

The Prevalence of Amblyopia and Eye Diseases among Pediatric Jewish Ethiopian Immigrants in Israel: An Observational Cross-sectional Study

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ABSTRACT

Background: In developed countries, amblyopia has an estimated prevalence rate of 1–4%, depending on the socioeconomic gradient. Previous studies performed on pediatric populations in Ethiopia demonstrated amblyopia rates up to 16.7%.

Objectives: To assess rates of amblyopia, refractive errors, strabismus, and other eye pathologies among Ethiopian-born children and adolescents who immigrated to Israel compared to Israeli-born children.

Methods: This observational cross-sectional study included children and adolescents 5–19 years of age who immigrated to Israel up to 2 years before data collection and lived in an immigration center. Demographic data and general health status of the children were obtained from the parents, and a comprehensive ophthalmologic examination was performed. Results were compared to Israeli-born children.

Results: The study included 223 children and adolescents: 87 Ethiopian-born and 136 Israeli-born. The rate of amblyopia in the Ethiopian-born group vs. Israeli-born was 3.4% and 4.4%, respectively. Even after controlling for age, there was still no significant difference between the two groups ($P > 0.99$).

Conclusions: Despite originating from a country with limited resources and fewer medical facilities, the amblyopia rate in Jewish Ethiopian immigrants was not higher, and even mildly lower, compared to Israeli-born children.

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KEY WORDS: amblyopia, Ethiopia, Israel, refractive error

The prevalence of amblyopia increases when accompanied by developmental delay, prematurity, a family history of amblyopia [2], certain ethnicities and geographic locations [4], lower quality medical services, and occupational and social class background [5]. In developed regions, the prevalence of amblyopia is estimated to be 1–4%, depending on the socioeconomic gradient [5–7]. Data on amblyopia prevalence in the developing world are scarce [8–13]. Previous studies on pediatric populations in Ethiopia demonstrated amblyopia rates of 16.7% in children under age 15 years of age in the southern part of the country [11], 2.7% among school-aged children in Addis Ababa [12], and 9.6% among school-aged children in the rural central part of the country [13].

We examined rates of amblyopia, refractive errors, strabismus, and other eye pathologies among recently immigrated Ethiopian children and adolescents and compared the results to an unpublished study conducted on Israeli-born children.

PATIENTS AND METHODS

Data were collected and analyzed in accordance with the policies and procedures of the institutional review board at the Ziv Medical Center and the tenets outlined in the declaration of Helsinki, with parental consent.

The research was performed in 2016 as an observational cross-sectional study. Children aged 5–19 years who lived in an immigration center located in Safed, Israel, were recruited. All children were born in Ethiopia and were of Jewish-Ethiopian origin. Most children came from low-income families. The children's families arrived from all over Ethiopia directly to the Safed Immigration Center. These immigrants were not refugees but rather came to Israel under the Law of Return due to their Jewish heritage. This center provides temporary housing for residents during their first 2 years in Israel.

A questionnaire regarding demographic information, health status, and medical history was completed by the parents with the help of a pediatric ophthalmologist. If needed, translation ser-

Amblyopia is defined as a unilateral or bilateral reduction in visual acuity that is not associated with any structural deformity of the visual pathways or the eye itself [1]. Amblyopia represents a failure of neural development in the immature visual system and is caused by an abnormal visual experience during early life resulting from visual deprivation, strabismus, or a refractive error [2,3].

vices were performed by an interpreter. All children underwent a comprehensive ophthalmic exam, including a Snellen visual acuity test by numbers or Lea symbols according to compliance and age, sensorimotor exams, automatic refraction (Canon RK-F1 Autorefractor, Canon Inc., Tokyo, Japan), retinoscopic cycloplegic refraction by cyclopentolate 1% hydrochloride eye drops (Cycloplegicedol, Edol laboratories, Portugal), and a slit-lamp examination of the anterior and posterior segments. Amblyopia was defined as a decrease of at least two lines in visual acuity with appropriate refractive correction [14]. Amblyopia was considered mild if visual acuity was 6/9 to 6/12, moderate if it was 6/12 to 6/36, and severe if it was worse than 6/36 [15].

Results were compared to the findings of an unpublished study conducted in 2016 on Israeli-born children, aged 7 years, in Hazor Haglilit, Northern Israel. All examinations (in both surveys) were performed by a single, experienced pediatric ophthalmologist (AV) who used the same resources and methodology. Results were also compared to previous studies on amblyopia conducted on Israeli and global pediatric populations.

STATISTICAL ANALYSIS

Chi-square and Fisher's exact tests were used to compare categorical variables. The Mann–Whitney test was applied to compare continuous variables. Logistic regression was used to study the association between origin and amblyopia rate while controlling for the child's age. All statistical tests were two sided, and a *P*-value ≤ 5% was considered statistically significant. NCSS software was used for all statistical analyses (NCSS 2021 Statistical Software (2021). NCSS, LLC. Kaysville, Utah, USA).

SAMPLE SIZE

Sample size was calculated using PASS 2021 Software (Power Analysis and Sample Size Software 2021. NCSS, LLC.). Sample size was calculate using an alpha of 5% and a power of 80%. For statistical considerations, we anticipated that the Israeli group would be 1.5 times larger than the Ethiopian group, and amblyopia rates would be 4% and 15% in the Israeli-born and Ethiopia-born, respectively.

RESULTS

The study comprised 223 children and adolescents: 136 Israeli-born children and 87 Ethiopian-born children and adolescents.

The Ethiopian-born group included 51 (58.6%) females. Mean age was was 10.4 ± 4.6 years (range 5–19 years). Three participants (3.4%) were diagnosed with unilateral amblyopia. One had mild amblyopia and two had moderate amblyopia. Two of them had anisometropic amblyopia and one had a unilateral amblyopia for no apparent reason. His refractive condition was normal, he had no strabismus, and his ocular examination revealed no pathology. Other ocular pathologies are presented in Table 1. One child had a unilateral ocular prosthesis due to an

unknown etiology, most likely a previous ocular trauma, and was excluded from the statistical evaluation.

Considering amblyopia risk factors criteria and based on results from Donahue and colleagues [16], we identified one participant with myopia > -3.0D, one with astigmatism > 2.0D, and one with anisometropia > 2.0D. None of the participants had hyperopia > 4.0D.

We compared our findings to those of a previous unpublished study on 7-year old Israeli-born children in Hazor Haglilit, Israel. The sex distribution in this group was similar (*P* = 0.67)

Of the 136 Israeli-born children, 6 (4.4%) were diagnosed with amblyopia: two with mild amblyopia and four with moderate amblyopia. The rate of amblyopia was slightly lower among the Ethiopian immigrant group than among Israeli-born children: 3.4% vs. 4.4%, respectively, although not statistically significant (*P* > 0.99). Amblyopia severity was also similar (*P* > 0.99). Even after controlling for age (using logistic regression), there was still no significant difference between Ethiopian-born and Israeli-born children in amblyopia rate (*P* > 0.99) [Table 2].

Table 1. Baseline characteristics of the two groups

	Ethiopian immigrants	Israeli-born	<i>P</i> -value
Number of patients	87	136	
Female, n (%)	51	75 (55.1%)	0.67
Male, n (%)	37 (42.5%)	61 (44.9%)	0.67
Age in years, mean ± SD (median)	10.4 ± 3.6 (10)	7 ± 0 (7)	< 0.05
Ocular history			
Vernal conjunctivitis, n (%)	2 (2.3%)	0	0.15
Central corneal scar, n (%)	0	1 (0.73%)	0.80

SD = standard deviation

Table 2. Amblyopia and visual acuity among Ethiopian-born and Israeli-born children

	Ethiopian immigrants	Israeli-born children	<i>P</i> -value
Any amblyopia, n (%)	3 (3.4%)	6 (4.4%)	<i>P</i> -value = 0.7
Mild amblyopia, n (%)	1 (1.1%)	2 (1.5%)	Fisher's exact > 0.99
Moderate amblyopia, n (%)	2 (2.3%)	4 (2.9%)	Fisher's exact > 0.99
Severe amblyopia	0	0	
Visual Acuity-Decimal, mean ± SD (median)	0.8 ± 0.2 (1)	0.9 ± 0.1 (1)	Fisher's exact > 0.99

SD = standard deviation

DISCUSSION

This study on Ethiopian children and adolescents who recently immigrated to Israel showed an amblyopia rate of 3.4%. Results were compared to a previous unpublished study on 7-year-old children in Hazor Haglilit, which found an amblyopia rate of 4.4%. Therefore, despite originating from a country with limited resources and fewer medical facilities and screening, and after a history of moving around between immigrant camps for years, the amblyopia rate among Jewish Ethiopian immigrants was not higher than that of the children born in Israel. Controlling for age did not change the results.

Moreover, the rate of amblyopia among the Jewish Ethiopian population of our cohort was lower than the rates reported in general pediatric Ethiopian populations (9.6–16.7%) [11,13]. While those studies did not provide data regarding the proportion of Jewish-origin children in their groups, we assumed it was very low according to the current estimated prevalence of Jews in Ethiopia, which was less than 0.0001% [17]. Most of these studies were population-based cross-sectional studies [7-10,12,13], with one being a hospital-based cross-sectional study, which could skew the results toward higher rates of amblyopia [11].

Our results could imply that the amblyopia risk factors and rates in our cohort are for that remains to be determined.

An environmental factor may also be an etiological factor, as most of these children were raised as part of the Jewish Orthodox community and were exposed to rigorous near-work activity during childhood. When compared to other educational systems, Orthodox Jews have a unique educational system that demands rigorous persistent near-work activity and a lengthy accommodative effort to read small characters beginning at a younger age.

Children in the Orthodox stream do not attend kindergarten but instead begin formal instruction at age 3 years, with a focus on hard studying and reading. Boys and girls attend separate schools and participate in distinct extracurricular activities. The amount of study hours progressively rises, primarily for males, to up to 16 hours per day for teens. Their persistent near work is distinguished by greater accommodative effort, which is followed by back-and-forth rocking movements to boost their attention. Adolescents who attend Orthodox schools are infrequently introduced to technology, particularly devices with displays and screens, both at school and in their daily lives. A prolonged near task has been demonstrated to produce ocular axial elongation [18]. The latter was suggested to be the culprit in the high incidence of refractive errors, mostly myopia and high myopia in the ultra-Orthodox Jewish community in Israel [19]. This risk factor for myopia, however, could be responsible for eliminating a baseline hyperopia, which is known to be much more amblyogenic than myopia [2,14].

Studies conducted globally show a wide range of amblyopia rates, from 0.26% in South Africa to 16.7% in the Ethiopian population. The vast difference in amblyopia prevalence rates could be explained by genetics, environmental factors, examination tools, and age of the participants. The results of previous global studies are presented in Table 3. In addition, different studies use different criteria for amblyopia definition.

There are several limitations to our study. For amblyopia, the number of participants is relatively low. Moreover, our study presents a single exam with no follow-up exams and a relatively large age distribution. Another possible limitation with regard to the study execution itself include cultural and linguistic barriers, which may contribute to lower quality exams.

Table 3. Previous research on the prevalence of amblyopia in Israeli and global pediatric populations

Author	Population study	Age range in years	Amblyopia percentage	Number of participants
Ethiopian immigration center in Safed, Israel (study)	Jewish Ethiopian immigrants in Israel	5–19	3.4%	87
Israeli-born children in Hazor Haglilit (study)	Israeli population	7	4.4%	136
Morad [20]	Israeli population	16	Israeli-born (0.98%), immigrants from the Former Soviet Union (1.5%)	290,000
Agaje [11]	Southern Ethiopia	0–15	16.7%	582
Bezabih [12]	Addis Ababa, Ethiopia	6–18	2.7%	804
Mehari [13]	Rural central Ethiopia	7–18	9.6%	4238
Friedman [7]	Baltimore, USA	0.5–6	Caucasians (1.8%), African Americans (0.8%)	3990
Ganekal [8]	Southern India	5–15	1.1%	4020
Fu [9]	Central China	5–15	1.0%	2893
Faghihi [10]	Mashhad, Iran	6–21	1.9%	2150

CONCLUSIONS

To the best of our knowledge, this study is the first to examine amblyopia among Jewish Ethiopian children. Despite coming from a region with fewer resources and medical facilities, the rate of amblyopia among Jewish Ethiopian immigrants was not higher compared to that of Israeli-born children. Our findings suggest that there may be a protective factor for developing amblyopia in the Jewish Ethiopian community.

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To move freely you must be deeply rooted.

Bella Lewitzky (1916–2004), modern dance choreographer, dancer, and teacher

If an animal does something, we call it instinct; if we do the same thing for the same reason, we call it intelligence.

Will Cuppy (1884–1949), American humorist and literary critic, known for his satirical books about nature and historical figures

Capsule

SUMO switches off immunosurveillance

As an extracellular cytokine, interleukin-33 (IL-33) is associated with hepatocellular carcinoma progression. However, Wang et al. found that as a nuclear factor, IL-33 was tumor suppressive, a function that was blocked in hepatocellular carcinoma cells. Intracellular IL-33 was SUMOylated in cell lines and tissues from hepatocellular carcinoma patients. SUMOylation involves the covalent attachment of a member of the SUMO (small ubiquitin-like modifier) family of proteins to lysine residues in specific

target proteins via an enzymatic cascade analogous to, but distinct from, the ubiquitination pathway. This posttranslational modification prevented the activation of cytotoxic T cells and macrophages in vivo. Thus, antitumor immunity in hepatocellular carcinomas is partially impaired by the loss of the nuclear factor function of IL-33.

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