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# Prevalence of Strabismus among Patients Attending Basrah Teaching Hospital, Basrah, Iraq

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### ABSTRACT

**Background:** Strabismus is a relatively widespread disorder. However, there is no local relevant study examined its prevalence.

**Objectives:** To measure the prevalence and types of strabismus.

Materials and methods: The study was a hospital-based cross-sectional study involving 10257 participants. Each participant underwent comprehensive ophthalmological examinations to assess strabismus, evident through their various characteristics. The patients were divided into two main groups: Concomitant and incomitant groups. Detailed data regarding the demographic (age, sex, age at presentation, and family history of strabismus) as well as the presence of amblyopia and diplopia were registered for every patient.

**Results:** Of 10257 participants, 6836 (66.6%) were male. The patients ranged in age from 4 months to 57 years, with a mean age of 1.68 years. The prevalence rate of strabismus was 6.5%. Esotropia (52.9%) was more prevalent than other types of strabismus. Strabismus was more common in ages under ten years old and in the ages of presentation under ten years old. There were no statistically significant differences (P-value > 0.05) between these two variables and strabismus. While male sex was significantly associated with a higher prevalence rate of strabismus (P-value = 0.019). A positive family history of strabismus, the presence of amblyopia or diplopia were more common in patients without strabismus than those with strabismus (P- value < 0.05).

**Conclusion:** Strabismus was a common (6.5%) disease. Esotropia was the most common type of strabismus. The study primarily observed strabismus in younger individuals and males, underscoring the significance of early screening in these groups. Contrary to expectations, the study found that having a family history of strabismus, amblyopia, or diplopia does not significantly impact the likelihood of developing it, suggesting that other factors may play a greater role in its prevalence. **Keywords:** Strabismus; Esotropia; Exotropia; Amblyopia; Prevalence.

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#### INTRODUCTION

trabismus is a relatively widespread clinical condition in which the axes of vision of both eyes are not aligned together [1, 2]. The well-known pathogeneses of strabismus are still unclear in most cases; however, they result from a combination of sensory, refractive, anatomic, and innervation disorders [3]. Various terms such as squint, wandering eyes, deviating eyes, crossed eyes, wall eyes,

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gaze turns, swivel eyes, and goggle eyes are commonly used to describe it [4]. The deviation may either be constant or intermittent, paralytic, or non-paralytic, and in different directions: Inwards (esotropia), outwards (exotropia), upwards (hypertropia), downwards (hypotropia), inwards rotation (incyclotropia), and outwards rotation (excyclotropia)[5]. It can affect binocular vision and depth perception, and it also can lead to amblyopia, diplopia, head tilt, and face turn; in addition, the patients can suffer from psychosocial and emotional impacts, poor self-esteem, low-income family communication, and depression, so early recognition and establishment of proper management are essential for binocular vision restoration and prevention of complications, especially at an

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early age [1, 5-8].

The global prevalence of strabismus varies widely, ranging from 0.8% to 9.86%[9, 10]. Our community has not thoroughly evaluated strabismus, despite its recognition as a significant medical and social concern. This condition, characterized by misalignment of the eyes, can profoundly affect an individual's health and social interactions. Accurate epidemiological information may contribute to the proper delivery of health care. This study examined the prevalence and types of strabismus among patients attending Basrah Teaching Hospital in Basrah, Iraq.

### MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted at the Ophthalmology Department of Basrah Teaching Hospital in Basrah, Iraq. Basrah Teaching Hospital is the largest hospital in Basrah, situated in the city center. It has over 640 patient beds across various medical and surgical departments, including ophthalmology. Basrah is a governorate in southern Iraq, located 550 km from Baghdad's capital, with a population of approximately 3 million [11]. The study covered the period from June 2022 to May 2024. The researchers collected a non-random sample of 10257 patients aged four months to 57 years, using a consecutive sampling method.

The research protocol received approval from the research and knowledge sector of the Basrah Health Directorate (Reference No. 504, date: May 16, 2022). The team obtained informed consent from all patients or their first-degree relatives.

Senior ophthalmologists examined all patients at the clinic. Those diagnosed with strabismus were referred to the Department of Ophthalmology for further evaluation by a team of two senior ophthalmologists, with assistance from the department's medical staff. The assessment included measuring and best-correcting visual acuity, conducting cycloplegic refraction, evaluating the anterior segment, and performing a fundus examination. Additionally, the team conducted a strabismus workup that included the corneal light reflex, cover tests, ocular motility evaluations, and a diplopia test when necessary. The ophthalmologists also evaluated the presence of amblyopia and diplopia.

Researchers selected patients with strabismus based on specific inclusion and exclusion criteria. To qualify for inclusion, participants must agree to join the study, be at least 4 months old, show a deviation of 10 prism diopters (PD) or more, and exhibit any form of strabismus. Patients were excluded if they refused to participate, were younger than 4 months, had a deviation of less than 10 PD, had a history of strabismus surgery, or presented cases of pseudo-strabismus.

After selection, the team categorized the patients into two main groups: concomitant (non-paralytic) and incomitant (paralytic or restrictive). They further divided the nonparalytic group into subcategories based on the type of deviation: Esotropia, exotropia, and purely vertical deviation.

Ophthalmologists administered and completed a prestructured questionnaire for this study, gathering essential patient information. The questionnaire recorded sociodemographic characteristics and clinical features, including age (in grouped categories: < 10, 10 to 19, 20 to 29, and  $\geq$  30), age at the onset of strabismus (categorized as > two years, two to ten years, and > ten years), sex, and whether there was a family history of strabismus (1st-degree relative) marked as yes or no. It also identified the type of strabismus (esotropia, exotropia, pure vertical, and incomitant) and noted the presence of amblyopia and diplopia (yes or no).

The data were analyzed using IBM SPSS (statistical package for social sciences, Chicago, IL, USA) version 20.0 on a Windows 10 computer. We assessed continuous and categorical variables to determine the prevalence rates and 95% confidence intervals (CIs) for strabismus in patients with various characteristics. We performed chi-square and Fisher's exact tests to compare the variables, setting the significance level at p < 0.05 to establish statistical significance.

#### RESULTS

A total of 10257 patients with an average age of 1.68 years (ranging from 4 months to 57 years) participated in this study. Among them, 6,836 were males (66.6%), and 3,421. Strabismus was diagnosed in 664 (6.5%) patients (95% CI: 6.0% to 7.0%)(Table 1).

The majority of the participants (60%) are in the age group < 10 years. However, there was no significant difference between the two groups (with or without strabismus) regarding the age of the patients (P-value = 0.069). Males accounted for approximately double the frequency of females. Strabismus also occurred about twice as often in males (4.2%) as in females (2.3%). The difference between the two groups was a statistically significant difference (P-value = 0.019). More than half of the participants presented with strabismus at an age younger than two years (64.2%). The prevalence rate of strabismus remained highest among those under two years old (4.2%) and did not show a statistically significant increase with older ages at presentation (P-value = 0.083). Most participants reported no family history of strabismus (83.1%). Among those without a family history, the prevalence rate of strabismus is higher at 5.1%, compared to just 1.3% in those with a family history. This is a highly statistically significant difference (P-value = 0.001). About a quarter (27.1%) of the participants had amblyopia. The strabismus was more common in patients without amblyopia (4.4%) compared to those with amblyopia (2.1%), with a P-value of 0.001. Ninety percent of participants experienced no diplopia, and strabismus was more common among those without diplopia (5.7%) compared to those with diplopia (0.8%), with a P-value of 0.016 (Table 2).

The highest strabismus type was esotropia (n = 351, 52.9%), while the least (n = 20, 3%) vertical strabismus. There was a highly statistically significant difference (P-value = 0.001) among the various types (Table 3).

## DISCUSSION

Strabismus is a common eye condition where the eyes are misaligned, often detected in outpatient ophthalmic clinics. It can appear as esotropia, exotropia, or hypertropia. Treatment options include vision therapy, corrective glasses or prism lenses, and surgical procedures. These interventions aim to improve binocularity and align the eyes, enhancing the patient's visual experience [2].

Our study identified a strabismus prevalence rate of 6.5%. In contrast, studies in other regions of Iraq reported different rates. For example, a hospital-based cross-sectional study in Baghdad investigated 200 patients over eight months and found a prevalence of 4.4% [12], with 75% diagnosed with esotropia and 25% with exotropia. In Kerbala, a schoolbased study surveyed 800 students over four months and reported a 17.9% [13] prevalence, examining all types of stra-

Table 1. Frequency and prevalence rates of strabismus along with their respective 95% confidence intervals (CIs)

Variable	Frequency	Prevalence	95% Confidence interval	
			Lower	Upper
With Strabismus	664	6.5%	6.0%	7.0%
Without Strabismus	9593	93.5%	93.0%	94.0%
Total	10257	100.0%	100.0%	100.0%

Table 2. The relationship between strabismus occurrence and sociodemographic and clinical characteristics.

Variable	With Strabismus		Without S	Without Strabismus		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Age (years)							
< 10	390	3.8%	5769	56.2%	6159	60%	
10-19	118	1.2%	1750	17.1%	1868	18.2%	0.000
20-29	97	0.9%	1472	14.4%	1569	15.3%	0.069
$\geq 30$	59	0.6%	602	5.9%	661	6.4%	
Sex							
Male	430	4.2%	6406	62.5%	6836	66.6%	0.010
Female	234	2.3%	3187	31.1%	3421	33.4%	0.019
Presentation age (years)							
< 2	431	4.2%	6149	59.9%	6580	64.2%	
2-10	136	1.3%	2490	24.3%	2626	25.6%	0.083
> 10	97	0.9%	954	9.3%	1051	10.2%	
Family history							
Yes	137	1.3%	1595	15.6%	1732	16.9%	0.001
No	527	5.1%	7998	78.0%	8525	83.1%	
Amblyopia							
Yes	215	2.1%	2568	25.0%	2783	27.1%	0.001
NO	449	4.4%	7025	68.5%	7474	72.9%	
Diplopia							
Yes	78	0.8%	949	9.3%	1027	10.0%	0.016
No	586	5.7%	8644	84.3%	9230	90.0%	0.010
Total	664	6.5%	9593	93.5%	10257	100%	

Table 3. The prevalence of strabismus types.\*

Strabismus types	Frequency	Percent
Esotropia	351	52.9%
Exotropia	254	38.3%
Vertical	20	3.0%
Incomitant	39	5.9%
Total	664	100%

\* P-value=0.001.

bismus and addressing the incidence of amblyopia. Also, the prevalence rate of strabismus in the world differs in different countries. The regions around Iraq reported variable rates: Saudi Arabia (21% [4]), Jordan (0.5%[14]), Iran (0.36%[15]), Turkey (1.84%[16]); And internationally: USA (3.8%[17]), UK (2.4%[18]), European countries (3.1%[9]), China (2.48%[19]), India (2.6%[20]), Ethiopia (17.9%[5]), and Pakistan (6.2%[10]). The wide variation in the prevalence of strabismus can be attributed to several factors: These include genetic predispositions, variations in study methodologies such as sample sizes and data collection techniques, differences in the age ranges of the populations studied, environmental factors such as exposure to certain visual stimuli or developmental conditions, and variances in access to healthcare services and early detection programs. These multifaceted elements collectively contribute to the disparities observed in strabismus incidence and diagnosis rates across different studies and populations [17].

Many previous studies have shown that esotropia is more common than exotropia, particularly among Caucasians. In contrast, exotropia tends to be more prevalent in Asian and African American populations. Azam et al. found similar results in a small sample of patients while examining various types of strabismus. However, they based their findings on a nonprobable sample of children aged 6 to 15 years and conducted the study over three months [10]. As in our study, which was consistent with other studies [4, 7, 10, 21-24]. Esotropia is more prevalent than other forms of strabismus, holds clinical significance. Early detection and effective management are vital in preventing potential vision loss, underscoring the importance of prioritized screening and refined treatment strategies. However, in other studies, the opposite was identified [6, 15, 19, 25]; like Chen et al. reported contrasting results in a large cohort study of children, evaluating the prevalence of strabismus. They emphasized exotropia and esotropia while examining the impact of a family history of strabismus, prematurity, and astigmatism [19]. Also, our study reported purely vertical strabismus (3.0%), which was also noted in other studies[15, 26]. Yoon et al. conducted a nationwide cross-sectional survey in Korea, examining major eye diseases such as various types of strabismus, ametropia, ptosis, and cataracts [26]. In addition, we also reported incomitant strabismus (5.9%), as other studies did[6, 10, 22]. Abuimara conducted a study on paralytic and horizontal strabismus using a cross-sectional approach. The study involved a sample size of individuals visiting non-government organizations' medical centers in the Gaza Strip over six months [22].

We found that the prevalence of strabismus was highest among children under the age of ten years. This trend likely arises because 60% of the study participants belonged to this age group, which aligns with results from other studies [1, 4, 6, 10], Lakshmi et al. conducted a prospective study with a large sample of patients and found similar results. They assessed strabismus prevalence in two age groups: 3–10 years, where it was 75%, and 11-16 years, where it was 25%[1]. However, some studies found no difference in strabismus rate between the different age groups [15, 23]. Our research revealed that strabismus primarily presents in children under ten years old, highlighting its higher prevalence in this age group. This means it is essential to check for strabismus early in a child's life. Finding and treating strabismus early can help prevent serious eye problems and improve a child's vision. Therefore, children must check their eyes regularly to catch signs of strabismus as soon as possible.

The current study found a higher prevalence of strabismus among males compared to females. This difference was primarily due to our sample's larger number of male participants. The demographic disproportion likely explains the observed increased prevalence of strabismus among males in our study; this indicates the potential requirement for gender-specific approaches in screening and treatment. As in another study [27], Alenezi et al. evaluated strabismus in a prospective study of patients and reported that males were more prevalent (73.9%) despite using randomly selected participants, but they were not closely matched in terms of sex. Another study found the opposite to be true [1]. Other studies found no difference in the prevalence of strabismus between the two sexes [15, 23].

The present study reported that a family history of strabismus did not significantly influence its prevalence. This result stemmed from collecting family history through the direct questioning of patients instead of clinically investigating other family members. This suggests that genetic predisposition may not significantly contribute to the prevalence of strabismus in the studied population. This study's results contradict another study, which identified a solid relationship between the two variables [4]. Alnuman et al. found a significant link between strabismus prevalence and family history of strabismus based on a large sample size gathered through an online questionnaire in a cross-sectional study [4].

Our study identified instances of amblyopia and diplopia, but there was no significant link between these conditions and the occurrence of strabismus. This suggests that while amblyopia and diplopia may coexist with strabismus, these conditions do not necessarily predict an increased likelihood of developing strabismus. These insights are valuable for healthcare professionals and researchers, highlighting the need for a comprehensive approach to screening and managing these visual disorders. Consequently, the complex interplay between these conditions should inform strategies for identifying and treating strabismus, ensuring tailored and effective interventions. In contrast to the results from other studies[6, 17, 24, 25], Nwachukwu and colleagues investigated the risk factors associated with strabismus in a sample of patients at a tertiary center. Their findings revealed that amblyopia is a notable risk factor for strabismus, especially esotropia. The study also considered other contributing factors such as refractive errors, prematurity, low birth weight, and sex [17]. The most familiar amblyopia type in literature is anisometropic rather than strabismic amblyopia [10]. Our study reported that the prevalence of amblyopia was only 2.1% in patients with strabismus and 25.0% in patients without strabismus.

This study is significant because it employed a substantial sample size to assess the prevalence of strabismus while conducting a prospective evaluation of the patient's eyes. Additionally, this study involved comprehensive ophthalmological examination techniques that facilitate detecting even milder cases of strabismus and managing those patients accordingly. Additionally, we evaluated and treated amblyopia and diplopia appropriately.

We should note several limitations to this study. First, it was carried out in a single hospital setting, which means the results may not apply to the wider population. Second, as this is a cross-sectional study, we cannot establish a causal relationship. Third, data was gathered from children and their families using a questionnaire, which may introduce bias. This could account for the lower prevalence rate of family histories of strabismus. Fourth, the research utilized a nonrandom sampling technique to include patients, a strategy that might impact the occurrence of outliers.

### CONCLUSION

The study reported that 6.5% of the patients exhibited strabismus. The esotropia was more prevalent than other forms of strabismus. The younger age, earlier age of presentation, and being male were associated with a higher prevalence of strabismus. No published studies have been conducted in Basrah hospitals focusing on strabismus, even though it can significantly impact the quality of life. Thus, large-scale screening studies are essential, and health education of the public with early treatment is necessary.

#### ETHICAL DECLARATIONS

#### Acknowledgments

We thank the ophthalmology outpatient clinic and department staff in the Basrah Teaching Hospital for permitting this study and the patients and their families for participating in the current study.

### Ethics Approval and Consent to Participate

This study was approved by the ethics committee of the research and knowledge sector of Basrah Health Directorate (Reference No. 504, 16-5-2022). All patients who participated in this study were provided with informed consent.

#### **Consent for Publication**

Not applicable (no individual personal data included).

# Availability of Data and Material

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

#### **Competing Interests**

The author declares that there is no conflict of interest.

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Authors' Contributions

Both authors contributed equally to this research, including collecting, analyzing data, interpreting results, and drawing conclusions. Both authors read and approved the final version

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