

## Food allergy in Argentinian schoolchildren: A survey-based cross-sectional study

### Alergia alimentaria en escolares argentinos: Un estudio transversal basado en encuestas

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#### RESUMEN

**Objetivos:** La información sobre la epidemiología de las alergias alimentarias (AA) en Latinoamérica es escasa permaneciendo incierta la magnitud y relevancia del problema. Nuestro objetivo fue estimar la prevalencia de AA en niños de edad escolar de Santa Fe, Argentina. **Material y Métodos:** Padres de niños de 5-14 años de edad contestaron un cuestionario validado el cual fue auto-administrado. **Resultados:** 1431 cuestionarios fueron regresados con respuestas válidas. Las prevalencias fueron [intervalos de confianza (IC), 95%]: "Reacciones adversas a los alimentos" 10.2% (8.7-11.9), "AA percibida, transitoria" 9.7% (8.3-11.4), "diagnóstico médico de AA, transitoria" 4.8% (3.8-6), "AA tipo inmediato, transitoria" 3.4% (2.6-4.5), "AA tipo inmediato, persistente" 1.4% (0.9-2.1), "anafilaxis inducida por alimentos" 0.8% (0.5-1.5). Los principales alimentos desencadenadores de "AA tipo inmediato, persistente" fueron: chocolate y chile (0.49% cada uno, IC 95%: 0.24-1.01), seguido de cacahuete, nueces y trigo (0.14% cada uno, IC 95%: 0.04-0.51). Tener antecedentes familiares de enfermedades alérgicas se relacionó positivamente con "AA tipo inmediato, transitoria" (P = 0.0002). Aunque ocho de 12 casos de anafilaxis buscaron atención médica, solo uno de estos casos reportó la prescripción de un auto-inyector de epinefrina. **Conclusiones:** Al menos 1.4% de los niños argentinos experimentan reacciones adversas a los alimentos sugestivas de AA de tipo inmediato y al menos la mitad de ellos necesitan una prueba confirmatoria y asesoramiento por un profesional de la salud. Debido a la baja frecuencia de prescripción de auto-inyectores de epinefrina en casos de anafilaxis, su uso debe alentarse entre los profesionales de la salud.

**Palabras clave:** Alergia alimentaria; Prevalencia; encuesta.

#### ABSTRACT

**Objectives:** There is scarce information about the epidemiology of food allergy (FA) in the Latin America region and remains uncertain the magnitude and relevance of the problem. Our aim was to estimate the prevalence of FA in schoolchildren from Santa Fe, Argentina. **Material and Methods:** A validated self-administered Spanish version of a structured questionnaire was utilized. Parents of 5-14-years-old children participated in the study. **Results:** 1,431 questionnaires were returned with valid responses (response rate of 35.3%). Prevalence estimations (CI, 95%) were as follows: "Adverse food reactions" 10.2% (8.7-11.9), "Perceived FA, ever" 9.7% (8.3-11.4), "Physician-diagnosed FA, ever" 4.8% (3.8-6), "Immediate-type FA, ever" 3.4% (2.6-4.5), "Immediate-type FA, current" 1.4% (0.9-2.1), "Food-induced anaphylaxis" 0.8% (0.5-1.5). The main foods triggering "Immediate-type FA, current" were: chocolate and chili (0.49% each, CI 95%: 0.24-1.01), followed by peanut, nuts and wheat (0.14% each, CI 95%: 0.04-0.51). Family history of allergic disease was positively related to 'immediate-type FA, ever' (P = 0.0002). Although eight out of 12 cases of anaphylaxis sought medical attention, only one of these cases reported the prescription of an epinephrine auto-injector. **Conclusions:** The data highlight that at least 1.4% of Argentinian schoolchildren experience adverse food reactions suggestive of immediate-type FA and that at least half of these cases need confirmatory testing and counseling by a health professional. Due to the low frequency of prescription of epinephrine auto-injectors in anaphylactic cases, the prescription of such devices should be encouraged among healthcare personnel.

**Keywords:** Food allergy, Prevalence, Survey.

#### Introduction

Food allergy (FA) is a persistent and potentially severe condition that negatively impacts on the quality of life of both allergic children and adults.

The prevalence of this immunological disorder is thought to be increasing and could affect 2-4% and 6-8% of the adult and child populations, respectively.<sup>1</sup> Annually, more than 30,000 North

Americans seek medical attention due to moderate or severe food allergic reactions. Unfortunately, around 50% of the severe anaphylactic cases die.<sup>1</sup> The prevalence of FA in children is well documented in developed countries,<sup>2</sup> but it is not in developing regions. For instance, only three population-based studies have used an in depth instrument to estimate the parent-reported prevalence of FA in Latin American schoolchildren.<sup>3-5</sup> Particularly, the Latin American region encompasses a big area with different sociocultural practices and socioeconomic factors, which influence the alimentary habits in children<sup>6</sup> and probably the prevalence rates of FA and the specific foods triggering it as well. Therefore, much remains to be explored in Latin America in order to know the magnitude and relevance of the FA problem. Thus, the aim of this study was to estimate at population level the parent-reported prevalence of FA in schoolchildren from Santa Fe, Argentina.

**Material and Methods**

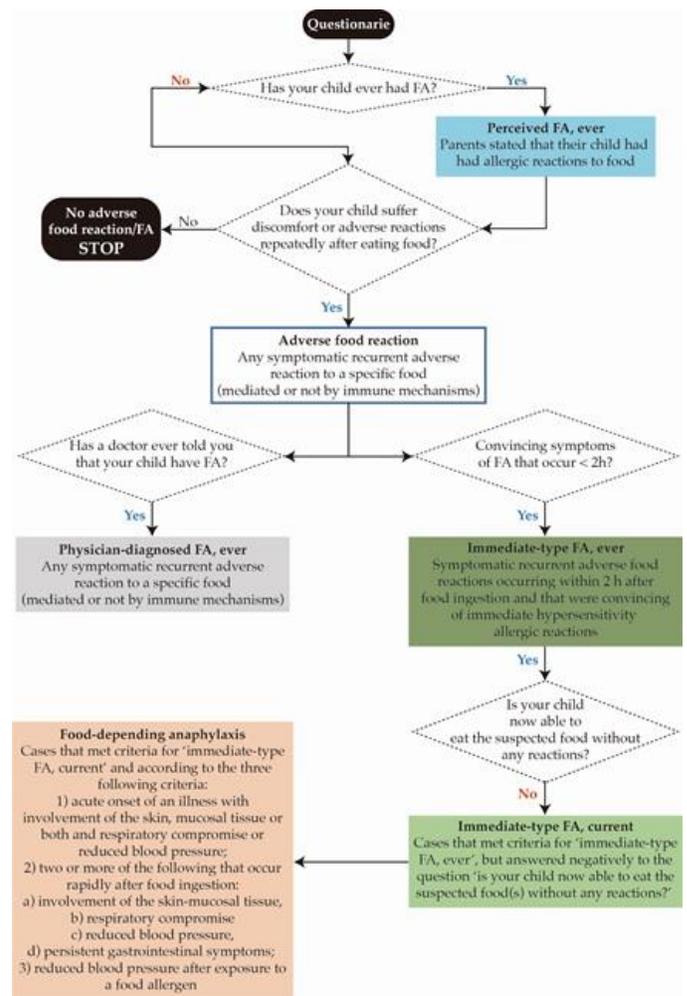
**Population survey**

A population-based cross-sectional study was conducted in Santa Fe, Argentina from April 3<sup>rd</sup> to 20<sup>th</sup> 2018. Six public and 3 private elementary schools geographically distributed at the north-west, center, and south of the city were chosen by convenience. At least two schools per area and 15 children per grade were included in the study (at least 105 children per school). The teachers (1<sup>st</sup> to 7<sup>th</sup> grade) handed out the questionnaires and the

informed consents. All documents were attached to the children’s homework notebooks. In the cases of non-response by the parents, the process was repeated for additional two times.

**Questionnaire and Definitions**

A Spanish version of a structured questionnaire (3) was culturally adapted (minor changes) and self-administrated by Argentinian parents (supplemental material). The definitions used in this study are shown in **Figure 1** (4,5).



**Figure 1.** Algorithm for identifying “Perceived FA, ever”, “Immediate-type FA, ever”, “Immediate-type FA, current”, and “Food-dependent anaphylaxis” cases. **FA:** Food allergy.

### Statistical analyses and ethical aspects

Descriptive statistics and two-tailed Fisher exact tests were carried out using PASW statistic software version 25.0 (SPSS Inc., IL, USA). Continuous variables were summarized by mean and the minimum and maximum values. A  $P$ -value  $< 0.05$  was considered statistically significant. OpenEpi software (3.03a) was used to estimate prevalence confidence intervals (CI, 95%). An Ethics Review Board of the Faculty of Biochemistry and Biological Sciences of the National University of the Litoral approved the study protocol (ethic approval number: Acta 01/18).

### Results

#### Demographic and clinical information

The demographic and clinical characteristics of the participants are shown in **Table 1**. The response rate was 35.3% [1,431 questionnaires were correctly answered (738/693 public/private schools)]. The proportion of female/male was 47.9%/52.1% ( $P > 0.9999$ ). A family history of allergic disease (first degree relatives) and having an allergic disease other than FA were parameters associated with "Immediate-type FA, ever" ( $P < 0.001$ ).

#### Prevalence estimations of adverse food reactions and FA

The prevalence estimations by age groups are summarized in **Table 2**. Twenty-seven cases that met criteria for immediate-type FA, either "ever" or "current", reported a physician-diagnosed FA (**Figure 2**). Stratified by gender, the prevalence

rates of immediate-type FA, either "ever" or "current", were quite similar ( $P > 0.9999$  in both cases). Eight out of 12 cases of anaphylaxis sought medical attention. Corticoids, an inhalator, and an epinephrine auto-injector were prescribed in one case each. The season of birth was not associated with "immediate-type FA" ( $P > 0.6552$ ).

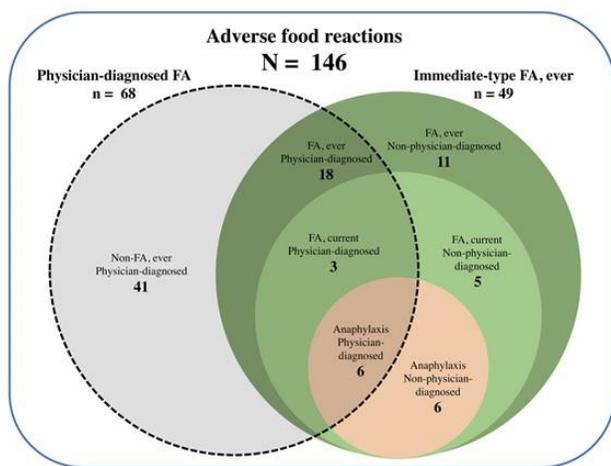
**Table 1.** Demographic and clinical characteristics of the studied population.

Variable	
Mean age in years (range)	<b>8.9</b> (5-14)
Sex	<i>n</i> (%)
Female	<b>686</b> (47.9)
Male	<b>745</b> (52.1)
<b>Season of birth</b>	
Spring	<b>349</b> (24.4)
Summer	<b>385</b> (26.9)
Autumn	<b>358</b> (25)
Winter	<b>339</b> (23.7)
<b>Allergic-related diseases</b>	
Allergic rhinitis	<b>164</b> (11.5)
Insect sting allergy	<b>137</b> (9.6)
Atopic dermatitis	<b>117</b> (8.2)
Urticarial	<b>104</b> (7.3)
Asthma	<b>88</b> (6.1)
Conjunctivitis	<b>79</b> (5.5)
Drug allergy	<b>37</b> (2.6)
Animal allergy	<b>33</b> (2.3)
Anaphylaxis	<b>12</b> (0.8)

**Table 2.** Prevalence estimations by age.

Assessment	Number of cases reported	5-9 years	10-14 years	Total	P-value
		n = 841	n = 590		
Prevalence % (CI, 95%)					
Adverse food reactions	146	9.9 (8-12.1)	10.7 (8.4-13.4)	10.2 (8.7-11.9)	0.658
Perceived FA, ever	139	9.4 (7.6-11.6)	10.2 (8-12.9)	9.7 (8.3-11.4)	0.651
Physician-diagnosed FA, ever	68	5.1 (3.8-6.8)	4.2 (2.9-6.2)	4.8 (3.8-6)	0.528
Immediate-type FA, ever	49	3.4 (2.4-4.9)	3.4 (2.2-5.2)	3.4 (2.6-4.5)	1.000
Immediate-type FA, current	20	1.3 (0.7-2.3)	1.5 (0.8-2.9)	1.4 (0.9-2.1)	0.820
Food-depending anaphylaxis	12	0.7 (0.3-1.5)	1 (0.5-2.2)	0.8 (0.5-1.5)	0.566

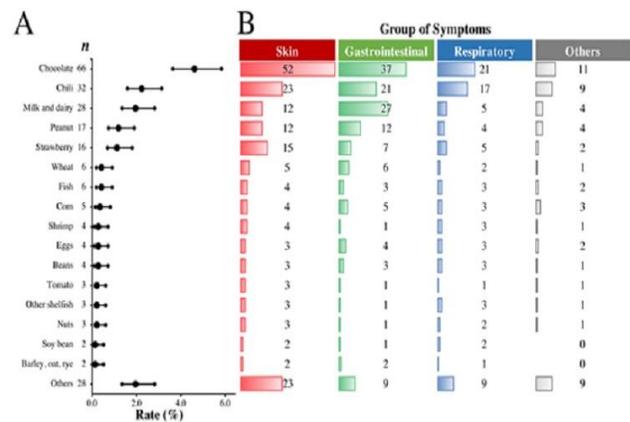
<sup>1</sup> FA: Food allergy.



**Figure 2.** Children that met criteria for immediate-type and physician-diagnosed FA. **FA:** Food allergy.

**Foods causing symptomatic adverse reactions in schoolchildren**

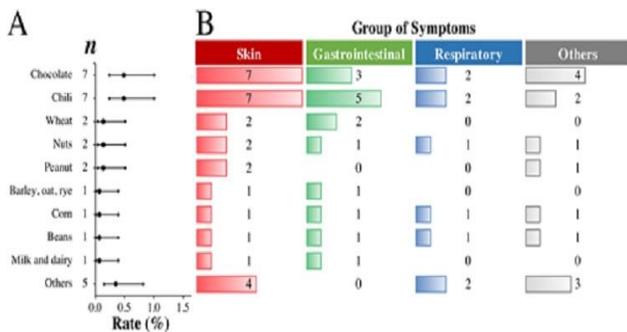
The most common foods causing adverse reactions and the specific symptoms associated with them are shown in **Figures 3A** and **3B**, respectively. Ninety-eight cases (67.1%) sought medical attention and 41 (28.1%) reported adherence to a restrictive diet (2 cases had no “physician-diagnosed FA, ever”).



**Figure 3.** Specific foods and symptoms associated with symptomatic adverse food reactions. (A) Adverse reactions rates by food (N = 1431; horizontal bars indicate confidence intervals, 95%); (B) Symptoms associated with adverse food reactions (N = 146).

**Common food allergens and clinical characteristics of FA**

The most common foods causing “immediate-type FA, current” and the symptoms associated with them are shown in **Figures 4A** and **4B**, respectively. Together, chocolate and chili accounted for 48.3% of the “immediate-type FA, current” cases and triggered 66.6% of the cases of anaphylaxis (n = 8). Other foods that triggered anaphylaxis were wheat (n = 2), milk and dairy, peanuts/chocolate, nuts, (n = 1 each).



**Figure 4.** Specific food allergens and symptoms associated with “immediate-type FA, current”. (A) “Immediate-type FA, current” rates by food (N = 1431; horizontal bars indicate confidence intervals, 95%); (B) Symptoms associated with “immediate-type FA, current” (N = 20).

## Discussion

The present study shows that adverse food reactions are common in Argentinian schoolchildren and that 1.4% of the children meet criteria for “Immediate-type FA, current”. This is the lowest FA prevalence rate reported in Latin American schoolchildren. Studies carried out in Chile, Mexico, and El Salvador reported FA prevalence rates from 3.5% to 5.5% using the same definitions of FA.<sup>3</sup> Other survey studies carried out in Latin America reported FA prevalence rates from 14.9% to 23.5%, but the target population and the definitions of FA were different.<sup>7</sup> The prevalence rates of chocolate and chili allergy in Argentinian schoolchildren (0.5%) were similar to those reported in Chile (0.8%)<sup>3</sup> and Mexico (0.5%)<sup>4</sup> and this is in line with the notion that the consumption of chili<sup>8</sup> and chocolate<sup>9</sup> is widespread in western countries. However, none of the Argentinian schoolchildren met criteria for shrimp or shellfish

allergy, which were the most common food allergens reported in Mexican schoolchildren.<sup>4</sup> Similarly, shrimp and shellfish were food allergens frequently reported in Chilean and Salvadoran schoolchildren.<sup>3-5</sup> Argentinian parents did not report cases of egg allergy although this food is a known allergen that affects children from the Latin American region and other regions from North America, Asia, and Europe.<sup>2,4,10</sup> Due to sociocultural practices and socioeconomic factors widely differ among Latin American countries and these aspects influence the children’s alimentary habits,<sup>6</sup> main food allergens are expected to differ among different Latin American regions.

The prevalence rate of anaphylaxis in Argentinian schoolchildren was 0.8%. This prevalence rate is lower than the rates reported in Chilean (2.6%), Mexican (1.2%) and Salvadoran (2.5%) schoolchildren, which were estimated using the same definitions of anaphylaxis.<sup>3-5</sup> Notably, only 1 out of 12 Argentinian schoolchildren that met criteria for food-induced anaphylaxis was advised to acquire an epinephrine autoinjector despite this device is the preferred emergency treatment for anaphylactic cases. Previous studies documented the lack of prescription of epinephrine autoinjectors in Argentina<sup>11</sup> and in other Latin American countries.<sup>3-5</sup> Notably, different from other countries in the Latin American region, epinephrine autoinjectors are commercially available in Argentina and this can help to increase awareness about the use and prescription of the autoinjectors by patients and healthcare personnel, respectively.

The main strengths of this study are its population-based design and the use of a validated in depth instrument previously utilized in other Latin American countries, which allows fair comparisons of the results. Furthermore, it has been described that the use of in depth instruments provides a fairly high detection efficiency (56-93%) (12,13). We should acknowledge that our study has some limitations. Firstly, the relatively low response rate (35.3%) could impact on the prevalence estimations. It is expected that individuals with knowledge about the disease studied would be more prompted to take the survey, however, this notion seems not to be the rule in the present study since the estimated prevalence rate of “immediate-type FA, current” is the lowest reported ever in Latin American schoolchildren. And secondly, our results were not corroborated with laboratory tests or other allergy tests commonly carried out in clinical practice, e.g. skin prick tests evaluations with fresh food extracts. Despite these limitations, our study provides useful epidemiological data regarding FA in Argentinian schoolchildren and serves as the groundwork for further epidemiological studies based on objective diagnostic criteria.

### Conclusion

This is the first population-based study conducted in Argentina to estimate the prevalence of FA. The parent-reported prevalence of FA in Argentinian schoolchildren was 1.4% and it is the lowest prevalence rate reported until now among Latin Amer-

ican countries. Due to the prescription of epinephrine auto-injectors in cases that met criteria for food-induced anaphylaxis is uncommon, the prescription and use of this emergency device should be encourage among health care professionals and anaphylactic individuals, respectively.

### Acknowledgements

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### References

1. Prescott SL, Pawankar R, Allen KJ, Campbell DE, Sinn JK, Fiocchi A, et al. A global survey of changing patterns of food allergy burden in children. *World Allergy Organ J* [Internet]. 2013;6(1):21.
2. Ontiveros N, Flores-Mendoza L, Canizalez-Roman V, Cabrera-Chavez F. Food Allergy : Prevalence and Food Technology Approaches for the Control of IgE-mediated Food Allergy. *Austin J Nutr Food Sci*. 2014;2(5):1029.
3. Hoyos-Bachiloglu R, Ivanovic-Zuvic D, Álvarez J, Linn K, Thöne N, de los Ángeles Paul M, et al. Prevalence of parent-reported immediate hypersensitivity food allergy in Chilean school-aged children. *Allergol Immunopathol (Madr)* [Internet]. 2014;42(6):527–32.
4. Ontiveros N, Valdez-Meza EE, Vergara-Jimenez MJ, Canizalez-Roman A, Borzutzky A, Cabrera-Chavez F. Parent-reported prevalence of food allergy in Mexican schoolchildren: A population-based study. *Allergol Immunopathol (Madr)* [Internet]. 2016 Jul;44(6):563–70.
5. Cabrera-Chávez F, Rodríguez-Bellegarrigue IC, Figueroa-Salcido OG, Lopez-Gallardo JA, Arámburo-Gálvez JG, Vergara-Jiménez M de J, et al.

- Food Allergy Prevalence in Salvadoran Schoolchildren Estimated by Parent-Report. *Int J Environ Res Public Health* [Internet]. 2018;15(11):2446. 85056097494&doi=10.3390%2Fijerph15112446&partnerID=40&md5=868e6be922c9355ec0b594a033e211e6
6. González-Jiménez R, León-Larios F, Lomas-Campos M, Albar MJ. Sociocultural factors determinants of eating habits of kindergarten schoolchildren in peru: A qualitative study. *Rev Peru Med Exp Salud Publica*. 2016;33(4):700–5.
  7. Marrugo J, Hernández L, Villalba V. Prevalence of self-reported food allergy in Cartagena (Colombia) population. *Allergol Immunopathol (Madr)*. 2008;36(6):320–4.
  8. Chopan M, Littenberg B. The association of hot red chili pepper consumption and mortality: A large population-based cohort study. *PLoS One*. 2017;12(1):1–10.
  9. Morze J, Schwedhelm C, Bencic A, Hoffmann G, Boeing H, Przybylowicz K, et al. Chocolate and risk of chronic disease: a systematic review and dose-response meta-analysis. *Eur J Nutr* [Internet]. 2019 Feb;1–9.
  10. Kim M, Lee JY, Jeon HY, Yang HK, Lee KJ, Han Y, et al. Prevalence of Immediate-Type Food Allergy in Korean Schoolchildren in 2015: A Nationwide, Population-based Study. *Allergy, Asthma Immunol Res*. 2017 Sep;9(5):410–6.
  11. Cardona V, Álvarez-Perea A, Ansotegui IJ, Arias-Cruz A, González-Díaz SN, Latour-Stafeld P, et al. Management of anaphylaxis in Latin America: current situation. *Rev Alerg Mex* [Internet]. 2017;64(2):171–7.
  12. Sicherer SH, Burks a W, Sampson H a. Clinical features of acute allergic reactions to peanut and tree nuts in children. *Pediatrics*. 1998;102(1):e6.
  13. Peveri S, Pattini S, Costantino MT, Incorvaia C, Montagni M, Roncallo C, et al. Molecular diagnostics improves diagnosis and treatment of respiratory allergy and food allergy with economic optimization and cost saving. *Allergol Immunopathol (Madr)* [Internet]. 2018;47(1):64–72.