

Food allergy to wheat, soybean and cassava in Benin: Literature Review

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Abstract

The objective of this study is to make a synthesis of the data relating to the food allergy to wheat, cassava and soy. Allergy is defined as a hypersensitivity reaction initiated by an immunologic mechanism. The mediator of this mechanism may be lymphocytes or immunoglobulin namely immunoglobulin (Ig) G and E. Dependent IgE allergies are the most common. Since the years 2008, many emerging allergens appear. These include allergens of wheat (gliadin, Glutenin), soybeans (Gly m 5, m 6 Gly and Gly m 4) and cassava (Man e5). The manifestations of these allergies are various, namely: lesions of eczema, pruritus, vomiting, diarrhea, rhinitis, cough, conjunctiva, etc. The prevalence of allergy to soy, wheat and cassava also increases very quickly. Biological diagnostic techniques improve from the test of Enzyme Linked Immuno-Sorbent Assay (ELISA) to the detection of cellular activation IgE dependent. In 2014 a new immunotherapy technique is established for cell triggering allergies. The usual preventive means are antihistamines, corticosteroids and the adrenaline auto-injectors pens. Today there is also a therapeutic education (TPE) of the patient and his family who teaches actions and specific knowledge in order to avoid accidents sometimes fatal and thus improve the quality of life of people with allergies. It is therefore essential to popularize the concept of food allergy in developing countries such as Benin for a better health of populations.

Keywords: Food allergy, wheat, soybeans, cassava, biological diagnosis.

Introduction

The word allergy comes from the Greek *allos* meaning another and *Ergon* meaning action; it has been used for the first time in 1906 by Von Pirquet back. The allergy is a hypersensitivity reaction initiated by an immunologic mechanism. The mediator of this mechanism can be lymphocytes or immunoglobulin namely immunoglobulin (Ig) G and E. The IgE dependent allergy is the most frequent and concern: some asthma and rhinitis, food allergies (AA), allergies to the venom of Hymenoptera and some drug allergies (F. Blanc, 2008). The Food Allergy is a reaction of the human immune system following the ingestion of food. The prevalence of food allergy varies with age, eating habits and many other factors. Although a food allergy can theoretically be triggered by any food, there is a "major" allergens group responsible for 80% of food allergies, which are: cow's milk, hen's egg, wheat and soybeans, peanuts, oilseeds (hazelnut, walnuts, almonds) as well as the fish (J. Wassenberg, 2011). The food allergy is a known problem for several centuries and its prevalence has increased considerably in recent years

and continues to progress, causing a major public health problem especially in the industrialized countries but also in developing countries that do not yet give a great importance (K. Abdellaoui, 2010; J. I. Boye, 2012). As Not being significantly involved in the Mortality and as far as the discomfort they cause remain tolerated, food allergies have almost no place within the health policy and especially in the developing countries. In Benin, the overall analysis of the vulnerability and food security (AGVSA) published in January 2014 (PAM, 2014) reveals that the population consumes mainly staples foods (cereals/tubers/legumes) with few vegetables and oil.

Among the most consumed cereals, the most important are essentially the corn and wheat (INRAB, 2015); the most consumed root is cassava (A. P. AGRE *et al.*, 2015) and soybeans is the legume the more appreciated by the Beninese especially for its use in the composition of the childhood meal. Because of their food importance, what's allergy to wheat, cassava and soybeans in Benin? This analysis of the literature aims to bring a part about the logistics to begin the treatment of this problem in Benin.

1. Methods

This literature review was made using a critical analysis of the scientific literature. The literature search was done by querying bibliographic databases Medline, Embase (Elsevier) and Google scholar. The research was limited to documents, theses and publications in English or French. After reading the titles and abstracts of the Work, as potentially relevant were read and discussed. The results are presented in the following lines.

2. Results

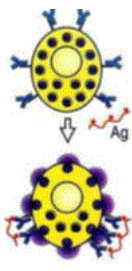
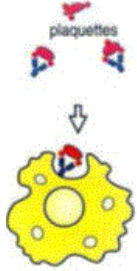
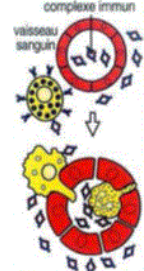
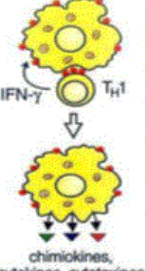
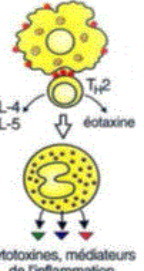

2.1 Classification of the allergy

Allergic reactions have been classified by Gell and Coombs (1963) into four categories depending on the speed of onset of symptoms and the main immunologic mechanism. It is of type hypersensitivity reactions:

- 1) Immediate, mediated by the IgE
- 2) Cytotoxic and cytolytic, mediated by IgG
- 3) Semi-late immune complexes) and
- 4) Delayed cell-mediated) Gell and Coombs cited by (A. Lifrani, 2006; L. Mondoulet, 2005).

Table 1 makes the summary

Table 1: Classification of Gell and Coombs

	Type I	Type II	Type III	Type IV		
Immune factor in question	Ig E	IgG	IgG	Cells T _H 1	Cells T _H 2	CTL
Antigen	Soluble Antigen	Antigen associated with the cell or matrix	Soluble Antigen	Soluble Antigen	Soluble Antigen	Cell Antigen
Effector mechanism	Activation of mast cells 	FcR ⁺ cells (phagocytosis, NK cells) 	FcR ⁺ cells Complement 	Activation of macrophages 	Activation of eosinophils 	Cytotoxicity 
Example of the hypersensitivity reaction	Allergic rhinitis, asthma, systemic anaphylaxis	Allergy to some drugs (e.g., penicillin)	Serum sickness, Arthus reaction	Contact dermatitis, tuberculin reaction	Chronic asthma, rhinitis Chronic allergic	Contact dermatitis

Source: (F. Blanc, 2008)

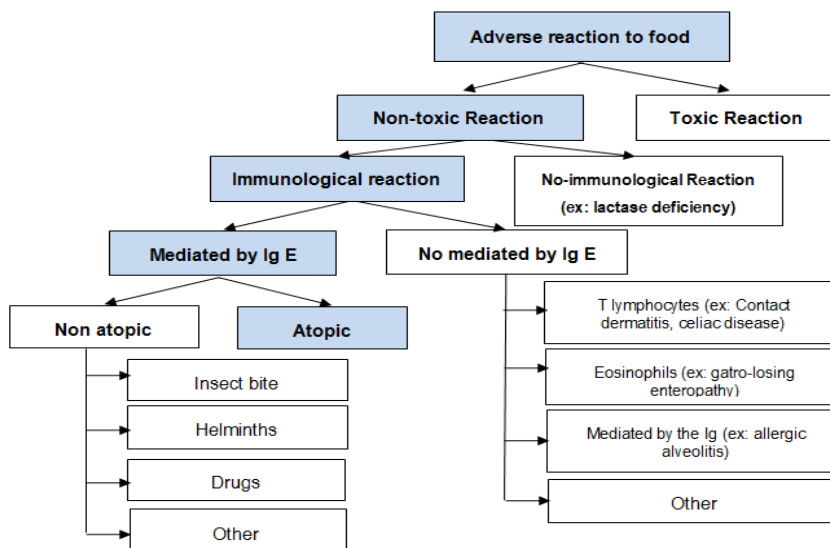


Figure 1: Detailed algorithm of the mechanisms of clinical manifestations of hypersensitivity Source: (S. Johansson et al., 2001)

Table 2: The most common food allergens for children and adults

Allergens	0-1 year 147 children (%)	1-3 years 359 children (%)	3-15 years 468 children (%)	Adults 287 (%)
Eggs	77.5	69.6	24.3	6.3
Milk	29.2	25.6	7	3.5
Peanut	19.7	37.6	49.3	10.1
Fruit in husk	2.7	4.4	10, 2	15.7
Legumes	0.6	4.4	13.4	5.9
Fish	0.6	5	10	3.1
Prunoïdees	0	0	0	31.3
Lawyer, banana, chestnut, Kiwi	0.6	1.3	5.3	22.6
Apiaceae	0	0	1.7	16.4
Wheat, grain	6.1	6.4	2.7	13.2

Source: (D.-A. Moneret-Vautrin, 2008)

Table 3: Emerging allergens responsible for severe anaphylaxis

Emerging allergens	2002	2003	2004	2005	2006	2007	Total Cases
Molluscs	6	10	6	3	6	6	37
Flour of Lupin	7	1	7	2	7	4	28
Cashew Nuts	5	3	6	4	1	9	28
Milks of sheep and goat	0	2	4	2	2	4	14
Buckwheat	3	4	8	1	6	3	25
Isolates of wheat	0	0	2	1	6	2	11
Quinoa	0	0	0	0	0	1	First case
Frog	0	0	0	0	0	3	3
Nectarine, Orange	0	0	0	0	0	2	2
Green barley	0	0	0	0	0	1	First case
Carrot	0	0	0	0	0	1	1

Source: (D.-A. Moneret-Vautrin, 2008)

Thanks to recent immunological knowledge, allergic reactions have been divided into two groups which are the toxic reactions and Non-toxic reactions, European Academy of Allergology and Clinical Immunology (EAACI) during 2001, has published a revised allergy nomenclature (S. Johansson *et al.*, 2001; P. Meyer *et al.*, 2003) (Figure 1).

2.2 Food Allergies

Food proteins, sources of raw materials and energy essential to human, do not constitute a danger for the organism. However, the immune system of some people genetically predisposed (atopic) develops a specific and inappropriate reaction against these proteins which become allergens. Thus initiated response causes a cascade of inflammatory reactions responsible for the symptoms of food allergy (D. Moneret-Vautrin, 2012).

2.2.1 Allergens

The Allergens are antigens causing allergies. These antigens are of animal or vegetable origin. They may be bodies of low molecular weight (isocyanates or anhydrides, chrome, nickel or formaldehyde), glycoprotein or carbohydrate. Each food has a large

number of potentially antigenic substances among which there are major, minor allergens and of isoallergens (A. Bentenni, 2013; D. A. Moneret-Vautrin, 1997).

According to the data of the WHO, more than 70 foods are at the origin of food allergy. Among them the most common are: Cereals containing gluten, shellfish, eggs, fish, peanuts, soy, milk and walnuts, hazelnuts and almonds (F. INFOSAN, 2006).

A study on the various populations of the European Union has made the point on the epidemiology of food allergens. Indeed, the milk, egg, peanut, nuts, are the first allergens of the child. The prunoïdees, the fruit of the Group latex, the apiaceae, wheat flour and nuts are the first Allergens of adults (Table 2).

Similarly, the Network of Allergovigilance in France has made case over the years 2002-2007 of new allergens responsible of Severe Anaphylaxis. It is a severe, potentially fatal, systemic allergic reaction appearing suddenly after contact with an allergenic substance (H. A. Sampson *et al.*, 2006). The relevant allergens are molluscs, lupin and wheat flours, cashew nuts and milk of sheep and goat (table 3).

Cereals therefore increasingly occupy a greater place in the family of allergenic foods. Nevertheless, they are the most important food resource both for human consumption and for livestock feed.

Table 4: Summary of clinical manifestations of food allergy

Type of Reaction	Target Organ	Clinical table	History
Cutaneous	Skin	Atopic dermatitis (or atopic eczema)	<ul style="list-style-type: none"> • The Lesions of eczema (poorly Limited, erythematous) on the face, the faces of the extension of the muscles, seat, flexural folds; • Pruritus
	Skin	Acute urticaria	<ul style="list-style-type: none"> • Eruptive dermatosis due to a dermal edema secondary to a vasodilatation and to an increase in capillary permeability; • The presence of pink papules edematous, itchy. • Dermatitis due to a hypodermic edema that can be fatal if it affects the mucous membranes pharyngo-laryngeal;
	The mucous membranes	Angiedema or angio-edema	<ul style="list-style-type: none"> • Swelling pinkish white, non-pruritic but accompanied by a sensation of voltage.
Oral-gastro-intestinal tract	Oral mucosa	Oral syndrome of Lessof	<ul style="list-style-type: none"> • Pruritus and labial edema, gingival, mouthpiece, or even a swelling of the glottis. • Nausea, vomiting, abdominal pain, diarrheal episodes, gastro-oesophageal reflux.
	Intestines		<ul style="list-style-type: none"> • Obstruction And Itching Nasal (inflammation of the mucosa of the), cough and crisis of sneezing, conjunctivitis.
In breathing	Nasal mucosa	Rhino-conjunctivitis	<ul style="list-style-type: none"> • Bronchial constriction leading to a respiratory discomfort, with dyspnea wheezing due mainly to a release of histamine
	Lung	Asthma	<ul style="list-style-type: none"> • Circulatory insufficiency acute, caused by a primitive vasodilation device linked to the massive release of mediators.
Systemic Issues		Anaphylactic Shock	<ul style="list-style-type: none"> • Put in game of the vital prognosis

Source: (C. Dubuisson *et al.*, 2002)

In Benin, they play a major role in agricultural production. Cereals frequently produced in Benin are: soybeans, corn, rice, sorghum, etc. The production of 2014 for corn amounted to 1.354.344 tons while that of cassava for the same year amounted to 4.066.711 tons (F. FAOSTAT, 2015).

2.2.2 History and epidemiology of food allergy

The food allergy is a known phenomenon for several centuries. Hippocrates (Vth century before Jesus Christ) and Galen (IIth century after Christ) have recognized that cow’s milk and goat’s milk could cause of characteristic symptoms of an allergic reaction. But it is only in the XXth century that allergy has been defined for the first time (F. Blanc, 2008).

The epidemiology of food allergy is done according to several stages chronologically and specific. It is:

- Surveys by questionnaires in general populations,
- The achievement of prick-tests,
- The dosage of specific IgE and
- Oral provocation test (OPT).

For more precision, additional data are provided by specialized medical networks (Sicherer and Sampson, 2014; S. H. Sicherer and H. A. Sampson, 2014; J. Wassenberg, 2011).

It is on the basis of this working method that prevalence of most popular allergens has been established. Several studies conducted in Europe with that of (D.-A. Moneret-Vautrin, 2008) indicates that the prevalence of food allergy in pediatric population is around 4.7 and 3.2% in adults. This statistic appear to tally with that of Dutau, which assesses the prevalence of allergy between 5 and 6% in the pediatric population (G. Dutau and F. Rancé, 2006). According (E. Bidat, 2006), 20% of the population think be allergic to one or more foods but only 2-4% are proven. It also confirms that food allergy is more common for children than for adults and it appears in three quarters of cases before the age of 15 (E. Bidat, 2006). The prevalence of allergens depends on the consumption habits, the age and the culinary habits of each country. Food allergies pose a major public health problem and are even classified according to the 4th place among global diseases (H. Mahroug, 2010).

2.2.3 Mechanisms of food allergy

Food allergy (immediate IgE dependent of type I) is classically done in 2 stages: awareness and the proper reaction. Awareness is performed during the first contact of the allergen with the immune system of the patient. It entails the production of specific IgE that are dispersed throughout the body and attach to "target cells". This first

phase is clinically silent and conditioning the body to react immediately to a second contact with the same allergen. The allergic reaction itself occurs in second contact with the allergen (or an allergen of structure similar to that in the case of cross-allergies). The formation of immune complex Antigen-antibody IgE led to the release of chemical mediators which is histamine and other mediators and pro-inflammatory cytokines. These mediators attract other cells (eosinophil granulocytes) in the injured tissue and promote allergic answer of allergic nature more or less serious depending on each individual (C. Dubuisson *et al.*, 2002; S. Nancey *et al.*, 2013).

2.2.4 Symptomatology

The allergic manifestations following the ingestion of food are very varied. They can affect all organs and differ according to the mechanism involved. The most common symptoms are reported in Table 4. The origin allergic of some symptoms, for example the chronic tiredness syndrome or migraine remains controversial.

2.2.5 Diagnosis of food allergy

The diagnosis of food allergy is a delicate, sensitive and meticulous exercise. The exploration of food allergies has been in time more and more codified to obtain a diagnosis of essential certainty. In fact, the diagnosis of food allergy can be clinical and / biological.

The clinical diagnosis is to undergo an interrogatory to the patient, a food survey and finally a clinical examination (A. Muraro *et al.*, 2014). The examination allows obtaining personal information especially on the family history of atopy. The clinical examination search palpable and immediate manifestation of allergic reaction. During the course of food investigation, the patient holds a food diary (for a week) in which he entered everything that is relative to his diet (M. Morisset, 2008). All information obtained as a result of these three tests play an important role in the orientation of laboratory tests for the diagnosis of a food allergy.

The biological diagnosis is subdivided into two categories namely the *in vivo* test and *in vitro* tests. *In vivo* tests include skin tests (prick-test, atopy patch), the tests of eviction, tests of the labial provocation, tests of oral provocations (simple blind: Its, double blind: DA) (L. Mondoulet, 2005). Nevertheless, the prick-test is the *in vivo* test the most practiced. It consists in depositing a small amount (a drop) of the allergen in aqueous solution of preference on the skin of the forearm or the back of the patient. Using a needle, the doctor, after cleaning, spades the skin at the level of the marks pre-marked to let penetrate the allergenic solution without ever causing bleeding. It must then wait 15 to 20 minutes to read the reaction. A positive reaction is manifested by the appearance of a papule whose diameter is measured for a

good interpretation (D. T. Agbozognigbe, 1998). The biological *in vitro* techniques *in vitro* biological used in the diagnosis of food allergy are diverse and varied but are all based on immunological methods. For the research of the IgE antibodies specific to an allergen, produce during the hypersensitivity reaction of type I, the techniques used are the radio Allergo-Sorbent test (RAST) or the Enzyme Linked Immuno-Sorbent Assay (ELISA); the immunoblots; ISO electro focusing; the use of allergens chips etc. (K.-E. El Cherfi, 2012; M. Morisset, 2008). There are also other methods of diagnosis of the AA which are based on the detection of cellular activation IgE dependent. In this category, the techniques are: the histamine-leukocyte release by basophils; the measurement of basophiles activation by flow cytometry; the "Cellular Allergen Stimulation Test" (CAST) etc. for the diagnosis of non IgE mediated allergic reactions, biological specific techniques are not yet developed up to this day. Their diagnosis is essentially based on the examination, the food safety investigation and the clinical examination.

The RAST (L. Wide *et al.*, 1967) is the reference diagnostic technique in the case of mediated IgE allergic reaction. The allergen is attached to a solid support and is incubated with the serum to be tested. The specific IgE allergen if present, bind to the support and are revealed by an antibody anti-IgE marked. Initially, the marker was radio-isotope; but currently it is replaced by a fluorescent or enzymatic marker. The rates of IgE measured are expressed in kUI.ml⁻¹ or IU.ml⁻¹ according to the commercial product used. The technique of determination of specific serum IgE, recognized as the best, is that of Pharmacia CAP System®. The results are expressed in kU_A.ml⁻¹: The detection threshold is set at 0.35 kU_A.ml⁻¹ (L. Mondoulet, 2005).

2.2.6 Prevention and treatment of food allergy

Prevention and treatment of food allergies is largely based on the eviction of the feed (s) in question, but it is often taken by default. Preventive measures such as antihistamines, corticosteroids, the adrenaline injectors pens have been implemented and are used to prevent recurrence (G. Dutau and F. Rancé, 2006). But from 2014 a new immunotherapy technique has been established for cell triggering allergies (S. Chirumbolo, 2014).

In France, there is a therapeutic education for food allergy in childhood. Indeed, the AA has a therapeutic education (TPE) of the patient and his family. Supporting the AA does not stop at a medical diagnosis and a simple information issued by the physician. These actions are complemented by the acquisition of specific knowledge in order to avoid sometimes fatal accidents and thus improve the quality of life. These skills are acquired during a real medical procedure that is the TPE (A. Nemni and J. Just, 2010).

Table 5: Steps of the Therapeutic education in the food allergy

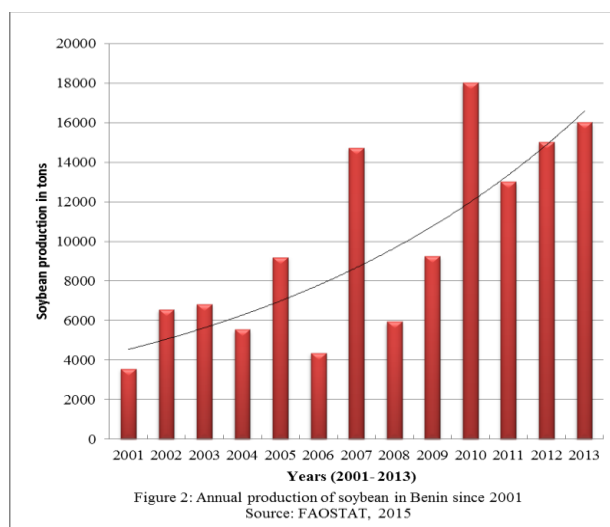
Know how to manage an allergic reaction	Know how to manipulate the Anapen®	Know the eviction regime	Get a kit organized and available
Recognize an allergic reaction	Remove the black cap	Quote the allergen (s) which he reacts	Quote all the drugs in the kit
Know When to Use an antihistamine	Correctly select the site of injection, between fold and cuture of the Trousers	Know that the ingredients are noted on the labels in descending order by weight	Check regularly to ensure the absence of expiry of drugs
Know when to use an oral corticosteroid	Install the Anapen®	Always read the labels, even if the food is not new	Ensure that the kit contains all medicines recommended
Know when to use a bronchodilator	Remove the clip above the red button	Know the possibility of indirect exposure (kiss and contacts, inhalation, Mixer...)	Ensure the presence of the package leaflet
Know when to use the Adrenaline	Trigger in now 10s	Information on the non-prepackaged foods (pizza for example)	Know the location of the at-home kit
Quote in the correct order the sequence of use	Call the emergency	Know the meaning of "traces", "manufactured in a place", "may contain"	Take anywhere the kit
Quote the emergency number in France, in Europe	Dial the correct number and give the essential information	Know the foods that can provide cross-reactions	
Know that a monitoring is essential in cases of use of adrenaline		Know the food crusaders to exclude	
Know why it is necessary to call the rescue of Emergencies		Be informed of the European regulations	
Knowledge, if necessary, manage a crisis of asthma with Beta-2 repeated and oral corticosteroids		Knowledge is not only speak to an adult referent	
Know disturb an adult in the case of allergic manifestations			

Source : (A. Nemni and J. Just, 2010)

2.3 Soy Food Allergy

The Soybean is a legume rich in proteins (40 g/100g of dry matter), fat (30 g/100g of dry matter) and containing the eight essential amino acids. It is coming from of Asia and has being used in the fermented form. It is widespread in occident and in Africa, leading both to different modes cultures and to new changes have been put in place by the agri-food industry (B. Hamza and B. A. Riad, 2013). It is by excellence used for protein enrichment formulations of infantile food and to combat malnutrition throughout the world (E. A. M. Assogba, 2012; FAOSTAT, 2013; FAOSTAT, 2015; S. Soro *et al.*, 2014). The Soybean is omnipresent in the industrial power and Cache under various designations namely: plant proteins textured (PVT), hydrolyzed vegetable protein (HVP), vegetable oil, vegetable margarine, lecithin, vegetable broth, milk's substitute, soy cheese (J. B. Boislève, 2010). In Benin, soybeans enter in the production of infant flour, biscuits, cheese, etc. Its production continues to increase over the years shows the statistics of the FAOSTAT (2015).

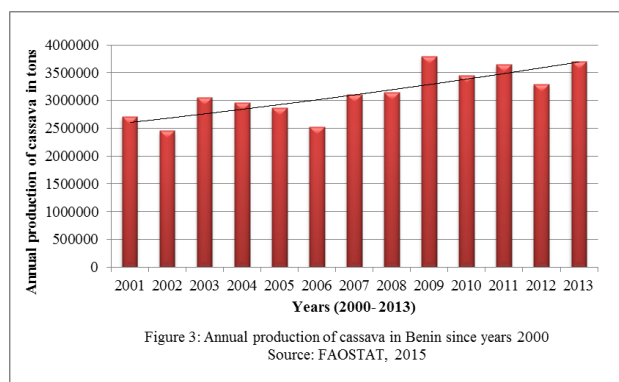
However, cases of allergy related to this cereal are revealed in recent years (A. Nemni *et al.*, 2006). Soy allergy is rare, but data from the network of allergovigilance in France showed soy as one of the emerging major allergens. The clinical manifestations are mainly IgE mediated with a risk of severe anaphylaxis, mainly subjects allergic to Birch pollen or peanuts.



One of the peculiarities of the soy allergy is characterized by the often high threshold for the onset of the symptoms (J. I. Boye, 2012; S.-A. Gomez-Andre *et al.*, 2012; K. Kuppannan *et al.*, 2014). It's basically skin rashes, gastrointestinal disorders, and upper respiratory tract and even a systemic generalized response to anaphylaxis which may cause the death. Soybean allergens are multiple. It's the protein Gly m 5, Gly m 6 and Gly m 4 but the most striking is Gly m 4 (T. Geng *et al.*, 2015; S.-A. Gomez-Andre *et al.*, 2012; S. Julka *et al.*, 2012). In Benin, there is not yet a database on soybean allergy.

2.4 Cassava Food Allergy

Cassava (*Manihot esculenta*) is a tropical food plant (Euphorbiaceae) with edible roots which has been introduced in Africa by the Portuguese since the 16th century. It constitutes one of the main sources of energy in the human diet of tropical regions. On the energy plan, it produces 8.2 million calories per hectare against 3.3 million for corn (Y. Diallo *et al.*, 2013; F. Nweke, 2005). It is cultivated as well for its leaves that for its roots, which come in the daily diet of many populations, especially Africans, under several forms. It is a plant easy to grow, meaning it tolerates the most hostile. It is cultivated in nearly 100 developing countries, including more than 30 in Africa. In Benin, the regions to favorable conditions for the culture of cassava are: Kétou, Sakété, Adja-Ouèrè in Ouémé; Aplahoué, Toviklin, Djakotomey, Houéyogbé, Klouékanmey in mono; Savalou, Dassa-Zoumè, Savè, Bantè, Ouèssè, Djidja in the Zou (F. Nweke, 2005). The statistical data of the annual production of cassava are presented by the figure 3.



According to the hydrocyanic acid content of the roots, the large varieties of cassava can be grouped into two broad categories:

- The sweet manioc: grown for local consumption of tubers (cooking of the tubers immersed in the water that is called the cassava boiled);
- The bitter cassava: mainly used for dishes after having undergone a fermentation (Y. Diallo *et al.*, 2013; L. Djilemo, 2007);

The cassava occupies a big place in the agro-food industry, because his transformation finished products very appreciated by populations are obtained and therefore an increased marketing.

The traditional derivatives of cassava are: gari and lafun (flour of fermented slice) are the come ahead (Y. P. Adégbola *et al.*, 2013), but there is also tapioca and other products used in the human diet such as starch, ethyl alcohol, the non-fermented cassava flour, called bread-making flour.

The cassava transformed starch has similar characteristics to potato starch in relation to the color, the taste and elasticity. The agro-alimentary usage of raw or transformed starch are numerous and in strong

growth. It is used as a thickener in the preparation of sauces, sausages, minced meat, soups, food for baby and children; it is also useful in brewery, pharmacy, etc. Transformed into glucose or dextrose, it serves as a sweetener candied fruits and jams. The non-food uses of starch are also numerous. It is the production of glue and adhesives for wood, envelopes, wall paper in the stationery and the textile industry (ESC, 2004).

The manioc flour is obtained from a grated cassava, dried and ground. It is a food very consumed by the African populations by both children and adults (V. J. Zannou-Tchoko *et al.*, 2011). However, the industrial use is not too strong in Benin. This flour has been and is the subject of research and development (Technology Program in Food and Agriculture (TPFA); development Program of root's plants and tubers (DPRT) in Benin) in West African countries in order to improve its quality, its color, its homogeneity, its smell, its particle size which decreases the organoleptic qualities of the finished product causing psychological blocks among consumers. All this explains well the reluctance of its use for the manufacture of industrial products (bread, cake, biscuits). But today there is a non-fermented cassava's flour of high quality meaning odorless, white color, homogeneous; of particle size closed to that of the wheat flour (CTA, 2008). This non fermented flour in addition to the traditional uses can be used by the food industry and agro-food sectors. It can replace or substitute the wheat flour, up to 100% in several preparations (bread, donuts, cookies, cake, crepe...) (I. Y. Bokossa *et al.*, 2013; L. Djilemo, 2007). In Benin, the substitution rate is not high: 15% for salted Bread and 15 to 50% for the sweet breads and pastry products (decree n°2008-571).

Despite, the range of products derived from cassava, its consumption today may induce an allergic reaction cross with the latex food group. In fact, people allergic to latex can also develop an allergy to boiled cassava. The Association of latex allergy and allergy to vegetable provenance food is called latex syndrome - fruit. An increasing number of vegetables sources (such as cassava) have been associated with this potentially fatal disease (A. Gaspar *et al.*, 2003; M. Ibero *et al.*, 2007). The first cases of allergic reactions after the ingestion of boiled cassava have been reported in Brazil and Mozambique respectively in 2004 and 2007 (K. S. Santos *et al.*, 2011). Man e5 is the first allergen purified from the cassava which demonstrates a cross reactivity of IgE with Hev b 5 which is the responsible allergen for latex allergy. The data suggest that Hev b 5 could act as primary sensitizer and could therefore lead to allergic manifestations on the consumption of manioc without prior exposure (K. S. Santos *et al.*, 2013). In Benin, no case of food allergy in cassava has been raised.

2.5 Wheat Food Allergy

The wheat is a cereal belonging to the family of grasses meaning, to a group of vegetables whose name,

etymologically, means "a grain producer". It is the cereal the most cultivated and the more consumed in the world (D. De Boissieu, 2012) generally and particularly in Benin. It is an important source of protein for human food. His grain contains 10 to 15% protein depending on the variety, which one distinguishes 4 groups: albumins, the globulins, gliadins and glutenins (F. Battais *et al.*, 2007). There are two categories of wheat: the soft wheat (production of flour child in the manufacture of the bread dough) and durum wheat (manufacture of pasta and semolina) (M. Rinaldi *et al.*, 2015). The producer countries are essentially: Brazil, Argentina, Australia, the United States, Canada, the Pakistan (FAO, 2008). Because appropriate climatic conditions (temperate climate, land rich), this cereal is not cultivated in Benin but rather imported. Among the imported products, it occupies the 13th place while the wheat flour occupies the 8th place (F. FAOSTAT, 2013).

However, this importation is not a stable as indicated the data of FAO which sets out that in 2000 the amount of wheat exported was 12207 T while 1721 T in 2005, 4701 T in 2010 and 27826 T in 2012 (FAOSTAT, 2015).

Despite its importance, the consumption of wheat can cause to some people, allergies cases (D. De Boissieu, 2012; C. Saadoun-Cousin *et al.*, 2002) . Wheat is one of the six foods involved in 90% of food allergies. It is involved in 5.2% severe anaphylaxis case reported between 2002 and 2005 to the network of allergovigilance in France. The frequency of wheat allergy appears with a high increase (E. Beaudouin *et al.*, 2007). The major allergens of wheat are mainly gliadins, which are with glutenins, grouped under the term of "gluten" (F. Battais *et al.*, 2007). Wheat allergy is a reaction to the protein components of wheat. One hand, albumin and globulin those are located in the outer shell of the grain of wheat and on the other hand, gliadin and gluten that occur inside the grain. The Glutenin and gliadin allergy is a food allergy caused by ingestion of flour. It can trigger gastrointestinal symptoms, including asthma or anaphylaxis. Albumin and globulin allergy is a respiratory allergy triggered by inhalation of flour; bakers are the first victims, it of the Baker allergy (P. Gillet, 2015; N. Rosenberg, 2002). According to the immunological mechanism in question, there are allergy IgE and non-IgE-mediated, including symptoms, diagnosis and support are different.

Wheat IgE mediated allergy occurs both to adults and children, but particularly among the latter. The symptoms can be immediate or delayed (D. De Boissieu and C. Dupont, 2005). Note that there is a particular form of wheat allergy IgE mediated that is singled out by an allergic reaction induced by effort. This allergy rare for small children is more described for the adolescent or young adult. Its particularity is that it occurs during physical exertion, only if the person has ingested the wheat, in any form, in the preceding hours. Ingestion of wheat is perfectly permissible if it is not followed by physical effort. Anaphylactic manifestations, beginning

after 10-15 minutes of physical effort, are often serious (D. De Boissieu, 2012).

Concerning non-IgE-mediated allergy, it's chronic digestive manifestations due to gluten intolerance: Celiac disease (MC). It is an immuno-dependent chronic enteropathy, affecting the small intestine in children and adult genetically predisposed, induced by the ingestion of food containing gluten. It is also under the names of non-tropical sprue or celiac sprue, gluten-sensitive enteropathy (J. F. Ludvigsson *et al.*, 2012; L. Saturni *et al.*, 2010). When gluten comes in contact with the digestive tract, the body produces autoantibodies IE antibodies directed against the body's cells. These autoantibodies affect primarily the small intestine (M. Brabant, 2013). Celiac disease is manifested by gastrointestinal symptoms: diarrhea, weight loss, steatorrhea; secondary edema symptoms of gastroesophageal reflux, vomiting, constipation, bloating, Borborygmi, infertility, neuropathic pain in the limbs, rashes, abdominal pain; a hypo albuminuria. The consequences of this disease are multiple and severe. Some of these are: malnutrition, osteoporosis, anemia, infertility or absence of menstruation, neuropathy and certain types of cancer (J. C. Bai *et al.*, 2013; M. Brabant, 2013).

Table 6: Different clinical forms of food allergy to wheat

Different clinical forms	Characteristics
Immediate Reaction	- Begins in the infant - IgE-mediated
Anaphylaxis induced by the Effort	- In Adolescents - IgE-mediated - Requires the sequence ingestion and then effort to trigger the reaction - Wheat allergy in 14-18% of cases - Delayed manifestation in the 3/4 of cases
Atopic dermatitis	- Better Review of Screening: Patch test
Forms chronic digestive	- In the infant - Not IgE-mediated - Differential Diagnosis main = disease celiac

Source: (D. De Boissieu, 2012)

In Benin, the diagnosis of wheat's alimentary allergy is not yet effective. However, the symptoms of this allergy especially the atopic dermatitis are often encountered (H. Adégbidi *et al.*, 2014) but it is only given to the patient a symptomatic treatment without an advance biological diagnosis.

3. Allergy: Inventory in Africa and Benin

In Africa, especially in the developing countries, information on the prevalence's value of alimentary allergies is insufficient. But this cannot be otherwise at the time where the national and international efforts are more focused on food security, the quality and diversity of food (J. I. Boye, 2012). In sub-Saharan Africa, the cutaneous sensitization to house dust mites is common with an inter-country variability. The awareness of the

mites namely *Dermatophagoides pteronyssinus* (TPD) is the highest (89%) followed by *Dermatophagoides farinae* (DF) with a percentage of 81%. The awareness of *Blomia tropicalis* (Bt) is not uncommon, it is important in some countries including Morocco and Senegal (L. El Fekih *et al.*, 2014). Similarly, the awareness of the main trophallergens, meaning to alimentary allergens is estimated at 27.7 per cent among allergic's children. The most common allergen in Maghreb is the cod and in Senegal is the peanuts (R. Cheikh *et al.*, 2013). In the Congo, it is essentially palm oil (*Elaeis guineensis*), cassava leaves (*Manihot esculenta*), the leaves of a shrub called vulgarly "rubber" by the Population (*Manihot glaziovii*) and some freshwater fish with a thorny radius to the dorsal fin and the pectoral fins (*Auchenoglanis occidentalis*, *Synodontis notatus*, *Eutropius niloticus*) which are suspected (J. M'BOUSSA and E. Kaoudi, 1990). In Togo, a study has been conducted on the risk factors and events associated with the atopic dermatitis which is one of the clinical signs of food allergy (J. Tchéssou *et al.*, 2016). In Benin, studies have been conducted on the respiratory allergy through the allergy naso-sinusienne (D. T. Agbozognigbe, 1998) and asthma (G. Agodokpessi *et al.*, 2015). Asthma is one of the Chronic Respiratory Diseases The most frequent and widespread in the developing countries (N. Koffi *et al.*, 2000; N. Pearce *et al.*, 2007). It is the main risk factor for severe alimentary allergies that can put into play the vital prognosis (G. Dutau and F. Rancé, 2007). The allergens concerned are the peanut, nuts (G. Dutau and F. Rancé, 2007), wheat and wheat (C. Dubuisson *et al.*, 2002). Dermatoses immuno-allergic have also been the subject of scientific work in Benin proving that they occupy the first rank of pediatric dermatitis dominated by the eczemas (H. Adégbidi *et al.*, 2014).

The exploration of the allergy under its alimentary angle especially linked to para-clinic allergic examination is not yet a reality in Benin. This analysis reveals the problematic of the allergy to foods of high consumption in Benin.

Conclusion

The alimentary Allergy is today, one of the endemics of the century. It progresses more and more especially in the developing countries. In Benin, due to the use of cereals such as wheat, soybeans and cassava, it is important to conduct extensive research on the food allergy related to their consumption.

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