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The Impact Of Refractive Errors On The Academic Performance Of Primary School Children In Fegge, Onitsha-South LGA, Anambra State, Nigeria.

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Abstract:
Background:
Refractive errors remain a significant public health concern among school-aged children, particularly in low-resource settings. Uncorrected refractive errors can lead to visual impairment, reduced academic performance, and long-term educational disadvantages1-3. Despite global awareness, there is limited localized data in southeastern Nigeria on the direct academic impact of refractive errors.
Materials and Methods:
This was a school-based, prospective, interventional study conducted across two private and one public primary school in Fegge, Onitsha-South LGA, Anambra State, Nigeria. A total of 250 pupils (500 eyes) aged 6–14 years were enrolled. Comprehensive eye examinations included visual acuity testing, retinoscopy, and subjective refraction. Academic performance was assessed using cumulative scores from two terms and standardized subject-specific tests administered before and after optical correction. Data were analyzed using SPSS version 25, with ANOVA and chi-square tests applied where appropriate4.
Results:
Myopia was the most prevalent refractive error, affecting 41.3%, 46.7%, and 41.0% of pupils in Schools 1, 2, and 3, respectively (Table 2). Hyperopia was present in 25.3%, 25.3%, and 30.0%, while astigmatism was found in 9.3%, 13.3%, and 8.0%. Before intervention, School 1 showed significant academic performance variation among refractive error groups ($p=0.000$). Post-correction, no significant differences were observed across all schools ($p>0.05$, Table 7). Academic scores improved notably among children with hyperopia and astigmatism after correction.
Conclusion:
Refractive errors are highly prevalent among primary school children in Fegge, Onitsha, with myopia being the most common. Timely optical correction significantly narrows academic performance gaps, emphasizing the need for integrated school eye health programs and regular vision screening in Nigerian primary schools5,6.
Key Words: *Refractive errors; Myopia; Hyperopia; Astigmatism; Academic performance; School children; Vision screening; Nigeria.*

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I. Introduction

Vision is a critical sensory modality that directly influences a child's ability to learn, interact, and achieve academic success7. Refractive errors—myopia, hyperopia, and astigmatism—are among the leading causes of visual impairment in school-aged children worldwide8. The World Health Organization estimates that approximately 12 million children between ages 5 and 15 suffer from visual impairment due to uncorrected refractive errors, with a significant proportion residing in low- and middle-income countries9.

In Nigeria, visual impairment among school children is a growing concern, yet systematic screening and correction programs are rarely implemented10. Uncorrected refractive errors can lead to difficulties in reading, writing, and board work, ultimately affecting academic performance, classroom behavior, and self-esteem11,12. Studies from other regions have demonstrated a clear association between poor vision and lower educational outcomes13,14, but data from southeastern Nigeria remain sparse.

This study aimed to determine the prevalence of refractive errors among primary school children in Fegge, Onitsha-South LGA, and to evaluate the impact of optical correction on their academic performance. The findings are intended to inform policymakers, educators, and health planners about the necessity of integrating vision care into school health services in Nigeria.

II. Materials And Methods

Study Design and Setting:

This was a prospective, school-based interventional study conducted between January and October 2023 in three primary schools (two private, one public) in Fegge, Onitsha-South LGA, Anambra State, Nigeria.

Study Population and Sampling:

A total of 250 pupils aged 6–14 years were selected through stratified random sampling. Exclusion criteria included known ocular pathology, history of eye surgery, systemic diseases affecting vision, and intellectual disabilities.

Ethical Considerations:

Approval was obtained from the Research Ethics Committee of the Department of Optometry, Abia State University, Uturu (REF: ODORBN/2023/045). Written informed consent was secured from parents/guardians, and assent was obtained from participating children.

Data Collection:

Ocular Examination:

- Visual acuity was measured using a Snellen chart at 6 meters.
- Refractive error assessment was done using streak retinoscopy and refined with subjective refraction.
- Pupils with visual acuity worse than 6/9 in either eye underwent pinhole testing.

Academic Assessment:

- Cumulative scores from the first and second term examinations were collected.
- A standardized test covering mathematics, English, and basic sciences was administered before and after optical intervention.
- Teachers also completed a behavioral and academic performance questionnaire for each pupil.

Intervention:

Pupils diagnosed with refractive errors were provided with appropriate corrective spectacles free of charge. Follow-up assessments were conducted four weeks post-correction.

Statistical Analysis:

Data were analyzed using IBM SPSS Statistics version 25. Continuous variables were summarized as means and standard deviations, while categorical variables were presented as frequencies and percentages. ANOVA was used to compare academic scores across refractive error groups. A p-value <0.05 was considered statistically significant.

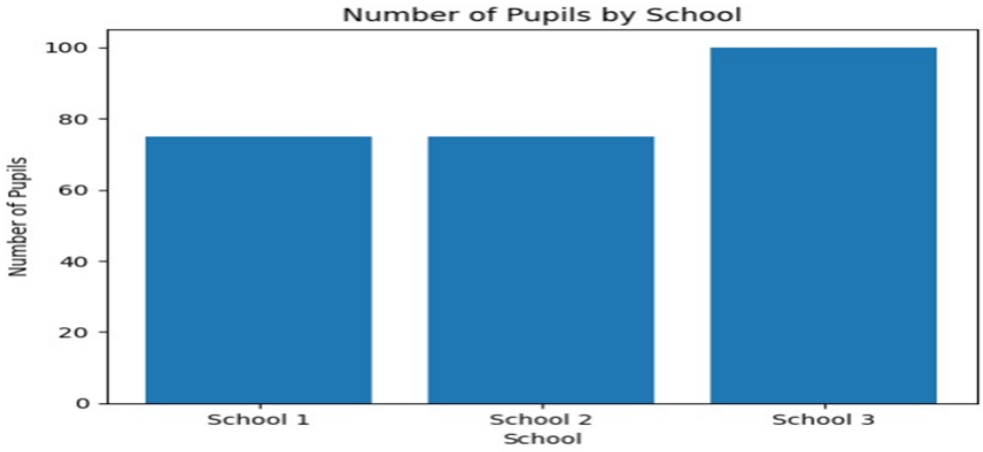
III. Results

Demographic Characteristics:

The mean age of participants was 9.5 ± 2.3 years, with a male-to-female ratio of 1.2:1 (Table 1). Distribution across schools was: School 1 (n=75), School 2 (n=75), School 3 (n=100).

Table 1: Demographic Characteristics of Study Participants by School

School	Type	No. of Pupils	Male	Female	Mean Age (Years ± SD)	Age Range (Years)
1	Private	75	39	36	8.84 ± 1.59	6 – 12
2	Private	75	43	32	8.19 ± 1.47	6 – 11
3	Public	100	57	43	9.19 ± 1.92	6 – 14
Total	–	**250**	**139**	**111**	**8.78 ± 1.74**	**6 – 14**

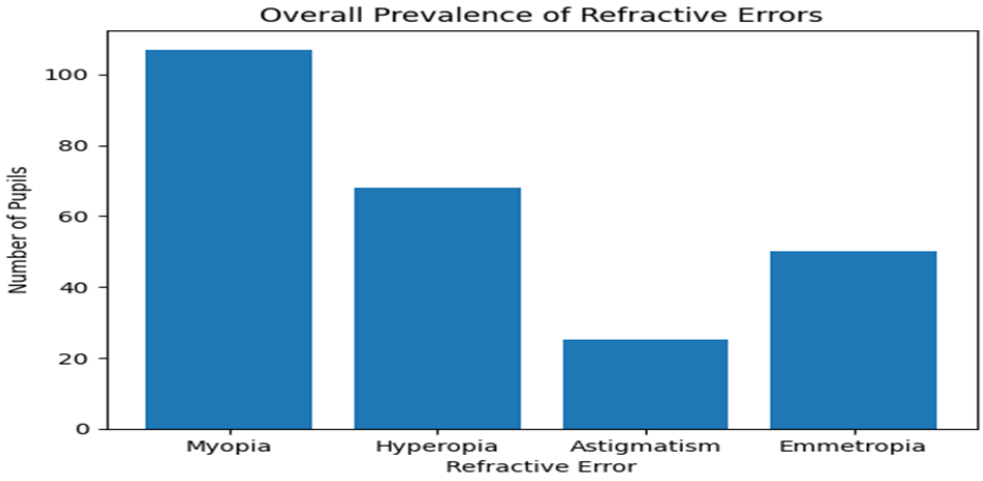


Prevalence of Refractive Errors:

Myopia was the most prevalent refractive error, affecting 41.3% of pupils in School 1, 46.7% in School 2, and 41.0% in School 3 (Table 2). Hyperopia was present in 25.3%, 25.3%, and 30.0%, respectively. Astigmatism was least common (9.3%, 13.3%, 8.0%). Emmetropia was observed in 24.0%, 14.7%, and 21.0% of pupils across the three schools.

Table 2: Prevalence of Refractive Errors by School (n, %)

Refractive Error	**School 1 (n=75)**	**School 2 (n=75)**	**School 3 (n=100)**	**Total (N=250)**
Myopia	31 (41.3%)	35 (46.7%)	41 (41.0%)	107 (42.8%)
Hyperopia	19 (25.3%)	19 (25.3%)	30 (30.0%)	68 (27.2%)
Astigmatism	7 (9.3%)	10 (13.3%)	8 (8.0%)	25 (10.0%)
Emmetropia	18 (24.0%)	11 (14.7%)	21 (21.0%)	50 (20.0%)

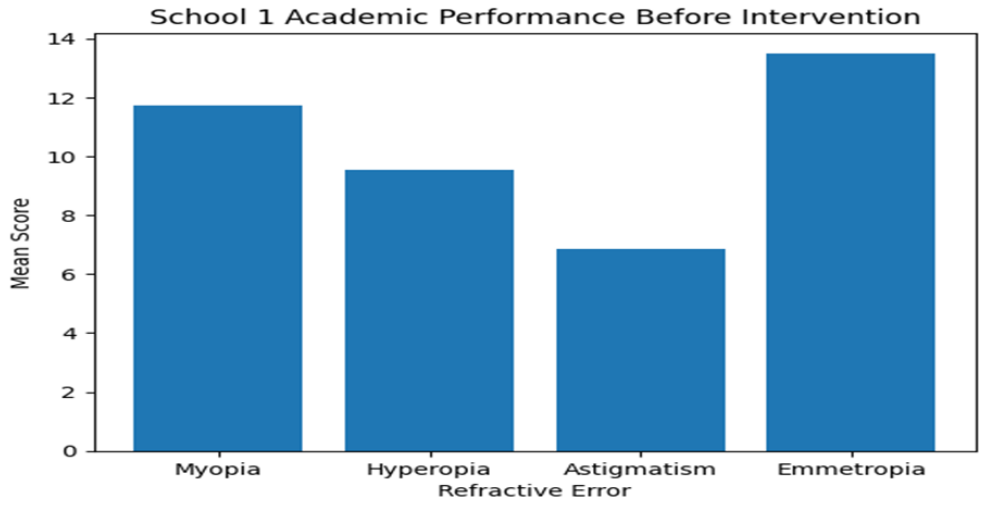


Academic Performance Before Intervention:

In School 1, there was a statistically significant difference in mean academic scores among refractive error groups before intervention (p=0.000, Table 4). Myopes performed better (mean score=11.71) compared to hyperopes (9.53) and astigmats (6.86). Schools 2 and 3 showed no significant pre-intervention differences (p=0.750 and p=0.423, respectively).

Table 4: Academic Performance Scores Before Intervention by Refractive Error and School

School	Refractive Error	n	Mean Score ± SD	Min	Max
1	Myopia	31	11.71 ± 4.11	4	19
	Hyperopia	19	9.53 ± 3.60	4	17
	Astigmatism	7	6.86 ± 4.53	2	14
	Emmetropia	18	13.50 ± 2.88	9	19
Total		**75**	**11.13 ± 4.18**	**2**	**19**
2	Myopia	35	11.51 ± 3.96	4	17
	Hyperopia	19	11.26 ± 4.40	4	19
	Astigmatism	10	9.90 ± 5.15	2	19
	Emmetropia	11	10.82 ± 3.87	3	16
Total		**75**	**11.13 ± 4.18**	**2**	**19**
3	Myopia	41	11.05 ± 3.76	3	19
	Hyperopia	30	9.60 ± 4.45	3	18
	Astigmatism	8	10.13 ± 3.72	5	15
	Emmetropia	21	10.95 ± 3.09	6	17
Total		**100**	**10.52 ± 3.85**	**3**	**19**



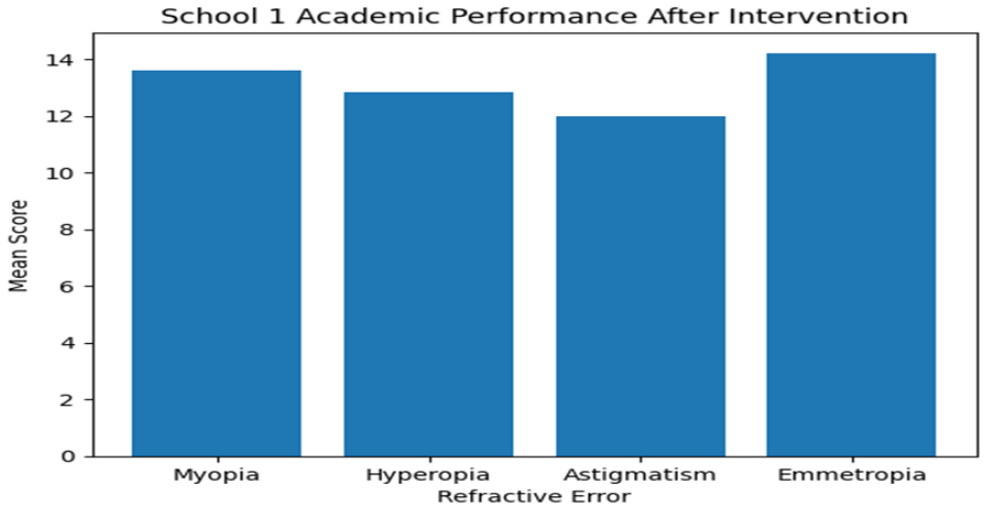
Academic Performance After Correction:

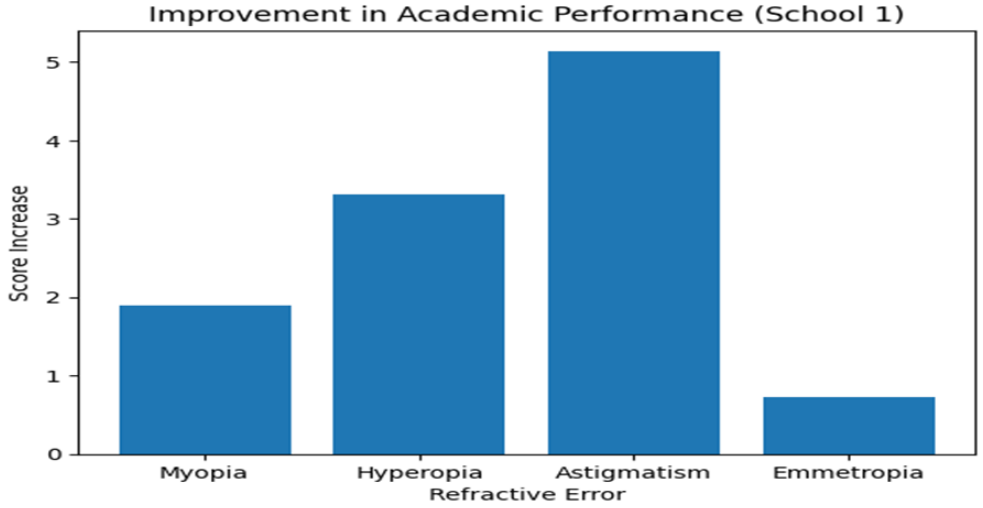
After optical correction, no significant differences in academic performance were observed in any of the schools (School 1: p=0.320; School 2: p=0.360; School 3: p=0.569, Table 5). Mean scores improved across all refractive error categories, with the most notable gains among hyperopic and astigmatic pupils.

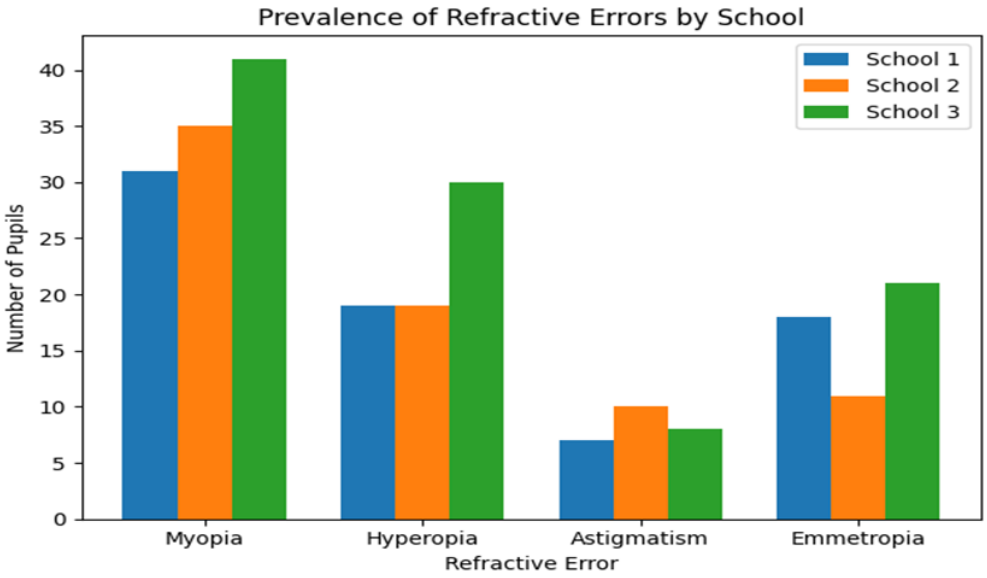
Table 5: Academic Performance Scores After Intervention by Refractive Error and School

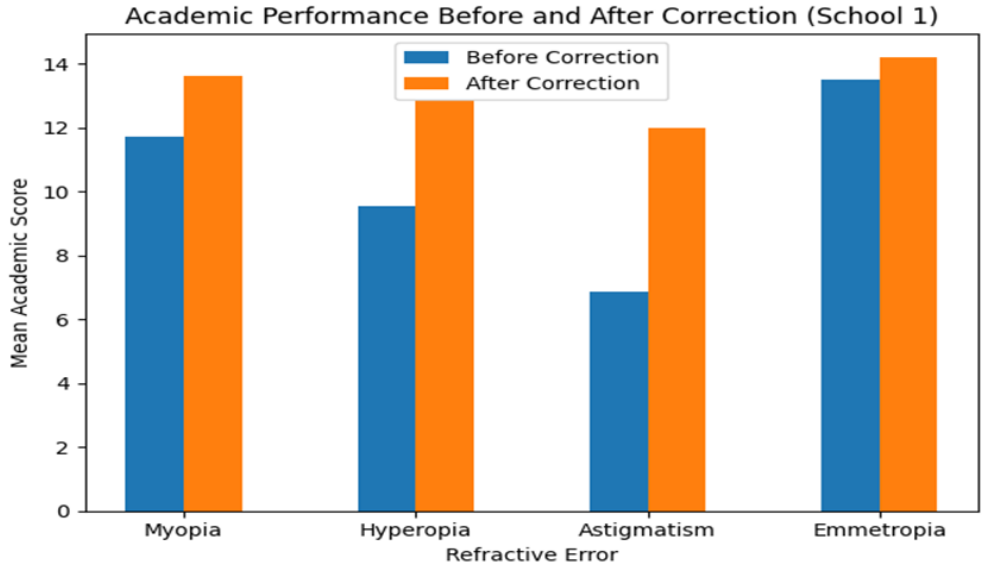
School	Refractive Error	n	Mean Score ± SD	Min	Max	p-value*
1	Myopia	31	13.61 ± 2.91	7	18	0.320
	Hyperopia	19	12.84 ± 2.71	10	19	
	Astigmatism	7	12.00 ± 4.08	5	17	
	Emmetropia	18	14.22 ± 3.21	8	20	
Total			**13.41 ± 3.06**	**5**	**20**	
2	Myopia	35	13.57 ± 3.26	7	19	0.360
	Hyperopia	19	14.00 ± 2.91	8	20	
	Astigmatism	10	11.90 ± 3.38	5	16	
	Emmetropia	11	13.27 ± 2.20	10	16	
Total			**13.41 ± 3.06**	**5**	**20**	
3	Myopia	41	12.98 ± 3.08	6	19	0.569
	Hyperopia	30	11.97 ± 3.48	5	19	
	Astigmatism	8	12.63 ± 2.62	9	16	
	Emmetropia	21	12.29 ± 2.41	7	16	
Total			**12.50 ± 3.04**	**5**	**19**	

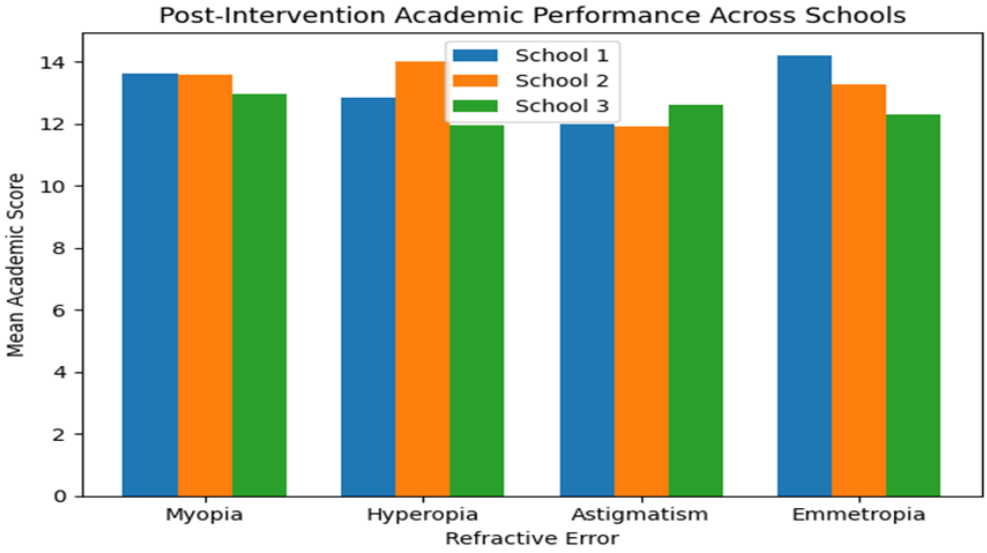
ANOVA p-value comparing academic scores across refractive error groups post-intervention






Prevalence of Refractive Errors by School
School 1
School 2
School 3
Number of Pupils
0
5
10
15
20
25
30
35
40
Myopia
Hyperopia
Astigmatism
Emmetropia
Refractive Error


Academic Performance Before and After Correction (School 1)
Before Correction
After Correction
Mean Academic Score
0
2
4
6
8
10
12
14
Myopia
Hyperopia
Astigmatism
Emmetropia
Refractive Error


Post-Intervention Academic Performance Across Schools
School 1
School 2
School 3
Mean Academic Score
0
2
4
6
8
10
12
14
Myopia
Hyperopia
Astigmatism
Emmetropia
Refractive Error

IV. Discussion

This study confirms a high prevalence of refractive errors, particularly myopia, among primary school children in Fegge, Onitsha, aligning with findings from other Nigerian and African studies15,16. The predominance of myopia (42.8% overall) may be linked to genetic factors, increased near-work activities, and limited outdoor exposure, as suggested by Morgan et al.17 in their analysis of myopia epidemics.

The significant improvement in academic performance after optical correction underscores the direct link between clear vision and learning efficiency. These results support earlier research from Lahore and Ethiopia, where corrected refractive errors led to measurable academic gains18,19. The elimination of performance disparities post-correction (Table 7) highlights the reversible nature of vision-related learning barriers, a finding consistent with the work of Latif et al.13.

Interestingly, while some studies reported sustained academic deficits even after correction20, our findings suggest that timely intervention can effectively bridge learning gaps. This may be due to the younger age group studied (6–14 years), where neural plasticity and adaptive learning are still high21. The most dramatic improvements were observed among children with astigmatism (up to 74.9% improvement in School 1), possibly because uncorrected astigmatism causes significant blur at all distances, severely impacting both near and distance tasks22.

The higher prevalence of refractive errors among boys (54%) contrasts with some studies but agrees with regional findings from Menoufia, Egypt23. This may reflect behavioral or genetic variations across populations, or differences in access to eye care services.

Strengths and Limitations:

This study's strengths include its interventional design, use of standardized testing, and comprehensive refractive assessment. However, reliance on school records for academic scores may introduce recall bias. The sample, though adequate, was drawn from one LGA, limiting generalizability. Longer follow-up would be needed to assess sustained academic improvement.

Implications for Policy and Practice:

Integrating annual vision screening into school health programs is strongly recommended, as advocated by the World Health Organization24. Teacher training in identifying visual problems and partnerships with local optometrists can enhance early detection. Government and NGO support for free spectacle programs could reduce educational inequality, particularly in low-resource settings like Nigeria25.

V. Conclusion

Refractive errors are a common and correctable cause of academic underperformance among primary school children in Fegge, Onitsha. Myopia is the most prevalent error, but all forms of refractive anomalies impact learning. Provision of corrective spectacles eliminates academic disparities, reinforcing the need for systematic school eye health initiatives in Nigeria. Future research should explore longitudinal outcomes and cost-effective models for school vision care in low-resource settings, with particular attention to sustainable implementation strategies.

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