

Case Report

Sensitization profiles of Seven (7) cases of Pollen-Food Allergy Syndrome (PFAS)- Grass pollen (Cynodon dactylon and Pennisetum typhoides) related Foods: SEEDS (chia, sunflowers, mustard), WHEAT, MAIZE, WATERMELON and CITRUS FRUITS

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- Skin Prick Test (SPT)
- Cynodondactylon
- Bermuda grass; Pennisetum typhoides
- Food Allergy

Abstract

Our Seven (7) cases of Pollen Food Allergy syndrome (PFAS), sensitized to grass pollens (Cynodondactylon and Pennisetum typhoides), have had history of Naso-Bronchial Allergy associated with Food allergy with symptoms of OAS (Oral Allergy syndrome), Urticaria and Angioedema after ingestion of specific food items seeds (chia, sunflowers, mustard), wheat, maize, watermelon and citrus fruits.

Our diagnosis was based on history, Skin Prick Test (SPT), and Specific IgE to aeroallergens and food allergens with Oral Food Challenge (OFC). In our seven cases, we suspected that allergic reactions to Foods and Grass pollen observed in these patients were due to cross reactivity induced by Profilin with or without associated co-factors example NSAIDs and Sulphites etc, which may be a marker of severity of the disease.

INTRODUCTION

There are two types of Food Allergy: class- I vs class II Food Allergy. Class I Food allergy is where the sensitization occurs through gastrointestinal (GIT), and class II Food Allergy is caused by prior sensitization to Aero-allergens and their cross reactivity (>70% identical homologous epitopes proteins) with Food Allergens [1]. Pollen- Food Allergy Syndrome (PFAS), is a class- II Food Allergy, which occurs in patients already sensitized to pollens with of signs and symptoms of Naso-Bronchial Allergy, subsequently progressive from Oral Allergy syndrome (OAS), to systemic reactions of Urticaria, Angioedema and Anaphylaxis after eating fruits, vegetables nuts and cereals [2]. Prevalence of Pollen-Food Allergy Syndrome (PFAS), was found to be 44% in the age group of 0-15 years in one of the studies done among patients in the UK. In grass pollen sensitised patient of Pollen-

Food Allergy Syndrome (PFAS), triggering foods like Hazelnut, Apple, Strawberry, Melon, Watermelon, Orange, Tomato, Kiwi, Potato, Swiss cheese, vegetable spices and Peanuts have been well documented [3]. Subtropical grasses (Cynodon dactylon, Pennisetum typhoides etc.), are phylogenetically and ecologically distinct from temperate region grasses of poidea family of lolium (Rye grass), Phalaris aquatica (canary), and Phleum pratense (Timothy). Both Cynodon dactylon (dhoob grass) and Pennisetum typhoides (Bajra) grass allergens belong to gramineae family. Cynodon dactylon is a creeping perennial grass, occurs in waste places, road sides, pastures and agricultural fields and is often planted in theme parks and athletic fields. Cynodon dactylon pollen is wind pollinated and flowers in late summer. It grows abundantly in our country (Delhi-47.5%, Lucknow-60.3%, Aligarh-16%, Kanpur-13% and Jaipur-10%) [4,5]. Cynodon dactylon contains 12 IgE binding proteins, among which Cyn d 1

is a major allergen and a single 34 kDa protein, Cyn d 7 is a 12 kDa calcium binding protein and Cyn d 12 is a profilin pan-allergen protein [6]. Cynodon dactylon pollen profilin (Cyn d 12), has substantial cross-reactivity with profilins from Tomato (*Solanum lycopersicum*) (Sola l 1), Cantaloupe (*Cucumis melo*), (Cue m 2), Sunflower (*Helianthus annuus*) (Hel a 2), Yellow mustard (*Sinapis alba*) (Sin a 4), Hazelnut (*Corylus avellane*) (Cor a 2), Peanut (*Arachis hypogaea*) (Ara h 5), Soyabean (*Glycine max*) (Gly m 3), Orange (*Citrus sinensis*) (Cit s 2) [7,8].

Pennisetum typhoides is highly allergenic with molecular weight 43 kDa protein, anemophilous and is cultivated for its grain as a crop and fodder in India. Its flowering seasons are September to October [9]. In plant tissue, there are major allergenic defense related proteins, which induce pollen related food allergy; these include (1) Members of pathogenesis related proteins 10 family (PR-10), (2) Profilins, (3) Non-specific Lipid Transfer Protein (nsLTP), and Gibberellin- regulated proteins [10,11]. Test profile to identify those sensitized to these three groups of proteins (*PR-10, Profilin and Lipid Transfer Protein*), by Component Resolve Diagnosis (CRD), should be selected according to the patterns of sensitization to their allergenic proteins in the specific country because Component Resolve Diagnosis (CRD), has a wide geographical variability depending on exposure to the pollen and ingested food in the particular area. Two main patterns of sensitization to PR-10, Profilins and Lipid Transfer Protein (LTP), allergens have been well described. If we do Specific IgE reactivity to BIRCH (Bet v 1-PR-10), pollen and PEACH (Pru p 3-LTP), allergen we can distinguish the patterns of sensitization to the *PR-10 like protein* (Bet v1- homologues) and *Profilin* (Phel p12 and birch (bet v 2), and Date palm (phod2). Both of these (*PR-10 and LTP*) are associated with Oral Allergy Syndrome (OAS), whereas, LTPs of mugwort and Date palm tree pollen are also associated with the risk of systemic reactions of Acute Urticaria/ Angioedema and Anaphylaxis [12]. Grass pollen have been reported to be most robustly associated Profilin sensitizer. To the best of our knowledge, the clinical relevance of cross-reactivity between *Cynodondactylon* and *Pennisetum typhoides* with seeds (chia, sunflowers, mustard), wheat, maize, watermelon and citrus fruits as seen in our seven cases has not yet been demonstrated. In our seven cases of Pollen Food Allergy Syndrome (PFAS), Clinical and Immunological diagnosis was based on history, Skin Prick Test (SPT), Serum Specific IgE (ImmunoCap, Thermofisher), and Oral Food Challenge (OFC). Although Component Resolved Diagnosis (CRD), is a reliable parameter in the diagnosis of cross-reactive proteins of pan-allergens (Profilin, Pathogenesis-related protein type-10 [PR-10], and Non-specific Lipid Transfer Protein [Ns LTP]), it could not be done due to its unavailability in India. Profilin is a ubiquitous family of proteins of about 12-16 kDa present in Eukaryotic cells and is involved in the control of Actin polymerization. It is a marker of disease evolution, an early marker of symptom severity in those suffering from Naso-bronchial and Food allergy with sensitization to pollen and plant foods. A positive Skin Prick Test (SPT) with profilin-enriched Date palm pollen extract shows a sensitivity and specificity that is very close to that of the recombinant grass pollen profiling [2].

We report a case series of 7 patients of Pollen Food Allergy Syndrome (PFAS), in whom the immediate allergic reaction was

induced by *grass pollen* (*Cynodon dactylon* and *Pennisetum typhoides*), with *foods* like seeds (chia, sunflowers, mustard), wheat, maize, watermelon and citrus fruits which is suspected to be mediated by cross-reactivity induced by the Profilin pan-allergen with or without associated co-factors (NSAIDs/Sulphites etc).

CASE 1

History

55 years old female presented with history of hypothyroidism, rhino-conjunctivitis (rhinorrhea, sneezing, itching and watering from eyes) during April to June months since 15 years. She also gives history of symptoms of Oral Allergy Syndrome (OAS), with facial and periorbital oedema, angioedema, urticaria, shortness of breath and dizziness after ingestion of Chia Seeds, Wheat, Bitterguard and spinach otherwise her vitals were within normal limit.

In-vivo and In-vitro testing







Blood investigations revealed (Table 1): Total IgE was elevated- 605 IU/ml. Skin Prick Test (SPT) were positive for Timothy grass (*Phleum pratense*)-8mm, Orchard grass (*Dactylis glomerata*)-8mm, Rye grass (*Lolium perenne*)-8mm, Bermuda grass (***Cynodondactylon***)-9mm, Velvet grass (*Holcus lanatus*)-8mm, Johnson grass (*Sorghum halapense*), corn (*Zea mays*)-6mm, ***Pennisetum***-9mm, Peanut-6mm, Wheat flour-6mm, Corn flour-6mm. serum specific IgE was positive for **Bermuda grass (*Cynodon dactylon*)->100 Kua/L, Wheat- 11.1 Kua/L, Peanut- 8.87 kUA/l.**

Oral Food Challenge (OFC)

Positive with Chia Seeds, Wheat, Bitterguard, Spinach. Onset of symptoms of Oral Allergy Syndrome (OAS) and Urticaria was in about 30 minutes.

Recommendations

She was given pollen Allergen Immunotherapy (AIT) and Inj Omalizumab along with supportive therapy with diet elimination

| Table 1: Total IgE, SPT and Specific IgE of case no. 1. | | | |
|---------------------------------------------------------|-----------|---------------------------------------------------------------------------------------|------------|
| | CASE 1 | | |
| TOTAL IgE | 605 IU/mL | Specific IgE | |
| SPT WHEAL SIZE | | | |
| Histamine | 6mm |  | N/A |
| <i>Cynodondactylon</i> | 9mm |  | >100 Kua/L |
| <i>Pennisetum</i> | 9mm |  | ND |
| Peanut | 6mm |  | 8.87 Kua/L |
| Wheat | 6mm |  | 11.1 Kua/L |
| Corn | 6mm |  | N/A |

of Chia seeds, Wheat, Bitter gourd and spinach. Symptoms gradually improved.

CASE 2

History

37 year old male presents with history of recurrent rhino-conjunctivitis, urticaria and angioedema associated with itching which aggravates on taking pizza, spicy food, dry fruits and watermelon on and off for the last 20 years. Otherwise his vitals were within normal limit.

In-vivo and In-vitro testing





Table 2 his serum immunoglobulin E was elevated Total IgE -104.0 IU/ml (normal range <87.0 IU/ml). Skin Prick Test (SPT), were positive for **Mugwort (Artemisia vulgaris)-8mm**, Mesquite (Prosopis juliflora) -6mm, **Bermuda grass (Cynodondactylon)-8mm**, **Wheat-4mm**, **Peanut-4mm**. Serum specific IgE was positive for **Mugwort (Artemisia vulgaris)-0.74 kua/L**, Common silver birch (Betula verrucosa)-0.75 kua/L, **Wheat-0.40 kua/L**, **Peanut-0.18kua/L**, Goosefoot (Chenopodium album)-1.13 kua/L, Bermuda grass (Cyanodon dactylon)-2.41 kua/L, Elm (Ulmus americana)-0.95 kua/L, Common pigweed (Amaranthus retroflexus)-2.46 kua/L, Common ragweed (Ambrosia elatior)-0.37 kua/L.

Oral Food Challenge (OFC)

Positive within an hour following ingestion of pizza, spicy food and watermelon.

Recommendations

He was given combined pollen Allergen Immunotherapy (AIT), and Inj Omalizumab along with supportive therapy and diet elimination of pizza, spicy food, dry-fruits and watermelon. Symptoms gradually improved.

| Table 2: Total IgE, SPT and Specific IgE of case no. 2. | | | |
|---------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------|------------|
| | Case 2 | | |
| Total IgE | 104.0 IU/ml | Specific IgE | |
| SPT-Wheal size | | | |
| Histamine | 6mm |  | N/A |
| Cynodon | 8mm |  | 2.41 Kua/L |
| Mugwort | 8mm |  | 0.74 Kua/L |
| Wheat | 6mm-wheal/12mm-erythema |  | 0.40 Kua/l |
| Peanut | 5mm |  | 0.18 kua/l |

CASE 3

History

21 years old female presented with history of seasonal rhino-conjunctivitis since 14 years. She has history of recurrent episodes of urticaria and angioedema which occur within an hour following ingestion of Sunflower seeds, Peanut, Coconut, Walnut, Coriander powder, Turmeric and NSAIDS (paracetamol and diclofenac). She has had history of repeated courses of oral steroids, anti-histamines and indigenous medicine with no relief. otherwise her vitals were within normal limit.

In-vivo and In-vitro testing

Table 3 total and Specific IgE were negative. Her vitals were within normal range. Total IgE was normal- 9.51 IU/ML. Skin Prick Test (SPT) were positive for Bermuda grass (Cyanodon dactylon)-4mm, wheat-3mm, walnut-3mm, coconut-4mm, but Serum specific IgE to Allergens was negative for.

Oral Food Challenge (OFC)

Positive with sunflower seeds, peanut, onset of symptoms of Oral Allergy Syndrome (OAS), and urticaria started within less than 30 minutes and were treated with anti-histamines and oral steroids.

Recommendations

She was given combined pollen Allergen Immunotherapy (AIT) and Inj Omalizumab along with supportive therapy and diet elimination of sunflower seeds and peanut. Symptoms gradually improved.

CASE 4

History

45 years old female presented with history of rhino-conjunctivitis and recurrent sore throat since 2 years with on and off difficulty in breathing. She gives history of symptoms of oral allergy syndrome (OAS), Urticaria, facial angioedema after eating maize and rice. Her vitals were normal.

In-vivo and In-vitro testing

Blood investigations revealed (Table 4), elevated Total IgE-550 IU/ml. Skin Prick Test (SPT), were positive for Cynodon dactylon-9mm, Pennisetum-6mm, wheat-4mm, maize-6mm, rice-6mm, Peanut-6mm. Serum specificIgE were positive for Cynodon 15 Kau/L, Wheat 21Kau/L, Peanut 8 Kau/L, Maize 28 kD [13].

Oral Food Challenge (OFC)

Positive with rice and maize.

Recommendations

She was prescribed pollen Allergen Immunotherapy (AIT), along with maize and rice elimination. Her symptoms improved

CASE 5

History : 21 years old female presented with history of rhino-conjunctivitis (sneezing, rhinorrhea, cough, wheezing, throat

Table 3: Total IgE, SPT and Specific IgE of case no. 3.

| CASE 3 | | | |
|-----------------|------------|--|--------------|
| TOTAL IgE | 9.51 IU/mL | | Specific IgE |
| SPT WHEAL SIZE | | | |
| Histamine | 3mm | | ND |
| Cynodondactylon | 4mm | | <0.01 Kua/L |
| Wheat | 3mm | | <0.01 Kua/L |
| Walnut | 3mm | | <0.01 Kua/L |
| Coconut | 4mm | | <0.01 Kua/L |
| Pennisetum | 4mm | | N/A |
| Peanut | 3mm | | <0.01 Kua/L |

Table 4: Total IgE, SPT and Specific IgE of case no. 4.

| Case4 | | | |
|----------------|-------------|--|---------------------------|
| Total IgE | 550.0 IU/ml | | Specific IgE |
| SPT-Wheal size | | | |
| Histamine | 6mm | | N/A |
| Pennisetum | 8mm | | N/A |
| wheat | 8mm | | 21 Kua/L |
| maize | 6mm | | 28 Kd (ref) |
| rice | 5mm | | 11.6 Kd and 14.6 Kd (ref) |
| Cynodon | 9mm | | 15 kua/L |
| Peanut | 6mm | | 8 kua/L |

irritation, watering from eyes) on and off since 10 years along with history of symptoms of Oral Allergy Syndrome (OAS), and Urticaria following ingestion of Sunflower seeds , mustard Seeds ,Wheat, Corn and Peanut within 30 minutes.

In-vivo and In-vitro testing

Table 5 total IgE was markedly elevated-1751 IU/ml.

Vitals were within normal range. Skin Prick Test (SPT) were positive for **Bermuda grass (Cynodon dactylon)-9mm, Peanut-3mm, Haloptelia- 6mm, Amaranthus spinosus-6mm**. Serum specific IgE was positive for **Bermuda grass (Cynodondactylon)-31.3 Kua/L, Wheat-23.0 kua/L, Peanut-27.5kua/L, soya bean-20.2 kua/L**.

Oral Food Challenge (OFC)

Positive with Sunflower seeds and Peanut within 30 minutes. Symptoms of Oral Allergy Syndrome (OAS) and urticaria were present.

Recommendations

She was given combined pollen Allergen Immunotherapy (AIT), and Inj Omalizumab along with supportive and diet elimination of Sunflower seeds, Peanut and Wheat. Symptoms gradually improved.

CASE 6

History

19 years old female presented with history of recurrent naso-bronchial allergy since 7 years. Also gives history of symptoms of Oral Allergy Syndrome (OAS), since 3 years (itching in the oropharynx), following ingestion of Tomato, Banana, watermelon and Orange.






In-vivo & vitro testing

Table 6 her serum immunoglobulin E was elevated Total IgE -975.0 IU/ml (normal range <87.0 IU/ml). Skin Prick Test (SPT), were positive for Bermuda grass (Cynodondactylon)- 8 mm, Pennisetum- 4mm ,Wheat-6mm, Peanut- 4mm. Serum Specific IgE were positive for Bermuda **grass (Cynodon dactylon)-**

Table 5: Total IgE, SPT and Specific IgE of case no.5.

| TOTAL IgE | 1751 IU/mL | | Specific IgE |
|---------------------|------------|--|--------------|
| CASE 5 | | | |
| SPT WHEAL SIZE | | | |
| Histamine | 6mm | | N/A |
| Cynodondactylon | 9mm | | 31.3 Kua/L |
| Peanut | 4mm | | 27.5 Kua/L |
| Haloptelia | 6mm | | N/A |
| Pennisetum | 3mm | | N/A |
| Wheat | 4mm | | 23.0 Kua/L |
| Amaranthus spinosus | 6mm | | N/A |

Table 6: Total IgE, SPT and Specific IgE of case no. 6.

| | CASE 6 | | |
|------------------|-----------|-----------------------------------------------------------------------------------|--------------|
| Total IgE | 975 IU/ml | | Specific IgE |
| SPT WHEAL SIZE | | | |
| Histamine | 3mm |  | N/A |
| Cyanodondactylon | 8mm |  | 82.1 Kua/L |
| Pennisetum | 3mm |  | N/A |
| Wheat | 6mm |  | 2.32 Kua/L |
| Peanut | 4mm |  | 1.41 Kua/L |

82.1kua/L, Milk -0.37Kua/L, **Wheat-2.32 kua/L**, Peanut-1.41kua/L, Soya bean-1.16 Kua/L.

Oral Food Challenge (OFC)

Positive for OAS after intake of tomato, banana, watermelon and orange within 15 minutes.

Recommendations

Her symptoms improved with Allergen Immunotherapy (AIT), Along with diet elimination of Tomato, Banana, watermelon and Orange.

CASE 7

History

7 years old male presented with history of rhinitis and asthma since 3 years, complains of oro-pharangeal itching after intake of citrus foods.

In-vivo and In-vitro testing

Table 7 his serum immunoglobulin E was elevated Total IgE -336.0 IU/ml (*normal range <87.0 IU/ml*). SPT were positive for **Cynodon dactylon-6 mm**, Wheat- 3mm, Peanut- 4mm. Serum specific IgE were positive for Bermuda grass (Cyanodon dactylon)-35.7kua/L, Wheat-4.76 kua/L, Peanut-3.97 kua/L and soya bean-2.13 kua/L.

Oral Food Challenge (OFC)

Positive in less than 30minutes after ingestion of citrus fruits.

Recommendations

Patient was advised diet elimination of citrus fruits.

DISCUSSION

Pollen Food Allergy Syndrome (PFAS), is an Immunoglobulin E Mediated immediate reaction. It represents co-morbidity of Naso-bronchial and Food allergy, due to cross reactivity (structurally homologous proteins), between plant pollen proteins and class 2 type of food allergens. Its clinical manifestation varies from





symptoms of Oral Allergy Syndrome (OAS), (Itching in oral mucosa and palate, burning and stinging in palate and throat, mild mucosal swelling on lip mucosa, oral mucosa, palate and throat), progressive to systemic symptoms such as systemic urticaria, angioedema of the airway, cough, dyspnea, vomiting and abdominal pain in some patients. The severity of symptoms depends on the concentration, nature and duration of the allergen exposure in a susceptible individual with or without presence of co-factors (exercise, alcohol, chemicals, NSAIDs) [1,3,12].

We report seven cases of Naso-bronchial allergy related to food allergens who are significantly positive to subtropical grass pollen (Cynodon dactylon and Pennisetum typhoides), and were associated with food allergy to seeds (chia, sunflowers, mustard), wheat, maize, watermelon and citrus fruits.

Among three of these cases (case number 1,2 and 3), case number one has had history of Oral Allergy Syndrome (OAS), Urticaria and Angioedema and Naso-bronchial Allergy sensitive to Cynodon: SPT-9mm, Specific IgE>100KuA/L, Pennsetium- SPT-9mm associated with Urticaria, lip and periorbital angioedema after intake of Chia seeds, Wheat, bittergourd and spinach (Pa). Chia seeds (*salvia sue panica*), is a new allergenic food belonging to *Lamiaceae* family. To the best of our knowledge, there are no cases in the medical literature describing allergic reactions due to chia seeds. Whether chia seed has cross-reactive proteins with plant food (Cynodondactylon and Pennisetum typhoides), is yet to be studied. Few studies have focused on allergic potential and antibody cross-reactivity among storage proteins in chia seeds. SDS PAGE of chia extracts revealed multiple proteins band with an apparent molecular weight ranging from 15 to 60 kDa and a common band around 31 kDa. The liposoluble chia extract showed 3 IgE-binding bands with molecular sizes of around 15, 17, and 29 kDa [14].

Wheat is a grass pollen from poaceae family, wheat contains albumin and globulin that may be responsible for its allergy. While molecular characterization of wheat allergen has shown many cross reactive allergens who are sensitized to grass pollens. The cross-reactive proteins of alpha purothionin, Tri a 37 and Tria 12 profilin epitope, alpha amylase inhibitor (Tri a 15) and LTP (Tri a 14),cross react with grass pollen. Tria a 37 is a plant defense protein, highly stable and resistant to heat and digestion; patients who have IgE antibodies against Tri a 37 have a four-fold increased risk of severe allergic symptoms upon wheat ingestion [15].

Table 7: Total IgE, SPT and Specific IgE of case no. 7.

| | CASE 7 | | |
|------------------|-----------|---------------------------------------------------------------------------------------|--------------|
| Total IgE | 336 IU/ml | | Specific IgE |
| SPT WHEAL SIZE | | | |
| Histamine | 3mm |  | N/A |
| Cyanodondactylon | 6mm |  | 35.7 Kua/L |
| Wheat | 3mm |  | 4.76 Kua/L |
| Peanut | 4mm |  | 3.97 Kua/L |

Case number 2 has history of Naso-bronchial allergy, sensitized to Mugwort (*Artemisia vulgaris*), Skin Prick Test (SPT)-8mm, Specific IgE – 0.74 KuA/L, Mesquite (*Prosopis juli.*), Skin Prick Test (SPT) – 6mm, Bermuda grass (*Cynodondactylon*), SPT -8mm, Specific IgE- 2.41 KuA/L gets Oral Allergy Syndrome (OAS) after ingestion of Pizza, Spicy foods, dry fruits & watermelon. This case has a high degree of sensitization to three groups of pollen allergens (*Cynodon dactylon* and *Artemisia vulgaris* and *Prosopis*). Many foods items are enriched with nuts seeds / additive preservatives. The severity of the symptoms in our allergic individuals depends on the amount of the allergen ingested and the degree of processing and storage of the food stuff containing additives and preservatives [12].

Case number 3, had history of Urticaria, Angioedema and anaphylaxis within 30 minutes of intake of sunflower seeds, peanut, coconut, walnut, coriander powder turmeric and NSAIDS (paracetamol and diclofenac). She was sensitized to *Cynodondactylon*, Skin Prick Test (SPT)-4mm and *Pennisetum typhoides*, Skin Prick Test (SPT) -4mm. Her clinical reactivity is not only due to the nature and type of the allergen but also due to co-factors (paracetamol and diclofenac). Sunflower seeds have been shown to cross-react with sesame seeds, mustard and poppy [16].

Case number 4 and 5 had history of Naso-Bronchial Allergy associated with Oral Allergy Syndrome (OAS), and Urticaria after ingestion of Maize & Wheat. Case number 4 was sensitive to *Pennisetum*, *Cynodon*, Peanut, Maize and Wheat.

Case number 4 was immunologically significantly positive to *Pennisetum typhoides* and gave history of acute Urticaria after ingestion of maize and rice. In this case further chemical characterization of maize was done [13,17]. IgE binding 28 kDa Protein smear of maize was observed. The smear consists of two discrete protein bands, as analyzed in the corresponding one dimensional SDS-PAGE. The results reveal that the two stated proteins show highest sequence homology in NCBI database with *Oryza sativa japonica* (rice), proteins with hypothetical molecular weight of 14.3 and 11.6 kDa respectively, may be due to profilin hypersensitivity.

Case number 5: Her symptoms could be explained by the cross reactivity between sensitization due to grass pollen as well as to tree and weed pollen. She is polysensitized with three groups of allergens: grass, weed and tree which is consistent with LTP sensitization

Case number 6 and 7 have had history of respiratory allergy along with Oral Allergy Syndrome (OAS) with oropharyngeal symptoms, after ingestion citrus fruits which correlates with the profilin hypersensitivity. *Cynodondactylon* a profilin pan-allergen has cross reactivity to certain foods such as melon, watermelon, citrus fruits, banana, pineapple, persimmon, Zucchini and tomato [3].

CONCLUSION

In our cases, we ascertained food allergy in our seven patients sensitized to grass pollens (*Cynodon dactylon* and *Pennisetum typhoides*), based on clinical history, questionnaires and sensitization test by Skin Prick Test (SPT), Specific IgE and

Oral Food Challenge (OFC) under observation. Pollen Food Allergy Syndrome (PFAS) with clinical manifestation of Naso-bronchial allergy associated with OAS, Urticaria and Anaphylaxis due to *Cynodon dactylon* (7 cases), and *Pennisetum typhoides* (6 cases), [both tropical grasses in India] related to seeds (chia, sunflower, mustard), wheat, maize, watermelon and citrus fruits has not yet been reported. To the best of our knowledge there is no such study done in India of suspected cross-reactivity between *Cynodon dactylon*, *Pennisetum typhoides* with seeds (chia, sunflowers, mustard), wheat, maize, watermelon and citrus fruits. In our seven cases it is the history and Oral Food Challenge (OFC), which confirmed the diagnosis rather than allergen sensitization to Skin Prick Test (SPT), and Specific IgE (Immuno Cap, Thermofisher). Moreover CRD helps to differentiate between 1) Component of weak stability, 2) component of risk or severity, 3) component of cross-reactivity, 4) Marker of genuine species-specific sensitization. These cases need further studies to confirm the diagnosis of profilin hypersensitivity.

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