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LETTER OPEN ACCESS

Food-Induced Anaphylaxis Reactions at School: A Room for Improvement

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To the Editor,

The prevention and management of allergic reactions at school is now recognized as a public health concern in many countries, with around 10% of pediatric anaphylaxis cases occurring at school [1]. In France, prevention measures in allergic children at school have been updated in 2021 and national policies mandated secondary schools to stock undesignated adrenaline auto-injectors (AAI) since 2019 [2]. There are only few published data on anaphylaxis at school, many from the United States [3].

The aim of our study was to analyze data on food-induced anaphylaxis (FIA) at school and describe their main characteristics and time trends. We conducted a retrospective analysis of an FIA cohort based on the Allergy-Vigilance Network (AVN) database (2002–2023) (see [Supporting Information](#) for Methods).

Of the 3119 FIA reactions recorded by the AVN, 1762 (56.5%) involved school-age children (3–18 years) and 157 (8.9%) occurred at school. The main characteristics and treatment of these 157 cases are detailed in Table 1 (see [Supporting Information](#) for additional results). Three groups of children have been identified

according to a history of food allergy (group 1: no prior food allergy; group 2: known food allergy to the culprit food; group 3: food allergy for another culprit food) with no difference between the three groups, except a history of asthma which was more frequently observed in group 3 compared to both other groups ($p=0.03$) (Table 1). Of the 112 food allergic children, 52 (46.4%) had received an individual healthcare plan (IHP) with an AAI available in 43 (82.7%).

The main foods involved in the FIA at school were peanut ($n=33$; 21.0%) and cow, goat, and sheep milk ($n=18$; 11.5%) (Figure S1). According to severity (Ring classification modified by Behrendt), 41 (26.1%) cases were classified as grade 3 and 5 (3.2%) as grade 4, including four deaths (all induced by milk) [4].

Intramuscular adrenaline was administered in 41 (26.1%) children but only in 22 (14.0%) at school (with an AAI in 17 [10.8%]). Comparing the three time periods, there was an increase in the absolute number of FIA cases at school and in adrenaline use ($p<10^{-3}$) but no significant variation in the rate of FIA cases among the number of FIA cases in school-aged children

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TABLE 1 | Main characteristics of the 157 children with food-related anaphylaxis at school recorded by the Allergy-Vigilance Network (2002–2023).

	Total	Children without any prior food allergy (group 1)	Food allergic children for the same allergen (group 2)	Food allergic children for other allergens (group 3)	p
<i>N</i> (%)	157	45 (28.7)	71 (45.2)	41 (26.1)	
Main characteristics					
Gender, boys, <i>n</i> (%)	97 (68)	26 (57.8)	41 (57.8)	30 (73.2)	0.22
Mean age, year (SD)	10.0 (4.7)	9.4 (5.1)	10.9 (4.3)	9.4 (4.9)	0.14
Atopic history					
Asthma	65 (41.4)	15 (33.3)	26 (36.7)	24 (58.5)	0.03
Allergic rhinitis	50 (31.8)	18 (40.0)	20 (28.7)	12 (30.7)	0.38
Atopic dermatitis	37 (23.6)	15 (33.3)	14 (20.1)	8 (19.5)	0.19
Asthma + AR	23 (14.6)	4 (9.6)	13 (18.6)	6 (14.6)	0.38
Asthma + AD	17 (10.8)	2 (4.7)	7 (9.9)	8 (19.5)	0.16
AR + AD	17 (10.8)	6 (13.4)	9 (12.8)	2 (4.9)	0.57
Asthma + AR + AD	7 (4.5)	0	6 (8.6)	1 (2.4)	0.22
Five main food allergens					
Peanut, 33 (21.0)		Peanut, 6 (13.3)	Peanut, 23 (32.4)	Milk, 6 (14.6)	0.64*
Milk, 18 (11.5)		Kiwi, 6 (13.3)	Milk, 11 (15.5)	Soybean, 5 (12.6)	
Hazelnut, 10 (6.4)		Celery, 5 (11.4)	Fish, 4 (5.9)	Kiwi, 4 (9.8)	
Soybean, 10 (6.4)		Soybean, 3 (6.7)	Hazelnut, 4 (5.9)	Peanut, 4 (9.8)	
Kiwi, 10 (6.4)		Hazelnut, 3 (6.7)	Cashew, 4 (5.9)	Hazelnut, 3 (7.3)	
Ring severity grade					
2	111 (70.7)	35 (77.8)	45 (63.4)	31 (75.6)	0.59
3	41 (26.1)	9 (21.7)	22 (31.0)	10 (24.4)	
4	5 (3.2) 4 deaths	1 (2.2)	4 (5.6) 4 deaths	0	
Severe clinical manifestations					
Laryngeal edema	36 (22.9)	12 (26.6)	13 (18.3)	11 (26.8)	0.46
Bronchospasm	67 (42.7)	15 (33.3)	31 (43.9)	21 (51.2)	0.24

(Continues)

TABLE 1 | (Continued)

	Total	Children without any prior food allergy (group 1)	Food allergic children for the same allergen (group 2)	Food allergic children for other allergens (group 3)	p
Cardiovascular	11 (7.0)	2 (4.4)	7 (10.5)	2 (6.1)	0.70
Management					
IHP + AAI	52 (33.1)/43 (27.4)	0	36 (50.9)/31 (43.1)	16 (39.2)/12 (29.3)	<0.001/<0.001
Use of AAI at school	17 (10.8)	0	13 (18.8)	4 (9.8)	0.02
Adrenaline injection during anaphylaxis	41 (26.1)	7 (15.6)	24 (34.5)	10 (25.3)	0.09
Oral corticosteroids during anaphylaxis	60 (38.2)	5 (11.1)	30 (41.7)	25 (61.0)	<0.001
Oral corticosteroids given at school	29 (18.5)	1 (0.2)	19 (26.4)	9 (22.0)	0.01
Oral antihistamines during anaphylaxis	74 (47.1)	19 (42.2)	33 (45.8)	22 (53.7)	0.56
Oral antihistamines given at school	25 (15.9)	2 (0.4)	18 (25.0)	5 (12.2)	0.020
EMS intervention at school	62 (39.5)	15 (33.3)	31 (43.1)	16 (39.0)	0.54
Hospital admission	63 (40.1)	15 (33.7)	28 (39.7)	20 (48.8)	0.34

Note. "Milk" refer to cow, goat, and sheep milk.

Abbreviations: AAI, adrenaline auto-injector; AD, atopic dermatitis; AR, allergic rhinitis; EMS, emergency medical services; IHP, individualized healthcare plan; SD, standard deviation.

*Friedman test.

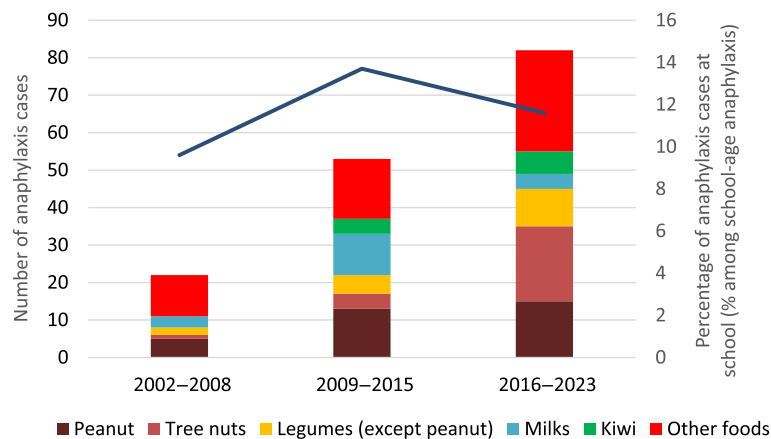


FIGURE 1 | Distribution of the 157 anaphylaxis cases at school reported by the Allergy-Vigilance Network by foods and time periods (2002–2023) (in bars, expressed as absolute number on the left side; in line, expressed as percentage of cases among the anaphylaxis cases in school-age children on the right side).

($p=0.71$), in the distribution of cases according to severity ($p=0.99$) or food triggers (peanut or other foods) ($p=0.48$ and $p=0.28$, respectively) (Figure 1 and Figure S2).

Our data illustrate how difficult it is to prevent the occurrence of anaphylaxis at school, with 29% of FIA occurring in children with no food allergy and a large variety of food allergens. Conversely, 45% of FIA occurred in children with a known food allergy and should be therefore avoidable. Most cases were related to accidental exposure and resulted in a complex series of avoidable errors or shortcomings from all parties. Peanut remains the most frequent food involved in FIA as reported throughout the world [1, 5]. To address issues regarding food avoidance, some schools have opted for allergen restrictions in school settings, but there is a lack of evidence that they are effective strategies [6]. A number of countries now require schools to have specific policies and procedures to keep food-allergic children safe.

Our data also highlight shortcomings regarding recognition and management of FIA cases with an alarming underuse (26%) of adrenaline. However, we found an increasing rate of adrenaline use over time, rising at 41% of cases from 2016 to 2023.

In conclusion, our study highlights that anaphylaxis occurring at school may lead to severe reactions, including death, with frequent unknown allergy to the culprit food and insufficient adrenaline use. There is a huge room for improvement in the prevention and management of anaphylaxis at school to focus on IHP use for food allergic children, promotion of training programs to school-canteen staff.

Author Contributions

G.P. analyzed, interpreted the data, and wrote the draft. Y.K.-A. performed the statistical analysis, interpreted the data, and reviewed the draft. G.P., A.D.-C., Y.K.-A., C.B., and D.S.-L. were major contributors in reviewing the draft and improving the paper with critical analysis. S.T. collected data from the Allergy-Vigilance Network.

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Conflicts of Interest

G.P. has provided consultation and speaker services for AI Therapeutics, Bausch+Lomb, Stallergenes, Novartis, DVB technology, ALK-Abello; serves as a medical consultant/advisor for Bioprojet, Theravia.

Data Availability Statement

The authors have nothing to report.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.