

# Preferred Spectacles among Nigerian School Children: Report from a Refractive Error in School Children (RESC) Study

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## Abstract

**Background:** Refractive error (RE) is the most common cause of visual impairment globally and affects about 12.8 million children (5–15 years). Uncorrected RE in children could lead to irreversible vision loss in the paediatric age group. Spectacles are commonly used to correct RE although preferred spectacle design pattern among children may influence spectacle use. **Aims:** This study aims to assess school children's preferred spectacle designs and the factors associated with these preferences in south east Nigeria. **Subjects, Materials and Methods:** A representative cross-sectional study among school children aged 5–15 years in South-East Nigeria. Participants were asked to independently select preferred spectacles displayed based on: frame colour, material, shape of ear-piece, lens size, and shape. Statistical analysis of data to yield frequencies and test of association was done using Chi-square. Binary logistic regression tested the strength of association. Adjusted odds ratios were calculated at 95% confidence interval and  $P < 0.05$  were considered significant. **Results:** The study comprised 5723 school children (males 46.9% and females 53.1%), aged  $10.49 \pm 2.74$  years. Their commonly preferred spectacles were red coloured (35.4%), had straight earpiece (80.6%), of plastic materials (62.8%), rectangular lens shape (55.3%), and medium lens sized (58.6%). Age was the most associated factor with spectacle choice preference among the school children ( $P < 0.05$  in four out of the five possible preferences evaluated). **Conclusions:** Spectacle preferences exist among the study population. Some demographic factors are associated with these preferences which should be considered in any childhood RE services.

**Keywords:** Nigeria, preferred spectacle, school children, spectacle design

## INTRODUCTION

Uncorrected refractive error (RE) is the most common cause of visual impairment worldwide.<sup>[1,2]</sup> It causes disability that impairs learning and quality of life,<sup>[3]</sup> affecting about 12.8 million children aged 5–15 years.<sup>[4]</sup> Spectacle is recommended and common for correcting RE in children.<sup>[5-7]</sup> However, spectacle compliance is better (22%–75%) when children made choice of spectacle frame.<sup>[8,9]</sup> In China, plastic and rectangular frames were preferred,<sup>[10]</sup> while poor cosmesis affected compliance in Mexico.<sup>[11]</sup> Children with craniofacial malformations preferred custom spectacle.<sup>[12]</sup> Data on spectacle preferences among African children are scant. We report finding on spectacle preferences among children in southeast Nigeria.

## SUBJECTS AND METHODS

This cross-sectional school-based survey was conducted between March and June 2018, using the modified refractive error study in children (RESC) study protocol.<sup>[13]</sup> This study was part of a larger Refractive Error Study in Children (RESC) in southeast Nigeria.

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**How to cite this article:** Udeh NN, Aghaji AE, Okoye OI, Oguego NC, Okoye O, Maduka-Okafor FC, *et al.* Preferred spectacles among nigerian school children: Report from a refractive error in school children (RESC) study. Niger J Med 2022;31:309-14.

**Submitted:** 30-Aug-2021

**Revised:** 04-Feb-2022

**Accepted:** 19-Feb-2022

**Published:** 24-Jun-2022

### Access this article online

#### Quick Response Code:



**Website:**  
www.njmonline.org

**DOI:**  
10.4103/NJM.NJM\_158\_21

The University of Nigeria Teaching Hospital (UNTH) Research and Ethics Committee, Enugu State reviewed and gave approval for the study which was carried out in accordance with the Helsinki Declaration and its later modifications. Approvals were also obtained from the Universal Basic Education Board and Postprimary School Management Board of each state. Institutional consent was granted by each school authority and informed consent obtained by parents/guardian of each child recruited.

The school children aged 5–15 years in South East Nigeria were the study population. South East Nigeria a component of the 6 geopolitical zones in the country which is made up of 5 states-Abia, Anambra, Ebonyi, Enugu, and Imo-with an estimated population of 21.9 million.<sup>[14]</sup>

Participants were selected in each state using multistage cluster sampling technique. At the initial stage, the Local Government Areas (LGAs) in the state were stratified into urban and rural and one LGA was randomly selected from each stratum. Then, four school strata were formed comprising of public and private of both primary and secondary schools. A school from each stratum was selected, and these selected schools formed the sampling frame. The classes which included primary 1–6 and junior secondary children aged 5–15 years, with an overlap of the age group both for the primary and the junior secondary school).

The total sample size was 5723. Based on the state by state population, 1133, 1151, 1096, 1167, 1176 were recruited from Abia, Anambra, Ebonyi, Enugu, and Imo states respectively. Two research teams were trained by the principal investigators and a Community Eye Health Specialist/Technical Adviser familiar with the RESC protocol. A 5-day training was carried out using the RESC protocol and each team comprised 2 ophthalmologists, an ophthalmic nurse, optometrist and a sociologist all of whom were experienced in paediatric eye care and research.

The study tool was a pretested questionnaire asking children to indicate their preference of spectacle based on five spectacle characteristics: (i) frame colour (black, blue, brown, green, red, white and yellow); (ii) frame/lens size (small  $\leq 40$  mm, medium  $>40 < 46$  mm, large  $\geq 46$  mm); (iii) lens shape (round, oval and square); (iv) frame material (metal and plastic); and (v) ear-piece shape (straight and curved).

The questionnaire for this study was developed and pretested in children at the eye clinic of the Ophthalmology Department in the UNTH, Enugu State prior to the survey. A pilot of this study was done in a LGA in Enugu State, which is unpublished and not a part of this study and report.

In this study, participants selected their choice from each group sequentially; with mirrors provided to aid them to see themselves wearing the spectacles before making their choices. These choices were recorded, and the questionnaire filled; with a check for completeness assessed on the spot by another team member.

Data obtained were double entered by trained data entry clerks into a database in SPSS (Statistical Package for the Social Sciences) [IBM SPSS Statistics for Windows, Version 22.0. Armonk, New York: IBM Corporation] software version 22.0. Data analysis was done to yield frequencies, and test of association between categorical variables was done using the Chi-square test while those with significant associations ( $P \leq 0.05$ ) were subjected to binary logistic regression to test the strength of association. Tests of significance were set at the 95% level.

## RESULTS

### Demographics

There were 5723 school children surveyed, consisting of 2686 (46.9%) males and 3037 (53.1%) females. Their mean age was  $10.49 \pm 2.74$  years. Most of the participants were in public schools, 3200 (55.9%) compared to private schools; more were in primary schools 3762 (65.7%) than secondary schools and more were schooling in urban setting 2873 (50.2%). Table 1 shows the demographic characteristics of school children surveyed.

### Spectacle preferences

Red-coloured spectacle frames were the most commonly preferred 2027 (35.4%) of the eight options of colours followed by blue colour 921 (16.1%). The majority of the children preferred frames with straight earpiece 4611 (80.6%) and those made of plastic materials 3593 (62.8%). Rectangular lens shape 3167 (55.3%) and medium lens sizes 3355 (58.6%) were mostly preferred. Table 2 shows the spectacle choice preferences of the participants.

### Associations with spectacle frame preferences

The choice of red over other colours of spectacle (including no choice at all) was strongly associated with the children's age ( $P = 0.04$ ), gender ( $P < 0.001$ ), and type of school ( $P = 0.009$ ). However, there was no association with the school location or

**Table 1: Demographic characteristics of school children surveyed**

Variable	Frequency $n=5723$ , $n$ (%)
Age group (years)	
5-10	2729 (47.7)
11-15	2994 (52.3)
Mean $\pm$ SD	10.49 $\pm$ 2.74
Gender	
Males	2686 (46.9)
Females	3037 (53.1)
School type/ownership	
Public	3200 (55.9)
Private	2523 (44.1)
Location of school	
Urban	2873 (50.2)
Rural	2850 (49.8)
Child's class	
Primary school	3762 (65.7)
Junior secondary school	1961 (34.3)

SD: Standard deviation

class of the child ( $P > 0.05$ ). Table 3 shows the binary logistic regression model of factors associated with school children's preferences for red over other spectacle colours or no choice of colour.

**Table 2: Spectacle choice preferences of participants**

Variable	Frequency (n=5723), n (%)
Preferred spectacle shape	
Round	1515 (26.5)
Oval	1027 (17.9)
Rectangular	3167 (55.3)
No preference	14 (0.2)
Preferred lens size	
Small	1199 (21.0)
Medium	3355 (58.6)
Large	1156 (20.2)
No preference	13 (0.2)
Spectacle colour preference	
Red	2027 (35.4)
Blue	921 (16.1)
White	917 (16)
Yellow	533 (9.3)
Green	420 (7.3)
Black	533 (9.3)
Brown	340 (5.9)
No colour preference	32 (0.6)
Preferred spectacle material	
Plastic	3593 (62.8)
Metal	2112 (36.9)
No preference	18 (0.3)
Preferred shape of ear piece	
Straight	4611 (80.6)
Curved	1094 (19.1)
No preference	18 (0.3)

The preference for medium-sized lenses over other sizes or no choice at all is strongly associated with child's age ( $P < 0.001$ ) and gender ( $P = 0.001$ ) while the preference for rectangular shaped spectacles over other shapes is strongly associated with child's age ( $P = 0.008$ ), gender, class and school location with  $P < 0.001$ . Table 4 shows the binary logistic regression model of factors associated with participant's preferences and no preferences for lens sizes and spectacle shapes.

The preference for straight over curved ear-piece frames is strongly associated with child's age ( $P < 0.001$ ), class ( $P < 0.001$ ), and type of school ownership ( $P = 0.03$ ) while preference for plastic spectacle material over metal is associated significantly with child's class ( $P < 0.001$ ) and type of school ownership ( $P < 0.001$ ). Table 5 shows a binary logistic regression model of factors associated with school children's preferences for shapes of earpiece and spectacle material.

### DISCUSSION

This study found that age was a strong determinant of spectacle choice preference among school children. It has a significant association with school children's preferred frame colour, shape of earpiece, lens shape, and size although age is not associated with the participants preferred lens material. Thus, making it the most common factor associated with their preferences. Although the red colour was generally preferred by the children in this study, older children (11–15 years) are more likely to prefer red colour than the younger age group. A study on colour preferences among Nigerian school children reported that school children generally prefer red colour irrespective of their ages.<sup>[15]</sup> However, the colour red having a wide range of shades (varying through lighter to darker red, and from a brighter range to dull red); as well as the varying

**Table 3: Binary logistic regression model of factors associated with school children's preferences for red over other spectacle colours or no choice of colour**

Variable	Preference for colour (n=5723)		P*	AOR (95%CI)
	Red, n (%)	Others and no preference, n (%)		
Age group (years)				
5-10	931 (16.3)	1798 (31.4)	0.04	1.162 (1.007-1.341)
11-15	1096 (19.2)	1898 (33.1)		
Gender				
Male	858 (15.0)	1828 (32.0)	<0.001	1.334 (1.196-1.488)
Female	1169 (20.4)	1868 (32.6)		
Class				
Primary school	1322 (23.1)	2440 (42.6)	0.307	NA
JSS	705 (12.3)	1256 (22.0)		
Type of School				
Public	1186 (20.7)	2014 (35.2)	0.009	0.863 (0.773-0.964)
Private	841 (14.7)	1682 (29.4)		
School location				
Urban	1022 (17.8)	1851 (32.3)	0.590	NA
Rural	1005 (17.5)	1844 (32.2)		

\*P value at bivariate analysis. OR: Odds ratio, AOR: Adjusted OR, CI: Confidence interval, NA: Not applicable, JSS: Junior secondary school

**Table 4: Binary logistic regression model of factors associated with school children's preferences and no preferences for lens sizes and spectacle shapes**

Variable	Preference for lens size (n=5723)		P*	AOR (95% CI)
	Medium, n (%)	Other sizes and no preference, n (%)		
Age group (years)				
5-10	1493 (26.1)	1236 (21.6)	<0.001	1.305 (1.135-1.501)
11-15	1862 (32.5)	1132 (19.8)		
Gender				
Male	1516 (26.5)	1170 (20.4)	0.001	1.188 (1.068-1.321)
Female	1839 (32.1)	1198 (30.0)		
Class				
Primary	2118 (37.0)	1644 (28.7)	0.197	NA
JSS	1237 (21.6)	724 (22.7)		
Type of school				
Public	1855 (32.4)	1345 (23.5)	0.129	NA
Private	1500 (26.2)	1023 (17.9)		
School location				
Urban	1710 (30.0)	1163 (20.3)	0.122	NA
Rural	1645 (28.7)	1204 (21.0)		
Variable	Preference for spectacle shapes		P*	AOR (95% CI)
	Rectangular	Others and no preference		
Age group (years)				
5-10	1384 (24.2)	1345 (23.5)	0.008	1.208 (1.052-1.387)
11-15	1783 (31.2)	1211 (21.1)		
Gender				
Male	1566 (27.4)	1120 (19.6)	<0.001	0.782 (0.703-0.869)
Female	1601 (28.0)	1436 (25.0)		
Class				
Primary	1946 (34.0)	1816 (31.7)	<0.001	1.375 (1.188-1.591)
JSS	1221 (21.3)	740 (13.0)		
Type of school				
Public	1766 (30.8)	1434 (25.1)	-	NA
Private	1401 (24.5)	1122 (19.6)		
School location				
Urban	1676 (29.2)	1197 (21.0)	<0.001	0.760 (0.684-0.846)
Rural	1490 (26.0)	1360 (23.8)		

\*P value at bivariate analysis. OR: Odds ratio, AOR: Adjusted OR, CI: Confidence interval, NA: Not applicable, JSS: Junior secondary school

study designs may be attributed to these findings. Older age is a documented risk factor for noncompliance with spectacle wear among school children.<sup>[11]</sup> This may imply that colour preference of older school children should be factored in the provision of spectacles in planning of school eye health programs in the study area.

We found that gender was a significant determinant of the preferred choice of spectacle frame colour, lens size, and shape, but it was not associated with preference for spectacle material and shape of earpiece in our findings. Females preferred medium size, plastic materials, red colour, and rectangular shape lens compared to males. A direct comparison cannot be made with another study,<sup>[10]</sup> that reported on spectacle preferences among school children due to variations in study designs. However, girls' preference of red-coloured spectacles compared with boys may have practical implications in stocking spectacles in paediatric eye care.

In our study, lens shape preference was significantly associated with urban location of the school. This may have deeper implications as urban residence was found to be a risk factor associated with noncompliance to spectacle wear among school children in Mexico.<sup>[11]</sup>

In contrast to our finding of straight earpiece being preferred in this study, school children's preference of curved earpiece has been observed in another study in China.<sup>[10]</sup> Parents and children have suggested that a curved earpiece is likely to hold the glasses in place and likely to ensure compliance of spectacle wear in children.<sup>[10]</sup> This suggests that cultural or contextual factors may play a role in children's spectacle preference.

Our finding that the school class being associated with spectacle lens shape and material is similar to a Chinese report,<sup>[10]</sup> where both primary and secondary school children considered material (plastic generally more preferred to metal)

**Table 5: Binary logistic regression model of factors associated with school children's preferences for shapes of ear piece and spectacle material**

Variable	Preference for shape of ear piece (n=5705)		P*	AOR (95% CI)
	Curved, n (%)	Straight, n (%)		
Age group (years)				
5-10	497 (8.7)	2222 (38.9)	<0.001	1.488 (1.259-1.758)
11-15	597 (10.5)	2389 (41.9)		
Gender				
Male	504 (8.8)	2175 (38.2)	0.288	NA
Female	590 (10.3)	2436 (42.7)		
Class				
Primary	761 (13.3)	2989 (52.4)	<0.001	0.620 (0.519-0.740)
JSS	333 (5.8)	1622 (28.4)		
Type of school				
Public	588 (10.3)	2602 (45.6)	0.03	1.160 (1.014-1.326)
Private	506 (8.9)	2009 (35.2)		
School location				
Urban	529 (9.3)	2335 (40.9)	0.259	NA
Rural	565 (9.9)	2275 (39.9)		

  

Variable	Preference of spectacle material		P*	AOR (95% CI)
	Plastic, n (%)	Metal, n (%)		
Age group (years)				
5-10	1678 (29.4)	1043 (18.3)	0.194	NA
11-15	1915 (33.6)	1069 (18.7)		
Gender				
Male	1696 (29.7)	980 (17.2)	0.457	NA
Female	1897 (33.3)	1132 (19.8)		
Class				
Primary	2271 (39.8)	1478 (25.9)	<0.001	1.455 (1.253-1.690)
JSS	1322 (23.2)	634 (11.1)		
Type of school				
Public	1932 (33.9)	1259 (22.1)	<0.001	1.259 (1.127-1.406)
Private	1661 (29.1)	853 (14.9)		
School location				
Urban	1828 (32.0)	1034 (18.1)	0.343	NA
Rural	1764 (30.9)	1078 (19.0)		

\*P value at bivariate analysis. OR: Odds ratio, AOR: Adjusted OR, CI: Confidence interval, NA: Not applicable, JSS: Junior secondary school

and shape very important in their evaluation of glasses design. Rectangular/square-shaped lens preference over round ones in their study,<sup>[10]</sup> is also similar to our findings. This may have implication when considering the manufacturing of paediatric spectacles presently; although it is a known fact that there is usually a trend with choices which may vary over time.

To the best of our knowledge, this is the first study to explore the spectacle preferences of school children in Nigeria. Spectacles are available in many shapes, sizes, and colours

and our selection may not have been representative of all the spectacles available. However, every effort was made to include the wide array of options available to us at the time of this study, and our findings indicate that there are spectacle preferences amongst school children. This study did not explore the cost implication of these preferred spectacles and this may be a barrier to the use of spectacles among school children in a resource-limited setting.<sup>[16]</sup> Further research is however indicated to determine how these choices may influence spectacle compliance among children.

## CONCLUSIONS

This study highlighted the spectacle designs preferred by school children in South-East Nigeria; findings may be used as a guide in planning paediatric spectacle services to enhance compliance to spectacle use among children. Further studies are needed to ascertain how the inclusion of popular preferences and especially allowing the child to make his choice will affect compliance with spectacle uptake and use by school children. Parents, caregivers, and relevant healthcare providers must recognize and incorporate the spectacle preference of the child when considering refractive correction.

## Limitations

This study was carried out using the spectacle designs available; diligent efforts were made to procure as many designs as possible. However, we acknowledge that there may be other designs which were not in the selection presented to the participants.

## Acknowledgment

This study was supported by the Tertiary education trust fund (Grant Number: TETF/DESS/NRF/UUNN/NSUKKA/STI/VOL. 1/B4.7).

## Financial support and sponsorship

The Nigeria tertiary education trust fund (TETFund).

## Conflicts of interest

There are no conflicts of interest.

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