PREVALENCE OF REFRACTIVE ERRORS IN SPECIAL NEEDS CHILDREN IN KANO STATE, NIGERIA

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Received: 18th June, 2022 **Accepted**: 30th June, 2023 **Published**: 30th June, 2023

ABSTRACT

Background: Uncorrected refractive errors (URE) persist as a public health problem among different ages and population groups worldwide, including special needs children.

Aim: This study was aimed to determine the prevalence of refractive errors in special needs children in Kano State.

Methods: It is a cross sectional Prospective study carried out on the special needs children. The external and internal structures of the participants' eyes were examined. Lea symbol chart was used to measure visual acuity at 3 meters. Objective and subjective refractions were carried out to determine their refractive status. Statistical Package for Social Sciences (SPSS) version 25 was used to analyze the data.

Results: Children (105) between the ages of 4-18 years were included and 81 participants had refractive errors. Prevalence of refractive error was 88.2%. Those between ages 13-15 and 16-18 years were largely affected. The prevalence of refractive error was more in males (71.1%). About 62% were more than age thirteen. The main causes of refractive errors were astigmatism (56.5%), hyperopia (21.1%) and myopia (10.5%).

Conclusion: Our result showed age increase and gender were the leading risk factors for refractive errors among special needs children. It also confirmed that astigmatism and hyperopia were the major causes of refractive error. Vision screening should be made compulsory for preschool special needs children which will make the burden of uncorrected refractive error to reduce.

Key words: Prevalence, special need, refractive errors.

INTRODUCTION

The primary function of the eye is vision. It plays a basic role in the acquisition of skills such as interpreting facial expressions, language, and skills requiring hand-eye coordination (Joshi and Somani, 2013). The eye takes a great part in the development and functioning of a child. Vision plays an integral role in the psychosocial development of children with special needs and compensates for certain impaired functions (Das *et al*., 2010).

Vision 2020 **"**The Right to Sight**"** initiative of the world health organization (WHO) rated refractive error in the disease listed for elimination of avoidable blindness. WHO (2006) estimates 1.2 million visually impaired children aged 5 to 15 years worldwide, due to URE that could be easily diagnosed and corrected with spectacle and contact lenses (Dandona *et al.,* 2001). Globally, URE (43%) was reported as a leading cause of visual impairment by WHO (Pascolini and Mariotii, 2012). Abnormal visual experience due to URE leads to amblyopia (Weakley, 2011). Early identification and intervention is needed to prevent amblyopia in children with URE. Millions of children are losing educational opportunities due to lack of adequate optical correction. WHO (2006).

Worldwide about 2.3 billion people have been reported to have refractive error; 1.8 billion of which have access to eye healthcare services. URE is the major eye problem worldwide, also the second cause of blindness (Fricke *et al.*, 2012). URE in children can bring about a substantial impact on learning process and educational capacity (Yingyong, 2010). Screening helps to identify unsuspecting children early and intervention provided. (Padhye *et al*., 2009)

A special needs child is a youth who has been determined to require peculiar essential requirements that other children do not use. Children with special needs are at a higher risk of ocular and visual problems than their peers (Salt and Sargent, 2014) because they often cannot communicate symptoms adequately. Most of the time special needs children have vision problems that often go unrecognized and undiagnosed. Any unidentified and unmanaged ocular – visual deformities in children with special needs may detrimentally affect their development, psychosocial behavior and learning capacity, adding further socio economic burden on the family (EL-Hazmi, 1997). The perseverance of untreated oculo–visual abnormality would greatly increase the impact of other forms of disability (Bodack, 2011) hence the need for a prompt and extensive oculo – visual assessment in this group of children who are at risk.

Therefore, there is need to evaluate the prevalence of refractive error in special needs children in Kano State, and intervene early to maximize their potentials.

MATERIALS AND METHODS

This research work was conducted in three different Local Government Areas of Kano State (Nasarawa, Tarauni and Kano municipal). Kano state shares boundaries with: Katsina State (North West), Jigawa State (North East), Bauchi State (South-East) and Kaduna State (South West). The state capital is Kano. It covers 499 km^2 (193 sq mi) with a population of 2,828,861 at the 2006 census (Kano Municipal, 2007). One hundred and five (105) participants were included for the study, from four special needs schools located in three different local government areas (Nasarawa, Tarauni and Kano municipal). . Purposive sampling of schools and systematic random sampling methods were used in selecting the participants. Ethical Approval was given by the thesis committee of the department of Optometry, Bayero University Kano, and the Ministry of Health's Research Ethical Committee of Kano State. Permission was obtained from each school principal to conduct the study. Consent/assent form was issued to the school children's that was signed and returned by the parents or care givers. Severe ocular cases detected during the examination, were referred to a nearby eye clinic for evaluation and proper management.

Research instruments and materials used were: The lea symbol charts (Distance and Near), Pen torch (keeler), Trial lens case and trial frame (topcon). Batteries (Alkaline), Direct eye examination and verbal interview. Comprehensive case history of each subject was taken and recorded.

The lea symbol chart and flash cards were used at different distances of 1m, 2m and 3 meters at far and 40cm at near to perform the visual acuity (VA) test. The VA was converted to meters from foot for uniformity using the Minimum Angle of Resolution (MAR). The participants who were verbal and understood the instruction responded appropriately while those non-verbals were given flash cards to identify the symbols while others used sign language, thumbs up and down or by nodding to identify the symbols, when the flash cards were presented. The chart was presented binocularly (both eyes) initially, then monocularly (Right Eye: OD First) and (left eye: OS). (Nwokedi *etal.*, 2018). External examination was done by observation of facial look, midline, nose, ear, mouth, lids; cleft, lower and upper, swelling, etc.

Pen torch light was used to examine the cornea, iris, anterior chamber, conjunctiva, sclera, pupillary responses, injections, congestion, and any abnormalities (deviations, nystagmus) observed and documented (Nwokedi *et al.,* 2018).

Internal examination: Ophthalmoscopy was done to observe the internal structures of the eyes including the optic disc and cup after dilatation with the dilating drops. The vertical cup/disc ratio, physiological cupping, retinal detachment, artery vein ratio, pigmentation and any other irregularity were determined (Nwokedi *et al.,* 2018).

Subjective refraction was used to determine the refractive error of the eye, by placing the lens power from objective refraction in the trial frame while the participant wearing the frame. This helped in determining the type of error of refraction (hyperopia, myopia and astigmatism) using: hyperopia ≥ + 0.75DS, myopia ≥ -0.75DS and astigmatism ≥ -0.75DC as the criteria for classification of refractive errors (Nwokedi *et al.,* 2018). The lens power was refined starting with the sphere before the cylinder. Binocular balancing was applied to create acceptance by patients in the two eyes working as a team.

Data were analyzed using SPSS version 25while the descriptive statistics was used to establish the means, range, refractive error values and standard deviations (SD) of the demographic data of the children. Chi Squared test was used to find out relationships between age and gender with refractive errors at p <0.05. Tables, pie-charts and bar-charts were used to present the results of this study.

RESULTS

The total of one hundred and five (105) participants were seen, eighty one (81) children were evaluated. The age range was four to eighteen (4 to 18) years. Prevalence of refractive error in this study was 88.2%.

Table 1 indicates that among the 81 persons with refractive error, that those between the age of 16 – 18 had the highest percentage of refractive error (35.8%) while those of 10-12 and 4-6 had the least percentage occurrence of (12.3%) and (7.4%) respectively. Table 2 Shows that 55 (85.9%) had normal – Mild visual impairment with a VA ≥ 6/18, 5 (7.8%) had moderate visual impairment VA < 6/18 to 6/60. Table 3 shows higher occurrence of normal to mild visual impairment (VA > 6/18) among age range 16 – 18 and 13-15 accounting for 20 (31.3%) and 17 (26.6%) respectively. Table 4 shows a higher occurrence of visual impairment in males then in females accounting for 44 (68.8%) and 20 (31.3%) respectively. Table 5 shows a higher occurrence of Simple hyperopic astigmatism [right eye 15(19.7%) and left eye 17(22.7 %)] followed by Hyperopia [right eye 16(21.1%) and left eye 15(20.0%)] respectively. Table 6 shows that hyperopia was the highest amongst participants aged 16 -18 years old accounting for 8(10.5%) followed by simple hyperopic astigmatism accounting for 15(19.7%).

Table 1: Distribution of the Study Participants by Age

Age (Years)	Frequency(n)	Percentage (%)
4 – 6	6	7.40
7 – 9	14	17.28
10 – 12	10	12.34
13 – 15	22	27.16
16-18	29	35.80
Total	**81**	**100**

Table 2: Distribution of the Study Participants by VA

Variable	OD (%)	OS (%)	OU (%)
Normal-mild V.I (VA ≥6/18)	54(84.4)	52(81.3)	55 (85.9)
Moderate V.I (VA <6/18 to 6/60)	5(7.8)	6(9.4)	5 (7.8)
Severe V.I (VA <6/60 to 3/60)	3(4.7)	3(4.7)	2 (3.1)
Blindness (VA <3/60)	2(3.1)	3(4.7)	2 (3.1)
Total	**64(100)**	**64(100)**	**64(100)**

Key: VA: Visual acuity; V.I: Visual impairment; OD: Oculus Dexter; OS:Oculus sinister; OU: Oculus uterque

Table 3: Shows the VA Participants by Age

Age range	Normal-mild V.I (%)	Moderate V.I (%)	Severe V.I (%)	Blindness (%)	Total (%)
4-6	3(4.7)	1(1.6)	0(0.0)	0(0.0)	4(6.3)
7-9	6(9.4)	0(0.0)	0(0.0)	1(1.6)	7(10.9)
10-12	8(12.5)	1(1.6)	0(0.0)	0(0.0)	9(14.1)
13-15	17(26.6)	1(1.6)	0(0.0)	0(0.0)	18(28.1)
16-18	20(31.3)	2(3.1)	3(4.7)	1(1.6)	26(40.6)
Total	**54(84.4)**	**5(7.8)**	**3(4.7)**	**2(3.1)**	**64(100)**

Key: VA: Visual acuity; V.I: Visual impairment

Table 4: Shows the VA of the Study Participants by Gender

Gender	Normal-mild V.I (%)	Moderate V.I (%)	Severe V.I (%)	Blindness (%)	Total (%)
Male	37(57.8)	4(6.3)	2(3.1)	1(1.6)	44(68.8)
Female	17(26.6)	1(1.6)	1(1.6)	1(1.6)	20(31.3)
Total	**54(84.4)**	**5(7.9)**	**3(4.7)**	**2(3.2)**	**64(100)**

Key: VA: Visual acuity; V.I: Visual impairment

Table 5: Shows the Study Participants by Refractive Status

Variable	OD [Right eye] (%)	OS [Left eye] (%)
Emmetropia	9(11.8)	8(10.7)
Myopia	8(10.5)	8(10.7)
Hyperopia	16(21.1)	15(20.0)
S.M.A	12(15.8)	12(16.0)
S.H.A	15(19.7)	17(22.7)
C.M.A	6(7.9)	6(8.0)
C.H.A	8(10.5)	7(9.3)
M.A	2(2.6)	2(2.7)
Total	**76(100)**	**75(100)**

Key: S.M.A: Simple myopic astigmatism; S.H.A: Simple hyperopic astigmatism; C.M.A: Compound myopic astigmatism; C.H.A: Compound hyperopic astigmatism; M.A: Mixed astigmatism.

Table 6: Distribution of Refractive Status by Age

Age group	Emmetropia (%)	Myopia (%)	Hyperopia (%)	S.M.A (%)	S.H.A (%)	C.M.A (%)	C.H.A (%)	M.A (%)	Total (%)
4-6	1(1.3)	0(0.0)	0(0.0)	0(0.0)	4(5.3)	1(1.3)	0(0.0)	0(0.0)	6(7.9)
7-9	0(0.0)	1(1.3)	3(3.9)	1(1.3)	4(5.3)	0(0.0)	1(1.3)	0(0.0)	10(13.2)
10-12	1(1.3)	1(1.3)	3(3.9)	2(2.6)	0(0.0)	1(1.3)	2(2.6)	0(0.0)	10(13.2)
13-15	4(5.3)	2(2.6)	2(2.6)	5(6.6)	4(5.3)	2(2.6)	2(2.6)	1(1.3)	22(28.9)
16-18	3(3.9)	4(5.3)	8(10.5)	4(5.3)	3(3.9)	2(2.6)	3(3.9)	1(1.3)	28(36.8)
Total	**9(11.8)**	**8(10.5)**	**16(21.1)**	**12(15.8)**	**15(19.7)**	**6(7.9)**	**8(10.5)**	**2(2.6)**	**76(100)**

Key: S.M.A: Simple myopic astigmatism; S.H.A: Simple hyperopic astigmatism; C.M.A: Compound myopic astigmatism; C.H.A: Compound hyperopic astigmatism; M.A: Mixed astigmatism

DISCUSSION

Globally uncorrected refractive error is a public health discusses especially in the special needs children in the developing countries. Despite its impact on the learning/academic activities there is very scares information of its prevalence in Kano State. This study evaluated the prevalence of refractive error in special needs children in three local government areas of Kano State. A very high prevalence of refractive errors of 88.2% found among children with special needs in this study, which is similar to 96.4% reported by Ljubic and Trajkovski, (2011), 76.4% by Aghaji *et al.* (2013) and 95.3% by Nwokedi *et al.* (2018). It was greater than that in Genapathy and Dinu, (2018) 54.5%, 11.0% reported by Bodack, (2011), 33.3% by Theodor *et al.* (2016), 46.1% reposted by Meghomala Das *et al.*, (2010) and 33.3% by Ezegwui *et al.* (2014). This may be as a result of lack of proper early identification and early intervention centers in the state. Our prevalence of *refractive errors was higher in males 54 (71.1%) than in females 22 (28.9%)* contrary to Nwokedi *et al.* (2018) study that reported refractive error being more common in females (94.9%) than in males (93.8%). This may be due to difference in distribution of males and females in our study. The prevalence of refractive error in our study increased in age which agreed with the findings of (Ljubic and Trajkovski 2011).

The magnitude of refractive error (spherical equivalent) is between -8.00 DS to +7.50 DS with a mean value of 0.11 DS #2.25DS. This finding is in contrast with -1.00 DS to #4.00 DS (spherical correction) reported by Ezegwui *et al.* 2014). It agreed with lower minus sphere and higher plus sphere by (Nwokedi *et al.* 2018). This may be attributed to the difference in the method and definitions.

The prevalence of hyperopia (21.1%) in our study was in line with (20.0%) reported by Katoch et al., (2007), (22.8%) by Meghomala *Das et al.* (2010) and 23.2% reported by (Ljubic and Trajkovski 2011). Our study's prevalence of 13.64% was higher that presented by Ganapathy and Dinu, (2018), 11.1% by (Ezegwui *et al.* 2018). The discrepancies may be due to definition and means of reporting refractive errors.

In our study, the prevalence of myopia was 10.5% and similar to 13.5% findings of Katoch *et al.* (2007), 7.7% by Nwokedi *et al.* (2018) and 9.6% by (Meghomala Das *et al.* 2010). These findings were lower than the prevalence of 40.91% reported by Ganapathy and Dinu, (2018) and 17.8% by Ljubic and Trajkorski (2011). These differences may be due to the number of participants with axial length conditions and definition of refractive error. The prevalence of astigmatism 56.5% in this study was in agreement with 55.3% findings of (Ljubic and Trajkovski 2011).

The prevalence of 34% and 36.3% reported by Katoch *et al.* (2007) and Ganapathy and Dinu, (2018) respectively was lower. These differences may be due to number of participants. Majority of our study participants belong to older school age group, with a mean age of 13.05 ±3.99 years. Our result was slightly higher than 10. 28 ± 3.2 years reported by Ezegwu *et al.* (2014) and 12.9 #3.3 years reported by (Ezeh *et al.* 2018).

It was lower than 14.9 #6.7 years by (Ljubic and Trajkovski 2011). These findings are in agreement with the mean age of 13.6 #3.7 years reported by (Nwokedi et al. 2018). The high school age maybe due to developmental delays of the special needs children and late presentation to optometrists for identification and intervention.

Astigmatism was the leading cause of refractive error next to it was hyperopia and myopia and hyperopic astigmatism was the highest type of astigmatism found in our study population. This was in agreement that reported by Nwokedi *et al.* (2018), Ezegwui *et al.* (2014) and Aghaji *et al.* (2013). Other examination carried out to assess the ocular health of participants included ophthalmoscopy, tonometry and penlight examination as presented in table; distribution of ocular assessment among study participants. Many subjects were diagnosed with multiple conditions. Refractive error with 46(56.8%) was highest (which was lower than 95.3% reported by Nwokedi *et al.* (2018), followed by refractive error and strabismus 11(13.6%), also was lower than 33.3% reported by (Aghaji *et al.* 2013). The findings from our study indicated that uncorrected refractive error in special needs children is often neglected and can delay development, hence affecting learning, activities of daily living and quality of life of the population; this can be improved by early identification and early intervention

CONCLUSION

Our study established that the prevalence of refractive error among special needs children was very high and were common among age range 13-15 and 16-18. The findings revealed that age and gender were the main risk factors for refractive errors in our study area. The results also shown, that hyperopia and astigmatism were the most common causes of refractive error. We therefore recommend a compulsory early identification and early intervention programme for children from birth to age 18 and provision of optometry eye clinic in forty-four (44) local government areas the state for vision screening, comprehensive eye examination and provision of multi-disciplinary early intervention services which will help to reduce the burden of developmental delays in special needs children.

REFERENCES

Aghaji, A. E., Lawrence, L., Ezegwui, I., Onwasigwe, E., Okoye, O., & Ebigbo, P. (2013). Unmet visual needs of children with Down syndrome in an African population: Implications for visual and cognitive development. Eur J Ophthalmol , 23, 3948.

Bodack, M. (2011). Eye and vision assessment of children with special needs in an interdisciplinary school setting. *Opt Vis Dev , 42*, 2206.

Dandona, R., & Dandona, L. (2001). Refractive error blindness. *Bull World Health Org , 79*, 237–243.

El-Hazmi, M. (1997). Early recognition and intervention for prevention of disability and its complications. *Eastern Med Health J , 3(1)*, 154–161.

Ezegwui, I. R., Lawrence, L., Aghaji, A. E., Okoye, O. I., Okoye, O., Onwasigwe, E. N., Ebigbo, P. O. (2014). Refractive errors in children with autism in a developing country. *Niger J Clin Pract , 17*, 467-70.

Ezeh, E. I., Ibanga, A. A., & Duke, R. E. (2018). Visual status of special needs children in special education schools in Calabar, Cross River State, Nigeria. *Niger Postgrad Med J , 25*, 161-5.

Fricke, T. R., Holden, B. A., Wilson, D. A., Schlenther, G., Naidoo, K. S., Resnikoff, S. (2012). Global cost of correcting vision impairment from uncorrected refractive error. *Bull World Health Organ , 90*, 728–738.

Ganapathy, K., & Dinu, K. (2018). Ocular disorders in children with learning disabilities in a tertiary Hospital, Pondicherry. *Indian Journal of Clinical and Experimental Ophthalmology , 4(3)*, 347-351.

Joshi, R. S., Somani, A. A. (2013). Ocular disorder in children with mental retardation. *Indian J Psychiatry*, 55(2), 170-172.

Kanu, S. A. (2008). Special Needs Education in Perspective. Child Care and Special Needs Education in Nigeria . *In: A. Olabisi (ed.)*, 1-12. Jos: Centre for Learning Disabilities and audiology.

Kano Municipal L.G.A. Population as per: Federal Republic of Nigeria Official Gazette (2007). "Legal Notice on Population of the details of the breakdown of the National and State Provisional Total 2006 census" Retrieved September, 2017.

Katoch, S., Devi, A., & Kulkarni, P. (2007). Ocular defects in cerebral palsy. *Indian J Ophthalmol , 55*, 154-6.

Ljubic, A., & Trajkovski, V. (2011). Refractive Error in Children and Young Adults with Down Syndrome. *ACTA Ophthalmol , 89*, 324-327.

Meghomala, D., Spowart, K., Crossley, S., & Dutton, G. N. (2010). Evidence that children with special needs all require visual assessment. *Arch Dis Child , 95*, 88892.

Nwokedi, O., Ekpenyong, B. N., Musa, N. R., & Ovenseri-Ogbomo, G. O. (2018). Refractive Errors in Children with Down syndrome in Lagos State, Nigeria. *JNOA , 20(2)*, 15-22.

Padhye, A. S., Khandekar, R., Dharmadhikari, S., Dole, K., Gogate, P., & Deshpande, M. (2009). Prevalence of uncorrected refractive error and other eye problems among urban and rural school children. *Middle East Afr J Ophthalmol , 16(2)*, 69–74.

Pascolini, D., & Mariotti, S. P. (2012). Global estimates of visual impairment. *Br. J. Ophthalmol , 96*, 614 - 8.

Salt, A., & Sargent, J. (2014). Common visual problems in children with disability. *Arch Dis Child , 99(12)*, 1163-8.

Theodor, S., Linda, L., & Stephen, S. (2010). Refractive error and ocular findings among infants and young children with severe problem behavior and developmental disabilities. *Journal of mental health research in intellectual disabilities* .

Weakley, D. R. (2001). The association between nonstrabismic anisometropia, amblyopia, and subnormal binocularity. *Ophthalmol , 108*, 163.

WHO (2006) press release. Sight test and glasses could dramatically improve the lives of 150 million people with poor vision. Geneva. Sep 11.

Yingyong, P. (2010). Refractive errors survey in primary school children (6–12 Years old) in 2 Provinces: Bangkok and Nakhon pathom. *J Med Assoc Thai , 93(10)*, 1205–10.