 American participants were analysed. The online FAQLQ-AF had a good construct validity (correlation with FAIM: $\rho = 0.72$; $P < 0.001$), internal consistency (Cronbach's $\alpha = 0.95$) and was discriminative for 'anaphylaxis' vs. 'no anaphylaxis' and 'number of food allergies'. The most striking finding was a significantly greater impairment in HRQL in the American participants, as compared with their Dutch counterparts (the total FAQLQ-AF scores were 4.3 vs. 3.5, respectively; $P < 0.001$, where 1 signifies no impairment and 7 signifies extreme impairment in HRQL).

Conclusions and Clinical Relevance The online American FAQLQ-AF is a valid instrument to measure HRQL in food-allergic patients in the United States. Additionally, HRQL of American food-allergic adults may be more impaired than Dutch food-allergic adults. The FAQLQ-AF can now be used to determine the HRQL in American food-allergic adults and can assist clinicians in optimizing management strategies for food-allergic patients.

Keywords EuroPrevall, food allergy quality of life questionnaire, food allergy, health-related quality of life, USA

Submitted 28 May 2010; revised 3 December 2010; accepted 2 January 2011.

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Cite this as: N. J. Goossens,

B. M. J. Flokstra-de Blok, B. J. Vlieg-Boerstra, E. J. Duiverman, C. C. Weiss, T. J. Furlong and A. E. J. Dubois, *Clinical & Experimental Allergy*, 2011 (41) 574–581.

Introduction

Of the Western adult population, 3–4% experience allergic reactions to foods [1]. This prevalence seems to have increased over the last 10 years [2]. Only a few foods cause most of the allergic (IgE-mediated) reactions: egg, milk, peanut, tree nuts and (shell)fish [3]. Unfortunately,

the only established way to manage food allergy is avoidance of the food that could potentially lead to allergic reactions. Additionally, the food-allergic individuals at risk of anaphylaxis should carry an epinephrine auto-injector (EAI) for emergency treatment [4].

It has been shown that experiencing food-allergic reactions impairs health-related quality of life (HRQL)

[5, 6]. Also, there seems to be no difference in HRQL between patients with a self-diagnosed food allergy and those in whom this has been verified by established clinical tests [7]. One of the major objectives of an international, multinational research project (EuroPrevall) was to develop and validate a series of questionnaires specific for the measurement of HRQL in food-allergic individuals. Four food allergy quality of life questionnaires (FAQLQs) have been developed and validated: the Food Allergy Quality of Life Questionnaire – Parent Form (FAQLQ-PF), – Child Form (FAQLQ-CF), – Teenager Form (FAQLQ-TF) and – Adult Form (FAQLQ-AF) [8–11].

The FAQLQ-PF, which was developed and validated in Ireland, has already been successfully translated and validated for use in the United States [11]. The FAQLQ-CF, FAQLQ-TF and FAQLQ-AF were developed and validated in the Netherlands, and an important aim of this study was to test the translated FAQLQ-AF for validity, reliability and feasibility in the language and cultural setting of the USA.

HRQL questionnaires may be more efficient when they are available online than when administered in a conventional paper format. Several studies have compared electronic and paper HRQL questionnaires. No significant differences in the validity and the obtained HRQL scores were found in studies comparing paper and electronic questionnaires in patients with irritable bowel syndrome [12] and asthma [13]. In the irritable bowel syndrome study, 50% of the subjects preferred the electronic version (13.9% preferred the paper version and 36.1% had no preference). The asthma study even found a preference of 69% for the electronic version. Several other studies have shown that electronic questionnaires are reliable [14], time-efficient [15] and that the results contain fewer missing values than with paper questionnaires [16]. It was therefore of interest to validate online versions of the FAQLQs.

The aims of this study were to validate the FAQLQ-AF in food-allergic individuals in the United States and to investigate the feasibility of the online version of this questionnaire. Subsequently, the outcomes of the online FAQLQ-AF in the United States were compared with the original Dutch FAQLQ-AF paper version.

Methods

Participants and procedure

Participants aged 18 years and older were recruited through the Food Allergy & Anaphylaxis Network (FAAN) website [17] by an advertisement under the 'research' link. By clicking on the link, participants directly entered the online English version of the FAQLQ-AF. Once the questionnaire had been completed, it was not possible to fill out the questionnaire again on that particular computer.

All patients with one or more food allergies, whether diagnosed by a health care professional or not, were included. Patients who only suffered from oral symptoms were excluded.

Materials

The original Dutch FAQLQ-AF was developed and validated in the Netherlands. Validation was performed using the Food Allergy Independent Measure (FAIM), which was developed especially for this purpose. The FAIM consists of four questions about the outcome expected by the participant following ingestion of the culprit food, one question about the number of foods one needs to avoid, and one question about the perceived impact on social life. The FAIM was found to be reliable and useful for establishing construct validity for HRQL questionnaires in food-allergic patients [8–11, 18, 19].

The participants answered the individual questions of the FAQLQ-AF and the FAIM on a 7-point scale (where 1 corresponds to no impairment and 7 to extreme impairment in HRQL). The individual items of the FAQLQ-AF may be found in Table 2. The FAQLQ-AF, FAIM and descriptive questions are included as an online repository. The total FAQLQ-AF score is the average score of all items of the FAQLQ-AF from an individual participant.

Translation and conversion

The Dutch FAQLQ-AF, FAIM and descriptive questions (concerning age, gender, type and number of food allergies, type of symptoms and diagnosis) were translated into English using the methodology set out by the World Health Organization [20]. The questionnaire package was first translated into English by a native English speaker (forward translation). Thereafter, the English questionnaire package was translated back into Dutch by a native Dutch speaker (back translation). And finally, the back translation was compared with the original Dutch version by a review committee. No important differences in the content or the meaning of the questions emerged.

The English questionnaire package (FAQLQ-AF, FAIM and descriptive questions) was converted into an online version using the survey software from <http://www.surveymonkey.com>. The content and the layout of this online questionnaire package were comparable with the original paper questionnaire package.

Construct validity and internal consistency

The construct validity of the online, English version of the FAQLQ-AF was investigated by computing the correlation between the FAQLQ-AF and the FAIM (individual FAQLQ-AF questions with total FAIM score; individual FAQLQ-AF questions with individual FAIM questions; total FAQLQ-

AF score with the total FAIM score). Moderate correlation coefficients (0.40–0.60) were expected [21]. Subsequently, the internal consistency of the FAQLQ-AF was measured using Cronbach's Alpha. An $\alpha \geq 0.70$ indicates good internal consistency [21].

Discriminative ability

Discriminative ability of the questionnaire was tested by grouping all participants, based on the characteristics that were expected to demonstrate significant differences in the total FAQLQ-AF scores. These groups were therefore based on gender (men vs. women) [7, 22, 23], severity of the allergy (experience of anaphylaxis vs. no experience of anaphylaxis) [10, 18, 24, 25] and number of food allergies (more than 3 vs. 3 or less) [6, 10, 18]. Anaphylaxis was determined by using the definition of the 'Symposium on the Definition and Management of Anaphylaxis' [24, 25]. Only the first criterion formulated during this symposium was used to identify participants who experienced anaphylaxis (acute onset of an illness with the involvement of the skin, mucosal tissue or both, with symptoms of respiratory compromise, reduced blood pressure or associated symptoms of end-organ dysfunction). This criterion was judged to have a sensitivity of 80% to identify anaphylaxis [24].

Feasibility

To evaluate the feasibility of the online version of the FAQLQ-AF, the time spent completing the questionnaire package was measured. Floor and ceiling effects of the online FAQLQ-AF were also investigated (i.e. floor effects and ceiling effects were measured as the percentages of the participants that reported a minimum and a maximum total FAQLQ-AF score, respectively) [26].

Cross-cultural comparison

The online version of the FAQLQ-AF and the resultant scores in the United States were compared with the results of 72 Dutch participants who completed a paper version during a previous study [10]. The participant characteristics, the total FAQLQ-AF scores, the total FAIM scores, construct validity and discriminative ability were compared.

Ethical approval

This study was part of the EuroPrevall Project, an international, multicentre research project funded by the European Union. Ethical approval was not needed, as the local medical ethics review commission (METC 2005/051) deemed that this research project did not fall within the Medical Research Involving Human Subjects Act. Parti-

cipants were informed about the study immediately after entering the link on the FAAN website.

Statistical analyses

Descriptive characteristics of the American participants were tested using the χ^2 test (gender distribution) and the Mann-Whitney *U*-test (age distribution). Construct validity was tested by calculating the Spearman's correlation coefficient of the individual questions of the FAQLQ-AF and the total FAQLQ-AF score with the total FAIM score. Discriminative ability was measured using the Mann-Whitney *U*-test. The time that a participant needed to fill out the questionnaire package was calculated by subtracting the start time from the end time. Cross-cultural comparisons concerning the descriptive characteristics of the American and Dutch participants were made using both the χ^2 test and the Mann-Whitney *U*-test. Subsequently, the outcomes of the total FAQLQ-AF score, total FAIM score and the individual FAQLQ-AF questions of the American and Dutch participants were compared using the Mann-Whitney *U*-test. The non-parametrical Mann-Whitney *U*-test was used when skewing of data was determined by the Kolmogorov-Smirnov test. Statistical analyses were performed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA).

Results

Participants

Between January 5 and March 11, 2009, 228 participants filled out the online FAQLQ-AF through the FAAN website. Participants were excluded because age was not reported ($n = 32$), age was under the minimum of 18 years ($n = 10$), gender was not reported ($n = 37$) or the symptoms experienced during an allergic reaction were not reported ($n = 30$). Data from 180 participants were available for analysis. The descriptive characteristics of these participants are shown in Table 1.

There were significantly fewer males than females, but no significant differences were found in the descriptive characteristics between male and female participants. All reported symptoms were grouped based on the organ system in which they occurred. Cardiovascular symptoms were reported in 51.7%, respiratory symptoms in 78.9%, gastrointestinal symptoms in 65.6%, skin symptoms in 82.8% and other symptoms in 69.4% of the participants. In Table 1, the symptoms are listed in order of decreasing severity [23, 24], where participants were allocated to groups according to their most severe symptom. The participants who were prescribed an EAI had the same gender distribution as participants who were not ($P = 0.93$), but those who had an EAI were significantly younger than those who did not (39 vs. 44 years; $P = 0.01$).

Table 1. Descriptive Characteristics of the American and Dutch Participants

	USA	Dutch	P
Participants (n)	180	72	
Gender (m/f)	22/158	18/54	0.01
Age, mean in years (SD)	40.6 (12.9)	37.2 (14.3)	0.06
Food Allergy, n (%)			
Tree nuts	80 (44.4)	42 (58.3)	0.12
Peanut	69 (38.3)	42 (58.3)	0.00
Milk	65 (36.1)	19 (26.4)	0.14
Shell fish	60 (33.3)	12 (16.7)	0.01
Soy	59 (32.8)	13 (18.1)	0.02
Fruit	54 (30.0)	35 (48.6)	0.10
Wheat	54 (30.0)	12 (16.7)	0.07
Vegetables	49 (27.2)	27 (37.5)	0.65
Egg	45 (25.0)	16 (22.2)	0.64
Fish	37 (20.6)	11 (15.3)	0.41
Sesame seed	35 (19.4)	13 (18.1)	0.80
Number of food allergies*, mean (SD)	3.49 (2.7)	3.51 (2.2)	0.46
Type of symptoms, n (%)			
Cardiovascular [†]	93 (51.7)	44 (61.1)	0.18
Respiratory tract [‡]	65 (36.1)	20 (27.8)	0.21
Gastrointestinal tract [§]	15 (8.3)	3 (4.2)	0.25
Skin [¶]	5 (2.8)	4 (5.6)	0.29
Other	2 (1.1)	1 (1.4)	0.86
Self-diagnosed food allergy, n (%)	20 (11.1)	9 (12.5)	0.76
EAI prescription, n (%)	113 (62.8)	14 (19.4)	<0.001

Bold values are $P < 0.05$.

*Number of food allergies for the specific foods mentioned in the table.

[†]Dizziness, palpitations, loss of vision, inability to stand, light headedness, collapse, loss of consciousness.

[‡]Tightening throat, difficulty swallowing, hoarseness, difficulty breathing, shortness of breath, wheezing, cough.

[§]Nausea, stomach cramps, vomiting, diarrhoea.

[¶]Itchy skin, red rash, swelling of the skin, hives, worsening eczema.

^{||}Swollen tongue or lips, symptoms of the nose or eyes.

Of all participants, 82.2% had experienced an anaphylactic reaction. These participants had the same gender distribution ($P = 0.96$) and age distribution ($P = 0.31$) as those who did not experience anaphylaxis. However, EAI prescription was significantly more frequent in the anaphylaxis group (69.6% vs. 31.2%; $P < 0.001$).

Construct validity and internal consistency

Construct validity was demonstrated by correlating the FAQLQ-AF with the FAIM. All individual questions of the FAQLQ-AF were significantly correlated with at least one of the FAIM questions (data not shown) and with the total FAIM score (shown in Table 2). Four of the 29 items did not reach the expected moderate correlation coefficient (0.40–0.60), which may indicate that these questions are less valid in the United States. The total FAQLQ-AF score correlated significantly with the total FAIM score

($\rho = 0.72$; $P < 0.001$). The FAQLQ-AF had an excellent internal consistency (Cronbach's $\alpha = 0.95$).

Discriminative ability

No significant difference was found in the total FAQLQ-AF scores between male and female participants (4.92 vs. 5.38; $P = 0.12$). The total FAQLQ-AF scores were significantly higher (indicating more impaired HRQL) in participants who had experienced anaphylaxis than in those who had not (5.41 vs. 4.89; $P = 0.03$). Also, the total FAQLQ-AF scores were significantly higher (indicating more impaired HRQL) in participants who were allergic to more than three foods than in participants allergic to three or less foods (5.7 vs. 5.1; $P < 0.001$).

Feasibility

In only 2 months, 180 participants could be included in this study. Moreover, these participants required an average time of < 12 min (11 min and 25 s; SD 15 min and 58 s) to fill out the total questionnaire package completely. The FAQLQ-AF had no floor or ceiling effects [no participants had the minimum mean score of 1 (best HRQL) or the maximum mean score of 7 (worst HRQL)].

Cross-cultural comparison

Participants. When comparing the American and Dutch participants, the percentage of female participants was found to be significantly greater in the United States (88% vs. 75%; $P = 0.01$). The mean age of the participants was comparable (41 vs. 37 years; $P = 0.06$). American participants reported allergy to shellfish (33% vs. 17%; $P = 0.01$) and soy (33% vs. 18%; $P = 0.02$) more frequently, while they reported allergy for peanuts less frequently (39% vs. 58%; $P = 0.00$). There were no significant differences in the prevalence of reported allergy to other foods. The mean number of reported foods to which individuals were allergic was not significantly different for American and Dutch participants (3.49 vs. 3.51; $P = 0.46$). Also, the severity of reported symptoms was comparable: cardiovascular (52% vs. 61%; $P = 0.18$), respiratory tract (36% vs. 28%; $P = 0.21$), gastrointestinal (8% vs. 4%; $P = 0.25$), skin (3% vs. 6%; $P = 0.29$) and other (1% vs. 1%; $P = 0.86$). The percentages of participants who did not obtain the diagnosis food allergy from a health care professional were similar (11.1% vs. 12.5%; $P = 0.76$). The percentage of American participants who were diagnosed by an allergist was comparable with the Dutch participants (67.2% vs. 62.5%; $P = 0.48$). There was no significant difference in the frequency of reported anaphylaxis between American and Dutch participants (82.2% vs. 81.9%; $P = 0.96$). However, the frequency of EAI prescription was

Table 2. Correlation Coefficient of the Individual FAQLQ-AF Questions with the Total FAIM Score in the USA and a Cross-Cultural Comparison of the FAQLQ-AF scores between the USA and the Netherlands

Individual FAQLQ-AF Questions	Total FAIM score*	FAQLQ-AF [†]		<i>P</i>
	USA	USA	Dutch	
How troublesome do you find it, because of your food allergy, that you				
1 must always be alert as to what you are eating?	0.52	6.0	4.6	<0.001
2 are able to eat fewer products?	0.48	5.8	5.3	0.049
3 are limited as to the products you can buy?	0.52	5.7	5.0	0.01
4 must read labels?	0.43	5.8	5.6	0.31
5 have the feeling that you have less control of what you eat when eating out?	0.48	5.8	4.4	<0.001
6 must refuse many things during social activities?	0.46	5.5	4.7	<0.001
7 sometimes frustrate people when they are making an effort to accommodate your food allergy?	0.33 [‡]	5.0	5.3	0.20
8 are less able to spontaneously accept an invitation to stay for a meal?	0.46	5.1	4.5	0.02
9 are less able to taste or try various products when eating out?	0.53	5.7	4.2	<0.001
10 can eat out less?	0.45	4.9	4.1	<0.001
11 must personally check whether you can eat something when eating out?	0.54	5.7	4.1	<0.001
12 hesitate eating a product when you have doubts about it?	0.47	5.9	4.1	<0.001
How troublesome is it, because of your food allergy				
13 that the ingredients of a product change?	0.51	5.4	4.7	0.01
14 that labels are incomplete?	0.46	5.6	4.6	<0.001
15 that the lettering on labels is too small?	0.35 [‡]	4.5	4.6	0.64
16 that the label states: 'May contain (traces of) ...'?	0.42	5.2	4.2	<0.001
17 that ingredients are different in other countries (for example during vacation)?	0.25 [‡]	4.3	4.5	0.47
18 that people underestimate your problems caused by food allergy?	0.43	5.9	4.6	<0.001
19 that it is unclear to which foods you are allergic? [§]	0.26 [‡]	3.6	4.3	0.02
20 that you must explain to those around you that you have a food allergy?	0.51	5.4	4.4	<0.001
21 for your host or hostess should you have an allergic reaction?	0.47	4.8	4.5	0.18
How worried are you because of your food allergy				
22 about your health?	0.54	5.0	4.1	<0.001
23 that the allergic reactions to foods will become increasingly severe?	0.52	5.4	4.4	<0.001
How frightened are you because of your food allergy				
24 of an allergic reaction?	0.63	5.3	4.8	0.04
25 of accidentally eating the wrong food?	0.53	5.2	5.3	0.87
26 of an allergic reaction when eating out despite the fact that your dietary restrictions have been discussed beforehand?	0.61	5.4	4.0	<0.001
Answer the following questions:				
27 To what degree do you feel you are being a nuisance because you have a food allergy when eating out?	0.41	5.1	4.0	<0.001
28 How discouraged do you feel during an allergic reaction?	0.50	5.8	4.3	<0.001
29 How apprehensive are you about eating something you have never eaten before?	0.55	5.6	3.4	<0.001
Total FAQLQ-AF score	0.72	5.3	4.5	<0.001

Bold values are $P < 0.05$.

*Spearman correlation coefficients between individual FAQLQ-AF questions and total FAIM score.

[†]FAQLQ-AF scores in the USA and the Netherlands, using Mann-Whitney *U*-test, range: 1.0–7.0; where 1.0 means no impairment.

[‡]Less valid items (correlation coefficients < 0.40).

[§]The only item were Dutch participants scored higher (more impaired HRQL) than the American participants.

significantly higher in the American participants (62.8% vs. 19.4%; $P < 0.001$).

Outcome of FAQLQ-AF and FAIM

American participants reported a significantly more impaired HRQL than Dutch participants (5.3 vs. 4.5; $P < 0.001$). The total FAIM scores in the American participants were also significantly higher than in Dutch participants

(4.4 vs. 3.9; $P = 0.00$). The standard deviations of the total FAQLQ-AF score and the total FAIM score were comparable in both groups [FAQLQ-AF (SD) 1.1 vs. 1.3 and FAIM (SD) 1.1 vs. 1.0].

In both the USA and the Netherlands, the total FAQLQ-AF scores were comparable between participants who were diagnosed by a health-care professional and participants who had a self-diagnosed food allergy (USA: 5.35 vs. 5.07; $P = 0.176$ and NL: 4.55 vs. 3.99; $P = 0.170$).

Table 2 shows the mean scores of the individual FAQLQ-AF items for the American and Dutch participants. Most of the questions were scored significantly higher in the American participants, indicating a more impaired HRQL. The biggest differences (more than 1.5 points) were seen in the following items: 'Less able to taste or try various products when eating out' and 'Feel discouraged during an allergic reaction'. Dutch participants scored significantly higher on only one question: 'Unclear to which foods you are allergic'.

Construct validity

The correlation of the total FAQLQ-AF score with the total FAIM score was 0.72 ($P < 0.001$) in the American participants, which was quite comparable to 0.76 ($P < 0.001$) [10] for the Dutch participants. The internal consistency of the online version of the FAQLQ-AF was also comparable to the original Dutch paper version (Cronbach's α 's were 0.95 and 0.97, respectively).

Discriminative ability

Discriminative ability was not shown for gender (male vs. female), in both American participants (4.92 vs. 5.38; $P = 0.12$) and Dutch participants (4.6 vs. 4.1; $P = 0.06$) [10].

However, discriminative ability was shown for experiencing anaphylaxis vs. not experiencing anaphylaxis in both American participants (5.4 vs. 4.9; $P = 0.03$) and Dutch participants (4.68 vs. 3.60; $P = 0.01$) [10]. Discriminative ability was also shown in American participants allergic to more than three foods vs. participants allergic to three or fewer foods (5.7 vs. 5.1; $P < 0.001$), which had also been shown in Dutch participants who scored 4.8 vs. 4.2, respectively ($P = 0.01$) [10].

Discussion

This study demonstrates that the online English version of the FAQLQ-AF is a valid and feasible instrument to measure health-related quality of life (HRQL) in food-allergic adults in the United States. This is an important step towards the understanding and evaluation of patient perceived HRQL in food-allergic patients. In addition, a significantly greater impairment in HRQL was shown in the American participants, as compared with their Dutch counterparts. The latter is a surprising finding, given the close similarity of the descriptive characteristics of the American and Dutch participants, including many features of food allergy that determine severity such as the number of foods causing symptoms and the type of symptoms reported. However, despite this similarity, the American participants perceived their food allergy as being more severe as measured with the FAIM and

had a greater impairment in HRQL as measured with the FAQLQ-AF.

This difference is unlikely to be the result of differences in the measurement properties of the original (Dutch language) and adapted (English language) instruments. It has been reported that the translation and adaptation of a quality of life instrument to another language and cultural setting could result in diminished responsiveness of the translated instrument [27], which would be expected to result in lower scores using the instruments in the new cultural setting. Therefore, the higher total FAQLQ-AF scores that were found in the American participants in the current study are unlikely to be due to an artefact resulting from the adaptation of the FAQLQ-AF.

Possible explanations for the consistently higher impairment scores in the American participants may be sought in cultural differences between the USA and the Netherlands. Unfortunately, only a few studies of cross-cultural differences in, for example, personality, health and coping are available [28, 29]. Other culture-related issues such as knowledge, attitudes and beliefs may differ between cultures and could possibly have accounted for the differences that were found in this study. The Chicago Food Allergy Research Surveys were developed to investigate these items in the United States [30, 31]. Such data are unavailable in the Netherlands, and it will therefore be of particular interest to adapt the Chicago Food Allergy Research Surveys for use in the Netherlands.

Another possible explanation is that there may be a greater variety and higher turnover of foods in the United States, compared with the Netherlands. Therefore, one might speculate that the risk of accidental exposure to injurious amounts of allergen is higher in the United States than in the Netherlands. Additionally, the risk of accidental exposure may have increased (in both the USA and the Netherlands) because of more stringent food labelling legislation. Several manufacturers lack the resources to implement allergen control systems and have therefore chosen to adopt precautionary labelling. Food-allergic consumers increasingly ignore these labels, which makes this precautionary food labelling a suboptimal allergen control practice [32, 33]. One might speculate that this precautionary labelling could be more common in the United States than in Europe because of greater food allergy awareness in the industry and more interest in protection against litigation in the United States, compared with the Netherlands.

Another explanation of the difference in the impairment scores between American and Dutch participants could be found in the differences in the practice of eating. In 1975, Americans spent much more time eating out than Europeans did. This difference became even greater in 2000 [34]. As eating out appeared to be one of the greatest risks for accidental exposure to food allergens [35], one might suggest that the need to avoid these practices may

have a great influence on quality of life for individuals who eat out frequently.

Finally, although the frequency of reporting anaphylaxis was similar in American and Dutch participants, American participants were more frequently prescribed an EAI. A previous study has shown that HRQL may deteriorate in patients who were prescribed an EAI [22], although this was in patients with venom allergy. The need to carry an EAI could remind allergic patients of the severity of their disease. Additionally, adult patients could be afraid or insecure about using the EAI during emergencies [36]. Thus, a possible cause of the greater impairment in the American participants included in this study may be the result of the higher prevalence of EAI ownership relative to Dutch participants.

A limitation of this study may be that the cross-cultural comparison may be influenced by unforeseen biases resulting from the differences in participant recruitment. Although the Dutch and American participants were surprisingly similar in many ways, including important characteristics related to food allergy, a number of potential biasing variables may exist. For example, all American participants entered the online FAQLQ-AF through the FAAN website; thus, the majority is likely to be a member of FAAN. These participants may possibly differ from non-members regarding food allergy education, involvement in research and innovation, health-related beliefs and attitude.

Four items of the FAQLQ-AF showed an insufficient correlation with the total FAIM score to confirm their validity in the United States. However, the total FAQLQ-AF showed good internal consistency and this internal consistency did not improve when the items mentioned were excluded from the questionnaire. Moreover, the FAQLQ-AF had shown good construct validity when tested with all 29 items included.

Although the online FAQLQ-AF showed good construct validity in American food-allergic adults, no single study can fully establish the psychometric properties of any questionnaire. The validation of a questionnaire is an

ongoing process and each study that investigates or uses the questionnaire makes the validity stronger. The validation process could for example be extended to obtain measurements from patients undergoing a food challenge or immunotherapy (longitudinal validity), as well as from patients who prefer to fill out the questionnaire in a conventional paper format. This could best be done in an outpatient clinic setting, in which the investigators are able to follow the patients and register the possible events affecting HRQL. However, until these studies are carried out, the FAQLQ-AF could be used in food-allergic adults as long as users keep this limitation in mind.

In conclusion, the online FAQLQ-AF is a feasible instrument to measure HRQL in food-allergic adults in the United States. The greater impairment that was found in HRQL in American than in Dutch participants deserves further investigation. In this context, differences in EAI prescription as well as the effects of such prescription on HRQL in food-allergic individuals are a priority.

Clinical relevance

The FAQLQ-AF can now be used to measure the impairment of HRQL in American food-allergic adults. This could be of great value in order to identify the possible factors that influence the HRQL in individual food-allergic adults. Therefore, the FAQLQ-AF could assist clinicians in designing (individual) management strategies that will optimize HRQL in food-allergic patients.

Acknowledgements

This research is supported by the EU through the Euro-prevall project (Food-CT-2005-514000) and Stichting Astmabestrijding (project 2009/014).

Sources of funding

This research is supported by the EU through the Euro-Prevall project (FOOD-CT-2005-514000) and Stichting Astmabestrijding (grant 2009/014).

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