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Original article

Knowledge and awareness of pollen-food allergy syndrome among dentists: A cross-sectional survey

Connaissance et sensibilisation au syndrome allergie pollen-aliments chez les dentistes : une enquête transversale

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ABSTRACT

Background and objective: This cross-sectional survey represents the first study to systematically quantify pollen-food allergy syndrome (PFAS) awareness and clinical management approaches among actively practising dentists.

Methods: Seventy-seven dentists in Istanbul, Turkey participated (mean age 34.4 ± 7.9 years; 72.7% female) in this cross-sectional, descriptive survey. The survey was distributed via an open link through professional messaging and social media platforms; accordingly, a response rate could not be calculated.

Results: Nearly all participants (97.4%) had received no postgraduate allergy training, and 94.8% reported inadequate or absent PFAS awareness. A critical recognition–application gap was identified: 62.3% selected the correct definition from multiple-choice options, yet only 37.7% correctly interpreted an equivalent clinical scenario involving raw versus cooked food reactions – and notably, 41.7% of those who correctly identified the definition still failed this scenario. More strikingly, 93.5% had never considered PFAS in differential diagnosis despite 54.5% reporting encounters with oral mucosal complaints in the preceding year. PFAS knowledge showed no association with professional experience, specialty, or prior patient encounters (all $P > 0.05$), indicating a systemic educational deficit rather than an experience-dependent gap. Conversely, 71.4% correctly identified allergy and immunology as the appropriate referral specialty, and 81.8% rated their educational need at the highest level.

Conclusions: These findings reveal that PFAS remains a diagnostically invisible syndrome in dental practice. Given dentists' frontline position in encountering oral mucosal symptoms – the hallmark presentation of PFAS – integration of allergic syndromes into dental curricula, structured allergist–dentist referral pathways, and practical screening protocols are urgently needed.

1. Introduction

Pollen-Food Allergy Syndrome (PFAS), also known as Oral Allergy Syndrome (OAS), is an IgE-mediated hypersensitivity disorder arising from cross-reactivity between inhalant pollen proteins and structurally homologous proteins in raw fruits, vegetables, and nuts [1,2]. It predominantly affects individuals with seasonal allergic rhinitis, presenting as rapid-onset pruritus, tingling, and oedema of the oral mucosa following ingestion of raw trigger foods [3,4]. Prevalence ranges from 40–70% among pollen-sensitised individuals [5–7], and although symptoms are typically localised, systemic reactions including anaphylaxis occur in 1.7–8.9% of cases [5,8].

Because PFAS symptoms are confined to the oral mucosa, patients frequently present to dentists before reaching an allergist. Dentists must therefore distinguish PFAS from contact stomatitis, oral candidiasis, angioedema, and other local reactions – yet failure to recognise PFAS risks both diagnostic delay and unnecessary dental interventions [9,10]. The potential for progression to anaphylaxis adds further urgency to timely recognition in the dental setting [11].

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Despite this clinical importance, the dental literature contains virtually no data on PFAS awareness among practising dentists. To the best of our knowledge, this is the first study to systematically quantify PFAS awareness, knowledge, and clinical management approaches in this professional group [6,7,9,10,12]. The primary aim was to identify the magnitude and nature of the knowledge deficit, and to inform the development of targeted educational interventions.

2. Materials and methods

2.1. Study design and setting

This cross-sectional, descriptive survey study was conducted to evaluate awareness, knowledge level, and clinical approach tendencies regarding Pollen-Food Allergy Syndrome (PFAS) among actively practising dentists.

2.2. Participants and sampling strategy

The study included dentists engaged in active clinical practice. Licensed general dentists and dental specialists who were actively practising and who provided digital consent were eligible for inclusion. Retired clinicians or those not currently engaged in clinical work, non-dentistry healthcare professionals, and respondents with incomplete or inconsistent answers were excluded. Participants were recruited using convenience sampling with a network-based distribution approach, as previously employed in dental professional surveys [13,14]. The survey link was disseminated via professional messaging groups (WhatsApp) and social media platforms (LinkedIn, Facebook, and Instagram). Because the questionnaire was distributed through an open link, the total number of individuals reached could not be precisely determined, and therefore a response rate could not be calculated. In total, 77 dentists participated in the study.

2.3. Data collection instrument

2.3.1. Survey development and validation

The survey form was developed by the researchers based on current literature and clinical guidelines regarding PFAS [1,2,5]. The content and scope validity of the survey was evaluated and approved by consensus by three expert panelists (two allergy and clinical immunology specialists, one dental specialist) [15]. The comprehensibility and technical functionality of the survey were tested through pilot application with 10 dentists excluded from the study; minor adjustments were made based on feedback to create the final form [16].

The final survey comprised four sections covering: demographic and professional characteristics (including age, gender, professional experience, specialty area, working environment, and postgraduate allergy training); familiarity with PFAS/OAS terminology and knowledge level (PFAS definition, the clinical importance of distinguishing raw versus cooked foods, and risk groups); clinical practice and patient management (frequency of patient encounters in the past year, inquiry about food and pollen allergy in patients presenting with oral mucosal complaints, consideration of PFAS in the differential diagnosis, initial management strategies, and awareness of the appropriate referral specialty); and educational need and perceived competency. Clinical practices and attitudes were assessed using a 5-point Likert scale ranging from 1 (never/inadequate) to 5 (always/very adequate) [17].

2.4. Data quality and participant privacy

To preserve participant privacy, the survey was conducted entirely anonymously; no personally identifiable information (name, surname, institution) was collected, and responses were recorded in a manner that could not be linked to identity information [18]. All participants accessed the survey after reading and approving the digitally presented informed consent text. To ensure single responses and reduce duplication risk, Google Forms' built-in settings (single response per device) were utilised. During the data cleaning process, incomplete or inconsistent responses were evaluated; however, no participant was excluded for this reason. All 77 participants were included in the analysis. The study design and reporting adhered to the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [13].

2.5. Statistical analysis

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) v26.0 software (IBM Corp., Armonk, NY, USA) [19]. For descriptive statistics, categorical variables were presented as frequency and percentage. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test; age was found to conform to normal distribution ($P > 0.05$). Data obtained from the Likert scale were reported as both frequency (percentage) alongside mean ± standard deviation. Although Likert-type items yield ordinal data, means and standard deviations were reported to facilitate practical comparability across items and with other survey-based studies, consistent with common practice in health professions education research.

Pearson's Chi^2 test of independence was used to evaluate relationships between categorical variables [20]. Fisher's exact test was used when any expected cell count was < 5 or when cell sizes were small [21]. McNemar's test was applied to compare paired binary outcomes (correct PFAS definition vs. correct clinical scenario) from the same subjects, to formally test the recognition–application gap. Effect sizes were calculated using Cramér's V for Chi^2 and Fisher's tests, and phi (φ) for McNemar's test. A two-tailed P-value < 0.05 was considered statistically significant for all tests. Bonferroni correction was not applied because analyses were exploratory and the number of comparisons was limited [22]. As this was a descriptive, exploratory study using convenience sampling, no *a priori* sample size calculation was performed. The primary objective was to describe PFAS awareness levels rather than test inferential hypotheses; therefore, statistical comparisons should be interpreted as exploratory.

2.6. Ethical approval

Full ethical approval for this study was granted by the Ethics Committee of Kanuni Training and Research Hospital (approval No.: 2025.09.244).

3. Results

3.1. Demographic and professional characteristics

A total of 77 dentists participated in the study (Table 1). The mean age of participants was 34.4 ± 7.9 years, with 72.7% ($n = 56$) being female. Mean professional experience was 9.8 ± 7.6 years; 45.5% ($n = 35$) of participants had less than 5 years of experience, while 54.5% ($n = 42$) had 5 years or more of experience. Of the specialisation distribution, 51.9% ($n = 40$) were general dentists, while 48.1% ($n = 37$) were specialists in various fields. Of the participants, 97.4% ($n = 75$) had not received any postgraduate training on allergy.

3.2. PFAS/OAS awareness and knowledge level

Participants' familiarity with PFAS/OAS terminology was quite low (Table 2). Of the participants, 45.5% ($n = 35$) stated they had never heard the term, while 49.4% ($n = 38$) indicated they had heard it but did not know what it meant. Only 5.2% ($n = 4$) reported knowing what PFAS/OAS was. These data demonstrate that 94.8% ($n = 73$) of participants had no awareness or inadequate awareness regarding PFAS. When asked about the definition of PFAS, 62.3% ($n = 48$) of participants could

Table 1
Demographic and professional characteristics of participants ($n = 77$).

Characteristic	n (%)
Age (years), mean ± SD	34.4 ± 7.9
Gender	
Female	56 (72.7)
Male	21 (27.3)
Professional experience (years), mean ± SD	9.8 ± 7.6
Professional experience category	
< 5 years	35 (45.5)
≥ 5 years	42 (54.5)
Specialty area	
General dentist	40 (51.9)
Specialist dentist	37 (48.1)
Postgraduate allergy training	
Yes	2 (2.6)
No	75 (97.4)

Table 2
PFAS/OAS terminology familiarity, recognition-based knowledge, and clinical application ($n = 77$).

Variable	n (%)
Familiarity with PFAS/OAS terminology	
Never heard	35 (45.5)
Heard but don't know what it is	38 (49.4)
Know what it is	4 (5.2)
Correct definition of PFAS	
Correct	48 (62.3)
Incorrect/don't know	29 (37.7)
Knowledge of clinical importance of raw/cooked food distinction	
Know	30 (39.0)
Don't know	47 (61.0)
Clinical scenario: raw apple vs. cooked apple/pie	
Correct	29 (37.7)
Don't know	47 (61.0)
Incorrect	1 (1.3)

provide a correct definition, while 37.7% ($n = 29$) provided an incorrect definition or stated they did not know. When knowledge of the clinical importance of distinguishing between raw and cooked foods was examined, 61.0% ($n = 47$) of participants indicated they did not know why this distinction was important. When presented with a clinical scenario (raw apple vs. cooked apple/pie), only 37.7% ($n = 29$) provided the correct answer, while 61.0% ($n = 47$) responded 'don't know' and 1.3% ($n = 1$) gave an incorrect answer. No statistically significant association was found between PFAS/OAS terminology familiarity and correct definition selection; participants who had never heard the term selected the correct definition at a comparable rate (62.9%) to those reporting partial familiarity (57.9%; Fisher's exact test, $P = 0.811$). Participants reporting full familiarity ($n = 4$) were excluded from this comparison due to insufficient cell size.

3.3. Clinical practice and patient management approaches

When frequency of encountering patients with oral mucosal complaints in the past year was examined (Table 3), 54.5% ($n = 42$) of participants reported seeing at least one patient, while 45.5% ($n = 35$) reported seeing no patients. Food-related inquiry for oral mucosal complaints was found to have a mean of 2.88 ± 1.46 on the 5-point Likert scale. Raw fruit/vegetable and oral symptom inquiry in patients with pollen allergy history had a lower mean (1.94 ± 1.33). Notably, 57.1% ($n = 44$) of participants reported never asking this question (score 1), while only 9.1% ($n = 7$) reported always asking (score 5). When asked

Table 3
Clinical practice and patient management approaches ($n = 77$).

Variable	n (%) or mean ± SD
Patient encounter with oral mucosal complaints in past year	
Yes	42 (54.5)
No	35 (45.5)
Food-related inquiry for oral mucosa (Likert 1–5)	2.88 ± 1.46
1 (never)	19 (24.7)
2	14 (18.2)
3	16 (20.8)
4	13 (16.9)
5 (always)	15 (19.5)
Raw fruit/vegetable inquiry in pollen allergy (Likert 1–5)	
Mean ± SD	1.94 ± 1.33
1 (never)	44 (57.1)
2	13 (16.9)
3	8 (10.4)
4	5 (6.5)
5 (always)	7 (9.1)
Consideration of PFAS in differential diagnosis	
Never	72 (93.5)
Sometimes/frequently	5 (6.5)
Initial approach strategy	
Don't know	33 (42.9)
Follow-up without treatment	22 (28.6)
Symptomatic treatment	6 (7.8)
Refer considering PFAS	16 (20.8)
Knowledge of referral specialty	
Allergy and immunology (correct)	55 (71.4)
Don't know	18 (23.4)
Otorhinolaryngology	2 (2.6)
Dermatology	2 (2.6)
Educational need regarding PFAS (Likert 1–5)	
Mean ± SD	4.77 ± 0.54
3	4 (5.2)
4	10 (13.0)
5 (highest)	63 (81.8)
Perceived referral competency (Likert 1–5)	
Mean ± SD	1.91 ± 1.10
1 (inadequate)	39 (50.6)
2	15 (19.5)
3	16 (20.8)
4	5 (6.5)
5 (very adequate)	2 (2.6)

Likert scale: 1: never/inadequate; 5: always/very adequate.

about consideration of PFAS in differential diagnosis, 93.5% ($n = 72$) of participants stated they never considered it, while only 6.5% ($n = 5$) indicated they sometimes or frequently considered it.

When participants were asked about their initial approach to a patient with pollen allergy history and oral mucosal pruritus/oedema, 42.9% ($n = 33$) responded 'don't know', 28.6% ($n = 22$) suggested follow-up without treatment, 7.8% ($n = 6$) suggested symptomatic treatment, and 20.8% ($n = 16$) stated they would refer thinking it might be PFAS. Regarding knowledge of the referral specialty, 71.4% ($n = 55$) of participants correctly identified allergy and immunology as the appropriate referral specialty, while 23.4% ($n = 18$) stated they did not know, 2.6% ($n = 2$) selected Otorhinolaryngology, and 2.6% ($n = 2$) selected dermatology.

3.4. Educational need and competency perception

The level of perceived educational need regarding PFAS was found to be quite high at 4.77 ± 0.54 on the 5-point Likert scale; 81.8% ($n = 63$) of participants gave the highest score (5 points). Perception of competency in patient referral was low (1.91 ± 1.10); 50.6% ($n = 39$) of participants felt inadequate.

Table 4
Relationships between PFAS knowledge and demographic and professional variables.

Independent variable	Dependent variable	*P*-value	Test	Effect size	Professional experience (< 5 vs. ≥ 5 years)	Correct PFAS definition	0.833	Fisher	V = 0.024
Patient encounter status	Consideration of PFAS in differential diagnosis	0.654	Fisher	V = 0.051					
Patient encounter status	Correct PFAS definition	0.161	Chi^2	V = 0.160					
Professional experience (< 5 vs. ≥ 5 years)	Knowledge of correct referral specialty	0.797	Chi^2	V = 0.029					
Terminology familiarity (never heard vs. heard but don't know)	Correct PFAS definition	0.811	Fisher	V = 0.027					
Correct PFAS definition	Correct clinical scenario	< 0.0001	McNemar	φ = 0.448					

3.5. Relationships between PFAS knowledge and demographic and professional variables

No statistically significant relationship was found between professional experience (< 5 years vs. ≥ 5 years) and correct PFAS definition ($P = 0.833$) (Table 4). Similarly, no significant relationship was found between patient encounter with oral mucosal complaints in the past year and consideration of PFAS in differential diagnosis ($P = 0.654$). No significant relationship was found between patient encounter and correct PFAS definition ($P = 0.161$). No significant relationship was detected between professional experience and knowledge of correct referral specialty ($P = 0.797$).

4. Discussion

This survey provides the first systematic quantification of PFAS awareness among dentists and reveals a uniform and profound knowledge deficit independent of experience or clinical exposure. Despite the fact that more than half of participants had encountered patients with oral mucosal complaints in the preceding year, PFAS was considered in differential diagnosis by only 6.5% – a near-complete dissociation between clinical encounter and diagnostic suspicion that underscores the syndrome's invisibility in dental practice.

PFAS, observed in 40–70% of individuals with pollen allergy [9,10,12] is an important health problem that can present clinically in a spectrum ranging from mild oral symptoms to anaphylaxis. Current literature emphasises that PFAS prevalence shows significant differences according to geographical region and predominant pollen type: birch pollen-associated PFAS is reported at 50–90% in Northern and Central Europe [5], whereas lipid transfer protein (LTP)-mediated reactions predominate in the Mediterranean region with lower overall PFAS rates [3]. Population-based studies report prevalence as low as 4.7% in Japanese adolescents [23] and as high as 70% in selected European pollen-allergic cohorts [5], reflecting this geographical heterogeneity. In Istanbul – a city with high pollinosis burden – dentists occupy a critical first-contact position for PFAS-related oral symptoms, yet our findings reveal that this role is currently unfulfilled.

Low PFAS awareness among dentists is not a situation specific to a particular region and reflects a general educational need amongst healthcare professionals [24,25]. In a study by Turner and colleagues among healthcare professionals in the United Kingdom, significant knowledge gaps and approach differences in PFAS management were identified [26]. In a population-based study by Kiguchi and colleagues in Japan, it was found that 59.3% of adolescents affected by PFAS did not know whether symptoms would decrease with heating or processing of foods [23]. These findings demonstrate that raising PFAS awareness amongst healthcare professionals is a global necessity. However, when dentists are concerned, the situation becomes even more critical because the characteristic symptoms of PFAS – pruritus, oedema, and erythema of the oral mucosa – cause patients to frequently consult dentists before allergists [9,10]. Specific, structured training programmes targeting dentists are therefore an urgent priority.

A notable finding is the substantial gap between recognition and application: while 62.3% correctly selected the PFAS definition from multiple-choice options, only 37.7% correctly interpreted a clinical scenario. This likely reflects passive recognition through logical reasoning rather than internalised clinical knowledge: terminology familiarity was not associated with correct definition selection ($P = 0.811$), and among those who did select the correct definition ($n = 48$), 41.7% still failed the clinical scenario. Definitional recall, in the absence of applied clinical reasoning, offers no diagnostic benefit. The recognition–application gap is therefore the most clinically meaningful metric in this dataset (McNemar $\chi^2(1) = 15.429$, $P < 0.001$, $\varphi = 0.45$).

Food-related inquiry for oral mucosal complaints had a mean score of 2.88 ± 1.46 on the 5-point Likert scale, whereas targeted inquiry about raw fruit/vegetable intake in patients with pollen allergy history was markedly lower (1.94 ± 1.33), indicating that general food-related questioning occurs at a moderate level but pollen-specific probing is consistently inadequate. Clinical history alone may be sufficiently informative to support the diagnosis, and the development of oral pruritus after consumption of raw apple with the absence of symptoms after ingestion of cooked apple (e.g., pie or jam) in a patient with seasonal allergic rhinitis history represents a highly characteristic presentation of PFAS [1,2].

In the differential diagnosis of PFAS, other oral mucosal pathologies such as contact stomatitis, oral candidiasis, burning mouth syndrome, angioedema, dental material allergies, and viral infections must be excluded [9,10]. Near-universal exclusion of PFAS from differential reasoning suggests that insufficient attention to reaction onset, food relationship, and seasonality leads to frequent misclassification as contact stomatitis or candidiasis. Yet the data also contain a constructive signal: 71.4% correctly identified allergy and immunology as the appropriate referral specialty, and 20.8% indicated they would refer a patient in the PFAS scenario – suggesting that referral knowledge exists but is not

activated in practice. Literature indicates that knowledge and awareness of healthcare professionals regarding allergic triggers play a key role in preventing potential allergic reactions [25,27]. In a survey of occupational allergies among French dentists, a personal history of general allergy was identified as the strongest predictor for developing occupational allergic reactions, highlighting the broader importance of allergy education in dental practice [14]. These findings support the need for allergic syndromes, particularly PFAS, to be included in dental education.

Although PFAS is commonly perceived as a mild, self-limiting syndrome, systemic reactions including anaphylaxis occur in a clinically relevant proportion of cases [11]. While Carlson and Coop's review reported anaphylactic shock development in 1.7% of PFAS reactions [5], in a multicentre study by Kim and colleagues in Korea, this rate increased to 8.9% [8]. The 2024 International Delphi Consensus emphasises that certain foods (nuts, soya beverages, smoothies/fresh fruit juices), particularly when consumed rapidly or in large quantities, can rarely trigger systemic symptoms [2]. Cross-reactive triggers also include tropical fruits. Jackfruit allergy has been identified as Bet v 1-related, with cross-reactivity demonstrated via a 17 kDa allergen [28]. Factors such as proton pump inhibitors, non-steroidal anti-inflammatory drugs, bariatric surgery, uncontrolled asthma, fasting, and exercise may increase PFAS symptom severity [2]. In this context, rather than viewing PFAS solely as a 'mild allergy', timely recognition of patients carrying risk for potential severe reactions is of critical importance [3,4]. Dentists' recognition of PFAS is directly related to patient safety not only in terms of correct specialty referral, but also risk communication (triggering foods, symptom timing, when urgent consultation is needed) and planning rapid medical support when necessary [27]. The low mean referral competency score (1.91 ± 1.10 on a 5-point scale) and the 50.6% who reported feeling inadequate in this role point to a serious confidence and competency gap that directly affects patient safety.

The absence of any association between PFAS knowledge and professional experience, specialty, or prior patient encounters points to a systemic curricular deficit rather than an experience-dependent gap – clinical exposure does not compensate for an absence of formal instruction. This framing carries an important implication: targeted educational intervention can be effective at any career stage. The 81.8% of participants who rated their educational need at the highest level provides both a mandate and a receptive audience for such programmes [24,26].

Our study has some limitations. Firstly, the sample was formed using convenience sampling, and its power to represent the general population is limited. Distribution through social media and messaging groups in particular may have caused selection bias in participants with certain demographic or professional characteristics. Secondly, our study has a cross-sectional design and does not allow for establishment of causality relationships. Thirdly, as the survey is based on self-report method, social desirability bias or recall bias may exist in participants' responses. Fourthly, survey participation rate could not be calculated, and the characteristics of non-respondents are unknown. Fifthly, as an exploratory descriptive study with no pre-specified primary hypothesis, formal a priori sample size calculation was not performed; however, all Chi^2 and Fisher's exact comparisons retained adequate cell counts (minimum expected frequency ≥ 1 in all analyses), supporting the validity of the statistical tests applied. Finally, while the questionnaire was developed based on current literature and expert consensus, it is not a standardised scale and its psychometric properties have not been comprehensively tested. Despite these limitations, our study provides an important contribution as the first systematic research evaluating PFAS awareness among dentists and presenting a comprehensive approach based on current guidelines. Additionally, the 62.9% correct-definition rate observed among participants who had never heard the PFAS term likely reflects the multiple-choice format of the survey instrument, which may have enabled logical elimination of distractors rather than genuine clinical knowledge recall; this limits the validity of the definition question as a standalone measure of true knowledge.

5. Conclusion

PFAS represents a diagnostically invisible syndrome in dental practice: near-universal unawareness, a profound recognition–application gap, and clinical inertia persist regardless of experience or patient exposure. Closing this deficit requires integration of PFAS – and allergic syndromes more broadly – into dental undergraduate curricula and continuing professional development, supported by structured allergist–dentist referral pathways [1,14]. Educational content should prioritise applied clinical reasoning over definitional recall, incorporating a brief screening algorithm (1-seasonal allergy history, 2-oral symptoms after raw food, 3-tolerance of cooked equivalent) and clear referral criteria [2]. Until such tools are developed, validated, and implemented at scale, dentists should be regarded as a priority target group for allergy education – uniquely positioned at the first point of contact for PFAS-related oral symptoms.

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The authors declare that they have no competing interest.

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