



Prevalence of Pseudoexfoliation Syndrome and Associated Factors among Adult Patients attended Menelik II Comprehensive Referral Hospital: Cross-Sectional Study

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Abstract

Background: Pseudoexfoliation syndrome is an age-related disorder characterized by the deposition of a distinct fibrillar extracellular material in various tissue and organs of the body. Ocular conditions including glaucoma and cataract are usually seen in patients with pseudoexfoliation syndrome. PEX etiopathogenesis involves both genetic and environmental factors. The lysyl-oxidase-like 1(LOXL1) gene, has been identified as strong genetic risk factors for PEX syndrome.

Objective To assess prevalence of pseudoexfoliation syndrome and associated factors among adult outpatients attended Menelik II Referral Hospital, Addis Ababa, Ethiopia from April to May 2024.

Methodology: A Hospital based cross sectional study was conducted among 334 adult outpatients who had attended Menelik II Referral Hospital from April to May 2024. Data was collected by PI using structured questionnaire then entered to SPSS version 26 for analysis. The descriptive statistics summarized and presented using summary statistics such as frequency tables and graphs. Binary logistic regression is used to identify candidate variables. Variables with p -value < 0.2 in binary logistic regression are further entered into a multivariable logistic regression model. Adjusted odds ratio with 95% CI is used to determine the strength of association and variables having p -values of less than 0.05 is considered as statistically significant. The final result of the analysis was presented by tables and graphs.

Result: A total of 334 adults participated in the study with a response rate of 93.3%. The median (\pm IQR) age of study respondents was 60(\pm 12) years and 53.3% were males. The proportion pseudoexfoliation syndrome was 37.1% [95% CI 31.7%, 41.9%]. The mean IOP and mean age were significantly higher among patients with pseudoexfoliation syndrome. Age, high IOP, glaucoma, cataract and outdoor work were significantly associated with the proportion of pseudoexfoliation. CCT was comparable between those with and without pseudoexfoliation syndrome..Thinning of CCT identified with aging.

Conclusion: *The study revealed the high prevalence of pseudoexfoliation syndrome among participants aged 40 years and older, and identified significant associations of pseudoexfoliation syndrome with age, elevated intraocular pressure (IOP), glaucoma, cataract, and outdoor work. Being hospital based study not involving large population of the various regions and ethnicity of the country limits to infer the study result to the whole population. Study at large scale representing population of the country is recommended to identify related factors to pseudoexfoliation syndrome in Ethiopia.*

Key words: *Pseudoexfoliation syndrome, CCT, Ethiopia, Addis Ababa.*

ABBREVIATIONS

CCT....CENTRAL CORNEAL THICKNESS

IOP...INTRAOCULAR PRESSURE

PEX...PSEUDOEXFOLIATION SYNDROME

PXG....PSEUDOEXFOLIATIVE GLAUCOMA

Introduction

Background

The ocular condition known as Pseudoexfoliation syndrome (PEX) was initially seen in Finnish patients in 1917(1). However, there is considerable variation in the prevalence of PEX across different regions and ethnic groups (2) and these variations may be attributed to differences in examination methods, the level of awareness among both doctors and patients and also age and demographics(3).

PEX clinically characterized by the deposition of fibrillo-granular material throughout the anterior segment of the eye. It is often accompanied by elevated intraocular pressure with or without glaucomatous optic nerve and visual field damage(4). PEX is considered not only as intraocular disease but as ocular manifestation

of a systemic disorder characterized by abnormal connective tissue metabolism throughout the body(5).

Statement of the Problem

Pseudoexfoliation syndrome is an ocular disorder associated to open angle glaucoma, which is known as pseudoexfoliation glaucoma and it is the most common secondary open angle glaucoma worldwide(6). PEX is an ocular condition that can affect either one or both eyes and becomes prominent as a person gets older(7). Additionally, it shows geographical and ethnic differences(8).zonular dehiscence can cause phacodonesis, lens subluxation/dislocation, and increased risk of vitreous loss during cataract extraction, thereby impacting cataract surgery techniques (7). The prevalence of pseudoexfoliation syndrome varies significantly among different ethnicities, reaching to approximately 30% in individuals from Scandinavian countries(9).

Rational of the Study

Pseudoexfoliation syndrome is an ocular disorder which varies among different regions and ethnic groups in ethiopia,and it is connected to multiple surgical complications and glaucoma. This research has several significant implications, Determining the prevalence and associated risk factors of PEX can contribute to the development intervention strategies and preventive measures to reduce the burden of PEX-related ocular complications in Ethiopia. Assessing the impact of PEX on visual acuity will help eye care professionals in Ethiopia enhance diagnostic approaches and management protocols targeted to the local population Hence, by evaluating the occurrence of pseudoexfoliation syndrome in Menelik II Referral Hospital, Addis Abeba,ethiopia it will provide valuable information about the ethnic and environmental factors distribution and clinical significance of this ocular condition and the study will contribute as valuable input for future research in this ocular condition.

Methods and Materials

Study Area

Menelik II Referral Hospital is located in Addis Ababa, the capital city of Ethiopia .It is one of the oldest hospitals in the country ,established and named after Emperor Menelik II in the late 19th century.it is tertiary eye care hospital . Moreover, Menelik II Referral Hospital is a peculiar institution in Ethiopia eye health care

system, contributing tremendously in training residents and fellowship programs , research and eye care .
The study has conducted among adult outpatient attending at this hospital.

Study design and period

Hospital based cross sectional study was conducted to assess the prevalence and associated factors of pseudoexfoliation syndrome among adult outpatients visiting Minilik-II Referral Hospital Addis Abeba, Ethiopia from April to May 2024

Source and study population

Source of population

All patients visiting outpatient department of Menelik II Referral Hospital during the study period

Study population

All adult patients (age >40) who visit ophthalmology department of Menelik II Referral Hospital during the study period were included.

Study unit

Consecutive patients age 40 and above visiting ophthalmology department of Menelik II Referral Hospital during the study period

Eligibility criteria

Inclusion criteria

All adult patients age above 40 were included

Exclusion criteria

Mentally or seriously ill

Patients with corneal opacity which hinders anterior segment examination

Sample size and sampling technique

The sample size needed for determining is calculated based on single population proportion formula.

By using the following assumptions:

$$n = (Z_{\alpha/2})^2 * p * (1-p) / d^2$$

Where: n=Sample size

Z= 1.96, 95% confidence level

P=34.6%

q =1-p

d= 5%

the sample size is calculated using the single population formula above considering the proportion of PXF ,p=34.6% which is taken from a study done in Gondar ,Ethiopia 95 % confidence interval and margin error of 5%. Then the calculated sample size is N =341 plus 5% non-response rate final sample size is 358.

All consecutive patients who came during the study period were included until the required sample size obtained.

STUDY VARIABLES

Dependent variable

Pseudoexfoliation syndrome

Independent variable

Socioeconomic and demographic characteristic

Age, Sex, Occupation, personal Income, outdoor activity, coffee consumption, smoking,

Ocular characteristics IOP, VA, CCT, cataract, glaucoma

OPERATIONAL DEFINITION

Participants were identified as having pseudoexfoliation syndrome if they showed any signs of

pseudoexfoliative material on the iris, pupil, or lens capsule in either eye, observed both before and after a dilated eye examination. Glaucoma was diagnosed in those with characteristic optic nerve damage or visual field defects, history of using anti-glaucoma medications or history of glaucoma surgery. participants who were exposed to direct sunlight(outdoor workers) were as considered as exposed to the sun. Additionally, individuals who consumed more than three cups of coffee daily were classified as coffee consumers.

DATA PROCESSING AND ANALYSIS

Data collection tools and procedures

After getting written informed consent a structured questionnaire was used and administered to collect demographic, lifestyle, and systemic health information. All participants were new patients taken from triage clinic. All ophthalmic examination was done by first investigator. Intraocular pressure measurement was done using Zeiss Visu plan 500(air puff tonometer), and visual acuity was assessed using illuminated Snellen chart. Comprehensive Ophthalmic examinations, slit-lamp bio-microscopy consisting full anterior segment examination to identify PEX and hand held ultrasound pachymeter ((Keeler PachPen) was performed after applying topical tetracaine to measure central corneal thickness. Posterior segment was assessed with Volk 90D lens after pupillary dilation with 1% tropicamide.

Data quality assurance

At the end of each day, all of the collected data was reviewed and checked for completeness and entered into a prepared data analysis software using SPSS Version 26 by the first investigator

Data processing and analysis

-> Data was entered, coded and analyzed using SPSS Version 26. Variables were compared using the appropriate statistical tests. P Values <0.05 was considered statistically significant.

-> Data was analyzed for frequency, range, mean and standard deviation of the different sociodemographic characteristics.

-> Any association of sociodemographic characters with the frequency pseudoexfoliation was analyzed

Result

1. Socio-demographic Characteristics of Study Participants

This study consisted of 334 adults who are age of 40 and above, which represents 93.3% response rate and 178 of them were males and 156 were females. The mean and median age of participants was 60 ± 11.89 and 60 respectively. The majority of the study participants were Orthodox (66.8%) followed by Muslim (21.3%), Protestant (9.9%) and Others (2.1%).

Table 1: Scio-demographic characteristics of the study participants, Menelik II Referral Hospital, Addis Ababa, Ethiopia 2024

Variable	Frequency	Percentage (%)
Age(years)		
40-50	87	26.0
51-60	96	28.7
61-70	89	26.6
>70	62	18.6
Sex		
Male	178	53.3
Female	156	46.7
Residence		
Rural	99	29.6
Urban	235	70.4
Religion		
Orthodox	223	66.8
Muslim	71	21.25
Protestant	33	9.9
Other	7	2.1
Educational level		
Unable to read and write	106	31.7
Only able to read and write	73	21.9
Primary education	51	15.3
Secondary education	46	13.8
College/University	58	17.4
Occupation		
Farmer	53	15.9
Merchant	22	6.6
Civil servant	43	12.9
Other	216	64.7
Martials status		
Single	19	5.7
Married	240	71.9
Divorced	18	5.4

Widowed	56	16.8
Others	1	0.3
Monthly income		
<1000	186	55.7
1000-2000	34	10.2
2001-3000	31	9.3
>3000	83	24.9

2. Ocular, Systemic and Behavioral Characteristics of Study Participants

Pseudoexfoliation material was identified in 124 participants, representing 37.1% of the study group. Among these, 84 participants (67.74%) had bilateral pseudoexfoliation, while 40 participants (32.26%) had unilateral pseudoexfoliation.

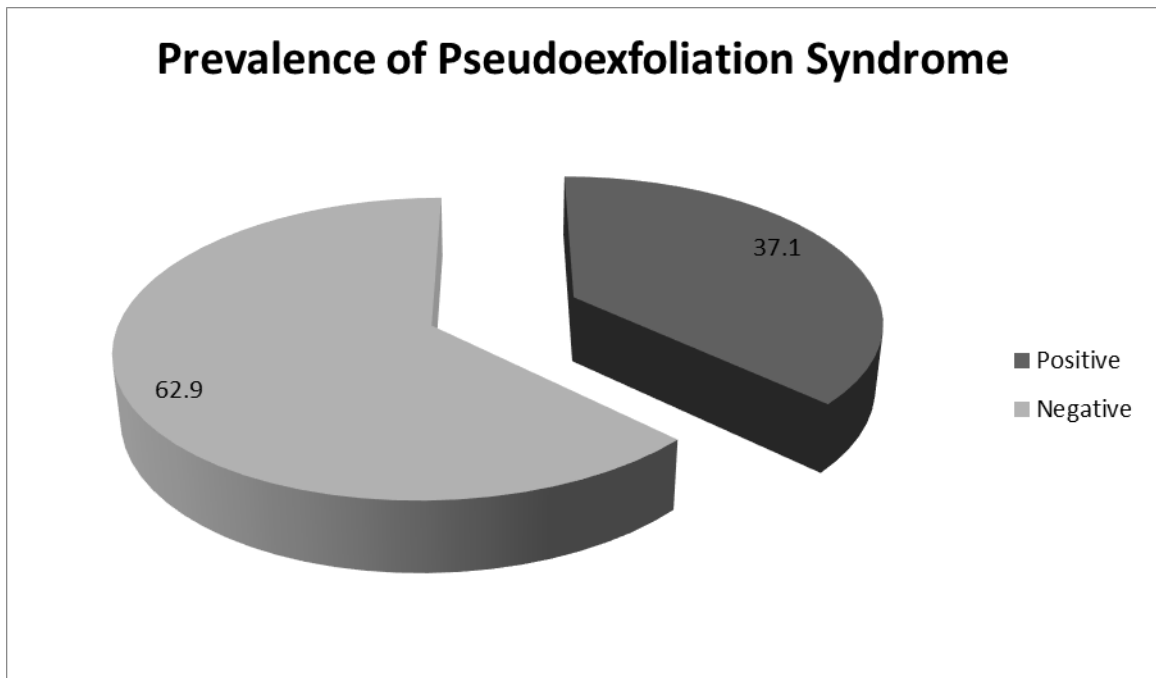


Fig 1: Prevalence of Pseudoexfoliation Syndrome

Table 2: Ocular, Systemic and Behavioral characteristics of the study participants in Menelik II Referral Hospital, Addis Ababa, Ethiopia 2024

Variables	Frequency	Percentage (%)
IOP (mmHg)		
OD ≤21	238	71.3
>21	96	28.7
OS ≤21	239	71.6
>21	95	28.4
Ocular condition		
Glaucoma	73	21.9
Cataract	166	49.7
Hypertension		
Yes	78	23.4
No	256	76.6
DM		
Yes	57	17.1
No	227	85.9
Sun exposure		
Yes	131	39.2
No	203	60.8
Coffee consumption		
Yes	101	30.2
No		

The bar chart below illustrates the percentage of participants with pseudoexfoliation syndrome (PEX) across different age groups. The chart shows the trend of PEX prevalence with age.

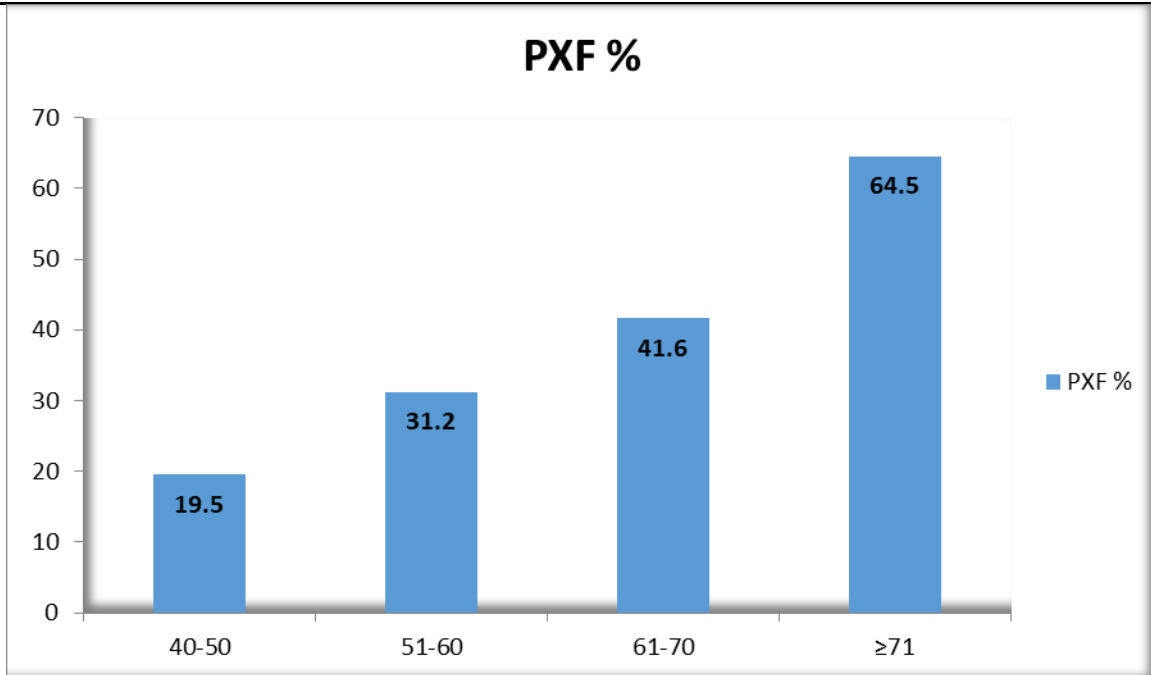


Fig 2: Prevalence of Pseudo-exfoliation Syndrome with respect to Age

The prevalence of PXF increases as visual acuity decreases. A statistical significance association was found between lower visual acuity and a likelihood of having PXF, P Value <0.05

Table 3: Association between the level of uncorrected visual acuity and the prevalence of PXF , Menelik II Referral Hospital Addis Ababa, Ethiopia 2024

		PXF PREVALENCE		P-value
		Positive no (%)	Negative no (%)	
VA OD	>6/18	21(18.4)	93(81.6)	<0.001
	6/18-6/60	21(26.6)	58(73.4)	
	6/60-3/60	33(57.9)	24(42.1)	
	<3/60	49(58.3)	35(41.7)	
VA OS	>6/18	23(19.7)	94(80.3)	<0.001
	6/18-6/60	14(21.9)	50(78.1)	
	6/60-3/60	24(48.0)	26(52.0)	
	<3/60	63(61.2)	40(38.8)	

3 Central Corneal Thickness of Study Participants

Regarding the central corneal thickness the results shows the following measurements ,Mean CCT for overall patient population was 519 ± 33.19 (Range 421-630) microns in the right eye and 520 ± 34.31 (Range 420-665) in the left eye.

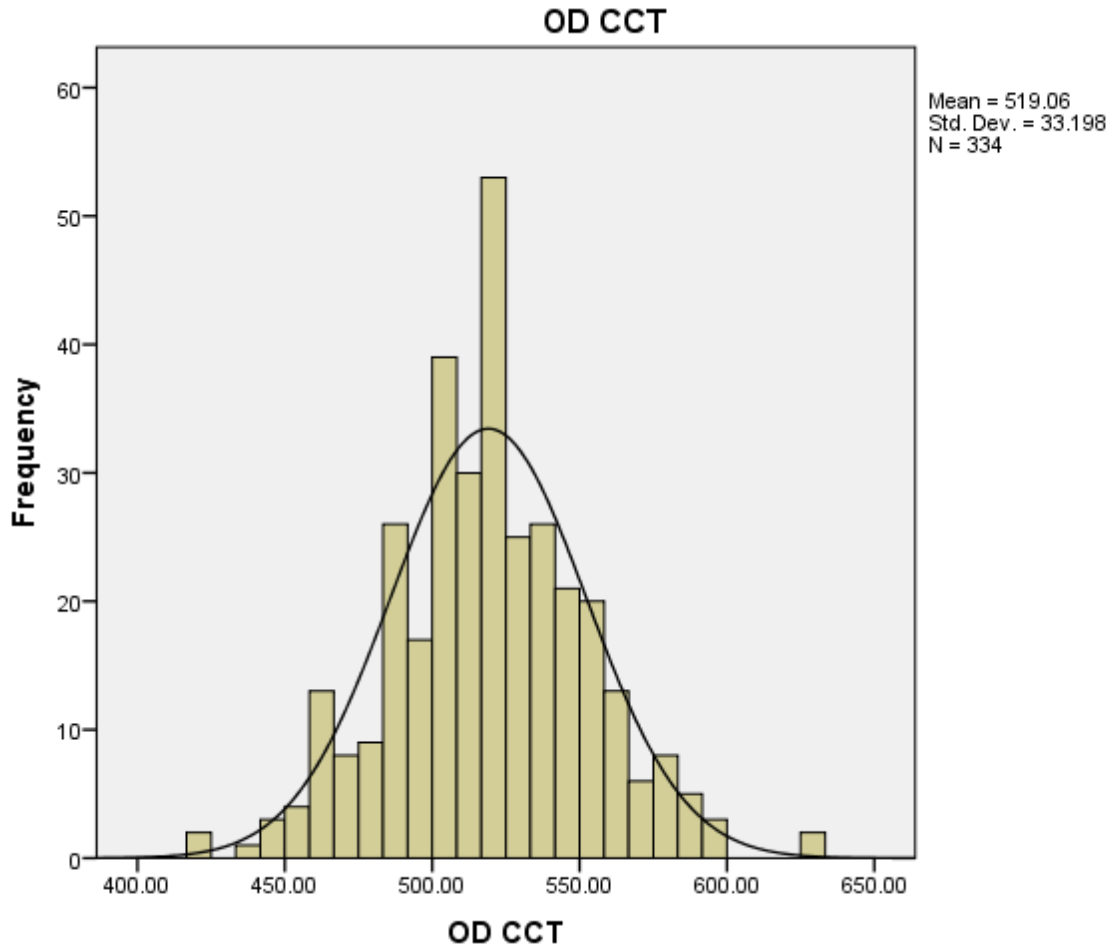


Figure 3: OD Central Corneal Thickness

There was no statistically significant difference in the mean Central Corneal Thickness (CCT) between the pseudoexfoliative group (517 ± 36) and the non-pseudoexfoliative group (520 ± 31), with a p-value of 0.456. Similarly, there was no statistically significant difference in CCT between both eyes and across sexes ($P > 0.05$).

A one-way ANOVA with post hoc analysis was conducted to compare the mean Central Corneal Thickness (CCT) across different age groups. The results showed that the mean CCT significantly decreases with

increasing age:

- Ages 40-50: 528±33
- Ages 51-60: 522±31
- Ages 61-70: 516±32
- Ages >71: 504±31

The p-value for these differences was less than 0.05.

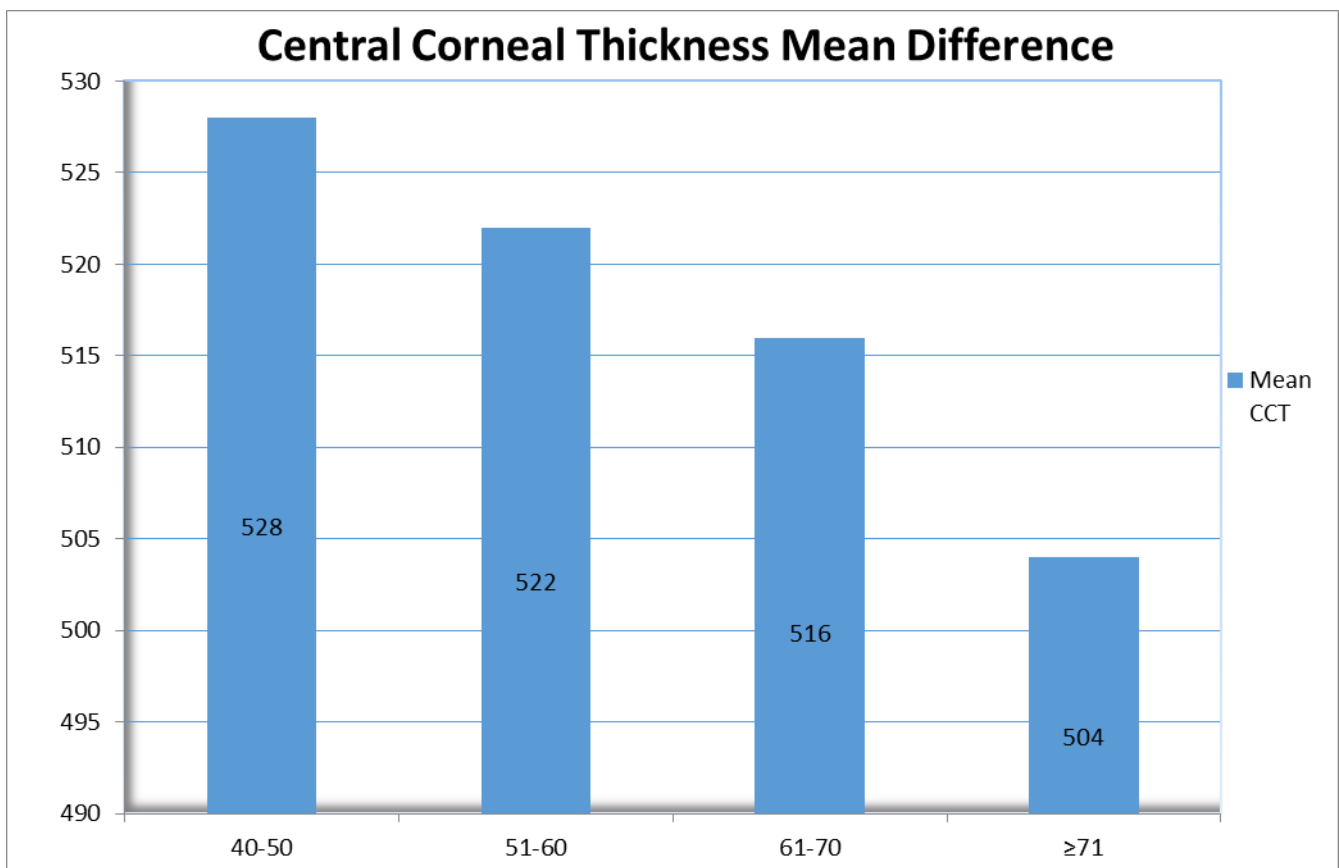


Figure 4: Mean CCT difference between Age groups

Table 4: Binary and multivariate logistic regression showing associated factors for Pseudo-exfoliation Syndrome among adults Addis Ababa, Ethiopia

Variables	PSEUDOEXFOLIATION		COR(95%CI)	AOR(95%CI)	p-value
	Positive (%)	no no (%)			
Age (in years)					
40-50	17(19.5)	70(80.5)	7.49(3.56,15.73)	4.22(1.61,11.09)	0.003
51-60	30(31.2)	66(68.8)	4.00(2.04,7.86)		0.001
61-70	37(41.6)	52(58.4)	2.56(1.31,4.99)	4.35(1.79,10.58)	0.006
>70	40(64.5)	22(35.5)	1.00(1.00,1.00)	3.43(1.41,8.30)	0.005
				1.00(1.00,1.00)	
Sex					
Female	51(32.7)	105(67.3)	1.43(0.91,2.24)	0.89(0.46,1.71)	0.716
Male	73(41)	105(59)	1.00(1.00,1.00)	1.00(1.00,1.00)	
Occupation					
Outdoor work	83(63.4)	48(36.6)	1.00(1.00,1.00)	1.00(1.00,1.00)	
Indoor work	41(20.2)	162(79.8)	6.83(4.17,11.19)	6.39(3.36,12.16)	0.000
Educational status					
Unable to read and write	65(61.3)	41(38.7)	1.00(1.00,1.00)	1.00(1.00,1.00)	0.047
Able to read and write	19(26.0)	54(74.0)	4.51(2.35,8.66)	3.47(1.46,8.25)	0.005
Primary education	17(33.3)	34(66.7)	3.17(1.57,6.39)	2.30(0.96,5.52)	0.063
Secondary education	11(23.9)	35(76.1)	5.04(2.31,11.03)	2.90(1.00,8.39)	0.049
Higher education	12(20.7)	46(79.3)	6.08(2.88,12.81)	2.62(0.95,7.23)	0.064
Residence					
Rural	56(56.6)	43(43.4)	1.00(1.00,1.00)	1.00(1.00,1.00)	
Urban	68(28.9)	167(71.1)	3.20(1.97,5.21)	1.49(0.72,3.08)	0.278
IOP					
>21 mmHg	56(58.3)	40(41.7)	1.00(1.00,1.00)	1.00(1.00,1.00)	
≤21 mmHg	68(28.6)	170(71.4)	3.50(2.14,5.73)	3.54(1.80,6.95)	0.000
Glaucoma					
Yes	42(57.5)	31(42.5)	1.00(1.00,1.00)	1.00(1.00,1.00)	
No	82(31.4)	179(68.6)	2.96(1.74,5.04)	2.43(1.19,4.97)	0.015
Cataract					
Yes	87(52.4)	79(47.6)	1.00(1.00,1.00)	1.00(1.00,1.00)	
No	37(22.0)	131(78.0)	3.90(2.42,6.27)	2.06(1.07,3.97)	0.030
Hypertension					
Yes	30(38.5)	48(61.5)	1.00(1.00,1.00)	1.00(1.00,1.00)	
No	94(36.7)	162(63.3)	1.08(0.64,1.82)	1.71(0.81,3.60)	0.159
DM					
Yes	14(24.6)	43(75.4)	1.00(1.00,1.00)	1.00(1.00,1.00)	
No	110(39.7)	167(60.3)	0.49(0.26,0.95)	0.89(0.36,2.18)	0.802
Coffee					
Yes	98(42.1)	135(57.9)	1.00(1.00,1.00)	1.00(1.00,1.00)	
No	26(25.7)	75(74.3)	2.29(1.40,3.76)	1.78(0.91,4.50)	0.093

In patients with PEX, the average intraocular pressure (IOP) was 22±10.3, significantly higher than the 17.2±5.4 observed in those without PEX (p-value <0.001). Additionally, the proportion of PEX among

patients with an IOP greater than 21 mmHg was 58.3%, significantly higher compared to the 28.6% in patients with an IOP of 21 mmHg or less (p-value <0.001).

Similarly the proportion of PXF was significantly higher in patients with glaucoma (57.5%) compared to those without glaucoma (31.4%).

The average age of patients with PEX was significantly higher at 65 ± 12 years compared to 57 ± 11 years for those without PEX (p-value <0.001). Furthermore, the prevalence of PEX increased with age significantly (p-value <0.05): 19.5% among patients under 50 years, rising to 64.5% in patients over 70 years.

The proportion of PXF did not show a statistically significant difference between males and females.

The proportion of PXF was significantly higher in participants who had outdoor occupation (63.4%) than those who have indoor occupations (20.2%). Moreover the proportion of PEX was significantly higher among illiterate participants and there was no statistically significant association between PXF and coffee users (p value 0.093).

Discussion

In this study, the proportion of PEX among adults over 40 years old was 37.1% [95% CI 31.7%, 41.9%]. This is comparable to a study conducted in Gondar in 2019, which reported a prevalence of 34.6% (12), and another study in Jimma in 2009, which found a prevalence of 35.82% (7). This consistency may be attributed to the fact that these are hospital-based studies. However, this study's prevalence is higher compared to other researches, such as studies from central Ethiopia (Baso and Worena) at 13.2% (13), Egypt in 2009 at 4.14% (15), Greenland at 4.5% (21), and Saudi Arabia at 3.5% (22). This variation may be explained by differences in study design, with the latter studies being community-based rather than hospital-based.

In this study, the proportion of PXF significantly increases as the age increases similar to studies done between February 2005 and June 2008, in Kinshasa (16), central Ethiopia, Baso and Worena (13) 2009 and 2011 in Western India (23) and this strengthen that PEX strongly age related process.

There was no significant gender predominance in our study ,in contrast a study done in 2005 and June 2008 Kinshasa(16) showed it was higher among females This may perhaps be due to women spending most of their time carrying out more outdoor activities compared with men but a study done in Gondar,2019 showed male predominance (12).

The result of this study showed that the mean IOP was significantly high among patients with PXF and the proportion of PXF among study participants with IOP >21mmHg 58.3 % was significantly higher than those having IOP ≤21mmHg 28.6%. this result is consistent with the study done in Baso and Worena(13),Gondar (12) and Mogadishu(14).

Previous studies have demonstrated an association between glaucoma and PXF, as seen in research from Gondar(12), Egypt,(15) and Kinshasa(16). Similarly, this study also found a significantly higher proportion of glaucoma among participants with PXF (57.5%) compared to those without it (42.5%). Therefore, identifying PXF is crucial for diagnosing and managing PXG, which is an aggressive form of glaucoma.

Participants who worked outdoors had a higher proportion of PXF compared to those working indoors, consistent with findings from studies conducted in Gondar and Korea(12,19). This may be attributed to increased sun exposure, which could contribute to a higher incidence of PXF.

In this study, there was no statistically significant difference in mean central corneal thickness (CCT) between the pseudoexfoliative group (517±36) and the non-pseudoexfoliative group (520±31) with a p-value of 0.456. This contrasts with research from India(23), which found that the pseudoexfoliative group had a thinner cornea. Additionally, this study observed that corneal thickness decreases significantly with age, aligning with findings from study conducted in Lithuanian adults(28). The thinning of the cornea with age may be attributed to reduction in keratocyte density and dehydration over time.

Conclusions

The study revealed the high prevalence of pseudoexfoliation syndrome among participants aged 40 years and older, and identified significant associations of pseudoexfoliation syndrome with age, elevated intraocular pressure (IOP), glaucoma, cataract, and outdoor work. Being hospital based study not involving large population of the various regions and ethnicity of the country limits to infer the study result to the whole population. Study at large scale representing population of the country is recommended to identify related factors to pseudoexfoliation syndrome in Ethiopia

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