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Symptom Score for Allergic Rhinitis

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Abstract

Objectives. To determine the prevalence of allergic rhinitis in our study population and the correlation between the Score for Allergic Rhinitis (SFAR) and nasal smear eosinophil count.

Study Design. Cross-sectional study.

Setting. Ear, nose, and throat clinic, University of Ilorin Teaching Hospital, Nigeria; a 450-bed tertiary health facility.

Subjects. Two hundred seventy-five consecutive, consenting patients who presented with nasal symptoms.

Methods. Information on the 8-parameter symptom score was collected using a semistructured questionnaire by interview. Nasal smear slides were air dried, fixed with 95% alcohol, stained using May-Grünwald-Giemsa stain, and examined under a light microscope.

Results. Of the 275 participants seen during the 1-year study, 116 (42.2%) were males. The mean $\pm$ SD age was 38.5 $\pm$ 16.3 (range, 14–75) years. Eighty-one (29.5%) were diagnosed with allergic rhinitis using a nasal smear eosinophil count. The most common symptom was excessive sneezing, involving 93% of patients with allergic rhinitis ($P < .001$). The prevalence of allergic rhinitis using SFAR was 31.6%. The SFAR cutoff was set at >8 ($P < .001$). The sensitivity and specificity for SFAR were 94.8% (confidence interval [CI], 90.5%–97.4%) and 95.1% (CI, 87.2%–98.4%), respectively. A high Spearman's correlation (0.88) was obtained for SFAR when correlated with nasal smear eosinophil count.

Conclusion. The prevalence of allergic rhinitis using SFAR was 31.6%. The study shows that SFAR can be used as a simple, valid diagnostic tool in allergic rhinitis. This is important in rural settings where access to laboratory investigations might not be readily available.

Keywords

symptom score, allergy, rhinitis, eosinophil count, adult

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Allergic rhinitis is a global health problem that results in significant disability.¹ It cuts across all ages and socioeconomic status, affecting 10% to 54% of the world population.^{1–4} We are not aware of a national registry from which the prevalence rate can be calculated, but in international reviews of articles published in English in peer-reviewed journals, a prevalence rate of 35% to 54% was recorded for Nigeria.^{2,3} The prevalence has increased over the past decade.³

The most established risk factor is a family history of allergy, particularly allergic rhinitis.⁵ Several genes are linked with atopy, including an area on chromosome 5q, where genes exist for interleukin (IL)–4 and IL-13, with markers associated with high levels of serum IgE.⁵ Environmental factors suggested include lifestyle changes; increased exposure to allergens, pollution, and irritants; dietary modifications responsible for diminution of protective nutrients; and infections leading to a reduction in Th1-type immune response (the hygiene hypothesis).⁶

Allergic rhinitis has been classified as seasonal, perennial, and occupational.⁷ Presently, it is classified as intermittent or persistent symptoms by the Allergic Rhinitis and Its Impact on Asthma (ARIA) group.^{1,2} Its diagnosis is usually based on coordination between a typical history of allergic symptoms and diagnostic tests.² This tests range from cytological to in vivo and in vitro tests.

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The basis of *in vitro* testing is immunoglobulin E (IgE), particularly allergen-specific IgE.⁸ Various *in vitro* serum-specific allergen assay tests are available: the Phadebas radioallergosorbent test (PhRAST),⁹ the modified radioallergosorbent test (mRAST),¹⁰ enzyme-linked immunosorbent assay (ELISA), and the Phadiatop system (pharmacia differential atopy test).¹⁰

In vivo tests refer to skin tests, a major diagnostic tool for allergy.^{11,12} When the procedure is done properly, they yield confirmatory evidence for the diagnosis of specific allergy. They include scratch tests, prick-and-puncture tests, and intradermal skin tests. Currently, the modified skin-prick test¹³ is the reference method recommended by position papers of the European Academy of Allergology and Clinical Immunology, World Health Organization, and the US Joint Council of Allergy, Asthma and Immunology.⁴

Allergens tests are not readily available in Nigeria; indeed, we doubt their usefulness because they are not locally manufactured.¹⁴ We have observed that when our patients change environment, especially travel overseas, their symptoms are relieved. This we consider to be freedom from responsible allergens. Thus, while working toward developing our locally manufactured allergens test, we could have an easily accessible tool to help diagnose fairly accurately allergic rhinitis and a strong basis for treatment. Our present modalities of treating allergic rhinitis consist mainly of avoidance of suspected responsible factors and antihistamines or other antiallergy medications. Immunotherapy is not widely in use.

An allergic symptom score thus becomes useful in everyday practice in our environment. A symptom score is a subjective and quantitative measure of an individual's well-being, using a questionnaire. Responses are analyzed to arrive at a diagnosis. The Score for Allergic Rhinitis (SFAR)¹⁵ involves 8 components, including the following: (1) nasal symptoms in the past year, including sneezing, runny nose, and blocked nose; (2) nasal symptoms accompanied with itchy-watery eyes (rhinoconjunctivitis); (3) months of the year in which the nasal symptoms occur; (4) triggers of nasal symptoms, including pollens and house dust; (5) perceived allergic status; (6) previous medical diagnosis of allergy; (7) previous positive tests of allergy; and (8) familial history of allergy. The assigned scores are presented in Appendix I (see appendix at www.otojournal.org), and an SFAR cutoff value of ≥ 7 was found to optimally discriminate between individuals with allergic rhinitis and those without.¹⁵

Nasal smear cytology is a useful diagnostic test with a moderately high sensitivity and a high specificity.^{14,16,17} The use of nasal smear eosinophil count is based on the crucial role of eosinophils in the pathogenesis of allergic rhinitis.¹⁸ Eosinophils in the nasal smear have been reported to display the best correlation with all the clinical and immunological parameters in allergic rhinitis.¹⁹ It is a cheap, non-invasive test that has no risk of anaphylactic reactions.

In Nigeria, earlier studies^{11,12,20,21} focused on skin sensitivity tests, highlighting the need to obtain locally available extracts for skin prick, as the allergens used were imported

from Europe.²² More recent studies have focused on nasal smear eosinophilia and symptom scores.^{14,17,23}

The study aims to determine the prevalence of allergic rhinitis in our study population and the correlation between SFAR and nasal smear eosinophil count among patients with nasal symptoms attending an ear, nose, and throat (ENT) clinic at a tertiary hospital in Nigeria.

Methods

This cross-sectional study was conducted on all consecutive, consenting participants who presented with nasal symptoms at the ENT clinic in the University of Ilorin Teaching Hospital, a 450-bed hospital, which caters to patients from various parts of the middle-belt region of Nigeria.

The sample size used for the study ($n = 275$) was estimated using the formula by Fisher et al.²⁴ All consenting participants, 13 years and older, presenting with nasal symptoms were included in the study (consent for pediatric participants was obtained from the guardian).

Patients who failed to give informed consent, were younger than 13 years (older children and adults were able to respond correctly to the structured questionnaires with respect to the symptom scores), were on antihistamine or other anti-allergy medications, had previous surgical operations involving the nose and paranasal sinuses, or had features suggestive of nasal and paranasal sinus malignancies were excluded.

The questionnaire was pretested. (SFAR [Appendix I], with its attributed score based on Annesi-Maesano et al,¹⁵ was adopted for this study.) This provided an idea of the level of difficulty, ambiguity, and complexity, which could hinder the administration of the questionnaire. The pretested questionnaire was analyzed and necessary modifications effected. The questionnaire was administered and filled by one of the authors (S.O.A.) mainly in English. For patients who could not understand English, the services of an interpreter were used to ask the questions in Yoruba, Hausa, Nupe, and Igbo.

The study was approved by the ethics and research committee of our hospital.

A nasal smear specimen was taken with a disposable sterile nasal probe by one of the authors (S.O.A.). A probe, one for each nasal cavity, was run along the medial surface of the inferior turbinate 2 to 3 times and the specimen smeared on a clear glass slide. Two separate slides were produced, one from each nasal cavity. These were air dried and fixed with 95% alcohol immediately. The slides were stained using May-Grünwald-Giemsa stain and examined under a light microscope, using a $\times 40$ power objective. The slides were examined using the set zigzag method²⁵ by a senior registrar (histopathology) under the supervision of a consultant histopathologist (one of the authors, K.A.A.). They were blinded to the results of the SFAR. The grading of the nasal smear eosinophilia was done according to Abhey, Rakesh et al, and Shioda and Mishima^{16,25,26}:

- Normal (1+): <10 cells/high-power field (HPF) or eosinophilia $<5\%$ of HPF

Table 1. Sociodemographic Characteristics of Participants

	All Participants (n = 275), No. (%)	Participants with Allergic Rhinitis (n = 81), No. (%)
Age range, y		
13-19	45 (16.4)	20 (24.7)
20-29	57 (20.7)	22 (27.2)
30-39	49 (17.8)	24 (29.6)
40-49	47 (17.1)	9 (11.1)
50-59	39 (14.2)	0
60-69	28 (10.2)	6 (7.4)
70-79	10 (3.6)	0
Sex		
Male	116 (42.2)	49 (60.5)
Female	159 (57.8)	32 (39.5)
Occupation		
Homemaker	24 (8.8)	11 (13.6)
Trader	21 (7.8)	9 (11.1)
Civil servant	140 (51.0)	36 (44.4)
Farmer	31 (11.3)	10 (12.3)
Artisan	23 (8.2)	5 (6.3)
Student	36 (12.9)	10 (12.3)

- Mild (2+): 10 to 30 cells/HPF or eosinophilia >5% of HPF
- Moderate (3+): numerous cells, not covering the entire microscopic field or eosinophilia about 50% of HPF
- Marked (4+): numerous cells, covering the entire microscopic field or eosinophilia >50% of HPF

The data were collated, checked for errors, and entered into the data input template. Statistical analysis was carried out using SPSS version 15.0 for Windows (SPSS, Inc, an IBM Company, Chicago, Illinois). The output obtained was presented in simple charts and tables.

The χ^2 test was used to test equality of proportions. Interitem correlations were also obtained to study relationships between the items in SFAR. All statistical tests were done at the 95% level of significance.

Results

Of the 298 individuals invited to participate in the study, 275 consented. Twenty-three patients did not consent to participate in the study. One patient did not want a probe inserted in his nose. Fifteen patients could not spare the time, and 7 caregivers needed the consent of biological parents of the younger patients. Of the 275 participants, 116 (42.2%) were male (male/female = 1.0:1.4) (**Table 1**). The age range was 14 to 75 years with a mean $\pm$ SD of 38.5 $\pm$ 16.3 years. Civil servants constituted 51.0% of participants.

Eighty-one participants were diagnosed with allergic rhinitis using nasal smear cytology. Thus, the prevalence of allergic rhinitis based on nasal smear count from the study was 29.5% (95% confidence interval [CI], 24.5%-34.5%). The prevalence

rate of the male population was significantly higher ($P < .001$) than the prevalence rate of the female population (49 of 116 male participants [42.2%] and 32 of 159 female participants [20.1%]) (**Table 1**). The prevalence of allergic rhinitis based on SFAR from the study was 31.6% (87 participants) with a 95% CI of 26.3% to 37.3%. Since there was an overlap in the confidence interval derived from both SFAR and nasal smear tests, the prevalence determined using the 2 methods was not significantly different for each method. The prevalence stated here refers to the sample prevalence and not the population prevalence of disease.

The pollen season accounted for the highest period of nasal symptoms in nonallergic participants (58.2%) and allergic patients (55.6%). Rhinoconjunctivitis was present in 75 (92.6%) with allergic rhinitis. In allergic participants, epithelial agents were accountable in 44 (54.3%) participants, whereas pollens were culpable in 37 (45.7%) participants. None of the 275 participants had previously had any form of allergic tests. There was a positive family history of allergic rhinitis in 10 (5.2%) nonallergic participants compared with 65 (80.2%) allergic participants. Fifteen (7.7%) nonallergic participants and 78 (96.3%) allergic patients responded positively to their perceived allergic status (**Table 2**).

As there were no differences in the nasal eosinophil counts obtained from both right and left nasal cavities, an aggregate count was used (hence the population size of 275). Fifty-eight (71.6%) of the cases with allergic rhinitis were in the moderate category and 23 (28.4%) were in the severe category (**Table 3**).

From **Table 4**, it can be seen that the optimum probability of correct classification (0.94) is given at SFAR <8 for no allergy and SFAR $\geq$ 8 for allergy. Specificity and sensitivity at

Table 2. SFAR Characteristics of Participants with and without Allergic Rhinitis

SFAR Characteristics	Participants without Allergy (n = 194), No. (%)	Participants with Allergy (n = 81), No. (%)	χ^2	P Value
Nasal blockage				
Present	106 (54.6)	69 (85.2)	23	<.001
Absent	88 (45.4)	12 (14.8)		
Runny nose				
Present	126 (64.9)	74 (91.4)	20.1	<.001
Absent	68 (35.1)	7 (8.6)		
Excessive sneezing				
Present	88 (45.4)	75 (92.6)	52.8	<.001
Absent	106 (54.6)	6 (7.4)		
Duration				
Perennial	47 (24.2)	36 (44.4)	0.169	.681
Pollen	113 (58.2)	45 (55.6)		
Occasional	34 (17.6)	0		
Rhinoconjunctivitis				
Absent	167 (86.1)	6 (7.4)	151.6	<.001
Present	27 (13.9)	75 (92.6)		
Triggers of allergy				
None	58 (29.9)		32.6	<.001
Epithelial	50 (25.8)	44 (54.3)		
Pollen, house dust mites	86 (44.3)	37 (45.7)		
Previous allergic tests done				
Present	0	0		
Absent	194 (100)	81 (100)		
Previous medical diagnosis				
Absent	186 (95.9)	15 (18.5)	173.9	<.001
Present	8 (4.1)	66 (81.5)		
Perceived allergic status				
Absent	179 (92.3)	3 (3.7)	200.3	<.001
Present	15 (7.7)	78 (96.3)		
Positive family history				
Absent	184 (94.8)	16 (19.8)	162.4	<.001
Present	10 (5.2)	65 (80.2)		

Abbreviation: SFAR, Score for Allergic Rhinitis. Boldface indicates statistical significance.

Table 3. Nasal Smear Eosinophil Count of Participants

Nasal Smear	Participants with Allergy (n = 81), Frequency (%)	Participants without Allergy (n = 194), Frequency (%)
Normal	0	121 (62.4)
Mild	0	73 (37.6)
Moderate	58 (71.6)	0
Severe	23 (28.4)	0

this cutoff point of 8, which also is the point of intersection between the sensitivity and specificity curves in **Figure 1**, are 94.8% (CI, 90.5%-97.4%) and 95.1% (CI, 87.2%-98.4%), respectively.

A high correlation was observed in the study using Spearman rank correlation, which is the level of agreement between SFAR and nasal smear classification of allergic rhinitis. This was 0.88, at the SFAR value of 8 (**Table 5**).

Discussion

The prevalence of 29.5% and 31.6% obtained for allergic rhinitis in this sample population by nasal smear eosinophil count and SFAR, respectively, is lower than the prevalence rate of 35% to 54% recorded for Nigeria in international reviews.^{2,3} A prevalence of allergic rhinitis in a third of the population underscores its importance, especially in allocation of health resources. But because it

Table 4. Sensitivity and Specificity Values at Various SFAR Cutoffs

SFAR Cutoff Values	Specificity	Sensitivity	Possibility of Correct Classification (POCCL)
2	0.22	1	0.451
3	0.39	1	0.571
4	0.63	1	0.731
5	0.87	0.98	0.898
6	0.92	0.96	0.935
7	0.92	0.96	0.935
8	0.95	0.95	0.942
9	0.96	0.92	0.938
10	0.96	0.88	0.938
11	0.96	0.77	0.902
12	0.96	0.77	0.902
13	0.96	0.64	0.865

SFAR	Nasal Smear, No.	
	Yes	No
Yes	77	10
No	4	184

Abbreviation: SFAR, Score for Allergic Rhinitis. χ^2 value = **213.5** at 1 degree of freedom. $P < .001$. Boldface indicates that the SFAR cut off value is 8.

is not life-threatening or stigmatizing, it may be relegated in health resource allocation.

We observed a significant male preponderance of allergic rhinitis in this study ($P < .001$). This is similar to other reports.^{11,17,20,27} Some studies have also reported a female preponderance.^{14,28} The reason for the male preponderance in this study is not known. There are reports of higher prevalence of allergic airway diseases in childhood in males with a reversal to female predominance in adolescents and adults.²⁹ This may be because females tend to present earlier, being more likely to overestimate the severity of the disease, whereas males underestimate it. There may also be a hormonal basis.^{30,31}

An SFAR cutoff value >8 optimally discriminated between patients with allergic rhinitis and those without, with sensitivity and specificity values of 95.1% (CI, 87.2%-98.4%) and 94.8% (CI, 90.5%-97.4%), respectively. This is a little higher than the reports from Annesi-Maesano et al¹⁵ (sensitivity and specificity of 74% [CI, 69%-79%] and 83% [CI, 79%-87%], respectively) and Piau et al²⁷ (sensitivity of 84% [CI, 77%-91%] and specificity of 81% [CI, 73%-89%]).

The correlation between SFAR and nasal smear eosinophil count in the study was 0.88 (using Spearman rank correlation coefficients). This implies that the use of SFAR as a tool for diagnosing allergic rhinitis in the absence of a laboratory investigation such as a nasal smear eosinophil count is almost 90% accurate. Thus, SFAR can be used as a simple, valid diagnostic tool in allergic rhinitis. This is important in rural settings, where access to laboratory investigations might not be readily available. However, these findings must still be

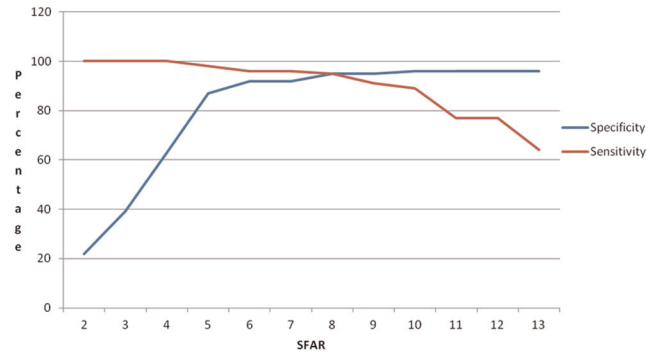


Figure 1. Graph of sensitivity and specificity of the score for allergic rhinitis intersecting at score 8. SFAR, Score for Allergic Rhinitis.

evaluated with the background knowledge of the presence of more diagnostic allergic tests, such as allergen-specific IgE and allergic skin sensitivity tests, which remain the gold standard in the diagnosis of allergic rhinitis.

The limitations of this study include the fact that it was a small sample hospital-based study. It may not be representative of the larger national population. Hence, there is a need to carry out a much larger study that would be community based. Also, conditions such as helminthiasis and nonallergic rhinitis with eosinophilia syndrome could cause nasal mucosa eosinophilia, hence reducing the sensitivity as well as specificity of the use of nasal smear eosinophilia as a diagnostic tool for allergic rhinitis. Moreover, SFAR is subjective, totally dependent on what the patient reports.

Table 5. Relationship between SFAR Cutoffs and Nasal Smear Count, Using Spearman's Correlation

SFAR Cutoff Values		Nasal Smear				χ^2	P Value	Spearman's Correlation Coefficient
		Normal (<5%)	Mild (>5%)	Moderate (<50%)	Severe (>50%)			
2	Allergic	90	61	58	23	24.2	<.001	0.278
	Nonallergic	31	12	0	0			
3	Allergic	65	53	58	23	52	<.001	0.399
	Nonallergic	56	20	0	0			
4	Allergic	34	38	58	23	102.1	<.001	0.577
	Nonallergic	87	35	0	0			
5	Allergic	9	17	56	23	176.3	<.001	0.789
	Nonallergic	112	56	2	0			
6	Allergic	0	15	55	23	209	<.001	0.853
	Nonallergic	121	58	3	0			
7	Allergic	0	15	55	23	209	<.001	0.853
	Nonallergic	121	58	3	0			
8	Allergic	0	10	54	23	217.9	<.001	0.881
	Nonallergic	121	63	4	0			
9	Allergic	0	10	51	23	205.3	<.001	0.853
	Nonallergic	121	63	7	0			
10	Allergic	0	8	50	22	202.4	<.001	0.851
	Nonallergic	121	65	8	1			
11	Allergic	0	8	43	19	161.4	<.001	0.758
	Nonallergic	121	65	15	4			
12	Allergic	0	8	43	19	161.4	<.001	0.758
	Nonallergic	121	65	15	4			
13	Allergic	0	8	37	15	124.1	<.001	0.663
	Nonallergic	121	65	21	8			

Abbreviation: SFAR, Score for Allergic Rhinitis. Boldface indicates statistical significance and that the SFAR cut off value is 8.

In conclusion, the prevalence of allergic rhinitis in this population group was 31.6% using SFAR and 29.5% using the nasal smear eosinophil count. There was a high correlation of SFAR with nasal smear eosinophil counts. We recommend that SFAR be used as a simple valid instrument to diagnose and monitor treatment of allergic rhinitis, as it has a positive correlation with standard diagnostic laboratory tests. Its use could also be relevant in larger community-based studies. A national registry of diagnosed cases of allergic rhinitis is desirable, to help follow changing trends. Also, efforts at developing indigenous skin-prick allergens to determine locally prevalent allergens, which will be more relevant and also cheaper, should be encouraged.

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Author Contributions

Foluwasayo Emmanuel Ologe, conception, design, patient care, interpretation of data, write-up, revision, approval of the final version for print; **Stephen Oluwatosin Adebola**, conception, design, patient care, data collection, data analysis, interpretation of data,

write-up, revision, approval of the final version for print; **Adekunle David Dunmade**, conception, design, patient care, interpretation of data, revision, approval of the final version for print; **Kayode Adebamiji Adeniji**, conception, design, data collection (laboratory), interpretation of data, revision, approval of the final version for print; **Benjamin Agboola Oyejola**, design, data analysis, interpretation of data, revision, approval of the final version for print.

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Supplemental Material

Additional supporting information may be found at <http://oto.sagepub.com/content/by/supplemental-data>

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APPENDIX I.

ATTRIBUTED SCORE AND REPARTITION FOR SCORE FOR ALLERGIC RHINITIS (SFAR) 15.

Item/Discrimination	Score/Points	Cumulative Score
Blocked Nose, Runny Nose, Sneezing in the past year (nasal symptoms)	1 for each symptom	3
Months of the Year	1 for Perennial 1 for Pollen season	5
Nasal Symptoms + Itchy eye (Rhinoconjunctivitis)	2	7
Triggers Pollens, House dust mites, Dust Epithelia (Cat, Dog)	2 1	9
Perceived Allergic Status	2	11
Previous positive Allergic test	2	13
Previous medical diagnosis of Allergy	1	14
Familial history of Allergy	2	16

Total points		16
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NB Month of the year: 1 for Perennial; 1 for Pollen season and 2 if perennial but worsened during pollen season.

Triggers: Pollens, House dust mites, Dust 2 for one or more trigger agents; Epithelia (Cat, Dog) 1; if a combination of both groups patient earned 2