Review Article

Prevalence of Refractive Errors and Amblyopia among Primary School Children in Eligible Arab Countries: A Systematic Review and Meta-analysis of Diagnostic Approaches

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ABSTRACT

A systematic review and meta-analysis were conducted according to PRISMA guidelines. PubMed, Scopus, Science Direct, Embase, and Google Scholar were searched for studies published from 2016 to 2023. The search was intended to cover Arab countries; however, eligible school-based data were identified from only 10 countries. Studies including children aged 5–19 years and reporting myopia, hyperopia, astigmatism, or amblyopia were included. Data from 30 studies were analyzed. Random-effects models were used, and heterogeneity was assessed using I^2. The sample ranged from 276 to 444,259 children and a combined sample size of 491,985. The reported prevalence of overall refractive errors, including myopia, hyperopia, astigmatism, and amblyopia, ranged from 8.2% to 50.0%. The pooled prevalence was 6.7% for hyperopia, 8.4% for astigmatism, and 2.2% for amblyopia. Myopia ranged from 1.7% to 25.0% but was not pooled because of substantial heterogeneity in diagnostic methods, age groups, study settings, and refractive cut-off definitions.

Keywords: Myopia; Amblyopia; Hyperopia; Arab Countries; Meta-Analysis.

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INTRODUCTION

Refractive errors (REs) are optical conditions in which the eye fails to properly focus light on the retina, resulting in blurred vision.[1] They include myopia, hyperopia and astigmatism, which, if left uncorrected, can lead to amblyopia. Globally, uncorrected refractive errors are the leading cause of visual impairment, affecting over 12 million children aged 6–12 years.[2] The World Health Organization had prioritized the correction of REs as part of the VISION 2020 initiative, recognizing their impact on educational attainment, quality of life, and long-term economic productivity.[3,4] Refractive errors, when undetected, significantly hinder academic performance, including reading, classroom participation, motor development, and social interaction, with amblyopia being a primary consequence of uncorrected vision problems during childhood.[5,6] If significant myopia, hyperopia, or astigmatism is left uncorrected during critical periods of visual development, neural processing in the visual cortex can be suppressed, leading to permanent visual loss even if optical correction is later provided.[7,8] In addition to refractive amblyopia, strabismic and deprivation-related amblyopia also affect children, but in this review, we focused primarily on refractive amblyopia, since it is preventable through timely

detection and treatment.

Previous studies estimate that 10–20% of school-aged children worldwide have a refractive error, with myopia being the most common subtype.[9,10] However, prevalence varies substantially between regions due to genetic, environmental, and socioeconomic influences. For example, East Asian populations report some of the highest global myopia rates, whereas African populations often report lower rates.[11-13] Some of the included studies used cycloplegic refraction, while others relied on non-cycloplegic or Snellen chart screening, which may underestimate hyperopia and mild astigmatism.

The situation in 22 Arab countries remains poorly characterized. This region encompasses diverse populations across North Africa and the Middle East, with wide variation in socioeconomic development, education systems, and healthcare infrastructure. Such factors may influence patterns of refractive error, yet standardized school-based vision screening programs remain limited across much of the region.[14-16] Previous studies conducted in Iraq, Saudi Arabia, Egypt, Sudan, and Morocco have reported widely differing estimates: myopia from 1.7% to 25%, hyperopia from 1.0% to 30.1%, astigmatism from 3.0% to 29.1%, and amblyopia up to 24.1%.[9,17] Importantly, these studies used inconsistent methodologies. Some employed cycloplegic refraction, the gold standard for pediatric populations, while others relied on non-cycloplegic or Snellen chart screening, which may underestimate hyperopia and mild astigmatism.[13,18] Definitions of refractive error also varied, with myopia sometimes defined as spherical equivalent ≤ -0.50 D and other times ≤ -1.00 D, further complicating comparisons.

These inconsistencies highlight important knowledge gaps: existing evidence is fragmented across countries, diagnostic cut-offs are not standardized, and the true regional burden of refractive error–related amblyopia remains uncertain. While some studies have touched on refractive error patterns in Arab children, comprehensive synthesis and pooled analysis have not yet been conducted.[19,20]

The primary objective of this review was to estimate pooled prevalence rates of myopia, hyperopia, astigmatism, and refractive amblyopia in Arab school-aged children. Secondary objectives were to assess methodological sources of heterogeneity, including diagnostic approach (cycloplegic vs non-cycloplegic refraction) and variable cut-offs, and to compare patterns across countries. The Arab region was chosen because it represents a large, demographically diverse population with uneven access to pediatric vision care, where the absence of standardized screening programs may exacerbate preventable visual disability.

METHODS

This study was a systematic review and meta-analysis conducted in accordance with the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses); however, the review protocol was not registered in PROSPERO. Which outlines the preferred methods for reporting systematic reviews and meta-analyses.

We conducted a systematic search of the literature across different databases including PubMed, Scopus, Google Scholar, Natural Sciences, and Science Direct, to identify studies investigating the prevalence of refractive errors in 10 countries including Iraq, Saudi Arabia, UAE, Sudan, Egypt, Libya, Palestine, Oman, Morocco, and Somalia. The target population was school-aged children in Arab countries, with studies required to report the prevalence of refractive errors or amblyopia. We screened original research articles using a standardized set of keywords. A total of 203 observational and retrospective studies that assessed the refractive error in the Arab world and studies published from 2016-2023, were identified for analysis. Figure 1 shows the study selection process in PRISMA flow diagram.

Eligible studies were required to be full-text, peer-reviewed research articles reporting the occurrence of myopia, hyperopia, astigmatism, or amblyopia in children aged 5–19 years. Only studies published in English between 2016 and 2023 were considered. Research was restricted to cross-sectional, population-based studies conducted in school settings across Arab countries. In addition, the reference lists of included articles were examined to identify further relevant studies.

Studies were excluded if they were review articles, interventional trials, theses, conference abstracts, or abstract and gray literature. Reports with duplicate data, poor methodological quality, or insufficient information to calculate prevalence estimates were also excluded.

Risk of Bias and Quality Assessment

The quality of the included studies was evaluated

using the Newcastle-Ottawa Scale (NOS) for cohort studies (Appendix 1 in the supplementary file). Two reviewers assessed the methodological quality of the included cross-sectional studies independently [MHM and NKH] using an adapted Newcastle–Ottawa Scale suitable for observational cross-sectional studies. The tool evaluated three domains: selection of participants, comparability of study groups, and outcome assessment, including the method used to diagnose refractive errors and amblyopia. Each study was categorized as low, moderate, or high risk of bias. Disagreements between the two reviewers were resolved by discussion, and when necessary, by consultation with a third reviewer [MTR]. The inclusion of studies in meta-analysis was determined by assessing their methodological quality. Studies deemed to have a low risk of bias were incorporated into the analysis as they were. For studies categorized as having a moderate or high risk of bias, careful consideration was given when interpreting their findings. To reduce bias, lower-quality studies were given less importance in the random-effects meta-analysis. Studies with significant methodological shortcomings, such as incomplete data or a lack of clarity in their methods, were omitted from the primary analysis to maintain the validity and reliability of the pooled estimates.

Data Collection

As shown in the flow chart in Figure 1, End Note software was used to collect the studies included in the meta-analysis. Initially, a total of 203 papers were retrieved from database searches and other sources. After reviewing the titles, papers that included the phrases “refractive errors” and “school students with refractive error in Arab countries” were selected for the abstract screening phase. From the original set of 203 papers, 56 duplicates were removed, an additional 95 studies were excluded following a more detailed review of the titles and abstracts. All articles that met the established criteria were selected for further analysis. Ultimately, 30 studies were included in this meta-analysis. The PRISMA flowchart provided below offers a detailed visual representation of the study selection process.

Data Extraction

The authors screened the titles by carefully reviewing all previously published international titles related to children with myopia, hypermetropia, astigmatism, and amblyopia that met the inclusion criteria. At the next step, the authors then screened the rest of the study, such as the abstract, the full texts of the studies were carefully reviewed to obtain the most essential information, such as gender, sample size, and the number of children with REs, in order to determine the prevalence of the complex based on statistics that include gender and refraction methods. After that, other information such as the year of publication, the names of the authors, the location, and the most important characteristics of the participating children such as gender, age, and sample size, were verified, in addition to the technique used to measure RE and the most important criteria as ‘pre-defined' to determine RE according to the study criteria that were previously determined. To find new solutions that contribute to resolving the differences between the authors in this review, advanced and non-disagreeable criteria and protocols were developed to bring the viewpoints closer together, clearly indicating the protocol used in this study.

Statistical Analysis

Statistical analyses were conducted using Stata version 16.0 (Stata Corp LLC, College Station, TX, USA) with the metan package. Due to the high heterogeneity among the included studies, the pooled prevalence was calculated using a random-effects model. Also, heterogeneity across studies was assessed using Cochran's Q test and quantified with the I^2 statistic, where I^2 values of 0-25%, 25-50%, 50-75%, and above 75% were considered to indicate no heterogeneity, low heterogeneity, moderate heterogeneity, and high heterogeneity, respectively. Results were reported and visualized using forest plots to display the individual and pooled prevalence, along with 95% confidence intervals (CI), and a funnel plot to illustrate report the distribution of published articles and potential publication bias. Statistical significance was set at a p-value of less than 0.05, and all analyses were conducted in a two-tailed format.

RESULTS

Most of the studies were conducted in Iraq (n = 8), followed by Egypt (n = 6) and Saudi Arabia (n = 7), Sudan (n = 3), and a single study was identified from each of the following countries: Oman, Palestine, Somalia, Libya, Morocco, and the United Arab Emirates.

The main characteristics of the included studies are summarized in appendix 2. The timeline of the published studies was from 2016 to 2023. The earliest studies were published in 2016; however, the most recent studies were published in 2023, and most of the studies were published between 2017 to 2020. The studies were conducted in different urban and regional settings. Iraq had the largest number of individual studies (n = 8), and it covered cities such as Baghdad, Erbil, Babylon, Amara, Kurdistan, and Al-Kut. Saudi Arabia followed with 7 studies, conducted in Riyadh, Medina, Jazan, Taif, and through a nationwide school-based program. Egypt contributed 6 studies from regions including Menoufia, Luxor, Beni-Suef, and Sinai. Other countries with single-site studies included Sudan (Al-Gezira and Khartoum), Palestine (Gaza), Somalia, Libya (Darnah), Morocco, Oman, and the United Arab Emirates (Dubai). Detecting refractive errors in school-aged children is important, especially in the hotspots' regions. However, some areas, such as those with low socioeconomic status, may require more attention due to a lack of available medical services.[21]

The participants' age across all studies ranged from 5 to 19 years, with most studies focused on the 6–12 years old cohort. Specific studies included younger children starting at age 5 or extended the upper limit to late adolescence at age 19.

Another study, such as Al-Rahili et al, included younger children starting from age 5. However, Kandi et al, and Al2Thomali et al, extended their upper age limit to 18 or 19 years.[1-3]

Sample size varied significantly across the included studies, ranging from the largest study, by Al Daajani et al, in Saudi Arabia, that included 444,259 children with a national school-based screening program to a minimum of 276 in Egypt reported by Farahata et al, with 276 participants.[17,22] Most studies had moderate sample sizes ranging between 300 and 2,000, which is typical for school-based surveys. In terms of sex distribution, most of the studies had a balanced ratio of males and females. However, a few studies had skewed samples, such as Ghalib et al, where 71% were female and Mohamed et al, which included only male participants.[4,6]

The prevalence of refractive errors is presented in detail in Appendix 3, ranging from 8.2% to 50.0%. The highest prevalence was observed in Agha et al, in Iraq (Erbil), where 50.0% of 6–14 year-old children were affected.[9] Other high-prevalence studies included Ghalib et al, in Sudan (Khartoum, 38.5%), Anera et al, in Morocco (47.9%) and Hussam Uldeen et al, in Iraq (Amara, 47.0%).[4,10,23] In contrast, the lowest prevalence was reported by Hawary et al, in Egypt (Luxor) with 8.2%.[5]Mohamed et al, reported in 8.9% and 9.5% in Sudan (Al-Gezira).[6,18]

In terms of identification tests, the most used method was the Snellen charts, which reported in almost all studies (n 28); some of them used that alone, and some used it in combination with cycloplegic refraction. In terms of the diagnostic tools, the most frequently employed instruments were the retinoscope and auto-refractometer, often used together to ensure accuracy.[24] Many studies used both tools in combination.[4,19,25] Studies such as Mohamed et al. and Al Daajani et al, used more standardized procedures by using all three: Snellen charts, cycloplegic refraction, and both diagnostic tools.[6,17]

Appendix 3 reports the distribution of myopia, hyperopia, astigmatism, and Amblyopia between children from primary schools across the included studies. The prevalence of myopia was different, ranging from 1.7% by El-Majri et al, (Libya) to 25.0% by Harby et al, (Oman).[25,26] Several studies, such as Agha et al, reported 10.7%, Halboos et al, 9.0%[15]and Al-Omair R. et al, 10.5% myopia rates.[9,15,27] In contrast, low prevalence of hyperopia was reported by Kandi et al, as 1.8% and Ahmed et al, as 1.0%.[2,10] High prevalence of hyperopia as reported as high as 30.1% was reported by Anera et al, (Morocco)and 20.1% by Hussam Uldeen et al, (Iraq).[11,12]

Astigmatism was also prevalent in several studies. The highest rate of astigmatism was reported by Agha et al, at 29.1%.[9] In addition, other studies have reported moderate rates, typically ranging between 3% and 15%, which show that astigmatism was a common refractive condition among the Arab pediatric population. However, Amblyopia was reported to be less frequent. Awad et al, (Palestine)reported amblyopia as 18.5%.[28] The lowest prevalence rates were reported by Mohamed et al, (0.6%) and Yamamah et al, (0.4%).[18,19]

A total of 30 studies were included in the meta-analysis of hypermetropia prevalence (Appendix 4). The pooled prevalence was reported at 6.7% (95% CI: 5.7% to 7.7%). In the included studies, the lowest prevalence of hyperopia was reported by Mohamed et al, at 0.6% (95% CI: 0.1% – 1.1%) and the highest was reported by Rasheed et al, with a proportion of 22.0% (95% CI: 17.8% – 26.2%).[6,7] There was high

heterogeneity among the included studies (Cochran's Q = 2677.44, df = 29, p < 0.001). The I^2 statistic reported that between-study heterogeneity was 98.9% (95% CI: 79.5%–99.7%). The assessment of publication bias reported no significant evidence of small-study effects or publication bias (Figure 2).

Totally, 27 studies were reported the astigmatism prevalence. The pooled prevalence of astigmatism in the Arab world was 8.4% (95% CI: 6.7% to 10.1%). Heterogeneity was reported to be high in these studies (Cochran's Q = 4304.82, df = 26, P< 0.001), with an I^2 of 99.4% (95% CI: 91.2% – 99.8%). However, assessment of the publication bias using Egger's test showed evidence of small-study effects that may suggest potential publication bias with Egger's test of 0.0013 (P = 0.020) and a bias intercept of 10.65 (P< 0.001) (Figure 3).

In assessments of Amblyopia, 12 studies were included in this meta-analysis with a pooled prevalence of 2.2% (95% CI: 1.5% to 2.9%). The significant heterogeneity was reported among the studies with Cochran's Q = 237.50 (df = 11, P< 0.001), and I^2 value of 95.4% (95% CI: 23.7% – 98.6%) and insignificant Egger's test slope coefficient (0.0017, P = 0.545) and significant bias intercept of 4.49 (P= 0.010) for assessment of publication bias (Figure 4).

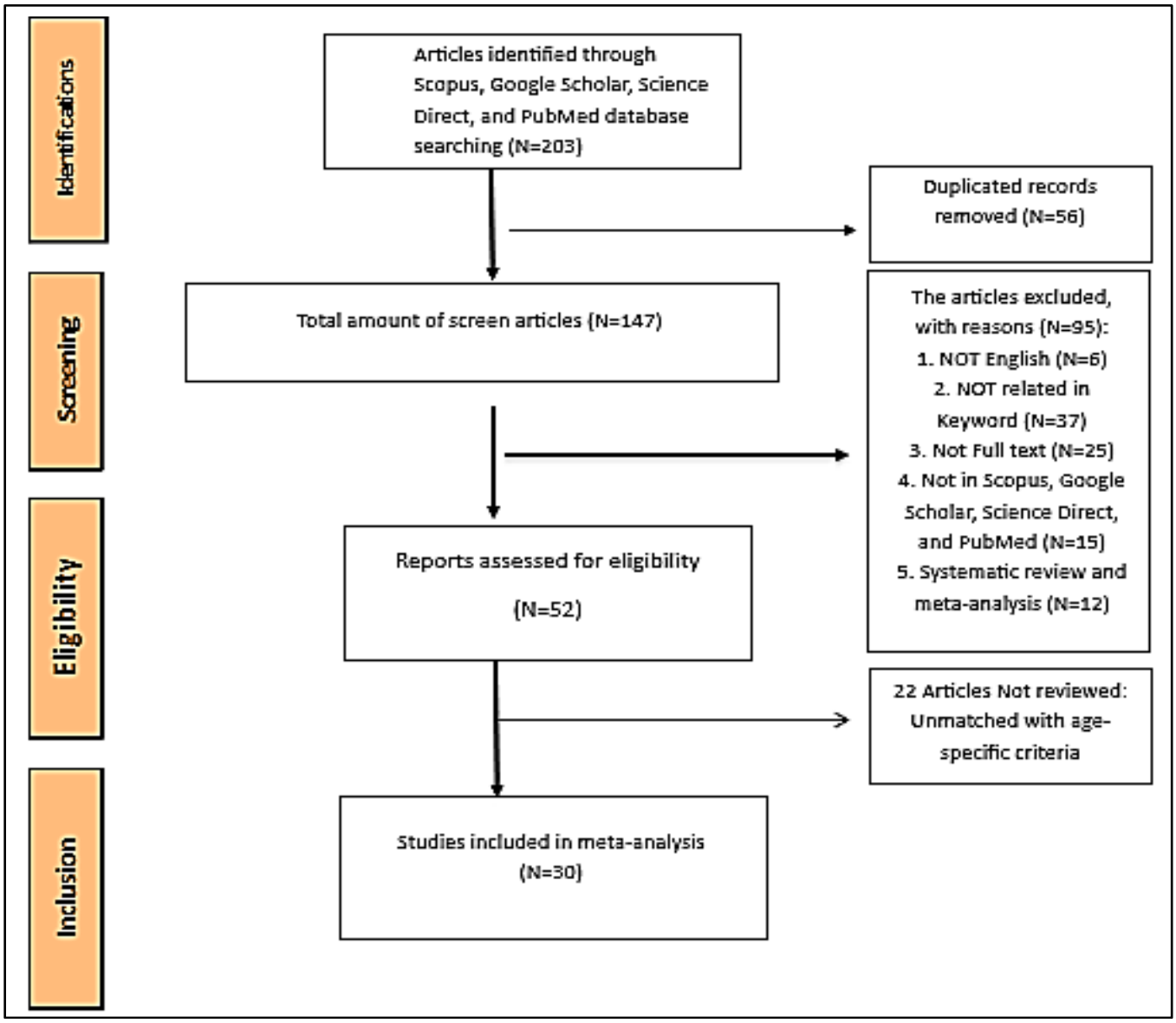


Figure 1: Diagram depicting the procedure for choosing studies based on the PRISMA Framework.

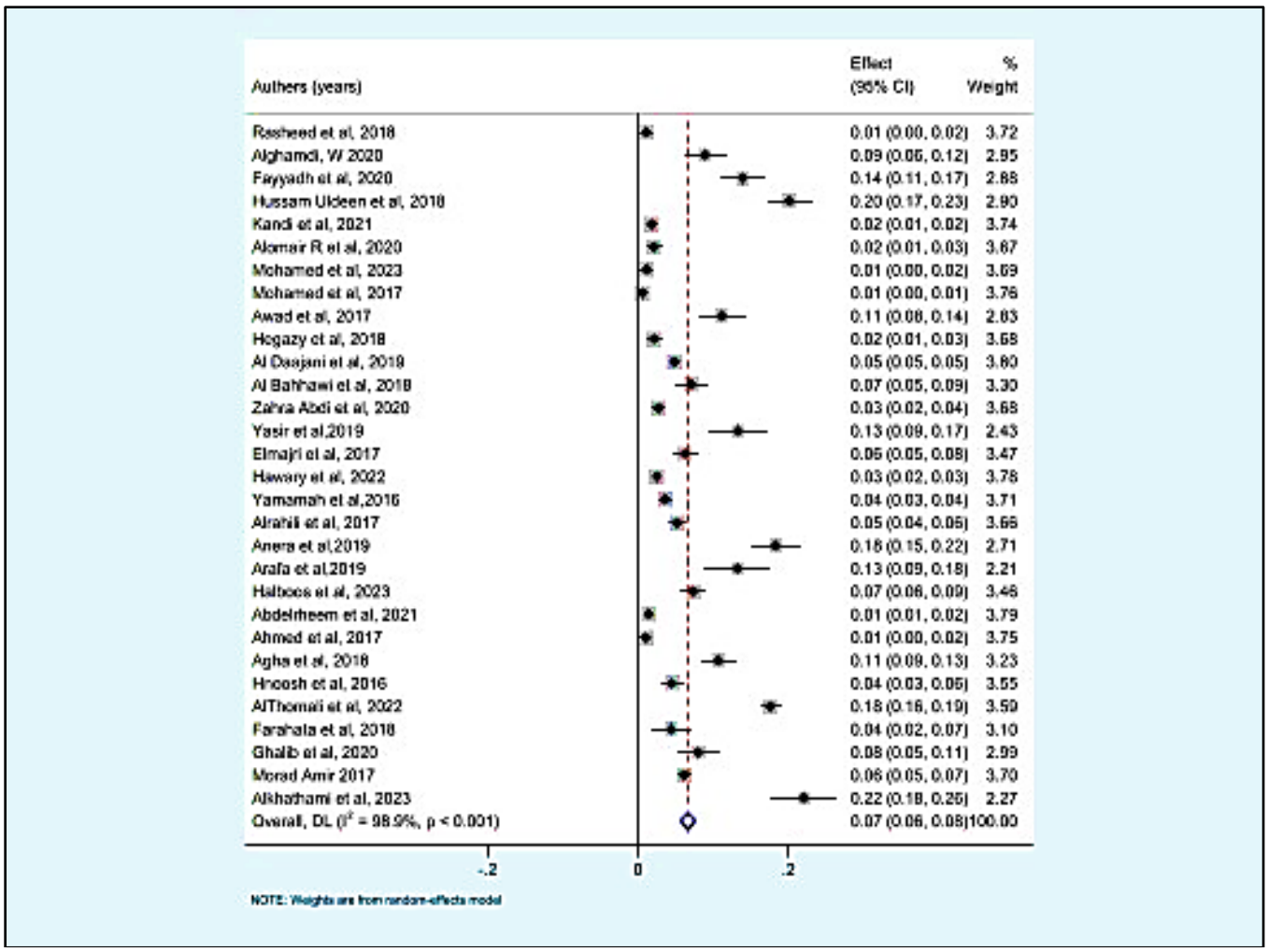


Figure 2: Funnel and Forest Plot of Meta-analysis of Hypermetropia Prevalence Meta-analysis of Astigmatism Prevalence.

A risk of bias assessment was performed for the included observational studies using a simplified version of the Newcastle–Ottawa Scale (NOS). The evaluation covered selection, comparability, and outcome domains. Ratings were categorized as Low risk (-), Moderate risk (/), and High risk (+). The results, summarized in Appendix 1.

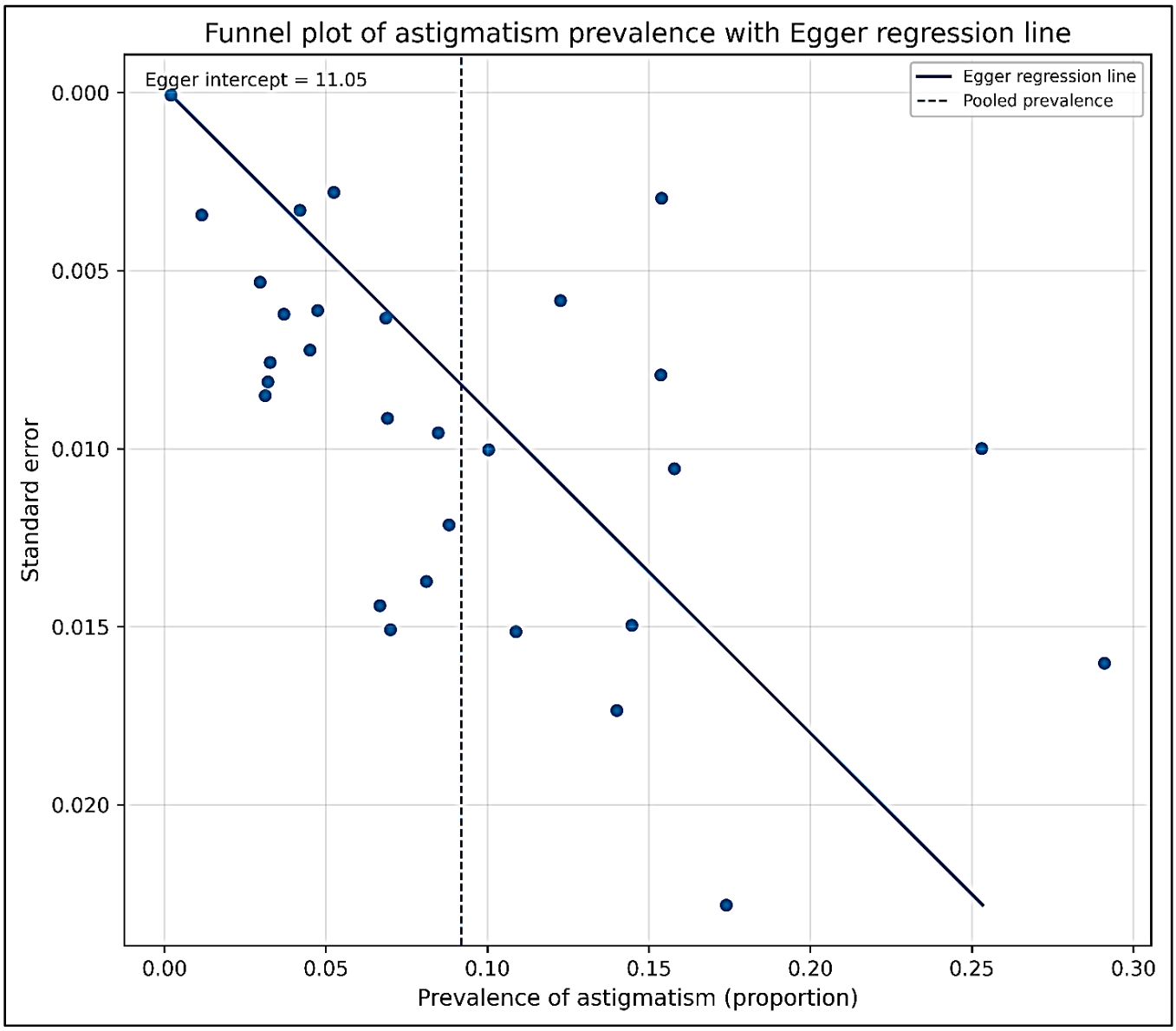
DISCUSSION

This is the first comprehensive study to determine refractive error and amblyopia in school-aged children in the Arab world. Our results showed significant variability in the reported prevalence of refractive errors, ranging from 8.2% to 50% in more than 10 studies conducted between 2016 and 2023. The highest rates were reported in Iraq, Morocco, and Sudan, while the lowest were seen in studies from Egypt and Sudan (Al-Gezira). The most frequently assessed age group was 6–12 years. Most studies used Snellen charts, while other studies employed cycloplegic refraction and diagnostic tools such as retinoscopes and autorefractors. This meta-analysis reports pooled prevalence rates for hyperopia (6.7%), astigmatism (8.4%), and amblyopia (2.2%) among primary school children in the Arab world. However, a pooled estimate for myopia could not be calculated due to significant heterogeneity among studies, with prevalence rates ranging from 1.7% to 25.0%. This variation in myopia prevalence across studies highlights the need for further standardization in study design and diagnostic approaches.

The observed differences in refractive error prevalence across Arab countries may be attributed to several factors, including urbanization, lifestyle, and access to vision care services. Urban environments, with increased screen time and indoor activities, tend

to correlate with higher rates of myopia. For example, urban areas often have greater exposure to screen-based activities, which have been linked to myopia progression in children.[15,20]Conversely, rural settings, where outdoor activities and less screen time are prevalent, may be associated with lower rates of myopia.[16] Furthermore, variations in healthcare access, such as the availability of school-based screening programs, could influence the detection and reporting of refractive errors, particularly in underserved or rural areas.[9] These regional disparities in healthcare infrastructure and public health programs may lead to differences in prevalence reporting, potentially underestimating refractive error cases in areas with limited access to vision care. However, while these factors may be associated with differences in prevalence, further research is needed to establish definitive causal links.

The issue of rural versus urban differences in refractive error prevalence was noted in several studies included in this review that require further investigation.[9] Future studies should aim to systematically analyze the impact of rural versus urban settings on refractive error prevalence, taking into account factors such as access to healthcare, lifestyle behaviors, and screen time. Studies focusing on urban-rural differences are crucial for understanding the



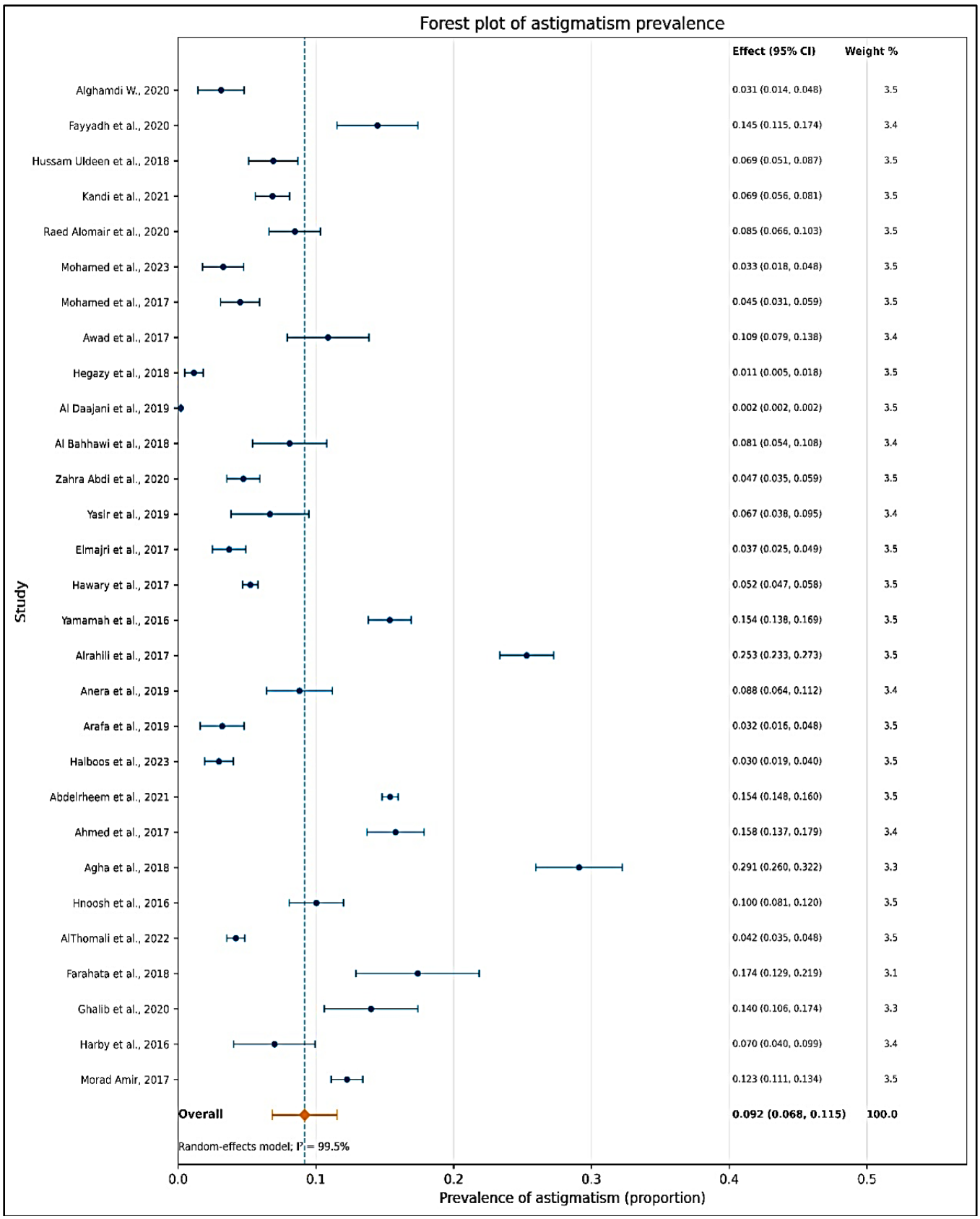
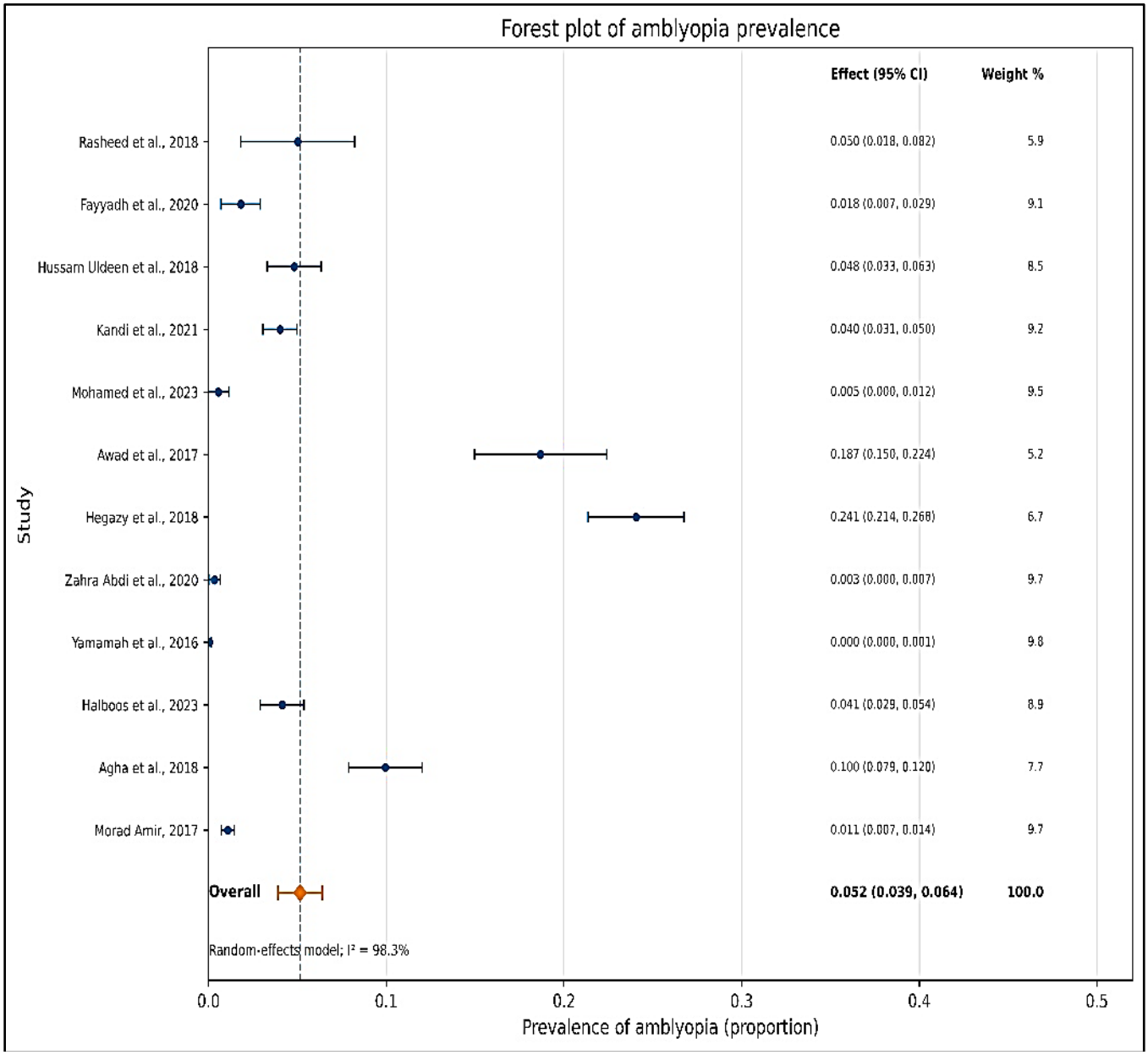


Figure 3: Funnel and Forest Diagram of the Meta-analysis on the Prevalence of Astigmatism, Meta-analysis on the Prevalence of Amblyopia.

broader context of refractive error prevalence in the Arab world. Studies conducted in the same country, one in rural/urban areas, showed a difference in prevalence between urban and rural settings. For example, Iraq and Saudi Arabia both had studies from multiple cities and regions that showed different prevalence rates, which may relate to urbanization levels, access to optometric services, or public health infrastructure.[1,3,7,17,23,24,27] However, most studies did not report the difference between urban and rural populations, which limits the conclusions about urban–rural differences.

Some of the previous studies included that older children reported higher myopia prevalence. This phenomenon supports the hypothesis that refractive errors, particularly myopia, may progress with age.[29]

Studies from non-Arab Middle Eastern countries, such as Iran and Turkey, have reported a prevalence of refractive errors ranging between 20% and 35%.[12] These similarities may be attributed to genetic backgrounds, cultural practices, and lifestyle changes, such as an increasing reliance on screen-based learning and indoor activities, which are associated with the development of myopia in patients.[29]



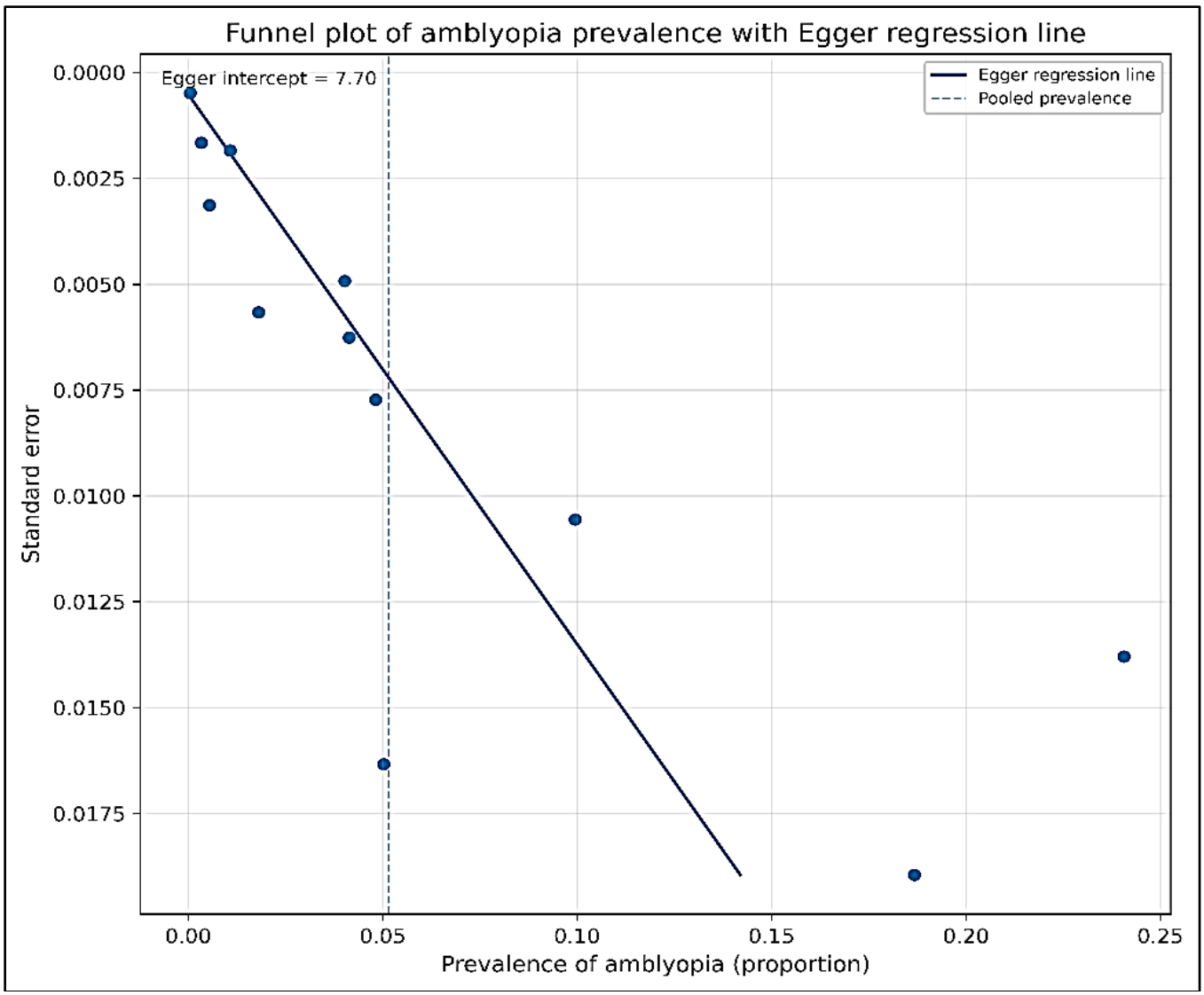


Figure 4: Funnel and Forest Plot of Meta-analysis of Amblyopia Prevalence.

Globally, the World Health Organization (WHO) recognizes uncorrected refractive errors as one of the leading causes of visual impairment in children.[30] Compared to countries with established national school vision screening programs, the Arab world still lacks standardized, large-scale eye screening in many countries. The low screening coverage may cause under diagnosis and underreporting of the prevalence of refractive errors. Hence, the differences reported in previous studies may be influenced by inequities in access to vision care, early screening, and public health policies, in addition to biological and environmental factors.

Early detection of refractive error is crucial at this age, not only for visual development but also for preventing academic difficulties. Undiagnosed refractive errors are known to impair reading ability, concentration, and overall academic performance. Subtypes like myopia and astigmatism are frequently under-detected, especially when limited diagnostic tools are available. In this area, cycloplegic refraction and autorefractometry can ensure more accurate and reliable diagnoses.

In areas where national screening programs are not standardized or widely implemented, investing in early and comprehensive vision screening can significantly improve early detection and treatment, leading to improvements in both educational outcomes and long-term eye health in children.

Table 1: *Distribution of refractive errors among the Amblyopia of primary schools in the studies.*

Author name	Myopia		Hyperopia		Astigmatism		Amblyopia	
	Number	Percentage %	Number	Percentage %	Number	Percentage %	Number	Percentage %
Rasheed et al	17	9.5%	22	12.3	NT	NT	9	5%
Al-Ghamdi, W	32	7.7%	37	8.9%	13	3.1%	NT	NT
Fayyadh et al	21	3.8%	77	13.9%	80	14.5%	10	1.8%
Hussam Uldeenet al	144	19.6%	148	20.1%	53	7.1%	37	4.8%
Kandi et al. (2021)	195	12.3%	29	1.8%	109	6.9%	64	4%
Raed Al-Omair et al. (2020)	89	10.5%	18	2.1%	72	8.5%	NT	NT
Mohamed et al. (2023)	28	5.1%	6	1.1%	18	3.3%	3	0.6%
Mohamed et al. (2017)	27	3.3%	9	1.1%	37	4.5%	NT	NT
Awad et al. (2017)	38	9%	47	11.1%	46	10.9%	79	18.5%
Hegazy et al. (2018)	95	9.9%	128	13.4%	11	1.5%	231	24.1%
Al Daajani et al. (2019)	25195	5.7%	21085	4.8%	875	0.2%	NT	NT
Al Bahhawi et al. (2018)	28	7.1%	19	4.8%	32	8.1%	NT	NT
Zahra Abdi et al. (2020)	110	9.1%	32	2.7%	57	4.7%	4	22.0%
Yasir et al. (2019)	34	11.3%	11	3.7%	20	6.7%	NT	NT
El-Majri et al. (2017)	16	1.7%	57	6.2%	34	3.7%	NT	NT
Hawary et al. (2017)	309	4.9%	165	2.5%	332	5.2%	NT	NT
Yamamah et al. (2016)	64	3.1%	75	3.6%	318	15.4%	1	0.4%
Al-Rahili et al. (2017)	13	2.3%	29	4.4%	479	25.3%	NT	NT
Anera et al. (2019)	50	9.1%	164	30.1%	48	8.8%	NT	NT
ARAFA et al. (2019)	62	13.2%	31	6.6%	15	2.9%	NT	NT
Halboos et al. (2023)	92	9%	74	7.3%	30	3%	42	4.1%
ABDELRHEEM et al. (2021)	687	4.7%	1325	8.9%	2275	15.2%	NT	NT
Ahmed et al. (2017)	33	2.8%	12	1%	188	15.8%	NT	NT
Agha et al. (2018)	82	10.7%	86	10.9%	234	29.1%	80	9.9%
Hnoosh et al. (2016)	146	16.3%	40	4.5%	90	10.1%	NT	NT
Al-Thomali et al. (2022)	337	9.2%	99	2.7%	154	4.2%	NT	NT
Al-Thomali et al. (2022)	45	12.3%	16	4.6%	48	13.2%	NT	NT
Ghalib et al. (2020)	44	11%	54	13.5%	56	16%	NT	NT
Harby et al. (2016)	73	25%	12	4%	20	7%	NT	NT
Morad Amir (2017)	159	5.1%	190	6.1%	386	12.3%	34	1.1%

This study had some limitations. One of the important limitations is the high heterogeneity across studies, as indicated by high I^2 values. This difference may be attributed to variations in diagnostic tools, age groups, sample sizes, and study settings. However, random-effects models were employed to address this limitation. Publication bias was identified in the astigmatism analysis, as indicated by Egger's test, suggesting that studies with lower prevalence results may have been underreported or unpublished. The inability to include all 22 Arab League states was a major limitation in the generalization of the findings across the entire Arab region.

Another important limitation was the different geographic distribution of studies. The dataset was mostly collected in Iraq, Saudi Arabia, and Egypt. At the same time, several Arab countries, particularly those in North Africa and the Gulf, were excluded. This imbalance restricts the generalizability of the findings to the entire Arab world. Additionally, differences in detection methodologies may affect

either the underestimation or overestimation of refractive error prevalence in different populations. The review protocol was not registered in PROSPERO, which should be considered a limitation because protocol registration improves transparency and reduces the risk of selective reporting. Although study quality was assessed using an adapted Newcastle–Ottawa Scale for cross-sectional studies, no subgroup or sensitivity analysis based on risk-of-bias category was performed. Therefore, the influence of lower-quality studies on the pooled estimates could not be fully evaluated.

CONCLUSION

This study revealed a high burden of refractive errors among primary school children in the Arab world, with prevalence rates varying widely across countries and subtypes. Myopia, hyperopia, astigmatism, and Amblyopia were all reported at the urgent levels. The findings report the gaps in geographic coverage, inconsistencies in diagnostic methods, and limited national screening efforts. To reduce visual impairment in children, there is a clear need for standardized, school-based vision screening programs, improved access to pediatric eye care, and early treatment.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

REFERENCES

1. **Al-Rahili NHR, Jadidy ES, Al-Ahmadi BSH, Abdula'al MF, Jadidy AS, Alhusaini AA, et al.** Prevalence of uncorrected refractive errors among children aged 3-10 years in western Saudi Arabia. Saudi Med J. 2017;**38(8):**804-810. Doi: 10.15537/smj.2017.8.20412.
2. **Kandi SC, Khan HA.** Epidemiological findings of refractive errors and amblyopia among the schoolchildren in Hatta region of the United Arab Emirates. Dubai Med J. 2021;**4(1):**3-9. Doi: /10.1159/000512521
3. **Al-Thomali TA, Al-Qurashi M, Al-Ghamdi AS, Ibrahim A, Al0-Swailmi FK.** Prevalence of refractive errors in school-going children of Taif region of Saudi Arabia. Saudi J Ophthalmol. 2022;**36(1):**70-74. Doi: 10.4103/sjopt.sjopt_46_21.
4. **Ghalib NM, Ibrahim SM, Bahakim NO.** Prevalence of Refractive Errors Among Primary School Children (6-15 Yrs) In Al-Khartoum-Sudan. Syst Rev Pharm. 2020;**11(10)**:674-678. Doi: 10.31838/srp.2020.10.99
5. **Hawary MB, Abd El-Reheem SS, Maebed AA, Gabr AF.** Refractive Errors Among Rural Schoolchildren In South Egypt. Al-Azhar J Pediatr. 2022;**25(2):**2745-2764. Doi: 10.21608/azjp.2022.259322
6. **Mohamed ZD, Vankudre GS.** Refractive error prevalence among the traditional Quranic boarding schools in Al-Gezira, Sudan. Afr Vis Eye Health. 2023;**82(1):**804. Doi: 10520/ejc-aveh_v82_n1_a804
7. **Rasheed BA, Rasheed TA, Al-Amiry AS.** Visual acuity and refractive errors in a sample of Iraqi school children in Baghdad 2016. Iraqi Med J. 2018;**64(2):**101-105.
8. **Omar R, Wong MES, Majumder C, Knight VF.** Distribution of refractive error among Chinese primary school children in a rural area in Pahang, Malaysia. Malays Fam Physician.;17(1):29-35. Doi: 10.51866/oa1251.
9. **Abdi Ahmed Z, Alrasheed SH, Alghamdi W.** Prevalence of refractive error and visual impairment among school-age children of Hargesia, Somaliland, Somalia. East Mediterr Health J. 2020;**26**(11):1362-1370. Doi: 10.26719/emhj.20.077.
10. **Anera RG, Soler M, de la Cruz Cardona J, Salas C, Ortiz C.** Prevalence of refractive errors in school-age children in Morocco. Clin Exp Ophthalmol. 2009;**37(2):**191-196. Doi: 10.1111/j.1442-9071.2009.02001.x.
11. **Biswas S, El Kareh A, Qureshi M, Lee DMX, Sun CH, Lam JSH, et al.** The influence of the environment and lifestyle on myopia. J Physiol Anthropol. 2024;**43(1):**7. Doi: 10.1186/s40101-024-00354-7.
12. **Hashemi H, Pakzad R, Ali B, Yekta A, Ostadimoghaddam H, Heravian J, et al.** Prevalence of Refractive Errors in Iranian University Students in Kazerun. J Curr Ophthalmol. 2020;**32(1):**75-81. Doi: 10.1016/j.joco.2018.08.001.
13. **Wu XY, Fang HH, Xu YW, Zhang YL, Zhang SC, Yang WH.** Bibliometric analysis of hotspots and trends of global myopia research. Int J Ophthalmol. 2024;**17(5):**940-950. Doi: 10.18240/ijo.2024.05.20.
14. **Dandona R, Dandona L.** Refractive error blindness. Bull World Health Organ. 2001;**79(3):**237-243.
15. **Halboos MT, Mohammed MH, Al Jenabi ZK, Hamad N.** Determination of refractive error and strabismus in two primary schools. J Ophthalmol Res Rev Rep. 2024;152:2-5. Doi: org/10.47363/JORRR/2024 (5).

16. **Little JA, Chan VF, Saw SM, Tham YC, Chew L, Foo LL, et al.** Current status of school vision screening-rationale, models, impact and challenges: a review. Br J Ophthalmol. 2025;**109(11):**1207-1214. Doi: 10.1136/bjo-2024-326726.
17. **Al Daajani MM, Al-Habib DM, Ibrahim MH, Al Shewear NA, Fagihi YM, Al-Zaher AA, et al.** Prevalence of Health Problems Targeted by the National School-Based Screening Program among Primary School Students in Saudi Arabia, 2019. Healthcare (Basel). 2021;9(10):1310. Doi: 10.3390/healthcare9101310.
18. **Mohamed ZD, Binnawi KH, Abdu M.** Prevalence and causes of childhood blindness and visual impairment in quranic boarding schools in Al-Gazira state of Sudan. Sudanese J Ophthalmol.2017;**9(2):**44-49. Doi: 10.4103/sjopthal.sjopthal_1_18
19. **Yamamah GA, Talaat Abdel Alim AA, Mostafa YS, Ahmed RA, Mohammed AM.** Prevalence of Visual Impairment and Refractive Errors in Children of South Sinai, Egypt. Ophthalmic Epidemiol. 2015;**22(4):**246-252. Doi: 10.3109/09286586.2015.1056811. Erratum in: Ophthalmic Epidemiol. 2015;**22(5):**357. Doi: 10.3109/09286586.2015.1091264.
20. **Elam AR, Tseng VL, Rodriguez TM, Mike EV, Warren AK, Coleman AL.** American Academy of Ophthalmology Taskforce on Disparities in Eye Care. Disparities in Vision Health and Eye Care. Ophthalmology. 2022;**129(10):**e89-e113. Doi: 10.1016/j.ophtha.2022.07.010.
21. **Galdón A, Vila-Vidal N, El-Gharbi M, Vinuela-Navarro V, Pérez-Corral J, Tomás N, et al.** The Impact of Socioeconomic Status on Visual Acuity Changes in Schoolchildren: A One-Year Follow-Up. Children (Basel). 2024;**11(10):**1226. Doi: 10.3390/children11101226.
22. **Farahata H, Marey HG, Badawi N, Allam H, Issa MM.** Prevalence of occult refractive errors in primary school students. Menoufia Med J.2018;31(1):267.
23. **Hussam-ul-Deen M, Mirzajani A, Hasan MH, Hussein AH, Jafarzadehpur E.** The prevalence of refractive errors among first grade of primary school in Amara, South of Iraq. Func Disab J. 2018;**1(1):**31-39. Doi:10.30699/fdisj.01.1.31
24. **Al-Jaberi HA, Ali IR, Noori ZTM.** Prevalence of refractive errors among school students in Iraq - A systematic review and meta-analysis. J Optom. 2025;**18(1):**100534. Doi: 10.1016/j.optom.2024.100534.
25. **El-Majri KA.** A survey of the prevalence of refractive errors among children in lower primary schools in Darnah city, Libya. Adv Ophthalmol Vis Syst. 2017;**7(5):**00235.Doi: 10.15406/aovs.2017.07.00235
26. **Al-Harby S, Al-Asbali T, Khandekar R.** Visual acuity and refractive status of Omani students with refractive error in grades 1, 4 and 7: A retrospective cohort study. Oman J Ophthalmol. 2016;**9(1):**27-31. Doi: 10.4103/0974-620X.176097.
27. **Al-Omair R, Al-Ghnam SA, Alnasser BN, Al-Muhawas HA, Al-Hoshan SA, Altamimi BS, et al. The** prevalence and predictors of refractive error among school children in Riyadh, Saudi Arabia. Saudi J Ophthalmol. 2021;34(4):273-277. Doi: 10.4103/1319-4534.322621.
28. **Awad KS, Al-Jarousha MA, Al-Asmar AI, Eslayeh AH, Alshaer DY, Elbanna SM.** The prevalence and major causes of low vision among children in Gaza strip, Palestine. IUG J Nat Stud. 2017;25(2):85-88.
29. **Philipp D, Vogel M, Brandt M, Rauscher FG, Hiemisch A, Wahl S, et al.** The relationship between myopia and near work, time outdoors and socioeconomic status in children and adolescents. BMC Public Health.2022;22(1):2058. Doi: 10.1186/s12889-022-14377-1.
30. Vision impairment and blindness. https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment. Accessed 10 May 2026

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