

# Prevalence of ocular pseudoexfoliation in Baso and Worena District, central Ethiopia

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## Abstract

**Background:** Pseudoexfoliation syndrome is an accumulation of fibrillary extracellular material in the anterior segment of the eye. It is the most common identifiable cause of glaucoma.

**Objective:** To assess the prevalence of pseudoexfoliation syndrome and its association with high intraocular pressure and glaucoma in Baso and Worena District, central Ethiopia.

**Methods and subjects:** A community-based cross-sectional study was conducted in Baso and Worena District, central Ethiopia, from 09 January to 08 February 2018. After a systematic random selection of participants, a questionnaire was administered. Study participants were then examined to assess the anterior segment of their eyes (using a portable slit lamp), measure intraocular pressure (using a Tono-pen AVIA®), and assess the dilated fundus of each eye (using a direct ophthalmoscope).

**Results:** A total of 682 people above 40 years of age were examined. The study participants' ages ranged from 40 to 89 years. The prevalence of pseudoexfoliation syndrome was found to be 13.2% for patients  $\geq 40$  years old (90/682), 17.6% for those  $\geq 50$  years old (85/483), 23.1% for those  $\geq 60$  years old (74/320), 34.1% for those  $\geq 70$  years old (42/123), and 27.8% for those  $\geq 80$  years old (5/18). Seventy one (78.9%) of the 90 participants who were found to have pseudoexfoliation syndrome had bilateral involvement and 19 (21.1%) had unilateral involvement. Prevalence increased with age and was highest for those aged 70 to 79. In twenty nine (32.2%) of the 90 cases, pseudoexfoliation syndrome was associated with high intraocular pressure, and 13 (14.4%) had high intraocular pressure and pseudoexfoliative glaucoma.

**Conclusions and recommendations:** Pseudoexfoliation syndrome is common in Baso and Worena District, central Ethiopia. It represents one of the major risk factors for glaucoma. [*Ethiop. J. Health Dev.* 2020; 34(1):54-58]

**Key words:** Pseudoexfoliation syndrome, glaucoma, intraocular pressure

## Background

Pseudoexfoliation syndrome (XFS) is a clinical entity characterized by the deposition of whitish-grey extracellular fibrins in the anterior segment of the eye and is commonly observed in older patients (1). This material may be found in many ocular tissues, including ciliary processes and zonular fibers, as well as in the anterior lens surface, pupillary margin, corneal endothelium, trabecular meshwork, and conjunctiva. Ocular XFS has been associated with the development of open- and closed-angle glaucoma and cataracts with zonular instability (2). XFS is the most common identifiable cause of glaucoma worldwide, accounting for the majority of cases in some countries, and causing both open and angle-closure glaucoma (3). It has already been reported that XFS is a major risk factor in modern extracapsular cataract surgery and phacoemulsification. The risk of intra-operative and post-operative complications is higher in eyes with XFS syndrome (4-6).

It is estimated that 60 to 70 million people worldwide are affected by XFS. The variation of incidence and prevalence of XFS in different countries, and even in different regions of the same country, has been shown in a previous study (7). Prevalence rates of XFS over the age of 60 are 25% in Iceland, 20% in Finland, 4% in England and 0% among the Inuit population (8-10). Reasons for this variation reflect a combination of differences in prevalence on the basis of the racial, ethnic, age and gender distribution of the population group examined; the clinical criteria used for making a diagnosis of exfoliation syndrome; the ability of the examiner to detect early stages and/or more subtle manifestations of the disorder; and environmental

factors. In particular, many cases go undetected because of failure to dilate the pupil, or to examine the lens with a slit lamp after dilation, and because of a low level of suspicion on the part of the examiner.

Although the population-based prevalence of XFS is well studied in the developed world, its magnitude in African countries, including Ethiopia, is not well documented. Understanding the magnitude of the syndrome and its risk factors is important in the prevention of glaucoma and other related eye disorders. Accordingly, the main purpose of this study was to assess the prevalence of XFS and its association with high intraocular pressure (IOP) and glaucoma in Baso and Worena District, central Ethiopia.

## Methods and subjects

A cross-sectional study was conducted in Baso and Worena District, central Ethiopia, from January 9 to February 8, 2018. Baso and Worena District is found in the highlands of central Ethiopia (2,250-3,250 meters above sea level) and is located 145 kilometers from Addis Ababa, the capital of Ethiopia. The average temperature ranges from 9°-15° centigrade, with average rainfall of 900-1,050mm. The district has a land mass of 1,208km<sup>2</sup> and contains around 31,945 households in 30 villages. The projected population size in 2018 was 137,365, of whom 72,711 were males.

To determine the sample size, the prevalence of XFS was taken to be 7.7%, as per the cross-sectional population-based prevalence study conducted by Rotchford *et al.* in 2003 of black South Africans above 40 years ( $p < 0.001$ ) (11). Assuming a precision of 2% and a confidence interval of 95%, the sample size was

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computed using a sample population proportion formula to reach a sample of 682, who were proportionally distributed in six villages.

The research and publication committee of the Department of Ophthalmology, College of Health Sciences, Addis Ababa University, approved the research, and verbal consent was obtained from all participants after explaining the relevance of the study. Consenting participants were examined for the presence of XFS. Individuals who suffered from ocular trauma, an active eye disease, or had undergone ocular surgery, were excluded from the study.

According to the latest national census in Ethiopia, the average number of people in each household aged 40 years and above is one. Six villages were selected for the study by lottery method, then systematic design was used. To obtain the sampling fraction, the total number of households (6,389) in the six villages was divided by 682. Every ninth household was included. Participants for examination were recruited by enumerators through house-to-house visits. To meet the required sample size, 682 households were visited. After selection, all the participants were subjected to interviews and an evaluation by the principal investigator (final-year resident of Ophthalmology). The collected information included demographic data such as age, gender, occupation and history of eye problems.

Visual acuity for all participants was assessed using a 'Snellen E chart' at a distance of 6 meters in the outdoors. Anterior chamber depth was assessed using the Van Herrick method, and the presence of pseudoexfoliative material was checked on pupillary borders, corneal endothelium and anterior lens capsules before and after dilation by 1% tropicamide using a Reichert PSL portable slit lamp. If a person was diagnosed with XFS, then IOP was taken by Tono-pen AVIA®, after 0.5% Tetracaine was instilled. Dilated fundus examination was done using direct

ophthalmoscopy to evaluate the optic nerve head of those with XFS. IOP and other examinations were done by the principal investigator, who received specific training for this study. Those individuals with XFS who had high IOP and/or glaucomatous disc damage were sent to Debre Birhan Referral Hospital for full evaluation by the senior ophthalmologist, after being put on 0.5% Timolol eye drops and/or acetazolamide tablets, depending on the extent of the IOP and the stage of the glaucoma.

The operational definition for XFS was a presence of dandruff-like white deposits on the anterior lens capsule or at the pupillary border. High IOP was considered if average pressure was more than 21 mmHg. Pseudoexfoliative glaucoma was diagnosed when IOP was more than 21 mmHg and there was glaucomatous optic nerve head findings.

Data was entered, coded and cleaned using SPSS version 20. For descriptive purposes, quantitative variables were presented as mean  $\pm$  standard deviation (SD), and qualitative data were reported in terms of proportions. In addition, age- and sex-adjusted prevalence rates were reported. For analytic purposes, convenient parametric analysis using Chi-square test was done. P-values less than 0.05 were considered statistically significant. The study proposal was approved by research and publication committee of the department of Ophthalmology, School of Medicine, College of Health Sciences, Addis Ababa University.

## Results

A total of 682 people above 40 years were examined. The study participants' ages ranged from 40 to 89 years. The collective mean age was 56.7 (SD $\pm$ 9.3); it was 64.3 (SD $\pm$ 8.9) and 54.1 (SD $\pm$ 9.2) for those with and without XFS, respectively. Ninety (13.2%) individuals were diagnosed with XFS. The prevalence of exfoliation increased as age increased, and it was maximum among the 70 to 79 age group (see Figure 1).

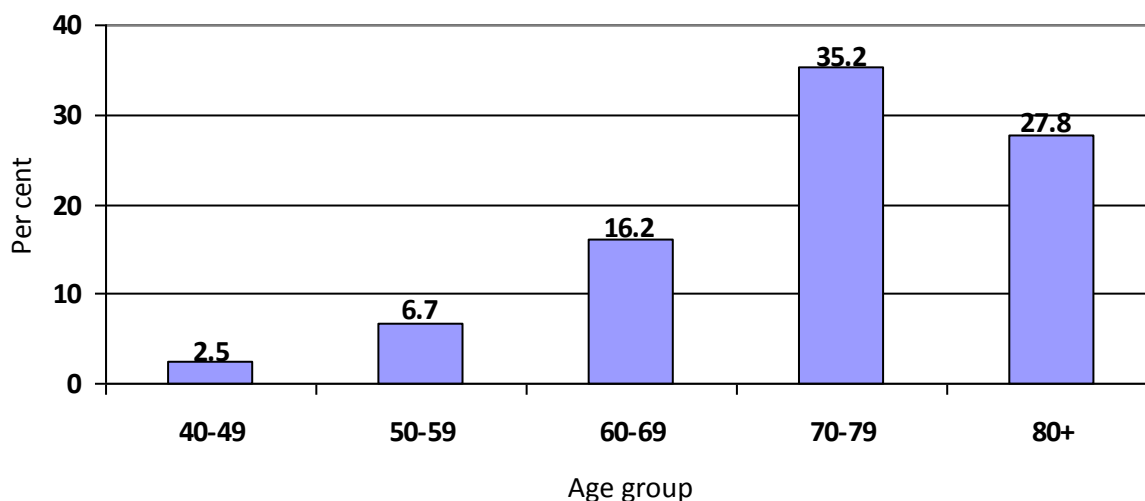


Figure 1: Distribution of XFS in the different age groups, Baso and Worena District, central Ethiopia, January to February 2018

The prevalence of XFS was found to be 13.2% (90/682) for individuals 40 years old and above; 17.6% (85/483) for those 50 years old and above; 23.1% (74/320) for those 60 years old and above; 34.1% (42/123) for those 70 years old and above; and 27.8% (5/18) for those 80 years old and above. The risk of

XFS occurrence based on age (odds ratio) was referenced at the 40-49 age range, and it was 45.78 at the age over 80. Of those cases with XFS, 71.1% were farmers, 24.5% were housewives and 1.1% were government employees, which was not statistically significant ( $P=0.572$ ) (see Table 1).

**Table 1: Distribution of patients according to age groups, sex and occupation, Baso and Worena District, central Ethiopia, January to February 2018**

Parameters	XFS+ No. (%)	XFS- No. (%)	P-value
<b>Sex</b>			
Males	63 (70)	384 (65)	0.759
Females	27 (30)	208 (35)	
<b>Age</b>			
40-49	5 (2.5)	194 (97.5)	0.038
50-59	11 (6.7)	152 (93.3)	
60-69	32 (16.2)	165 (83.7)	
70-79	37 (35.2)	68 (64.8)	
>80	5 (27.8)	13 (72.2)	
<b>Occupation</b>			
Farmers	64 (14.2)	386 (85.8)	0.572
Housewives	22 (11.4)	171 (88.6)	
Merchants	–	8 (100.0)	
Government employees	1 (7.1)	13 (92.9)	
Others	3 (17.7)	14 (82.3)	

Visual acuity of XFS individuals was significantly less ( $P<0.001$ ) than those without exfoliation. The cause of  $<6/60$  vision for individuals with XFS was attributable to cataract and glaucoma (see Table 2). Seventy one (78.9%) individuals had bilateral involvement of XFS and 19 (21.1%) had unilateral involvement; thus, the number of bilateral involved eyes was greater ( $P<0.001$ ), and as the age increased the involvement of

both eyes also increased. Of the 19 cases with unilateral involvement, nine cases involved the right eye and 10 cases involved the left eye. The difference between right or left eye was not significant ( $P>0.05$ ). In terms of the prevalence of XFS, there was no significant difference between males and females. There was no difference of pseudoexfoliation syndrome seen between male and female.

**Table 2: Association between the level of visual acuity without glasses and prevalence of XFS, Baso and Worena District, central Ethiopia, January to February 2018**

Parameters	XFS+ No. (%)	XFS- No. (%)	P-value
<b>VA OD</b>			
>6/18	50 (8.70)	524 (91.3)	<0.001
6/18-6/60	24 (33.3)	48 (66.7)	
6/60-3/60	6 (16.7)	30 (83.3)	
	80	602	
<b>VA OS</b>			
>6/18	56 (9.60)	528 (90.4)	<0.001
6/18-6/60	20 (29.4)	48 (70.6)	
6/60-3/60	5 (16.7)	25 (83.3)	
	81	601	

Twenty nine (32.2%) of the participants with XFS had increased IOP, of whom about 17.8% (n=16) had increased IOP only, with the remaining 14.4% (n=13) having high IOP with glaucomatous disc damage ( $P<0.001$ ). Of those diagnosed to have XFS with glaucomatous disc damage, 23.1% were female ( $P=0.543$ ). Ten (14.1%) of 71 bilateral XFS patients and three (15.8%) of 19 unilateral XFS patients had glaucoma ( $P<0.001$ ). Of the 90 individuals with XFS, 61 (67.8%) had no increased IOP or glaucomatous disc

damage, 16 (17.8%) had high IOP, and 13 (14.4%) had both high IOP and XFG.

#### Discussion

This study has shown that the prevalence of XFS in Baso and Worena District, central Ethiopia, was 13.2% among participants above the age of 40. This proportion is greater than the proportions reported in population-based studies in India (6%), Saudi Arabia (9.3%), and among Chinese Singaporeans (0.2%) (12-

14). The variety of study results relating to XFS is explained by differences in geographic, ethnic and racial features, as well as by the age and gender distribution of the examined participants, and the variability of methods and criteria used to diagnose XFS.

Only three population-based studies that have been conducted in Africa have been published: two from South Africa (11) and one from Tanzania (18). Bartholomew found XFS to be 5.1% in the Bantu population above 30 years of age (17). Rotchford *et al.* reported a prevalence of 7.7% in Hlabisa and 6% in Temba of the same ethnic population in South Africa among individuals who were above 40 years of age (11). Interestingly, a population-based glaucoma prevalence study in rural Tanzania, East Africa, yielded no cases of XFS among a sample of 3,268 subjects older than 40 years old (17). The prevalence rates of XFS in our study were higher than in many other countries. It was highest in those aged between 70 and 79 years old (35.2%). The reasons for this high prevalence could be genetics; spending lots of time outdoors (specifically farmers), leading to high solar exposure; and dietary habits such as high coffee consumption and low folic acid intake.

Of the total population examined, the prevalence of XFS in males and females was statistically the same. There are various findings on the gender distribution of XFS in the literature. While one study reports no difference (18), some studies suggest that XFS is more prevalent in men, while others indicate it is more prevalent in women (19,20). Bilateral XFS was seen in 78.8% of cases in this study, which is similar to a study from Greece that reported bilateral XFS to be more frequently seen than unilateral XFS (20). The reported prevalence of glaucoma among those with XFS has been found to vary in different populations: 2.8% in South Africa, 12.0% in Iceland, 14.2% in Australia, (11, 21, 22) and 14.4% in this study.

#### Limitation of the study

The limitation of this study was the use of a portable slit lamp and direct ophthalmoscope – with these instruments, it is not possible to detect all XFS cases and glaucomatous optic neuropathy.

#### Conclusions and recommendations

This study has shown that XFS is an age-related disorder, and that prevalence increases with age. The prevalence of XFS among Ethiopian individuals aged 40 years and above in Baso and Worena District, central Ethiopia, was 13.2%. Our study has shown that XFS is age-related and prevalence was highest (35.2%) for those age between 70 and 79.

Since the prevalence of XFS is high in Ethiopia, ophthalmologists should look for this condition before doing cataract surgery, in order to prevent or decrease intraoperative complications. While this study showed a high prevalence of XFS, a study conducted in Tanzania revealed zero prevalence. The reason for this difference may be due to study design, genetics and environmental factors, such as high coffee

consumption and low folic acid food intake. Further studies that have a good design, that are based on a representative population, which examine why there is a peculiarly high prevalence of the disorder, and which explore its associated factors, are warranted.

#### Acknowledgements

We would like to thank Professor Abebe Bejiga, Dr. Negussie Deyessa and Ato Wassie for their invaluable comments. We would also like to thank study participants and Baso/Worena District Health Office for all their assistance during data collection.

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