

# Epidemiological patterns of ocular morbidity among under five years of age children in Khartoum State-Sudan 2020

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## Research article

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# Abstract

**Background:** Development of the visual system begins prenatally and continues after birth. However, owing to how personal and subjective a person's sight is, children may not realize they have a vision problem. Visual impairment in early childhood can significantly impair development of visual, motor, and cognitive function and lead to adverse psychosocial consequences. This research aimed to study the epidemiological patterns of ocular morbidity in children aged less than five years old.

**Methods:** The study is a retrospective patient record study carried out in three tertiary eye care hospitals in Khartoum State- Sudan. All children records for the year 2019 were reviewed, and the total number included was 10886 patients' files. The records were reviewed estimate the number of under five years of age children and the patterns of ocular morbidity. The data were summarized and analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. The proportions were estimated, patterns of ocular morbidity were identified according to age groups and gender.

**Results:** The proportion of under five years children was 5% of the total population and 45% of the total children below 16 years. The predominant age group affected with ocular morbidity is (3–5 years old with 53%). Eye infections affected (19%), allergic eye diseases (16.8%), orbital diseases (12.4%), refractive errors (10.8%), squint (9.3%), corneal diseases (6.6%), cataract (6%), glaucoma (2.3%), neurogenic eye (2%) and tumors (0.23%). There are some variations in morbidity according to age groups among the under five years of age children.

**Conclusions:** The proportion of under five years children is high. The predominant ocular morbidity affecting children below five years of age is eye infections, followed by allergic eye diseases and refractive errors while other serious and blinding eye diseases mounted a considerable percentage. Although of small percentage but worth mentioning that malignant eye tumors were one of the patterns of ocular morbidities affecting children of under five years of age. Patterns of ocular morbidity showed some gender variations.

## Background

Development of the visual system begins prenatally and continues after birth. However, owing to how personal and subjective a person's sight is, children may not realize they have a vision problem.

At the early three years of age, vision improves rapidly over the first few months of their life, with the ability to judge distance (depth perception) developing at around five months of age. By two years of age, a child's hand-eye coordination and depth perception should be well developed <sup>[1]</sup>.

Between the 3–5 years of age, development of accommodative facility (ability of the eye/s to focus on stimuli at various distances and in different sequences in a given period of time), vergence ability (movement of both eyes in opposite directions to obtain or maintain single binocular vision) and eye

movements continues until the child is around five years of age. Toys, games and playtime activities help this by stimulating the process of vision development [2].

There are many different eye conditions and diseases that can affect a child's vision. If an eye condition is suspected or if a child fails a vision screening, he or she should be referred to a pediatric ophthalmologist to further evaluation and diagnosis. Early detection and treatment is so important to avoid lifelong visual impairments [3].

Visual impairment (VI) in early childhood can significantly impair development of visual, motor, and cognitive function and leads to adverse psychosocial consequences. For example, the Vision in Preschoolers study reported that VI from uncorrected hyperopia was associated with deficits in early literacy and in other essential skills for school readiness. More importantly, interventions such as spectacle correction in preschool children, have been shown to restore the visual-motor function of affected ametropic preschool children back to emmetropic levels [4-8].

## Methods

The overall objective of this research was to study the epidemiological patterns of ocular morbidity in children aged less than five years old.

Children defined in this study are any person aged less than 16 years of age.

The study was retrospective patient record study carried out in three tertiary eye care hospitals in Khartoum State- Sudan. All children records for the year 2019 were reviewed, and the total number included was 10886 patients' files.

## Selection of the hospitals:

The three selected hospitals are group of nine highly specialized and equipped hospitals with electronic records system located in different regions in Sudan. Including three hospitals in Khartoum State and other six hospitals located in different regions of the country. The overall hospitals outpatients' number is about 40,000 per month and the number of surgeries performed monthly is about 5500. The three hospitals in Khartoum state are tertiary eye care hospitals with pediatrics ophthalmology department, nine pediatric consultants' ophthalmologists. These three hospitals receiving pediatric patients from Khartoum State and referred children from the other six hospitals outside, in addition to referral from other general and ophthalmic hospitals. The average children outpatient number among these hospitals is about 1500 child per month and the number of surgeries among children is about 200 surgeries per month.

## Review process:

The hospitals have electronic records encompasses all patients personal and medical records. The records were reviewed in two stages; the first one to estimate the number of under five years of age children and the second stage to identify the types and patterns of ocular morbidity among this age group with concern of age class and gender.

## **Data management and analysis:**

The data were sorted, cleaned, categorized, and summarized on master sheet and then analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. The proportions were estimated, patterns of ocular morbidity were identified according to age groups and gender.

## **Ethics and permissions:**

The study was reviewed and approved by Albasar Institutional Review Board. Permissions were obtained from each hospital for research conduction and publication of the results.

In this study anonymity of hospitals, health care providers and patients was of utmost importance. All necessary measures were taken to ensure confidentiality of the collected information. During the data collection, the records were never left unattended and they were stored in a locked room. Data were directly entered into a password protected electronic database.

## **Results**

The proportion of affected children in this study was 5% of the total population (Figure I) and 45% of the total children below 16 years (figure II). The predominant age group affected with ocular morbidity is (3–5 years old with 53%) (Figure III). Eye infections affected (19%), allergic eye diseases (16.8%), orbital diseases (12.4%), refractive errors (10.8%), squint (9.3%), corneal diseases (6.6%), cataract (6%), glaucoma (2.3%), neurogenic eye (2%) and tumors (0.23%) (Figure IV). There are some variation in morbidity according to age groups among the under five years of age children (Figure V).

## **Discussion**

This research was conducted to study the epidemiological patterns of eye diseases among children below five years of age.

The male participants were a little more as the males to females ratio was 1.1:1. Out of 10886 children affected with eye problem, the proportion of children below five years of age out of the total population was 5%. This is a considerable number of affected children at this age group. The age group of this study mounted about 45% of the total children affected with eye problem, thus the under five years group of children is almost half of the total affected children. These results are coincidently matching the result of

study conducted in Ethiopia in which it revealed a percentage of 50% of ocular morbidity affecting the older children (6–15 years) [9].

The study revealed that, there are different patterns of eye diseases affecting children under five years of age and these vary from simple to blinding diseases. The predominant eye problem affecting those children is eye infections mounting almost 19% of the total affected participants. This type of eye diseases includes bacterial, viral and fungal eye infections. Allergies with their different types were the second type of eye problems affecting the participants of this study and mounted about 17% of the total. Refractive errors; namely myopia, hyperopia and astigmatism were the third commonest type of eye disorders affecting children of under five years of age.

The diseases of the orbit, including lids, tear canals and eye globe represented a considerable amount among the under five years children where it mounted a little more than 10% of the affected study participants. The commonest form of this group of disorders is naso-orbital canal obstruction that might lead to serious complication if not probably managed. These complications might be due to infection which can spread to the surrounding facial tissue causing cellulitis and abscesses that intern if not managed, it could lead to more serious infection that eventually may affect the brain. The other form of this group of eye diseases is the lid swellings in form of infection, inflammation and tumors. Almost the same pattern of eye diseases with minimal variation in the order of higher and lower percentage in this study was reported in a study conducted rural Egyptians pre-school children. Their study found the highest percentage of ocular morbidity was refractive errors, unlike in this study where it was the third in order. Otherwise their study was matching the finding of this research [10].

More than 9% of the children under five years of age were affected with squint disorders and 2.8% were affected with neurologically related eye disorders. Cerebral visual impairment (due to damage to the visual pathways in the brain) is the leading cause of severe visual impairment and blindness in children in high-income countries. It is also an emerging cause in low-income countries, where a relatively high proportion is attributable to perinatal factors and so potentially avoidable through better perinatal care. Cerebral visual impairment may be missed because it usually affects children who also have other disabilities such as cerebral palsy or learning difficulties. A community-based study of cerebral palsy in Bangladesh showed that a third of children had reduced visual acuity and over half had visual perception problems which adversely affected their quality of life [11].

The study divulged that other serious eye problems which may cause some form of blindness; including corneal diseases, cataract retinal, glaucoma and retinal diseases in sum affected more than 15%. Among these blindness leading disorders, corneal diseases were on top representing 6.6%. Diseases affecting the cornea are considered serious as it is one of the most sensitive and exposed parts of the eye and may be lost causing legal blindness due to simple trauma scar or infection. Therefore, cornea diseases are of concern to all ophthalmologists especially when occurred to this young group of patients. Following cornea diseases, cataract counted 6% of the total affected children of this study. Cataract, the commonest eye disease of all ages is as well has it's percentage among the young ages. Although

cataract is a leading cause of blindness when affects both eyes, or one eye in case the other one affected with other blinding diseases, but the good thing is that it can be treated with relatively simple procedure and the outcome is usually satisfying. Studies discussed that congenital cataract and Retinopathy of Prematurity (ROP) affect visual functions in very early ages and they can be prevented or treated. Modalities to prevent, diagnose and manage these conditions are available. Visual prognosis after cataract surgery in young children has improved considerably. But, congenital and infantile cataracts are still responsible for 10% of global childhood blindness and the leading cause of blindness in many countries of Africa [12, 13].

Glaucoma affected 2.3% of the under five years children. In term of numbers, more than 250 children at this young age were at risk to serious vision loss. Glaucoma in children is a rare disease with variable incidence across countries and ethnic groups. The incidence of primary congenital glaucoma (PCG) in western countries, such as Ireland, Britain, and the USA, lies within 1 per 10–20,000 live births [14–18]. However, the incidence of glaucoma is higher in the Middle East, including Saudi Arabia, where consanguineous marriages are more prevalent. The estimated incidence of PCG in Saudi Arabia is 1 per 2500 live births [19, 20]. According to the congenital glaucoma registry at King Khaled Eye Specialist Hospital, the Southern region of Saudi Arabia has the highest prevalence rate of glaucoma (27.8%), followed by the Western province (23.6%) and the Central region (22.2%). However, the lowest prevalence was recorded in the Eastern province (11.1%) and the Northern province (9%).

Although it might sound small amount, but it worth mentioning that 0.23% of the under five years children of this study were affected to eye malignant tumors with the predominant type of retinoblastoma. The eye tumors are very risky due to the link and narrow distance between the eye globe and brain which is already connected with the eye through the optic nerve and the retina making a good chance for the malignant spread. Fabian and et al stated that retinoblastoma is the most common eye cancer of childhood. However, it is a relatively rare disease, occurring in approximately one out of every 16,000–18,000 live births in the global population. Its incidence is similar across populations, and does not vary according to gender, ethnicity or socio-economic status. Worldwide, approximately 8,000 children develop retinoblastoma each year, with the vast majority presenting with the disease before the age of 5 years [21].

The patterns of eye diseases according to child gender as yielded in this study showed some variations. The majority of eye diseases affected males more than females; namely cataract, glaucoma, orbital diseases, infections, allergies, tumors and neurogenic eye disorders. Diseases that affected females more than males were retinal diseases, refractive errors and squint disorders. Although the males in this study were more than females but still from percentage point of view we will find that males were more affected with eye disease than females after considering the proportion of both genders. Males were more affected than females with ocular disorder in other study as well conducted by Demissie and et al [22].

## Conclusions

The proportion of under five years children affected with eye diseases was 5% out of the total population and represented 45% of the total children. The predominant ocular morbidity affecting children below five years of age was eye infections followed by allergic eye diseases and refractive errors, while other serious and blinding eye diseases mounted a considerable percentage among the participants of this study including orbital diseases, corneal diseases, cataract and glaucoma. Although of small percentage but worth mentioning that malignant eye tumors were one of the patterns of ocular morbidities affecting children of under five years of age. Patterns of ocular morbidity showed some gender variations.

## **Abbreviations**

**VI**

Visual impairment

**SPSS**

Statistical Package for the Social Sciences

**ROP**

Retinopathy of Prematurity

**PCG**

Primary Congenital Glaucoma

## **Declarations**

### **Ethics approval and consent to participate**

This research was reviewed and approved by Al-basar Institutional Review Board.

Ethical permissions were obtained from the hospitals administration.

### **Consent for publication**

Written informed consent was obtained from the hospitals administration for publication of this article and any accompanying images. A copy of the written consent will be available for review by the Editor-in-Chief of this journal.

### **Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

## Funding

None.

## Authors' contributions

MI collected, analyzed and interpreted the data and he was the major contributor in writing this article.

HI reviewed the article and added valuable comments

AM reviewed the article and added valuable comments

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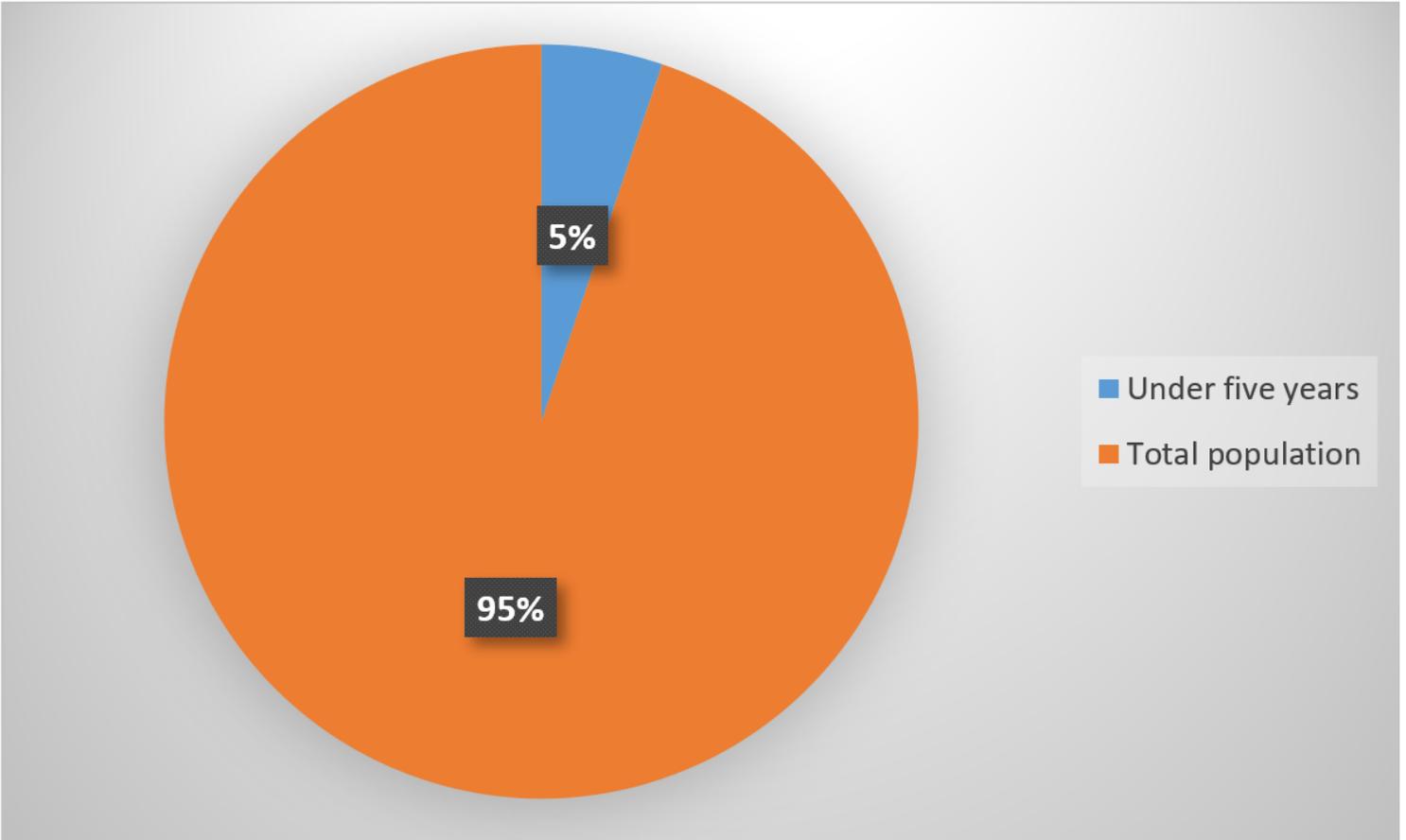
Not applicable.

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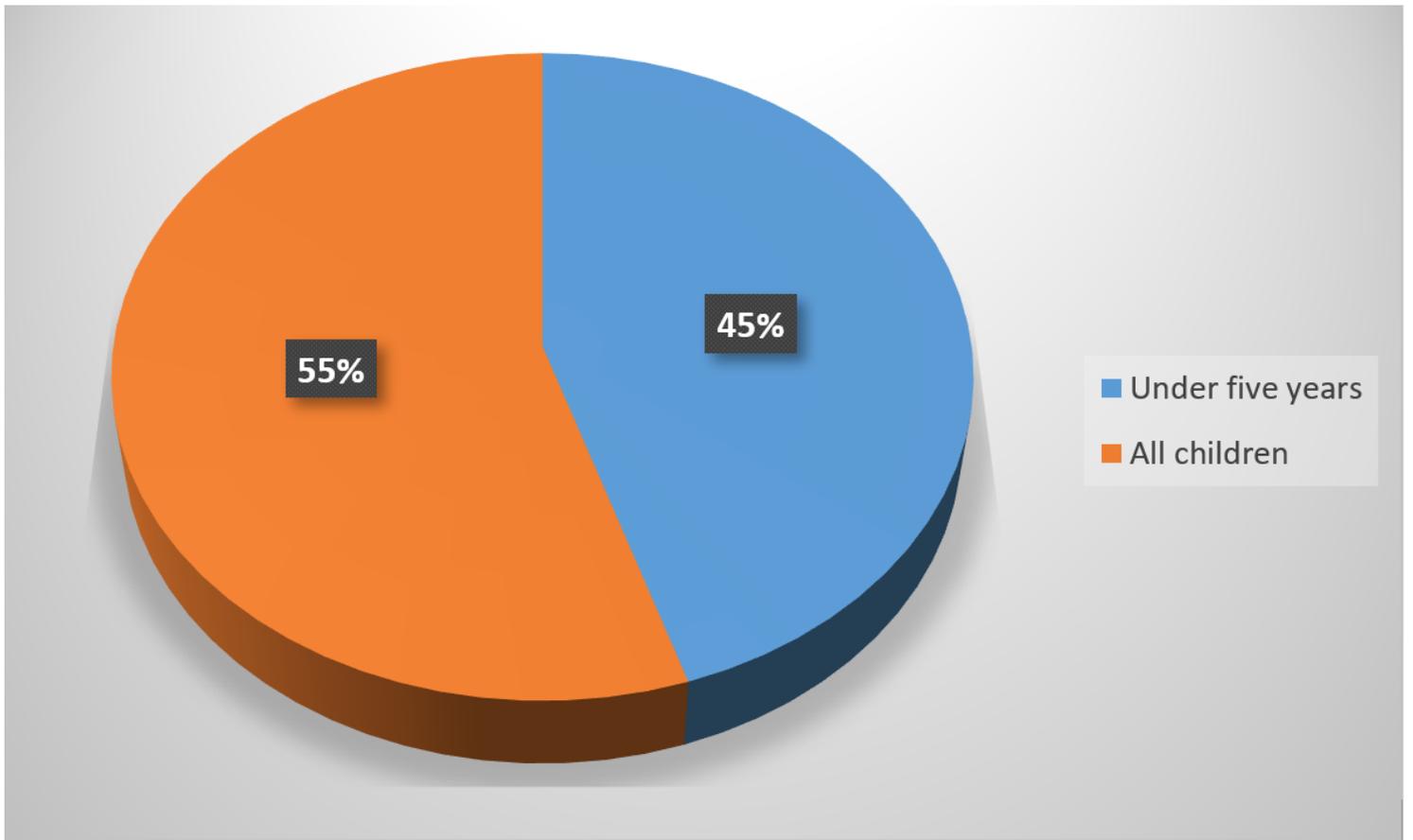
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## Figures



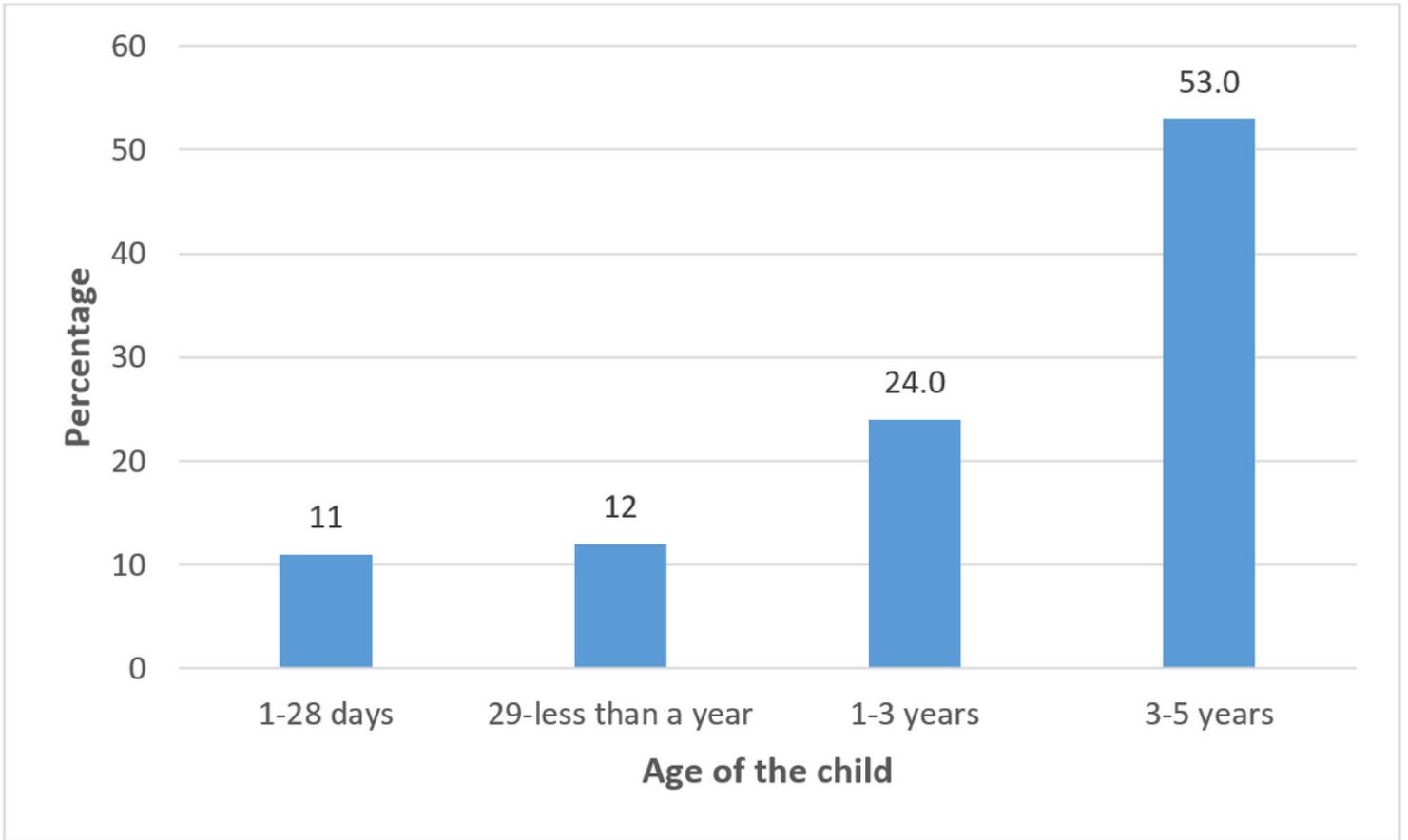
**Figure 1**

Proportion of under five years of age children in comparison to total population



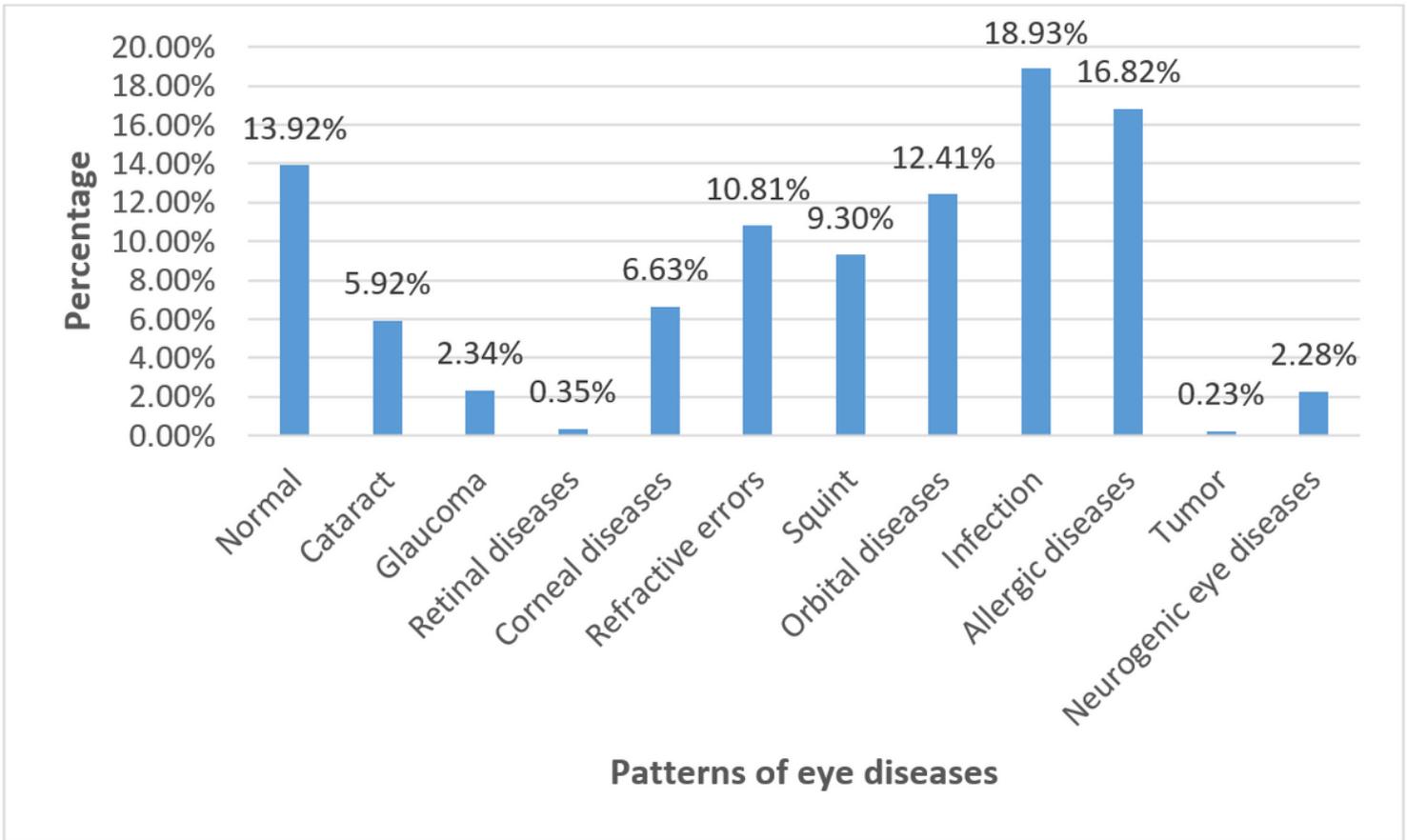
**Figure 2**

Proportion of under five years of age children in comparison to all children



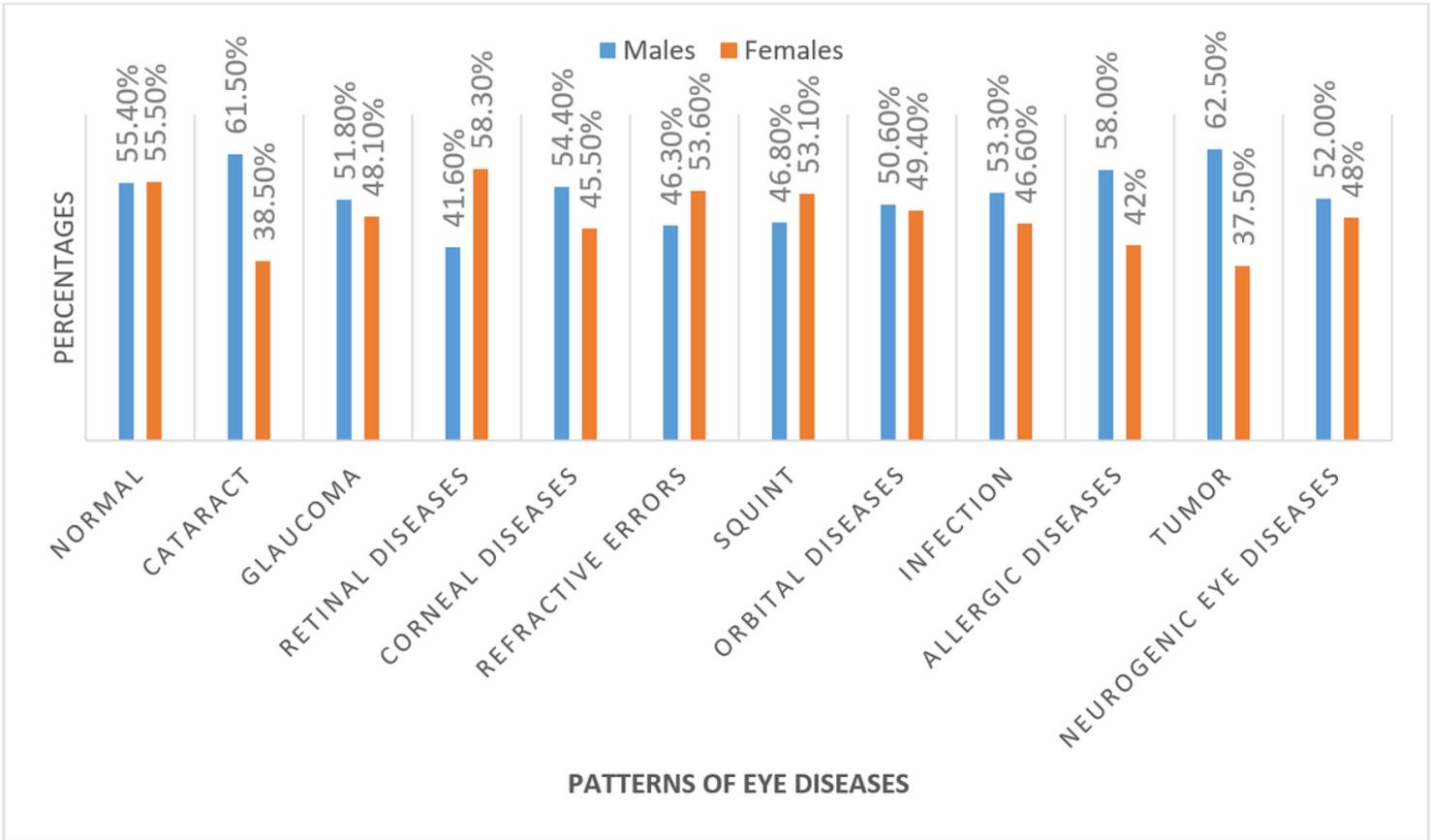
**Figure 3**

Age groups of under five years of age children



**Figure 4**

Type of ocular morbidity among children aged less than five years old



**Figure 5**

Variations in patterns of ocular morbidity according to gender among children aged less than five years old