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Assessment of Visual Acuity and Associated Factors among 6–12-Year-Old Children Attending Shahid Dr. Aso Hospital in Sulaymaniyah City/Iraq

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ABSTRACT

Background: Childhood visual impairment is a major health issue that affects quality of life and academic achievement; these challenges may persist into adulthood. **Objectives:** To assess visual acuity (VA) status and associated factors among 6–12-year-old children. **Methods:** A descriptive cross-sectional study was carried out at Shahid Dr. Aso Teaching Eye Hospital in Sulaymaniyah City, Kurdistan Region, Iraq, from December 2025 to March 2026. VA was measured using a Snellen E chart at 6 m in standard lighting conditions. A structured questionnaire was used to collect data about children's age, gender, birth order, grade level, screen habit, reading habit, sleep habit and outdoor activity. Data were analyzed using Statistical Package for the Social Sciences version 24. **Results:** A total of 268 children with a mean age of 9.02 ± 1.88 years were included according to the inclusion criteria. Approximately two-thirds of the sample (62.7%) suffered from bilateral abnormal VA, nearly one quarter (23.9%) suffered from unilateral abnormal VA, and (13.4 %) had normal VA. A statistically significant association was seen between impaired VA and age, birth order, grade level, screen time, taking breaks during screen use, outdoor activity duration and bedtime. **Conclusion:** Abnormal visual acuity was highly prevalent among studied children and significantly associated with multiple factors. These findings underscore the need for early vision screening and healthy visual behaviors to prevent and detect visual impairment early.

Index Terms: Visual Acuity, School-Age Children, Visual Impairment, Factors

1. INTRODUCTION

Vision is one of the most important senses for humans. It is the primary channel that people connect with their surroundings. Vision and eye health have an impact on many aspects of life, including health, sustainable development, and the economy [1]. Childhood and adolescence are crucial periods for visual development [2].

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Visual acuity (VA) is a basic indicator of visual function that shows how well the eye can see small details at a specific distance. It plays a crucial role in children's overall learning capacity, academic achievement, development, and quality of life [3]. VA grows rapidly, reaching full development around the age of eight.

Visual impairment (VI): An ocular disorder that impacts the visual system and one or more of its functions, such as VA, can greatly reduce a person's quality of life and daily activities. VI can have an adverse effect on children's learning and development,

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particularly in their early years. A child learns more than 85% of what they learn through visual stimuli [4], [5].

Globally, 2.2 billion people of all ages have refractive errors, and the prevalence in children varies greatly by region, increasing particularly in urban and higher-income areas [6]. Studies show that approximately 18.9 million children under the age of 15 years have impaired VA, with uncorrected refractive error accounting for the majority of these cases [7].

According to large global analyses, approximately one-third of children and adolescents worldwide through 2020–2023 suffer from myopia, and it is expected to reach nearly 40% by 2050. This has an impact on VA in school populations around the world [8], [9].

In Iraq, approximately 89% of people have normal VA, according to population-level surveys and screening data. Small but significant percentages have decreased vision or blindness, and VI increases significantly with age [10]. According to a synthesis of epidemiological studies, the prevalence of refractive errors in school-age children and adolescents is approximately 27.6% [11]. Based on VA assessment, approximately 18.7% of children between the ages of 6 and 15 years in pediatric hospital-based studies in Baghdad had VI [12]. According to one published study that is currently available, 19.6% of primary school students in Erbil, Kurdistan region of Iraq, had refractive defects [13].

Various factors can contribute to decreased VA, including family history, congenital factors, duration of exposure to light, and screen exposure from devices such as computers, televisions, and phones. Other factors include the reading position, the distance between the eyes and books during reading, and the position for watching television [14], [15]. Therefore, this study aimed to investigate the VA and the factors contributing to decreased VA in children to provide valuable insights for interventions and preventive measures.

2. METHODS

2.1. Design

A cross-sectional descriptive study design was carried out to assess VA status and associated factors among 6–12-year-old children.

2.2. Setting of the Study

The study was conducted at Shahid Dr. Aso Teaching Eye Hospital, the main public hospital that offers eye care services to all ages in Sulaymaniyah city, Kurdistan region of Iraq.

2.3. Study Population

A total of 268 children aged 6–12 years, and using non probability sampling technique were selected according to inclusion criteria and using a sample size calculation tool based on the hospital statistical unit of new cases over the 3 months and a required sample size of approximately 268. The population consists of children visiting for eye examination during the period of data collection, and parents accompanying the children will also participate by providing relevant information about the child.

$$Sample\ size = \frac{\dfrac{z^2 \times p(1-p)}{e^2}}{1 + \dfrac{z^2 \times p(1-p)}{e^2 N}}$$

$z = 1.96$, $p = 0.5$, $e = 0.05$,
$N = 875$

$$Sample\ size = \frac{\dfrac{(1.96)^2 \times 0.5(1-0.5)}{(0.05)^2}}{1 + \dfrac{(1.96)^2 \times 0.5(1-0.5)}{(0.05)^2 \times 875}} = 268$$

N = Population size
e = Margin of error (percentage in decimal form)
z = z-score (desired confidence level, 95%: z-score=1.96)

2.4. Inclusion and Exclusion Criteria

Children aged 6–12 years presenting for routine eye examination or visual complaints (new cases), who were physically and cognitively able to complete the VA test and had parental consent, were included. Excluded criteria involve children with neurological or developmental disorders affecting assessment or data collection, those receiving treatment for ocular conditions influencing VA, and those who speak languages other than Kurdish.

2.5. Inclusion Data Collection Tool

A structured questionnaire developed based on previous literature was used to collect demographic data, screen habits, reading habits, sleep habits, and outdoor activity duration. VA was assessed using a Snellen E chart at 6 m under standardized lighting conditions. VA was classified according to the (World Health Organization, International Classification of Diseases 11th Revision) criteria as normal VA (≥0.5 decimal); abnormal VA is worse than (0.5 decimal) in one or both eyes.

2.6. Validity and Reliability of the Study Instrument

The questionnaire's validity was assessed for content validity and was reviewed by a panel of 17 experts in the fields of pediatric nursing, ophthalmology, and public health. The study instrument was pretested on 15 children to ensure clarity, feasibility, and applicability. The pilot sample was drawn from the same setting but was excluded from the final study sample. Cronbach's alpha was used to get to the result of the reliability of the participations; the value of Cronbach's alpha is 0.86.

2.7. Data Collection Procedure

The researcher approached eligible children and their parents or guardians at the study setting, using the Kurdish language to explain the purpose of the study, and obtained verbal informed consent. Data were collected by face-to-face interviews using the structured questionnaire. In addition, each child's VA was objectively measured using a standard Snellen E chart under standardized conditions, with each eye tested separately at a distance of 6 m, and the results recorded as uncorrected VA. The average time required for each participant was approximately 20–30 min. All eligible participants agreed to participate and completed both the questionnaire and VA test.

2.8. Ethical Considerations

Ethical approval was obtained from the Ministry of Higher Education and Scientific Research and the Ethical Committee of the College of Nursing/University of Sulaimani (code:2/9b) on November 17th, 2025, and the Ministry of Health/the administration of Shahid Dr. Aso Hospital code: 21269 on December 14th, 2025, before data collection.

2.9. Statistical Methods

Data were checked for completeness and analyzed using the Statistical Package for the Social Sciences version 24. Descriptive statistics were applied to summarize the variables, with categorical data presented as frequencies, percentages, mean and standard deviation. Associations between VA status and study variables were examined using the Chi-square test, with statistical significance set at $P < 0.05$.

3. RESULTS

Socio-demographic characteristics of participating children are presented in Table 1. The largest proportions of the children were aged 10–12 years (43.3%), followed by 8–9 years (30.6%), and 6–7 years (26.1%). The mean age of the participants was 9.02 ± 1.88 years. More than half of the participants were male (54.48%), and 45.52% were female. Regarding birth order, the largest percentage was second-born children (34.33%), followed by first-born children (30.60%), third-born children (20.90%) and fourth-born or later children (14.18%). In terms of grade level, majority of the participants were in Grade 4 (22.39%), followed by Grade 2 (17.91%), and Grade 3 (15.67%), Grade 1 students were (12.69%), and Grade 5, 6, and 7 were (10.45%), (11.94%), (8.96%), respectively.

The distribution of children by level of VA is given in Fig. 1. The findings showed that the majority of children (62.7%) had bilateral abnormal VA, (23.9%) had unilateral abnormal VA, and only (13.4%) had normal VA.

Table 2 shows the association between VA status and the socio-demographic characteristics of the children. A highly

TABLE 1: Socio-demographic characteristics of children

Child socio-demographic	Frequency	Percentage
Child age (years)		
6–7	70	26.1
8–9	82	30.6
10–12	116	43.3
Mean±standard deviation	9.02±1.88	
Gender		
Male	146	54.48
Female	122	45.52
Birth order		
First	82	30.6
Second	92	34.33
Third	56	20.9
Fourth or more	38	14.18
Grade level		
Grade one	34	12.69
Grade two	48	17.91
Grade three	42	15.67
Grade four	60	22.39
Grade five	28	10.45
Grade six	32	11.94
Grade seven	24	8.96
Total	268	100.0

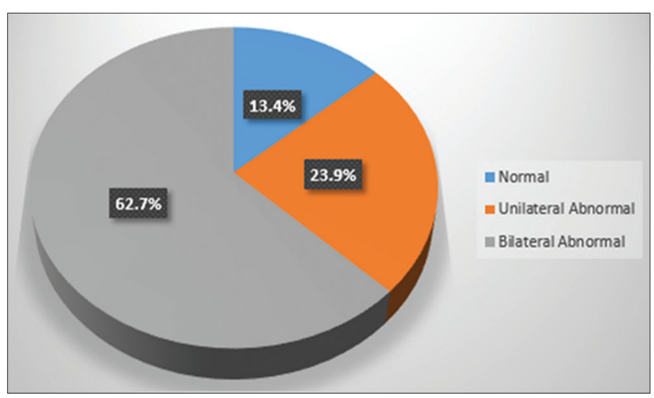

Fig. 1. Distribution of sample according to children level of visual acuity.

TABLE 2: Association between visual acuity status and socio-demographic characteristics of children

Child socio-demographic	Normal	Unilateral abnormal	Bilateral abnormal	*P*-value
	Frequency (%)	Frequency (%)	Frequency (%)	
Child age (years)				
6–7	2 (5.56)	26 (40.63)	42 (25.00)	0.002
8–9	16 (44.44)	12 (18.75)	54 (32.14)	
10–12	18 (50.00)	26 (40.63)	72 (42.86)	
Gender				
Male	22 (61.11)	34 (53.13)	90 (53.57)	0.69
Female	14 (38.89)	30 (46.87)	78 (46.43)	
Birth order				
First	12 (33.33)	28 (43.75)	42 (25.00)	0.009
Second	18 (50.00)	12 (18.75)	62 (36.90)	
Third	4 (11.11)	14 (21.88)	38 (22.62)	
Fourth or more	2 (5.56)	10 (15.62)	26 (15.48)	
Grade level				
Grade one	2 (5.56)	12 (18.75)	20 (11.90)	0.000
Grade two	0 (0.00)	16 (25.00)	32 (19.05)	
Grade three	8 (22.22)	8 (12.50)	26 (15.48)	
Grade four	10 (27.78)	4 (6.25)	46 (27.38)	
Grade five	4 (11.11)	6 (9.38)	18 (10.71)	
Grade six	2 (5.56)	16 (25.00)	14 (8.33)	
Grade seven	10 (27.78)	2 (3.13)	12 (7.14)	
Total	36 (100)	64 (100)	168 (100)	

statistically significant association was found between VA status and age, birth order, and grade level at $P = 0.002$, 0.009, and 0.000, respectively. However, no statistically significant association was observed between VA status and gender $P > 0.05$.

Table 3 reveals the association between VA status and related factors among children, showing a highly statistically significant association between VA status and hours spent on digital screens/day, daily outdoor time, and usual bedtime at $P = 0.000$, 0.001, 0.003, respectively. Furthermore, a statistically significant association was found between VA status and taking breaks during screen use at $P = 0.033$, while no statistically significant associations were found between age at which the gadget was started using, distance holding screen from eyes, reading time, reading distance, taking breaks during reading, frequency of outdoor activities, and duration of sleep with VA status and $P > 0.05$.

4. DISCUSSION

The present study involved 268 children attending Shahid Dr. Aso Hospital in Sulaymaniyah City, Iraq, visiting for eye examination, with ages ranging across the primary school years and a computed mean age of 9.02 ± 1.88 years. It shows that more than half of the participants were below 10 years of age, placing the sample predominantly within the middle childhood developmental stage [16].

The present study showed a slightly higher proportion among male children than females. Similar results were reported in vision screening among children 7–9 years of age as a threshold for VI. 51.5% of them were male and 48.5% were female of the study population of school-aged children screened for VI [17]. Another study in southern China that assessed VI in children and adolescents revealed a high proportion of male participation [18].

Data on birth order showed that the largest subgroup was second-born children, followed by first-born, third-born, and children of the fourth birth order or higher. This pattern is consistent with observations in many low- and middle-income country settings, where moderate family size is most common [19]. Birth order has been associated with differential parental resource allocation, nutritional intake, and academic performance, with some evidence suggesting that later-born children may receive comparatively less dietary and educational investment than their elder siblings [20], [21].

The grade-level distribution spanned from Grade 1 through Grade 7, with Grade 4 representing the most heavily enrolled category, and Grade 7 the least. Evidence suggests that visual demands increase with advancing grade level due to greater exposure to reading, writing, and near-work activities, which are strongly associated with reduced VA [22]. Current findings are consistent with previous studies exploring the classroom

TABLE 3: Association between children's visual acuity status and related factors

Factors	Normal	Abnormal		*P*-value
		Unilateral	Bilateral	
	Frequency (%)	Frequency (%)	Frequency (%)	
Screen time/day				
<2 h	16 (44.44)	4 (6.25)	14 (8.33)	0.000
2–4 h	11 (30.56)	18 (28.13)	26 (15.48)	
>4 h	9 (25.00)	42 (65.63)	128 (76.19)	
Take breaks during screen use				
No	22 (61.1)	54 (84.38)	122 (72.62)	0.033
Yes	14 (38.9)	10 (15.63)	46 (27.38)	
Age started using gadget (years)				
≤2	2 (5.56)	8 (12.50)	30 (17.86)	0.135
3–4	32 (88.89)	48 (75.00)	114 (67.86)	
>4	2 (5.56)	8 (12.50)	24 (14.29)	
Distance holding screen				
<30 cm	4 (11.11)	6 (9.38)	22 (13.10)	0.139
30 cm	32 (88.89)	58 (90.25)	146 (86.90)	
Daily study time/day				
<2 h	22 (61.11)	34 (53.13)	112 (66.67)	0.093
2–4 h	8 (22.22)	24 (37.50)	46 (27.38)	
>4 h	6 (16.67)	6 (9.39)	10 (5.95)	
Reading distance				
<30 cm	2 (5.56)	8 (12.50)	16 (9.52)	0.526
30 cm	34 (94.44)	56 (87.50)	152 (90.48)	
Taking breaks during reading				
No	0 (0.00)	2 (3.13)	12 (7.14)	0.149
Yes	36 (100.00)	62 (96.88)	156 (92.86)	
Daily outdoor duration				
>2 h	15 (40.5)	9 (13.8)	23 (13.9)	0.001
1–2 h	14 (37.8)	8 (12.3)	22 (13.10)	
<1 h	4 (10.8)	29 (44.6)	69 (41.6)	
Never	4 (10.8)	19 (29.2)	54 (32.5)	
Frequency of outdoor activities/week				
Every days	11 (29.7)	16 (24.6)	38 (22.9)	0.269
3–5 days	5 (13.5)	9 (13.8)	22 (13.10)	
1–2 days	17 (45.9)	21 (32.3)	52 (31.3)	
Never	4 (10.8)	19 (29.2)	54 (32.5)	
Sleep duration				
<6 h	24 (66.67)	36 (56.25)	102 (60.71)	0.093
6–8 h	2 (5.56)	16 (25.00)	40 (23.81)	
>8 h	10 (27.78)	12 (18.75)	26 (15.48)	
Usual bedtime				
Before 9 pm	2 (5.56)	0 (0.00)	0 (0.00)	0.003
9:00–10:00 pm	8 (22.22)	26 (40.63)	52 (30.95)	
After 10:00 pm	26 (72.22)	38 (59.38)	116 (69.05)	
Total	36 (100)	64 (100)	168 (100)	

VA statement; both distance and near VA demands become more challenging in higher grades, potentially contributing to visual strain and impairment [23].

The findings demonstrate children's level of VA, it shows that the majority of them had abnormal VA, compared to only a small proportion having normal VA, and two-thirds of them were suffering from bilateral abnormality, meaning the right and left eyes were abnormal in terms of VA. Nearly one quarter of children suffered from unilateral abnormality, meaning that only the right or left eye was abnormal; it is worth mentioning that the proportion of normal eyes recorded the lowest percentage of the sample, because of a study done in an eye hospital. The present finding is alien to a study done in Scotland [24]. Another hospital-based cross-sectional study in China (2021) shows that bilateral VA abnormality can exceed unilateral in school-age children, particularly in populations where refractive errors (myopia, hyperopia, and astigmatism) are the predominant cause [25].

The present study demonstrated a statistically significant association between child age and VA status. Bilateral visual abnormality was more prevalent among children aged 10–12 years, while unilateral abnormality was equally distributed between children aged <8 years and 10–12 years. This finding suggests that vision problems progress with age, due to prolonged educational activities and more time spent on near-work tasks and digital screens. Similar findings were reported that older school-aged children had a higher prevalence of VI [26].

Regarding gender, no statistically significant association was observed between gender and VA abnormality, although males constituted a slightly higher proportion of both unilateral and bilateral abnormalities. This result is consistent with findings reporting no significant gender difference in VA impairment among school children [27].

Birth order showed a highly statistically significant association with VA status; second-born children represented the highest proportion of bilateral abnormalities, whereas first-born children had a greater proportion of unilateral abnormalities. Variations in parental attention, socioeconomic conditions, and child-care practices among larger families may contribute to this difference. A previous study also suggested that family-related demographic characteristics may influence children's visual health outcomes [27], [28].

The study additionally found a highly significant association between grade level and VA status. Bilateral abnormalities were more common among children in grade four, while unilateral abnormalities were higher among grade two and grade six students. A similar study found that higher school grades were associated with increased VI among school-aged children; increasing academic load, reading demands, and prolonged near activities in higher grades contribute to this pattern [29].

Concerning screen time, a very highly significant association was found between daily screen time and VA status, with children spending more than 4 h on screens showing higher rates of bilateral VI. That is aligned with a previous study that showed screen time was a key modifiable risk factor; more than 2 h a day was associated with an increased risk of vision problems [30]. There is growing evidence that sustained near work, including computer, tablet, and smartphone use, may contribute to the onset and progression of VI and ocular fatigue. Not all screen time has the same consequences. Compared to bigger displays viewed at intermediate distances, smaller fonts, strong contrast, short working distances, and other factors may cause more accommodative and visual stress [31], [32].

The study also found a significant relationship between taking breaks during screen use and VA status, where VA abnormalities were more prevalent among children who did not take breaks. Similar findings were reported: taking regular breaks during screen use may reduce digital eye strain and visual fatigue among children [33]. Recent studies found that more frequent or self-paced breaks were associated with lower eye strain symptoms and better visual comfort during prolonged near work [34]. The commonly recommended "20-20-20 rule" (looking at something 20 feet away for 20 s every 20 min) is considered beneficial for reducing digital eye strain and supporting visual health.

In the current study, there were relationships between the age at which they started using gadgets and distance holding the screen with VA status, even though they were not statistically significant. A previous study reported that early screen exposure was not significantly associated with VA after adjustment for confounding factors, suggesting that the duration and intensity of screen use may have a greater effect on visual outcomes than the age at which screen use began [35]. Another study show using gadgets and TV for extended periods and at close range may cause increased accommodation, thus increasing the risk of VI [36].

The present study found no statistically significant association between daily reading time and VA abnormalities. However, children with bilateral abnormalities more frequently reported studying <2 h daily. Previous studies reported inconsistent findings regarding near-work duration and VI [37]. Reading distance was not significantly associated with VA status in the current study ($P = 0.526$). Most children maintained a normal reading distance of approximately 30–40 cm compared to previous research, which suggested that very close reading distances may increase visual stress and contribute to refractive changes in children [38].

No statistically significant association was observed between taking breaks during reading and VA abnormalities. Nevertheless, regular breaks may help reduce accommodative stress and eye fatigue during prolonged near work. Recent studies demonstrated that periodic breaks during reading tasks can improve visual comfort and reduce digital eye strain symptoms [39].

Regarding outdoor activity, the present findings indicate a statistically highly significant association between outdoor activity duration and VA status among children. Children who spent <1 h outdoors or never participated in outdoor activities showed higher percentages of bilateral abnormal VA, whereas children with longer outdoor exposure demonstrated better visual outcomes. Similar findings were reported in recent studies indicating that increased outdoor time is associated with reduced risk and progression of myopia among children and adolescents [40]. The biological explanation is usually tied to higher light intensity outdoors stimulating dopamine release in the retina, which inhibits the axial elongation of the eye.

The present study showed no statistically significant association between outdoor activity frequency and VA status. However, children who never participated in outdoor activities had a higher proportion of bilateral abnormal VA compared with those who engaged in outdoor activities more frequently. A previous study reported that regular outdoor exposure has a protective effect against myopia and VI in school-aged children [41].

Sleep duration showed no statistically significant association with VA status among children. Most children in all groups slept <6 h/night. A previous study reported inconsistent findings regarding the relationship between sleep duration and visual problems, with some studies finding no significant association between shorter sleep duration and myopia progression [42].

Usual bedtime was significantly associated with VA status. Most children with bilateral visual abnormality reported sleeping after 10:00 pm; late bedtime may be related to prolonged screen exposure and poor sleep quality, which can negatively affect eye health and contribute to VI progression in children [43].

5. CONCLUSION

Based on findings, researchers concluded that among 268 children who visited Shahid Dr. Aso Eye Hospital, bilateral VI was greater than unilateral VI, and a small proportion of children had normal VA. In addition, the analysis showed significant associations between VA status and some demographic variables, such as age, birth order, grade level, and some variables in factors such as screen time, taking breaks during screen use, outdoor activity duration, and bedtime.

6. RECOMMENDATIONS

The study suggests that childhood VI is still a significant public health problem in Sulaymaniyah city, Kurdistan region of Iraq. Vision screening should be given at regular intervals in primary schools to ensure early detection of VI.

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