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Prevalence of cataract and its associated factors among adults aged 40 years and above living in Durame town, Southern Ethiopia, 2023: a community-based cross-sectional study

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ABSTRACT

Objective This study aimed to assess the prevalence of cataract and associated factors among adults aged 40 years and above in Durame town, Southern Ethiopia.

Design A community-based cross-sectional study was conducted using a systematic random sampling method.

Setting The study was conducted in Durame town, Southern Ethiopia.

Participants The study included 734 adults aged ≥40 years who lived in Durame town for more than 6 months.

Main outcome measures Data were collected using face-to-face interviews completed by an interviewer and ophthalmic examinations.

Results A total of 734 study participants aged 40 years and above were involved. The prevalence of cataract was 29.16% (95% CI: 25.89% to 32.59%). Factors associated with the prevalence of cataract were older age of 70–95 years (adjusted odds ratio (AOR)=8.60, 95% CI: 3.09 to 23.90), being diabetic (AOR=2.27, 95% CI: 1.37 to 3.74), exposure to sunlight (AOR=2.83, 95% CI: 1.45 to 5.53), trauma to eye (AOR=2.39, 95% CI: 1.19 to 4.81), hypertension (AOR=1.86, 95% CI:1.16 to 2.99) and glaucoma (AOR=5.36,95% CI: 3.13 to 9.18).

Conclusion The prevalence of cataract was lower than previous national survey results. Old age, known history of trauma to eye, hypertension, diabetes, exposure to sunlight and glaucoma had statistically significant association with cataract.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study provided up-to-date evidence on the magnitude and factors associated with cataract to reduce blindness in Southern Ethiopia.

⇒ This study demonstrates the temporal association between predictive factors and cataracts, not the actual causation.

⇒ Since the study mainly focuses on quantitative data, it provides limited information on the qualitative aspects and their impact relationship.

INTRODUCTION

Cataract is a condition where the eye's lens becomes cloudy, leading to blurred vision and possibly blindness.[1] Opacification occurring on or inside the lens can impede the amount of light entering the retina, causing a reduction in vision that correlates with the degree of opacification.[2] Cataracts can be either congenital or acquired, with the latter resulting from various factors such as ageing, metabolic disorders, trauma, intraocular inflammation and ocular or systemic conditions.[3] Cataracts are most common in elderly individuals, with age-related cataracts being the most prevalent.[4]

Globally, cataracts are the leading cause of blindness and the second-leading cause of moderate and severe visual impairment. Over 100 million people worldwide are affected by cataracts, with 17 million cases resulting in blindness.[5] Nearly 70 million people worldwide experience bilateral blindness or moderate to severe visual impairment due to cataracts.[6] As the ageing population grows, cataract-related blindness is increasing, putting more pressure on healthcare systems.[7] The number of people who are blind due to cataracts is increasing as a result of population growth and longer lifespans.[8] In 2020, there were an estimated 15.2 million blind people aged 50 and over, and an additional 78.8 million individuals with moderate and severe visual impairment due to cataracts worldwide.[9] However, individuals living in low-income countries face a higher burden of cataracts due to limited access to cataract surgery.[10]

Cataract-related blindness is widespread in developing countries due to high service costs and limited access to surgery. We must act to ensure equal healthcare access for

everyone.[11] Access to relatively simple and cost-effective treatment for cataracts is limited in low-income and middle-income countries, where over 90% of people with visual impairment due to cataracts reside.[12] Cataract surgery is currently the only treatment available that can effectively address all types of cataracts.[13] Due to limited eye care facilities, high user fees and transportation costs, many people have poor access to eye care services.[12]

The prevalence of cataracts in people aged 40 and older ranges from 11.8% to 18.8%.[10] Cataracts are a major public health concern in sub-Saharan Africa, accounting for over 46% of blindness cases, and 52.4% and 70.6% of moderate and severe visual impairments due to cataracts, respectively.[14] The 2005/2006 national survey on blindness and low vision in Ethiopia identified cataracts as the leading cause of blindness (49.9%) and low vision (42.3%). Cataracts in adults over 40 can lead to secondary glaucoma and uveitis, increased dependency and decreased mobility, economic loss, mortality, decreased quality of life and increased risk of failure.[15 16]

Evidence has shown several risk factors associated with cataract, including smoking, marital status, educational status, diabetes, sunlight exposure, high body mass index, steroid use, increasing age and female gender.[17]

Cataract is currently the primary cause of blindness and visual impairment in Ethiopia.[18] Despite existing studies on cataract prevalence in Ethiopia, most have been conducted in hospitals, with only one study being community-based. This highlights a significant gap in research, particularly regarding the prevalence of cataracts in southern Ethiopia, including the study area. This study aims to address this gap by assessing the proportions of cataracts and the factors associated with them in patients aged 40 years and above. Understanding the prevalence of cataracts and the related factors in the population is crucial for preventing visual impairment and effectively implementing the VISION 2030 program in Ethiopia.

METHOD AND MATERIALS
Study design, period and area
A community-based cross-sectional study was conducted in Durame town, located in southeastern Ethiopia, between 25 April 2023 and 30 May 2023. Durame is the administrative centre of the Kembata Tembaro Zone and is situated 112 km away from Hawassa, the capital of Sidama regional state and 280 km away from Addis Ababa, the capital of Ethiopia. The town has a latitude and longitude of 7°14′N 37°53′E and an elevation of 2101 m above sea level. The average temperature in Durame ranges from 16.5°C to 29.8°C. According to the Durame town health office, the town has three kebeles, which are the smallest administrative units in Ethiopia: Lalo, Kasha and Zeraro. The current total population of Durame is 65 852, with 31 367 being males and 34 485 being females. Adults aged 40 years and above account for 21 257 of the total population. The town has 10 248 households distributed across the three kebeles. Despite the presence of enough health facilities in the town, there is only one eye-care centre that does not provide cataract surgery services (obtained from Durame town health office unpublished source).

Study population and eligibility criteria
All adults aged ≥40 years who lived in Durame town for more than 6 months and were available during the data collection period were included in the study. However, adults who have bilateral pseudophakia, Phthitic (enucleated) eyes and bilateral corneal opacity which prevent to visualise crystalline lens were excluded from the study.

Patient and public involvement
Patients and/or the public were not involved in the study design, conduct of the study or plan to disseminate the result of this study to the study participants.

Sample size determination and sampling procedures
The sample size was determined using the single population proportion formula $n = \frac{(Z\alpha/2)^2 \times P(1-P)}{d^2}$ with the following consideration (n=sample size, Z=the value of z statistic at 95% confidence level=1.96, p=the estimated proportion of cataract from previous study=20.1%,[19] d=margin of error of ±3% and 10% non-response rate. The final sample size was determined to be 755. There were three kebeles (the smallest administrative unit) found in Durame town. A systematic random sampling technique was applied to select the required study participants from those three kebeles. The households were selected after calculating the sampling interval (K-value). The calculated sampling interval was 13 (k=10 248/755=13.57). The first household was chosen using a simple random sampling method (lottery method). Then, one adult aged 40 years and above was recruited in every 13th household. If more than one adult of aged 40 years and above were found adults in one household, lottery method was used to select one. An immediate next-door household was included in the interview when there was no eligible person who fulfilled the inclusion criteria at the selected household.

Operational definitions
Cataract
A clouding or loss of transparency of the lens within the posterior capsule, nucleus and/or cortex of the eye is revealed with slit lamp examination of the crystalline lens.[20]

Cataracts
A nuclear cataract (NC) was identified with a Lens Opacities Classification System III (LOCS III) score greater than 4 for nuclear opalescence (NO) or greater than 4 for NC. Similarly, a cortical cataract (CC) was indicated by an LOCS III score greater than 2 for CC, while a significant posterior subcapsular cataract (PSC) was identified with an LOCS III score greater than 2.[21]

Visual impairment

Functional limitation of eyes or visual system due to visual disorder or disease that can result in a visual disability or a visual hand cap with a presenting visual acuity of <6/12.[22]

Cigarette smoking

Individuals are classified as smokers if they have smoked more than 100 cigarettes in their lifetime, and as non-smokers if they have smoked fewer than 100 cigarettes in their lifetime and have no current history of smoking.[23]

Sunlight exposure

Participants who are exposed to sunlight for 6 hours or more per day are considered exposed whereas those with sunlight exposure less than 6 hours per day are considered non-exposed.[23]

Sleeping duration

Participants who considered exposed if the individual slept for more than 6 hours and non-exposed if the individual slept for 6 hours or less per day.[23]

Diabetic mellitus

If the individual has/had a known diagnosed diabetic mellitus or undergoing antidiabetic therapy.[24]

Systemic hypertension

If the individual has/had a known diagnosed hypertension or undergoing antihypertensive therapy.[25]

Glaucoma

If the individual has/had known diagnosed glaucoma or undergoing antiglaucoma therapy.[26]

Myopia

If the individual has/had a known diagnosed myopia.[27]

Data collection tool and procedure

The eligible participants were interviewed through an interviewer-administered questionnaire after taking informed written consent. The questionnaire covered sociodemographics and other relevant variables. The questionnaire was adapted from various literature and administered by a trained ophthalmic nurse practitioner. Two optometrists conducted an examination using Snellen's visual acuity chart, portable slit lamp biomicroscope and direct ophthalmoscopes. The data collection process was supervised by the principal investigator. The principal investigator provided 1 day of training to the data collectors on data collection techniques, instrument use and how to maintain ethical standards. A pretest was conducted on 5% (37) of the sample size in Angacha before the actual data collection to check for completeness, appropriateness and common understanding. Modifications were made accordingly. To ensure the quality of the data, the PI closely supervised the data collection procedure on a daily basis. A review was conducted in the field to check the completeness of the questionnaire, and any corrections were made in the field. The data were then coded for data management. Data cleaning and cross-checking were also done before data analysis.

Table 1 Sociodemographic and economic characteristics of study participants aged 40 years and above in Durame town, Southern Ethiopia, 2023 (n=734)

Variables	Categories	Frequency	%
Age	40–49	174	23.71
	50–59	229	31.20
	60–69	205	27.93
	70–95 years	126	17.16
Sex	Male	390	53.13
	Female	344	46.87
Marital status	Never married	66	8.99
	Married	484	65.94
	Divorced or separated	48	6.54
	Widowed	136	18.53
Educational status	Unable to read and write	158	21.52
	Primary school	115	15.67
	Secondary school	253	34.47
	College and above	208	28.34
Health insurance	Yes	339	46.19
	No	395	53.81
Monthly income (ETB)	<2000	371	50.54
	2000–5999	166	22.62
	≥6000	197	26.84

ETB, Ethiopian birr.

Grading of lens images

Lens opacities were assessed using the LOCS III by experienced optometrists. After dilating the pupils with tropicamide eye-drops (1%), cataract grading was performed using a portable slit lamp biomicroscope while referencing LOCS III standard photographs. The examiner identified specific lens opacities and assigned a severity grade. The severity of lens opacities was categorised into four main groups: NO, NC, CC and PSC.

Statistical analysis

The data collected were exported to Stata V.14 for analysis. Descriptive statistics, such as frequency and percentage, were used to summarise the data. To check the multicollinearity of variables, the variance inflation factor and the tolerance test were used. To determine the factors associated with cataract, binary logistic regression was applied. Variables with a $p<0.2$ in the bivariable analysis were included in the multivariable regression analysis. The goodness of the model fit was tested using the Hosmer-Lemeshow test. Variables with a $p<0.05$ in the

Table 2 Health-related data of the study participants aged 40 years and above in Durame town, Southern Ethiopia, 2023 (n=734)

Variables	Categories	Frequency	%
Family history of cataract	Yes	143	19.48
	No	591	80.52
Diabetes mellitus	Yes	171	23.30
	No	563	76.70
Systemic hypertension	Yes	271	36.92
	No	463	63.08
Glaucoma	Yes	156	21.25
	No	578	78.75
Myopia	Yes	175	23.84
	No	559	76.16
Steroid use	Yes	139	18.94
	No	595	81.06
Visual impairment	Normal	377	51.36
	Mild	85	11.58
	Moderate	106	14.44
	Severe	92	12.53

Table 3 Health behaviour/lifestyle and environmental factors among study participants aged 40 years and above in Durame town, Southern Ethiopia, 2023 (n=734)

Variables	Categories	Frequency	%
Smoking cigarette	Yes	37	5.04
	No	697	94.96
Sleep duration	Exposed	113	15.40
	Non-exposed	621	84.60
Exposure to sunlight	Non-exposed	147	20.03
	exposed	587	79.97
Trauma	Yes	156	21.25
	No	578	78.75

n, sample size.

multivariable logistic regression analysis were considered statistically significant at the 95% CI.

RESULT
Sociodemographic data of study participants
A total of 734 study participants were involved in this study giving a response rate of 97.2%. The mean age of the study participants was 58.6 years with ±12.4 SD.

From the total study participants, 390 (53.13%) were males. About 484 (65.94%) were married. About 158 (21.53) were unable to read and write and 198 (26.98%) study participants were government employees (table 1).

Health-related data of adult participants
About 143 (19.48%) of study participants had a family history of cataract, 171 (23.30%) had diabetes mellitus, 271 (36.92) had systemic hypertension and 156 (21.25%) had glaucoma (table 2).

Health behaviour and environmental factors of participants
Of the total study participants, 37 (5.04%) were cigarette smokers and 156 (21.25%) had a history of eye trauma (table 3).

Prevalence of cataract
The prevalence of cataract among study participants of aged 40 years and above in Durame town was 29.16% (95% CI: 25.89% to 32.59%).

Prevalence of different type of lens opacity
Of the total number of participants, 8.86% had posterior subcapsular opacity, 0.27% had nuclear opacity, 11.99% had cortical opacity and the remaining had combination of the above.

Factors associated with cataract
In bivariable binary logistic regression factors: Age, marital status, educational status, monthly income, smoking, eye trauma, diabetes mellitus, hypertension, glaucoma, steroid medication, myopia and sunlight exposure were associated with cataract at a p<0.25. Then, multivariable binary logistic regression was used to assess the relative effect of the independent variables on the outcome variable. In multivariable analysis factors such as age, known history of trauma to the eye, diabetic mellitus, hypertension, exposure to sunlight and glaucoma had significant association with cataract.

The odds of having cataract among study participants aged 70–95 years was 8.60 (adjusted odds ratio (AOR)=8.60, 95% CI: 3.09 to 23.90) times higher compared with participants aged 40–49 years. On the other hand, the odds of having cataract in adults aged 50–59 years was 2.74 (AOR=2.74, 95% CI: 1.16 to 6.48) times higher compared with aged 40–49 years.

The odds of having cataract was 2.27 (AOR=2.27, 95% CI: 1.37 to 3.74) times higher among diabetic participants when compared with participants who did not have diabetic mellitus. In adults who spend≥6 hours per day on average sunlight, the odds of having cataract was 2.83 (AOR=2.83, 95% CI: 1.45 to 5.53) times higher compared with those adults who spend less than 6 hours per day. The odds of having cataract in adults who had known history of trauma to the eye in their lifetime was 2.39 (AOR=2.39, 95% CI: 1.19 to 4.81) times higher compared with those who did not have a history of trauma to the eye in their lifetime.

The odds of having cataract in adults with systemic hypertension were 1.86 (AOR=1.86, 95% CI: 1.16 to 2.99) times higher than in adults who did not have systemic hypertension. In adults who had glaucoma, the odds of having cataract was 5.36 (AOR=5.36, 95% CI: 3.13 to 9.18) times higher when compared with adults without glaucoma history (table 4).

Table 4 Factors associated with cataract among study participants aged 40 years and above in Durame town, Southern Ethiopia, 2023 (n=734)

Variable	Cataract		COR (95% CI)	AOR (95%CI)	P value
	Yes	No			
Age					
40–49	11	163	1	1	
50–59	40	189	3.14 (1.56 to 6.31)	2.74 (1.16 to 6.48)	0.022
60–69	83	122	10.08 (5.15 to 19.73)	5.65 (2.37 to 13.46)	<0.0001
70–95 years	80	46	25.77 (12.67 to 52.43)	8.60 (3.09 to 23.90)	<0.0001
Marital status					
Never married	5	61	1	1	
Married	135	349	4.72 (1.86 to 12.00)	0.64 (0.19 to 2.15)	0.475
Divorced or separated	12	36	4.07 (1.32 to 12.48)	0.57 (0.13 to 2.42)	0.445
Widowed	62	74	10.22 (3.87 to 27.02)	0.57 (0.15 to 2.13)	0.403
Education status					
Unable to read and write	83	75	1	1	
Primary school	40	75	0.48 (0.29 to 0.79)	0.81 (0.41 to 1.61)	0.548
Secondary school	41	212	0.17 (0.11 to 0.28)	0.53 (0.24 to 1.18)	0.121
College and above	50	158	0.29 (0.18 to 0.45)	1.05 (0.29 to 3.79)	0.938
Smoking cigarette					
No	205	492	1	1	
Yes	9	28	0.77 (0.36 to 1.66)	1.46 (0.54 to 3.95)	0.452
Eye trauma					
No	133	445	1	1	
Yes	81	75	3.61 (2.50 to 5.23)	2.39 (1.19 to 4.81)	0.014
Diabetes mellitus					
No	118	445	1	1	
Yes	96	75	4.83 (3.35 to 6.94)	2.27 (1.37 to 3.74)	0.001
Systemic hypertension					
No	84	379	1	1	
Yes	130	141	4.16 (2.97 to 5.82)	1.86 (1.16 to 2.99)	0.011
Glaucoma					
No	112	44	1	1	
Yes	102	476	11.88 (7.89 to 17.88)	5.36 (3.13 to 9.18)	<0.0001
Steroid use					
No	176	419	1	1	
Yes	38	101	0.90 (0.59 to 1.35)	0.85 (0.40 to 1.81)	0.680
Myopia					
No	118	441	1	1	
Yes	96	79	3.01 (2.15 to 4.20)	1.52 (0.93 to 2.49)	0.093
Sunlight exposure					
Non-exposed	60	87	1	1	
Exposed	154	433	0.52 (0.35 to 0.75)	2.83 (1.45 to 5.53)	0.002
Monthly income (ETB)					
<2000	115	256	1.25 (0.85 to 1.84)	0.74 (0.23 to 2.38)	0.615
2000–5999	47	119	1.10 (0.69 to 1.75)	1.27 (0.50 to 3.22)	0.619
≥6000	52	145	1	1	

AOR, adjusted odds ratio; COR, crude odds ratio; ETB, Ethiopian birr; n, sample size.

DISCUSSION

The finding of this study showed that prevalence of cataract among adults was 29.16% (95% CI: 25.89% to 32.59%) which was in line with the study conducted in Malaysia 26.8%.[28] This might be due to similarities in study population which was done in older populations, study design and ocular examination of study participants.

However, this study finding was much lower than the studies conducted in Debre Markos 57%,[20] Ghana 48.9%,[29] South Africa 44%,[30] Northern Indian[31] and in Korea 87.8%.[32] The differences in results may be attributed to variations in study settings, geographical locations and the characteristics of study populations among participants. For example, studies conducted in Debre Markos, Ethiopia[20] and Ghana were institutional based, which may lead to an overestimation of cataract prevalence. Additionally, the populations in the studies from Northern India[31] and Korea[32] consisted of adults aged 50 years and older, which is older than the population in our study. Age is one of the most significant risk factors for cataracts, as indicated by various studies. Moreover, the research conducted in Northern India specifically focused on diabetic populations, contributing to a higher prevalence of cataracts in that study compared with ours.

The prevalence of cataract in this study was higher compared with studies conducted in Ethiopia 20.1%,[19] Nigeria 19.8%,[32] Southwestern Nigeria 2%,[33] Poland 12.10%[26] and Korea 25.2%.[32] This discrepancy may stem from variations in sociodemographic characteristics of the study populations, as well as differences in study settings and the availability and accessibility of cataract surgical services in those areas.

In this study, older age was significantly associated with cataract. This finding was similar to studies conducted in Whagmira, Ethiopia,[19] Ghana,[29] Nigeria,[32] India,[34] China[35] and Korea.[15] As people age, the cell membranes, including the lens epithelial cells, which are responsible for maintaining the balance of ions and metabolism of the entire lens, may become damaged. This can lead to an accumulation of fluid inside the lens. Additionally, abnormal differentiation of lens fibres and the formation of protein aggregates can occur, both of which contribute to the development of cataracts.[36]

This study found a significant association between exposure to sunlight and cataract, which is consistent with a study done in Korea.[15] This is because exposure to ultraviolet radiation can harm lens proteins and cells, leading to cataract formation due to oxidative stress damage.[37]

Having history of diabetic mellitus was significantly associated with cataract in this study. There was similar evidence in studies conducted in South Africa,[30] Sankara Nethralayia India,[38] Singapore[28] and Poland.[26] This could be due to high blood sugar (blood glucose) levels can create an imbalance of water content in the crystalline lens that can accelerate the development of cataracts.[39]

In this study, known systemic hypertension was associated with cataract. This result is consistent with findings of Korean study.[15] Cataract development is closely related to systemic inflammation and hypertension. Inflammatory mechanism can lead to conformational changes in proteins in the lens capsules, exacerbating cataract formation. Certain antihypertensive medications can also induce cataracts.[25]

In this study, having a history of glaucoma was significantly associated with cataract. This similar association was observed in a study conducted in Lodz, Poland.[26] There is no direct link between cataracts and glaucoma, although treatment of glaucoma can accelerate cataract formation in certain situations.[40]

History of trauma to the eye in the lifetime of the adult was significantly associated with cataract. This association is consistent with a study conducted in Whagmira, Ethiopia.[19] The possible reason might be that trauma to the eye can disrupt the normal physiological condition of the crystalline lens. This can be caused by damage to the epithelial membrane, leading to an increase in fluid influx into the lens. As a result, the lens fibres become swollen and thickened, ultimately leading to the development of cataracts.[41] If the trauma is caused by an electric shock, cataracts may result from the coagulation of proteins and osmotic changes that occur in the crystalline lens.[42]

Strengths and limitations of the study

This study provided up-to-date evidence on proportion and associated factors of cataract among adults aged 40 years and above living in Durame Town, Southern Ethiopia. This is important to raise awareness about cataracts and their risk factors among the population. Understanding these factors can lead to early detection and treatment, potentially reducing the burden of visual impairment in the community. Being a cross-sectional study, this study demonstrates the temporal association between predictive factors and cataracts, not the actual causation. Since the study mainly focuses on quantitative data, it provides limited information on the qualitative aspects and their impact relationship.

CONCLUSION

In this study, the prevalence of cataract was lower than previous national survey results. Besides, older age, known history of trauma to eye, hypertension, diabetes, exposure to sunlight and glaucoma had statistically significant association with cataract.

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