

ORAL IMMUNOTHERAPY AS A TREATMENT FOR COCOA ALLERGY

Juliette Caron^a, Bouchra Mahjoub^a, Sophie Carra^a, Paul-Emile Bara^a, Sidonie Bonne-Grardel^a, Anne Herman^b, Florence Libon^c & Christine Delebarre-Sauvage^a.

^aAllergy Unit, Saint Vincent-de-Paul Hospital, Catholic University of Lille, Lille, France

^bDepartment of Dermatology, Cliniques universitaires Saint-Luc, Catholic University of Louvain, Brussels, Belgium

^cDepartment of Dermatology, Sart Tilman University Hospital Center, Liège, Belgium

Case report

Recently, cocoa has been reported as an allergen [1,2,3]. Up to now, only 4 reported cases of immunoglobulin E (IgE)-mediated sensitized patients to cocoa were confirmed by positive oral food challenge (OFC) [1, 2]. Avoidance is the only current treatment and the impact of oral immunotherapy (OIT) on this allergy remains unknown.

We report the case of a 12-year-old girl who developed hives after eating chocolate for many years. She had asthma, allergic rhinitis and atopic dermatitis. She also avoided hazelnuts, buckwheat, and walnuts because of severe reactions to those allergens. The initial allergy work-up revealed a positive skin prick test (SPT) to cocoa powder at 9 mm and positive cocoa-specific IgE at 0.50 kUA/L (Table 1). A white chocolate open OFC at a cumulative dose of 44.4 g containing cocoa butter without cocoa powder was nonreactive. Another open OFC was performed to confirm cocoa allergy and to start cocoa OIT. The OFC began at 50 mg of cocoa protein. Then, increasing doses (twice the cumulative dose) were administered every 20 min until a reaction at 873 mg of cocoa protein, which was called the eliciting dose (ED). The patient developed rhinitis, hives, dyspnea, and cough. The OFC was stopped. She received desloratadine 5 ml orally, dexchlorpheniramine 5 mg intravenously and salbutamol 2 puffs. From the ED, a home OIT protocol was put in place consisting of eating cocoa protein daily. OFC and OIT protocol were made with cocoa powder Van Houten® (Stollwerck GmbH, Norderstedt, Germany) containing 20% of cocoa proteins. At home, the initial dose of cocoa OIT was 1/10th of the ED, then the doses were increased monthly without exceeding half of baseline ED. Every 6 months a new OFC was performed to increase the doses at home (Fig. 1a). In case of intercurrent illness, OIT was to be stopped during those days. If the protocol was stopped for more than 5 days, the patient was asked to contact the unit to prevent adverse reactions. The patient reached 3050 mg of cocoa protein without reaction in OFC after 30 months of OIT (Fig. 1a). Due to the patient's weariness, induction was stopped, and a maintenance phase was implemented. She had to consume 3 times a week 20 g of dark chocolate Cote d'Or mignonette® (Mondelez France, Clamart, France) containing 1274 mg of cocoa protein. Note that after a year of cocoa OIT, she began a hazelnut OIT, which was unsuccessful. The ED did not exceed 55 mg of hazelnut protein in 3 years.

KEYWORDS: Desensitization ; Food allergy ; Skin prick test ; Oral food challenges ; Chocolate

Table 1. Patient initial allergy assessment: specific immunoglobulin E (IgE) for allergens along with clinical history and allergy management

Specific IgE	Initial biological results (kUA/L)	Initial clinical history	Allergy management
Cocoa	0.50	Hives	Avoidance Oral immunotherapy
Walnut	7.64	Anaphylactic reaction	Avoidance
<i>rJug r 1 (2S albumin)</i>	3.37	–	–
<i>rJug r 3 (LTP)</i>	<0.10	–	–
Hazelnut	58.80	Anaphylactic reaction	Avoidance Oral immunotherapy
<i>rCor a 1 (PR-10)</i>	<0.10	–	–
<i>rCor a 8 (LTP)</i>	<0.10	–	–
<i>rCor a 9 (11S globulin storage protein)</i>	49.20	–	–
<i>rCor a 14 (2S albumin)</i>	36.40	–	–
Pecan	2.98	No clinical history; no consumption	Avoidance
<i>rAna o3 (2S albumin)</i>	0.31	–	–
Pistachio	0.26	No clinical history; no consumption	No avoidance as the skin prick test was negative
Brazil nut	1.84	No clinical history; no consumption	Avoidance
<i>rBer e1 (2S albumin)</i>	0.54	–	–
Macadamia nut	4.96	No clinical history; no consumption	Avoidance
Buckwheat	0.78	Anaphylactic reaction	Avoidance

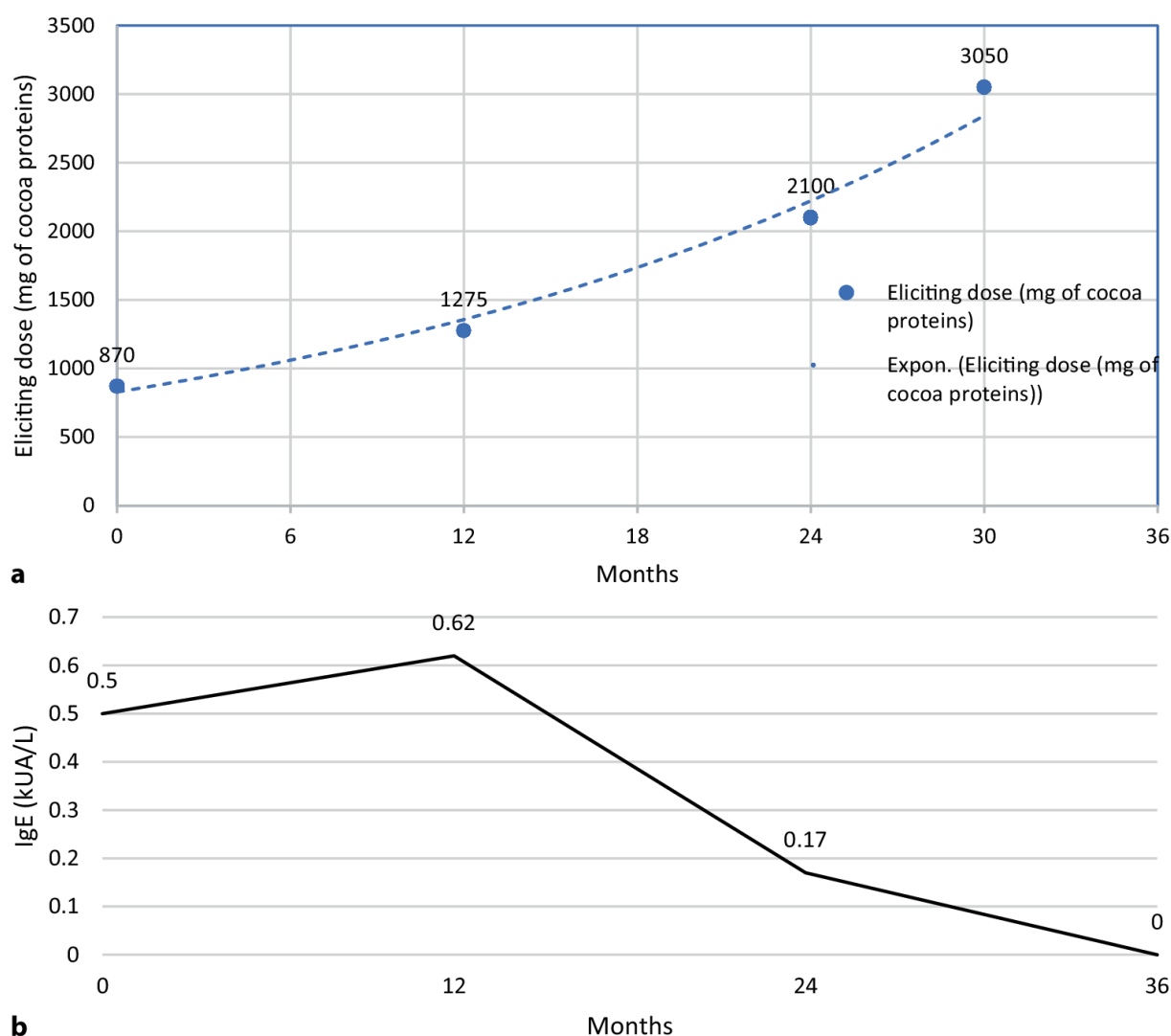


Fig. 1. Eliciting dose (**a**) and cocoa-specific immunoglobulin E (IgE; **b**) during cocoa oral immunotherapy (OIT)

During the tolerance induction period, cocoa powder SPT remained stable at 9 mm. SPT with histamine phosphate 10 mg/ml was always positive at 5 mm and negative control 0.9% saline solution was negative. But cocoa-specific IgE decreased (Fig. 1b). Specific IgE were positive if >0.10 kUA/L. At 30 months of cocoa OIT, the patient subsequently discontinued her protocol for more than 15 days due to an infection. She did not contact the department as recommended. She resumed cocoa OIT by consuming 1274 mg of cocoa protein at home and had immediate generalized hives, dyspnea, abdominal pain treated by intramuscular adrenaline 300 µg. Cocoa OIT was abandoned. Loss of tolerance was confirmed at month 34 during an OFC with an ED of 420 mg of cocoa proteins. Patient consent was obtained to publish this article.

This is the first case of cocoa allergy to have benefited from OIT for at least 30 months. OIT could be effective in case of cocoa allergy. Further studies are needed to evaluate the efficacy and safety of cocoa OIT. It seems that a 50% reduction in IgE is not a good predictive factor for sustained unresponsiveness after discontinuing cocoa OIT [4]. Protein involved in the reaction has not been identified in our case. According to literature, it appears that a cocoa bean 2S albumin may be

responsible [5]. This protein has high sequence similarity (>52%) to several 2S albumins from known allergenic sources such as walnut [6]. This could explain the patient's cross-sensitizations (Table 1).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

JC was the major contributor in writing the manuscript. BM, SC, PEB, SBG, AH, FL and CDS took part in the writing of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

J. Caron, B. Mahjoub, S. Carra, P.-E. Bara, S. Bonne-Grardel, A. Herman, F. Libon and C. Delebarre-Sauvage declare that they have no competing interests.

References

1. Bentradi S, Zakariya M, Guiddir T, Nemni A. Anaphylaxie IgE médiée à la fève de cacao : à propos d'un cas. *Rev Fr Allergol*. 2023;63:103355.
2. Lopes JP, Kattan J, Doppelt A, Nowak-Węgrzyn A, Bunyavanich S. Not so sweet: True chocolate and cocoa allergy. *J Allergy Clin Immunol Pract*. 2019;7:2868–71.
3. Wognin SB, Tchicaya A-F, Kouassi YM, Koffi-Oura S, Bonny J-S, Nemery B. Allergie et cacao : tests immunologiques et échantillonnage atmosphérique dans une usine de transformation de fèves de cacao en Côte d'Ivoire. *Arch Mal Prof. Environ*. 2014;75:53–8.
4. Pourvali A, Arshi S, Nabavi M, Bermanian MH, Shokri S, Khajoei S. Sustained unresponsiveness development in wheat oral immunotherapy: predictive factors and flexible regimen in the maintenance phase. *Eur Ann Allergy Clin Immunol*. 2023;55:174.
5. Nin Valencia A, Retes LS, Bartolomé-Zavala B, Perdomo Gutiérrez G, Bigorra T. Allergy to Theobroma Cacao. *Clin Case Rep*. 2024;12:e8803.
6. Kochhar S, Gartenmann K, Guilloteau M, McCarthy J. Isolation and Characterization of 2S Cocoa Seed Albumin Storage Polypeptide and the Corresponding cDNA. *J Agric Food Chem*. 2001;49:4470–7.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.