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Published in:
Allergo Journal International

DOI:
10.1007/s40629-024-00314-8

Publication date:
2024

Document version:
Publisher's PDF, also known as Version of record

Allergo J Int
https://doi.org/10.1007/s40629-024-00314-8

Impact of dietary counselling on allergic reactions in children with food allergy

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Received: 13 August 2024 / Accepted: 23 September 2024

Summary
Purpose Dietary counselling in the field of food allergy aims primarily to empower individuals to prevent allergic reactions, but its impact on allergic reactions remains unclear. This study examined the impact of dietary counselling and other factors on allergic reactions in children with food allergies.
Methods In a multicentre study, parents of children (0–10 years) recently diagnosed with food allergies completed online questionnaires collecting data on subsequent allergic reactions. Data were collected at baseline and at 3, 6 and 12 months postdiagnosis. We fitted a negative binominal model to the data in order to quantify effects of counselling, time period and multiple food allergies on food allergy reaction rates.
Results Among the 48 enrolled children, 31 encountered a total of 85 food allergic reactions. The monthly reaction rate decreased from 0.28 in the first 3 months to 0.07 between 6 and 12 months. Children receiving counselling from a dietitian demonstrated a lower ratio (incidence rate ratio [IRR] = 0.37, confidence interval [CI] 0.19–0.72, $p = 0.004$). Those with more than three food allergies have an increased ratio compared to those with one to two food allergies (IRR = 6.18, CI 2.75–3.89, $p < 0.001$).
Conclusion Individual dietary counselling has the potential to prevent subsequent allergic reactions after diagnosis as it reduced the risk of allergic reactions by 63%. This impact might be most pronounced in the early months following diagnosis. Children with multiple food allergies are at a higher risk of allergic reactions and should, therefore, be prioritized to receive dietary counselling.

Keywords Dietitian · Food hypersensitivity · Allergic symptoms · Management · Paediatrics

Abbreviations

CI	Confidence interval
IR	Incidence rate

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Published online: 25 November 2024

IRR Incidence rate ratios
SE Standard error

Introduction

Reducing the number of allergic reactions an important aim in the management of food allergies [1]. Weiss and Marsac, for example, found that experiencing one anaphylactic reaction dramatically increased the risk of posttraumatic stress syndrome in children [2]. More recently, Kilic et al. confirmed that the fear of anaphylactic reactions afflicts children with food allergy and their families with higher levels of anxiety than healthy controls [3]. Reducing the number of allergic reactions may therefore reduce psychological and physical harms.

Various international studies have investigated allergic reactions in children with food allergies after diagnosis [4–10]. The annual reaction rates range between 0.1 and 0.8 reactions per child per year. In two comprehensive studies exploring allergic reactions in children with diverse food allergies, cow's milk, hen's egg, and peanut consistently displayed the highest rates, with milk ranking first [8, 9]. Between 20% and 70% of children experienced at least one allergic reaction postdiagnosis [5, 6, 8, 9]. Notably, the different survey periods and designs pose challenges to direct comparison. Nevertheless, these findings underscore the consistent occurrence of allergic reactions despite a confirmed diagnosis.

International guidelines recommend counselling by dietitians to avoid allergic reactions [1, 11, 12]. A retrospective study of children with egg allergies by Bégin et al. in 2017 found that a lack of dietary counselling increased the risk of an accidental reaction 1.89-fold [13]. However, the retrospective study design poses a risk of recall bias. A subsequent study by Kapoor et al. demonstrated that families who had multidisciplinary care including input from dietitians were significantly better at avoiding allergens and managing reactions. However, this study did not include a control group without dietary counselling, nor did it isolate the specific effects of dietary counselling [14]. As a result, the current evidence on the impact of dietary counselling on the frequency of allergic reactions remains inconclusive. The GA²LEN Network has identified this lack of data on the role of dietitians in paediatric allergy management as a research gap in their latest guidelines [15]. Moreover, the draft guideline from the European Academy of Allergy and Clinical Immunology underscores the necessity for studies examining the impact of individualized dietary management on accidental exposure incidents [12].

A thorough understanding of the factors that influence the occurrence of allergic reactions is crucial to tailor interventions to the specific needs of children with food allergies. Therefore, prospective studies on the influence of these factors are of utmost importance. The main objective of this project is to evaluate the impact of dietary counselling on allergic reactions in children diagnosed with food allergy within the first year after diagnosis, but also to explore the number of food allergies and the time period since diagnosis as factors influencing the number of allergic reactions.

Methods

Study population

The *ER*naehrungsberatung von Kindern mit *NA*hrungmittelallergien (ERNA) study (German: dietary counselling of children with food allergy) is a multicentre study investigating dietary counselling in children with food allergy during the first year after diagnosis. This study assessed the impact of dietary counselling on the quality of life, allergic reactions, nutritional status, and diet diversity in children (aged 0–10 years) with IgE-mediated food allergies. This article exclusively presents data concerning the number of allergic reactions. A comprehensive description of the research methodology is available in a previously published PhD thesis [16]. Recruitment for the study took place between 2019 and 2021 at four hospitals situated in the German-speaking region of Switzerland. The sample size was calculated using G*Power 3.1.9.2 (Heinrich Heine University, Düsseldorf, Germany) [17], requiring 55 participants per group to detect a 30% mean difference in quality of life with 80% power, accounting for a 20% dropout rate [16]. The study population consisted of children recently diagnosed with IgE-mediated food allergy (FA), without additional chronic conditions like coeliac disease or cystic fibrosis, aiming to minimize any extra influences on their nutritional status. Non-IgE-mediated food allergic children were excluded due to the less reliable nature of their diagnosis. Additionally, caregivers lacking sufficient proficiency in the German language to provide accurate responses to questionnaires and those who had already undergone dietary counselling prior to enrolment were excluded from participation in the study.

Dietary counselling

Randomization into groups was precluded by ethical considerations as it would involve withholding dietary counselling from one of the groups. Nonetheless, before initiating the study, a practice guideline for dietary counselling of children with food allergies was developed, involving dietitians from participating hospitals, a paediatric allergist, and a patient representative, based on the Nutrition Care Process [18, 19]. The practice guideline comprises 25 recommendations encompassing nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring. Dietitians recorded the number of counselling

Table 1 Sociodemographic and clinical characteristics of the participants at baseline

Variable		With counselling		Without counselling		Total		*P* value
		n	%	*n*	%	*n*	%	
Total	–	29	100.0	19	100.0	48	100.0	–
Study site	Zurich	18	62.1	8	42.1	26	54.2	0.386
	Basel	7	24.1	7	36.8	14	29.2	–
	St Gallen	3	10.4	4	21.1	7	14.6	–
	Aarau	1	3.4	0	0.0	1	2.1	–
Gender	Male	19	65.5	12	63.2	31	64.6	0.867[b]
	Female	10	34.5	7	36.8	17	35.4	–
Emergency kit	Yes	24	82.8	16	84.2	40	83.3	0.895[b]
Initial symptoms[a]	Cutaneous	28	96.6	17	89.5	45	93.8	0.968[b]
	Gastrointestinal	16	55.2	5	26.3	21	41.7	0.049
	Respiratory	9	31.0	6	31.6	15	31.2	0.968[b]
	Cardiovascular	3	10.3	0	0.0	3	6.2	0.148[b]
Number of foods allergies	1–2	18	62.1	17	89.5	35	72.9	0.037[b]
	≥ 3	11	37.9	2	10.5	13	27.1	–
Allergenic foods[a]	Tree nuts	17	58.6	10	52.6	27	56.3	0.683[b]
	Hen's egg	15	51.7	8	42.1	23	47.9	0.514[b]
	Cow's milk	12	41.4	1	5.3	13	27.1	0.006[b]
	Peanut	6	20.7	6	31.6	12	25.0	0.394[b]
	Soy	5	17.2	0	0.0	5	10.4	0.056[b]
	Others	8	27.6	2	10.5	10	20.8	0.155[b]
Education level	Primary	0	0.0	0	0.0	0	0.0	0.337[b]
	Secondary	8	27.6	8	42.1	16	33.3	–
	Tertiary	20	69.0	11	57.9	31	64.6	–
	No indication	1	3.5	0	0.0	1	2.1	–
Income (CHF per year)	< 50,000	0	0.0	0	0.0	0	0.0	0.177[b]
	50,000–100,000	8	27.6	3	15.8	11	22.9	–
	100,000–200,000	13	44.8	15	78.9	28	58.3	–
	> 200,000	4	13.8	1	5.3	5	10.4	–
	No indication	4	13.8	0	0.0	4	8.3	–

Mean age of children was 23.8 months (standard deviation [SD] = 26.2), mean age of children with dietary counselling was 16.6 (SD = 12.3), mean age without dietary counselling was 34.8 (SD = 36.7)
$p = 0.026$[c]
[a] Multiple answers possible
[b] Pearson's Chi-squared test
[c] Wilcoxon rank sum test

sessions and documented the implementation of the practice guideline.

Data collection

Data collection was carried out using a standardized questionnaire at the time of diagnosis and at 3, 6 and 12 months thereafter. The questionnaires could be completed either online or on paper to minimize participant exclusions. The section of the questionnaire related to allergic reactions included 12 items. Initially, parents of the children were asked whether any allergic reactions had occurred since the last survey. If they gave a positive reply, participants proceeded to indicate the number of reactions observed. For each of these reactions, information was gathered regarding the timing, foods consumed prior to the reaction, the suspected trigger of the reaction, the duration from food consumption to the onset of the reaction, and the specific symptoms experienced. Data on dietary counselling were reported by caregivers and dietitians documented the counselling.

Statistics

Descriptive statistics of continuous variables are presented as means and standard deviations. Categorical variables are presented in absolute and relative frequencies. The observed monthly reaction rates were described over the three observation periods (baseline [BL] to 3 months, 3–6 months and 6–12 months) and with respect to the between-subject factors counselling, multiple food allergies (≥ three food allergies) and allergenic foods, using means and standard de-

Table 2 Mean (M) monthly reaction rates, standard deviation (SD), and range per time period for all children, stratified to dietary counselling, the number of food allergies (FA), and the baseline (BL) food allergies

Variable	BL to 3 months			3–6 months[a]			6–12 months[b]		
	M	SD	Range	M	SD	Range	M	SD	Range
All children	0.28	0.47	0.00–2.00	0.17	0.38	0.00–1.67	0.07	0.12	0.00–0.50
Counselling									
No	0.46	0.62	0.00–2.00	0.13	0.40	0.00–1.67	0.08	0.14	0.00–0.50
Yes	0.17	0.29	0.00–1.00	0.20	0.38	0.00–1.67	0.07	0.11	0.00–0.33
Number of FA									
1–2 FA	0.24	0.49	0.00–2.00	0.11	0.32	0.00–1.67	0.05	0.12	0.00–0.50
≥ 3 FA	0.41	0.39	0.00–1.00	0.33	0.49	0.00–1.67	0.12	0.13	0.00–0.33
Cow's milk allergy–									
No	0.30	0.51	0.00–2.00	0.19	0.42	0.00–1.67	0.07	0.13	0.00–0.50
Yes	0.23	0.32	0.00–1.00	0.14	0.26	0.00–0.67	0.06	0.11	0.00–0.33
Hen's egg allergy									
No	0.20	0.38	0.00–1.67	0.20	0.40	0.00–1.67	0.10	0.14	0.00–0.50
Yes	0.38	0.53	0.00–2.00	0.14	0.37	0.00–1.67	0.04	0.09	0.00–0.33
Tree nuts allergy									
No	0.33	0.55	0.00–2.00	0.13	0.38	0.00–1.67	0.07	0.14	0.00–0.50
Yes	0.25	0.40	0.00–1.67	0.21	0.39	0.00–1.67	0.07	0.12	0.00–0.33
Peanut allergy									
No	0.28	0.49	0.00–2.00	0.15	0.41	0.00–1.67	0.04	0.11	0.00–0.50
Yes	0.31	0.39	0.00–1.00	0.25	0.29	0.00–0.67	0.15	0.13	0.00–0.33

[a] Two participants did not answer the second questionnaire
[b] One participant did not answer the third questionnaire

viations. We fitted a Poisson model with offset to the number of allergic reactions, with period, counselling, and multiple food allergies as independent variables, including all two- and three-way interactions in the initial model. We also included age and cow's milk allergy as confounding variables. If there was evidence of overdispersion, we also fitted a negative binomial generalized linear model (glm.nb) and a generalized linear mixed model for the negative binomial family (glmer.nb). The Akaike information criterion (AIC) was used for model comparison. Sequential tests for three- and two-way interaction terms were performed. We computed point and interval estimates for the contrasts of interest on response scale, that is, incidence rate ratios (IRR) for period, counselling and multiple food allergies. The Tukey method was used to adjust for multiple testing. The significance level was set to 0.05. Statistical analysis was performed with R statistical software version 4.2.1, using the MASS, lme4, emmeans and effects package.

Ethics

The Bern Ethics Committee (ID 2018-012116) and the Research Ethics Committee for the Faculty of Health & Human Sciences and Peninsula School of Medicine & Dentistry, Plymouth University ethically approved the study. Caregivers of children signed an informed consent prior to beginning the study and they had the option to terminate their participation in the study at any time without giving a reason.

Results

Complicated by the COVID-19 pandemic, only 48 children were enrolled in the study despite extending the recruitment phase from the originally planned 9 months to 2 years (January 2019 to February 2021). More participants for the counselling group were recruited ($n = 29$). During the 1-year follow-up period, two participants did not complete the 6-month questionnaire, and one did not complete the 12-month questionnaire. In Table 1, sociodemographic and clinical characteristics of the included children and their parents are presented. Notably, the groups were not equal in size; the counselling group was larger than the noncounselling group. Additionally, children who received counselling were significantly younger, with a mean age of 16.6 months (SD = 12.3), compared to those without counselling, who had a mean age of 34.8 months (SD = 36.7). The distribution of allergic triggers differed between the groups, although some similarities were observed. In both groups, tree nuts were the most common trigger, followed by hen's egg. However, the counselling group exhibited a significantly higher proportion of cow's milk allergy and multiple food allergies (≥ 3 foods). The median number of counselling sessions was two (IQR = 2), ranging from one to seven meetings over the 1-year period.

Parents of 31 (65%) children reported a total of 85 allergic reactions to food within the first year following diagnosis, which corresponds to a harmonic mean annual reaction rate of 1.81. Six reactions

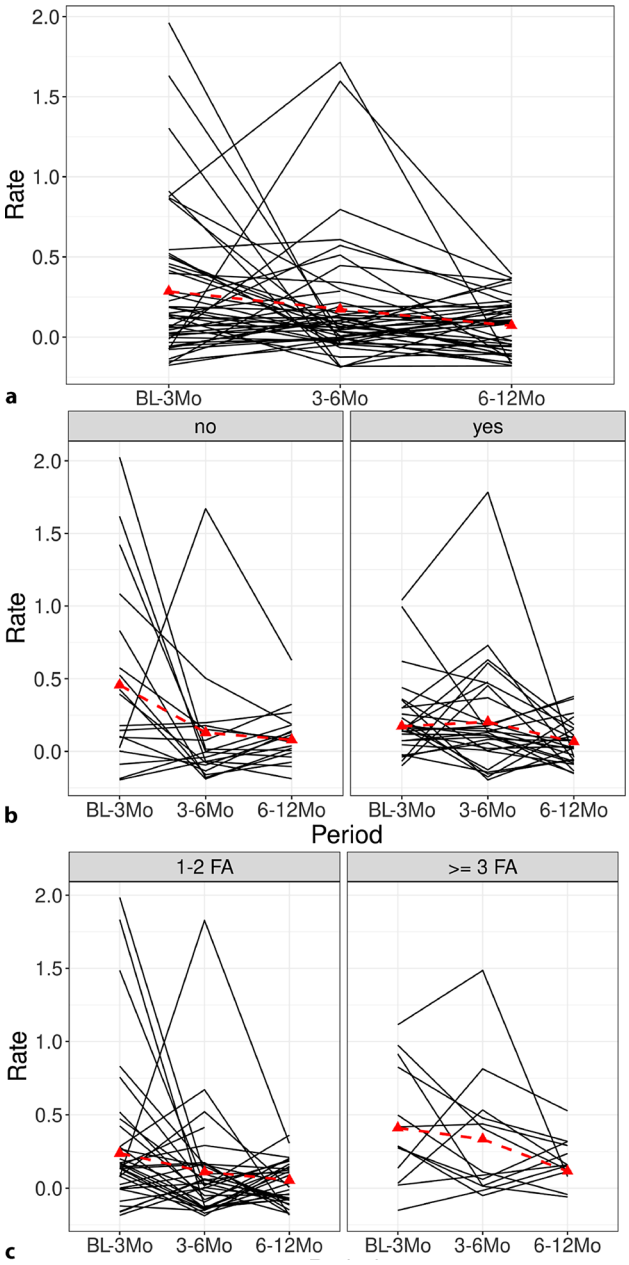

Fig. 1 Monthly reaction rate per child and mean for the three time points. **a** All children, **b** children with and without dietary counselling, and **c** children with one or two food allergies and those with three or more food allergies. *BL* baseline, *FA* food allergies, *Mo* months

were excluded, because parents suspected pollen or animal hair as triggers. Specifically, in the group without counselling, 14 children (74%) experienced 42 allergic reactions (incidence rate [IR] = 2.2), while in the group receiving counselling, 17 children (59%) encountered 43 allergic reactions (IR = 1.5). Table 2 provides a comprehensive breakdown of monthly reaction rates across the three distinct time periods. The monthly reaction rates for all children steadily decrease from 0.28 in the initial 3 months postdiagnosis to 0.07 in the final 6–12 months. Furthermore, children with three or more food allergies consistently exhibited higher reaction rates compared to those with one or two allergies across all time periods. The monthly reaction rate for children who did not receive dietary counselling was 2.7 times higher in the first 3 months following diagnosis compared to the group receiving counselling. However, in the other two periods, there is no major difference, and the counselling group reaction rate is higher between 3 and 6 months than the group without counselling. In the first 3 months mean monthly reaction rates in children with hen's egg (M = 0.38) and peanut (M = 0.31) allergy were higher than the average of all children (M = 0.28).

Figure 1 provides a visual representation of monthly reaction rates across the three time periods. In Fig. 1a, the figure reveals variations in monthly reaction rates over the study period. While some children display consistent trends, others exhibit fluctuations in their reactions. Notably, a few children appear as outliers in the figure, showing exceptionally high reaction rates. When comparing children with counselling to those without (Fig. 1b), it becomes evident that during the first period, some children, particularly in the noncounselling group, experience high reaction rates, which decrease in the subsequent periods. In Fig. 1c, it is apparent that children with three or more food allergies still exhibit high reaction rates in the second and third periods, representing exceptions in comparison to those with one or two allergies.

Analysis of error distribution showed evidence of overdispersion. The optimal model was the negative binomial model. Sequential tests for three-way and two-way interactions led to a main effects model with period, counselling, multiple food allergies as independent variables, age, and cow's milk allergy as confounding variables. Table 3 displays the incidence rate ratios (IRR) and standard errors (SE) for the impact of dietary counselling, multiple food allergies, and time periods in the adjusted negative binomial model. The IRR for counselling was 0.37 (CI [0.19, 0.72], $p = 0.004$), indicating that participants who received counselling had less than half the rate of allergic reactions compared to those without counselling. Participants with multiple allergies, however, had more than six times the rate of allergic reactions compared to those with only one or two food allergies (IRR = 6.18, CI [2.75, 13.89], < 0.001). The IRR for comparing the last 6 months to the first 3 months is 0.27 (CI [0.12, 0.62], $p = < 0.001$), but the IRR for other time period contrasts were not significant.

Figure 2 presents model-based predictions on the response scale derived from the negative binomial model, illustrating the monthly reaction rate and their associated CI as a function of period (a), counselling (b), multiple food allergies (c), age (d) and cow's milk allergy with and without counselling (d). Notable findings from Fig. 2 include a decrease in predicted monthly reaction rates over the three time

Table 3 Incidence rate ratios (IRR), confidence intervals (CI), standard error (SE), and *p*-values (*p*) for counselling, the number of food allergy (FA), the time period, adjusted for milk, and age in the negative binominal model

Variable	IRR	SE	95% CI		*p*
			LL	UL	
Counselling					
Yes/no	0.37	0.13	0.19	0.72	0.004
Number of food allergies					
≥ 3 FA/1–2 FA	6.18	2.55	2.75	13.89	< 0.001
Time period					
3–6 months/BL to 3 months	0.62	0.21	0.27	1.39	0.34
6–12 months/BL to 3 months	0.27	0.10	0.12	0.62	< 0.001
6–12 months/3–6 months	0.44	0.17	0.18	1.06	0.074

BL Baseline, *UL* upper limit, *LL* lower limit

periods (a), differences between groups with and without counselling, for all children (b) and for those with cow's milk allergy (d), as well as distinctions between those with multiple food allergies and those with one or two food allergies (c). Moreover, it shows the reduction of the predicted monthly reaction rate with age (c).

Discussion

The main finding from this study is that dietary counselling significantly reduced the risk of experiencing allergic reactions by 63%. Additionally, children with multiple food allergies are at more than six-fold higher risk of allergic reactions than children with one or two food allergies. Moreover, the likelihood of experiencing an allergic reaction significantly decreases throughout the 1-year follow-up period.

This study found a notably higher annual rate of reactions (1.81) compared to other studies that have reported rates from 0.12 to 0.81 [4, 6–8, 10]. The reasons for this discrepancy are not clear. One explanation could be that our study initiated follow-up immediately upon diagnosis, in contrast to most other studies that began follow-up 1–3 years after diagnosis [6, 7, 13]. As we demonstrated, reaction rates are highest in the first 3 months following diagnosis. It is possible that this early period may have been missed in other studies, leading to an underestimation of reaction rates. Another potential factor is the risk of recall bias in the retrospective studies, which might have influenced the number of reported reactions [5, 6, 9]. In the ERNA study, parents reported allergic reactions over 3–6 months, which is shorter than 1 year or even longer periods seen in other studies. Additionally, parents were informed at the outset of the study that they would be reporting reactions, which could have made them more aware. Furthermore, children in our study were recruited in allergy units in children's hospitals, potentially resulting in higher prevalence of multiple food allergies compared to other studies.

Children with cow's milk allergy exhibited lower monthly reaction rates compared to the rest of the cohort. This finding contradicts the results of a study by Hicks et al., where a significantly higher proportion of children with cow's milk allergy experienced at least one allergic reaction [9]. The lower reaction rate in our study may be due to increased dietary counselling in children with cow's milk allergy. However, since there was only one child with cow's milk allergy not undergoing dietary counselling, we were unable to analyse this potential impact.

Participants receiving dietary counselling exhibit a significantly reduced rate of experiencing allergic reactions, with the rate being 0.37 times that of individuals lacking such counselling derived from the negative binominal model. Thus, children who do not receive counselling are associated with 2.70-fold greater rate of allergic reactions. This is higher than that found in the only other study on the influence of dietary counselling on allergic reactions. Bégin et al. found 1.89-fold increased risk in egg-allergic children without dietary counselling [13]. However, this study was retrospective and, therefore, may suffer from underreporting due to recall bias. The difference may also be related to this study's inclusion of many different food allergies, as well as children with multiple food allergies.

Our data also show that the number of food allergies had a significant impact on the rate of allergic reactions. In fact, having multiple food allergies exhibited the most substantial effect, with a 6.18-fold higher risk compared to children with 1–2 food allergies. Notably, Cherkaoui et al. reported a reduced rate of allergic reactions in a cohort of peanut-allergic children with a history of additional food allergies [7]. They attributed this effect to participants exercising greater caution due to their perception of being at higher risk. This contrasts with our results, and the difference is challenging to explain. However, the association between the number of food allergies and the frequency of allergic reactions is logical, as it may be more difficult to avoid exposure to a greater number of allergens.

Our study observed that children exhibited the highest monthly rates of allergic reactions (0.28) during the first 3 months following diagnosis. Notably, the reaction rate was more than twice as high in the group without counselling compared to those who received dietary counselling. Cherkaoui et al. further demonstrated that in children with peanut allergies, a longer disease duration reduces the risk of allergic reactions, suggesting that substantial time is required to develop the ability to avoid allergenic foods [7]. Dietary counselling may expedite this learning process, potentially explaining the differences in monthly reaction rates between the two groups during the initial 3 months postdiagnosis. Both groups exhibited significantly fewer reactions per month in the final 6 months of the study. Although some children may

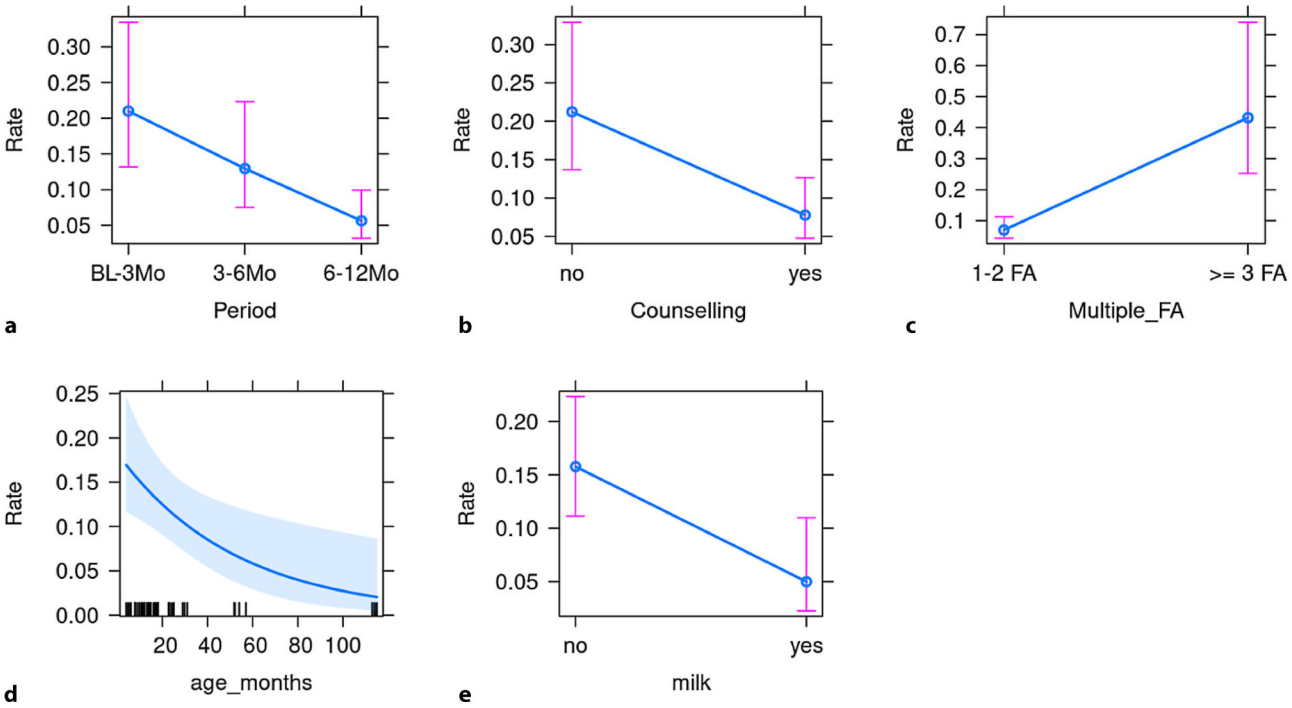

Fig. 2 Model-based predictions on response scale of monthly allergic reactions rate across time period (**a**), with and without counselling (**b**), the number of food allergies (**c**), age (**d**) and milk allergy with and without counselling (**e**). *BL* baseline, *FA* food allergies, *Mo* months

have outgrown their food allergies, considering the young age of the cohort and the high prevalence of tree nut allergies, this factor alone is unlikely to account for the overall reduction in allergic reactions [20]. Instead, a learning effect for participants, both with and without dietary counselling, over the long term is more plausible. This underscores the importance of initiating dietary counselling for allergen avoidance as soon as possible following diagnosis.

Our results show that even with the diagnosis of food allergy, it is challenging to avoid the allergy-eliciting food. This may be attributed to the considerable knowledge and experience necessary to effectively avoid the allergenic food as well as the difficulty of controlling food intake that occurs in out of home settings. This is also reflected in the fact that the number of allergic reactions seems to decrease with experience. Dietitians individualise advice depending on the food excluded, the age of the patient and concurrent dietary exclusions for other reasons [18]. They empower children and/or their parents to read labels and adapt to changing circumstances such as the transition from kindergarten to school as well as special situations like eating out [18]. These interventions seem to help to avoid allergic reactions.

One of the strengths of this study lies in the prospective data collection within the ERNA study over a 1-year period from diagnosis, with a low attrition rate of just 4%. However, the study population is relatively small, as the target of 110 participants was not met despite several recruitment extensions [16]. While the results are significant, a larger study could have provided further insights. Additionally, diagnoses were based on allergists' assessment using medical history and sensitisation, rather than employing the gold standard of a double-blind placebo-controlled food challenge. Recall bias may have affected results, as participants had to remember allergic reactions over 3–6 months. Digital survey tools could improve future studies by allowing direct documentation of reactions, symptoms, and food consumed, potentially reducing recall errors, possibly with the addition of photos for enhanced accuracy.

As this is not a randomized controlled study, it is important to acknowledge that establishing a definitive causal relationship is not possible. For instance, it remains possible that parents who choose dietary counselling may, in general, exhibit higher levels of anxiety compared to those who do not opt for counselling. Consequently, these parents may be more inclined to adopt precautionary behaviours and avoid potentially risky situations. Nevertheless, it is worth noting that there were no discernible differences between these groups in terms of food allergy-related quality of life, including factors such as food-related anxiety, during the initial 3 months following diagnosis [16].

It should be noted that the number of reactions observed in the ERNA study may be too small to generate representative statements. A broader and more comprehensive study would be necessary to obtain more meaningful and representative data on factor

impacting allergic reactions in children with food allergies. Nevertheless, this study provides valuable insights into allergic reactions in children with food allergies and forms a basis for future research in this area.

Dietary interventions that aim to reduce the number of allergic reactions should be carefully developed and evaluated. Evaluation studies can provide insights into which interventions are effective and provide the best support for children with food allergies and their families. In addition to studies, regular monitoring of allergic reaction is crucial.

Conclusion

Allergic reactions take place regularly even after the diagnosis has been made. Dietary counselling may have the potential to reduce the rate of allergic reactions. Counselling should be initiated directly after diagnosis because the risk of allergic reactions is especially high in the first months following diagnosis. Children with multiple food allergies might especially benefit from dietary counselling.

Acknowledgements The authors express their gratitude to the entire ERNA study team, as well as allergists and dietitians in the study centres, and all caregivers who provided data on allergic reactions for this analysis. Additionally, we would like to express our appreciation to the allergy foundation 'Allergiestiftung Ulrich Mueller-Gierok' for their financial support of the project.

Funding This work was supported by the allergy foundation 'Allergiestiftung Ulrich Mueller-Gierok'

Author Contribution All authors contributed to this manuscript. Statistical analysis was done by Andre Meichtry. The first draft of the manuscript was written by Julia Eisenblätter and Nia Stephens-Metcalfe. All authors commented on previous versions read as well as approved the manuscript.

Funding Open access funding provided by Bern University of Applied Sciences

Data Availability The data that support the findings of this study are available from the corresponding author, JE, upon reasonable request.

Conflict of interest J. Eisenblaetter, N. Stephens-Metcalfe, A. Meichtry, K. van der Horst, C. Roduit, F. Bellutti Enders, I. Skypala and M. Hickson declare that they have no competing interests. A. Koehli received travel support from Allergopharma/Dermapharm AG.

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