

Prevalence of Pre-mature Presbyopia In Diabetic And Non Diabetic person: A Cross Sectional Community Based Study In Rural Lucknow

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Abstract

Aim: Onset premature presbyopia is common in diabetic person compare to non diabetic person. **Background:** Presbyopia is a natural aging process of the eye in which the loss of flexibility of the crystalline lens takes place over a number of years. **Material and methods:** A comparative cross-sectional study was carried out in camp organized by department of optometry Era University, in rural area of Lucknow between 2017 and 2018. Within the context of this survey, 1066 eligible patients at least 30 years were randomly selected for interview and underwent near-vision testing. Eligible patients were refracted and given best distance correction. A sample of 1066 people aged 30–90 years with distance visual acuity >6/18 with snellen chart was selected. **Results:** Onset of presbyopia across various ages among diabetes group was different compared to normal group. Onset of presbyopia in patients aged from 30 to 35 years, was 7 out of 7(100%) among diabetes group and 0% in normal group (0 out of 133). **Conclusions:** The results indicated that the onset of presbyopia among diabetes group was earlier than normal group.

Key words: Presbyopia, people, prevalence, lens flexibility, accommodation, diabetes.

I. INTRODUCTION

Diabetes is a comparatively prevalent and serious disease caused by the inability of the body to produce insulin or consume sugar. In diabetics, either pancreas is not capable of producing adequate insulin, or cells might not be able to appropriately respond to insulin. In the basis of World Health Organization (WHO) definition, 2-hour glucose of over 200 is called "problematic", and 2-hour glucose of 140-200 is called "impaired glucose tolerance". Also, fasting glucose of over 100 mg/dl is called "problematic", and that of 100-126 is called "impaired fasting glucose tolerance"¹⁻³. Chronic high blood sugar causes changes in all blood vessels which in turn engage sensitive bodily organs in minor and major complications such as stroke, myocardial infarction, cardiac failure, renal failure, as well as ophthalmological disorders. Diabetic ophthalmological disorders are among the major causes of blindness and low vision worldwide, annually engaging hundreds of thousands of patients in severe ophthalmological conditions. Presbyopia is the age-related reduced accommodation and is frequently associated with a progressive inability to read fine print and to write⁴. The onset of presbyopia depending to the near tasks but is gradual and the patient's accommodative amplitude becomes inadequate for his or her visual needs. There are substantial optical changes in the human lens with increasing age and during accommodation, since both the magnitude and the sign of the spherical aberration change with age and stretching⁵. Good near vision is important, even among populations who use it for tasks other than reading and writing. The human lenses exhibited a distinct viscoelastic behavior and the research evidence most strongly supports a loss of elasticity of the crystalline lens, although changes in the lens's curvature result from continual growth and loss of power of the ciliary muscles. With progressive hardening and the loss of elasticity of the lens, and its ectodermal growth it will become harder and harder for the ciliary muscle to accommodate by contraction⁶⁻⁸. Study show that means intraocular pressure in diabetes was more than in non diabetes. However, the mean intraocular pressure among both sexes of both groups did not show a significant statistical difference⁹.

Current global estimates show that approximately 1.1 billion people are affected by presbyopia, nearly a third of them are 50 years or older¹⁰. From crude data available, the prevalence of presbyopia is projected to be 35.6% in people aged 35 years and older and increases to 40.3% for people aged 50 years and older¹⁰. More than 90% of these individuals are in developing countries^{11,12}. It also adversely affects quality of life, both in the developed and developing world¹³, and has a huge impact on productivity¹⁴. However, there is conflicting evidence from different studies showing that investment in health improves productivity¹⁵⁻¹⁸. It is also known that the global labour productivity has slowed down negatively, affecting the global economy. The study shows that a simple pair of presbyopic glasses in tea workers (mainly women) in India improved their productivity by more than 20%. Moreover, with increasing age, productivity increased in the intervention group, but it decreased in the control group, indicating the adverse effects of uncorrected presbyopia on productivity with increasing age. Productivity in the intervention group also increased with increased compliance to glasses and consequent improvement in quality of life. Functional presbyopia (i.e, vision less than N8 restored to N8 with correction) has to be differentiated from objective presbyopia, which includes individuals who need correction both for distance and near vision, to plan for targeted interventions.

The prevalence of presbyopia in different countries is reported by various studies. It is estimated that there were 1.04 billion people globally with presbyopia in 2005, of which 517 million had no spectacles or inadequate spectacles¹⁹. Of 400 people aged 40–50 years in Zanzibar, East Africa, the overall prevalence of presbyopia was 89.2% and out of them who needed correction, only 17.7% had spectacle²⁰. In south India of 5587 subjects 30 years of age or older had prevalence of presbyopia was 55.3%²¹.

Diabetes fatally affects all the major parts of the body and can even be a major contributing risk factor for visual impairment. Many studies have explored the association between diabetes and age-related eye diseases ARED. A total of 61.7% of 1709 persons age 40 years and older who resided in 3 villages of Tanzania were presbyopic. A higher prevalence of presbyopia was associated with increased age, female gender, higher educational level, and residence in town²². A study indicated the prevalence of presbyopia of the 800 patients who lived in rural areas, was 286(35.75%) and they began showing entered presbyopia at or before the age of 38 years²³⁻²⁴. The onset of presbyopia in this report may be a result of environmental conditions including high average temperature, significant much ultraviolet radiation, chronic deficiency of essential amino acids, and exposure to toxic factors, particularly hair dye. In the year 2000, blindness or low vision, mainly caused by age-related eye diseases (ARED, including cataract, glaucoma, age-related macular degeneration (AMD), and diabetic retinopathy (DR), affected more than 3.3 million Americans aged 40 years or older; this number is predicted to increase more than 50% by 2020²⁶. Diabetes harms nearly every organ of the body, causes many diseases, and worsens the general health of smokers. Tobacco annually results in approximately 443,000 deaths in the United States²⁷. Many studies have explored the association between diabetes and ARED. The 2004 Surgeon General's report on diabetes concluded that a causal relationship exists between diabetes and nuclear cataract and found evidence that was suggestive of a relationship between diabetes and AMD²⁸. Several observational studies have determined that diabetes is a strong risk factor for the development of neovascular age-related macular degeneration, cataract, and thyroid eye diseases^{29, 30}. A few studies is conducted on Prevalence of presbyopia among Diabetes population in Iran, Therefore we designed this study with the aim of determining the prevalence of differences in age at onset and progression of presbyopia between diabetes and non diabetes patients in Qazvin-Iran³¹.

II. METHODS

A comparative cross-sectional study was carried out in camp organized by department of optometry Era University, in rural area of Lucknow between 2017 and 2018. The aim of this study was to determine the correlation between the onset of presbyopia and diabetes. Within the context of this survey, 1066 eligible patients at least 30 years were randomly selected for interview and underwent near-vision testing. Eligible patients were refracted and given best distance correction. A sample of 1066 people aged 30–90 years with distance visual acuity >6/18 with Snellen Chart was selected. Of those studied enumerated 700 were categorized as samples and 366 of participants as controls, normal group were aged between 40 and 90 years of old who coming to eye camp and were unable to read the N8 optotype with distance correction in place. Eligible subject referred to Rural Health Center of Era Lucknow Medical College for ophthalmic examination that included Snellen Visual acuity, color vision, slit lamp biomicroscopy of the anterior segment as well as examination of the fundus. Demographic data including age and gender were obtained from all participants. Testing both habitual distance visual acuity (uncorrected or with current correction) and corrected near visual acuity identifies refractive error or ocular disease and enables assessment of the patient's ability to function during near tasks. Near vision was tested and corrected to the nearest +0.75 diopter. Near visual acuity is defined as the ability to read the N8 optotype at a distance of 25-35 cm in the participant's usual visual state J-chart. Ocular refraction was measured using streak retinoscope. Snellen visual acuity measurements were taken using a standard projected eye chart with black letters on a white background. Subjective refraction was performed on the right and then the left eye of all eligible subjects, both without (uncorrected visual acuity) and with (presenting visual acuity) spectacles. The data collected were analysed using SPSS program with Chi2 and student t test with $P < 0.05$.

III. RESULT

1066 participants were included in our study. Of those, 707 diabetes were categorized as samples and 359 normal (healthy) patients as control group. People were aged between 30 and 90 years. Age of Onset of presbyopia among sample group was between 30 and 70 years and it was 40 to 90 years among control group (table 1 and figure 2).

Among all groups irrespective to diabetic and non diabetic the male subjects were either farmer or house worker and factory worker. Female workers were maximum house wife.

Onset of presbyopia across various ages among diabetes group was different compared to normal group. (table 1 & figure 2), onset of presbyopia in patients aged from 30 to 35 years, was 7 out of 7(100%) among diabetes group and 0% in normal group (p value < 0.05 , $=0.001$). 90 out of 99 (91%) were presbyopes in group aged 36-40 years were using glasses for near task in diabetic groups while only 4 out of 43 reported using glasses in normal group (p value < 0.05 , $=0.001$). 137 out of 137 patients with ages between 41-45 year among diabetes group needed to use glasses for near tasks, but 32 out of 34 in normal group needed presbyopic glasses. There were significant differences in the age of onset and earlier progression of presbyopia was detected between diabetes and normal patients ($p = 0.001$). The results of this study showed diabetes patients catch presbyopia at earlier ages than non-diabetes patients. This study reported that, 20% of patients in diabetes group and 10% in normal group had positive family history of diabetes. There was significant correlation between onset of presbyopia and family history of diabetes ($P < 0.01$).

Table 1:- Prevalence of presbyopia among various ages in Diabetic and non diabetic groups (no=1066).

Age Groups(year)	DM			NDM			Total	p Value
	Total	Presbyopes	%	Total	Presbyopes	%		
30-35	7	7	100%	133	0	0	140	$\chi^2=140, <.001$

36-40	99	90	91%	43	4	9.30%	142	$\chi^2=89.2, <.001$
41-45	137	137	100%	34	32	94%	171	$\chi^2=8.15, .004$
46-50	131	131	100%	27	27	100%	158	NA
51-55	83	83	100%	21	21	100%	104	NA
56-60	91	91	100%	43	40	93%	134	$\chi^2=6.49, .011$
61-65	66	66	100%	21	20	95%	87	$\chi^2=3.18, .075$
66-70	39	39	100%	13	10	77%	52	$\chi^2=9.55, .002$
71-75	23	23	100%	9	9	100%	32	NA
76-80	18	18	100%	10	9	90%	28	$\chi^2=1.87, .172$
81-90	13	12	92.30%	5	5	100%	18	$\chi^2=.407, .523$
Total	707	697	98.5%	359	177	49.3%	1066	$\chi^2=391, <.001$

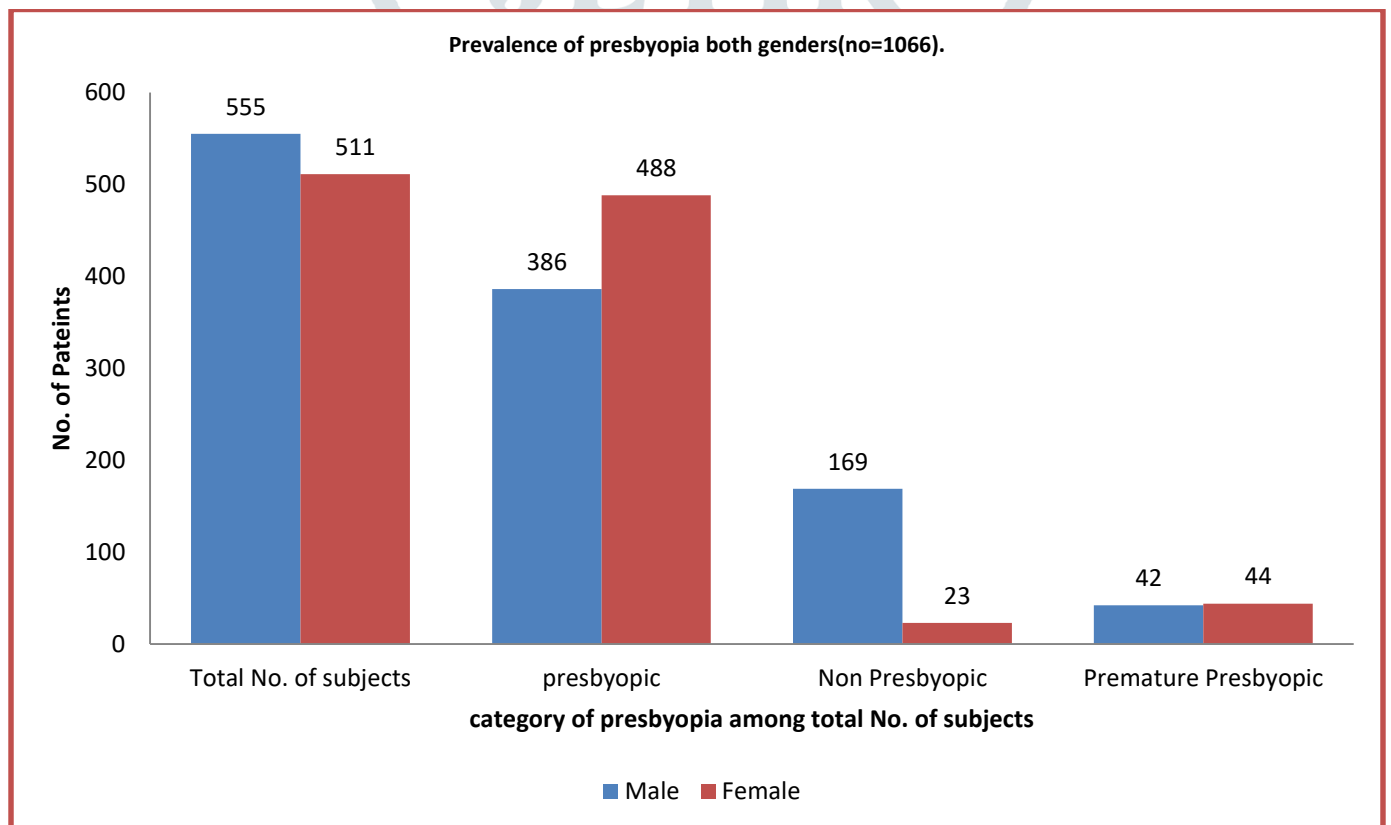


Figure 1:- Prevalence of presbyopia both genders (no=1066).

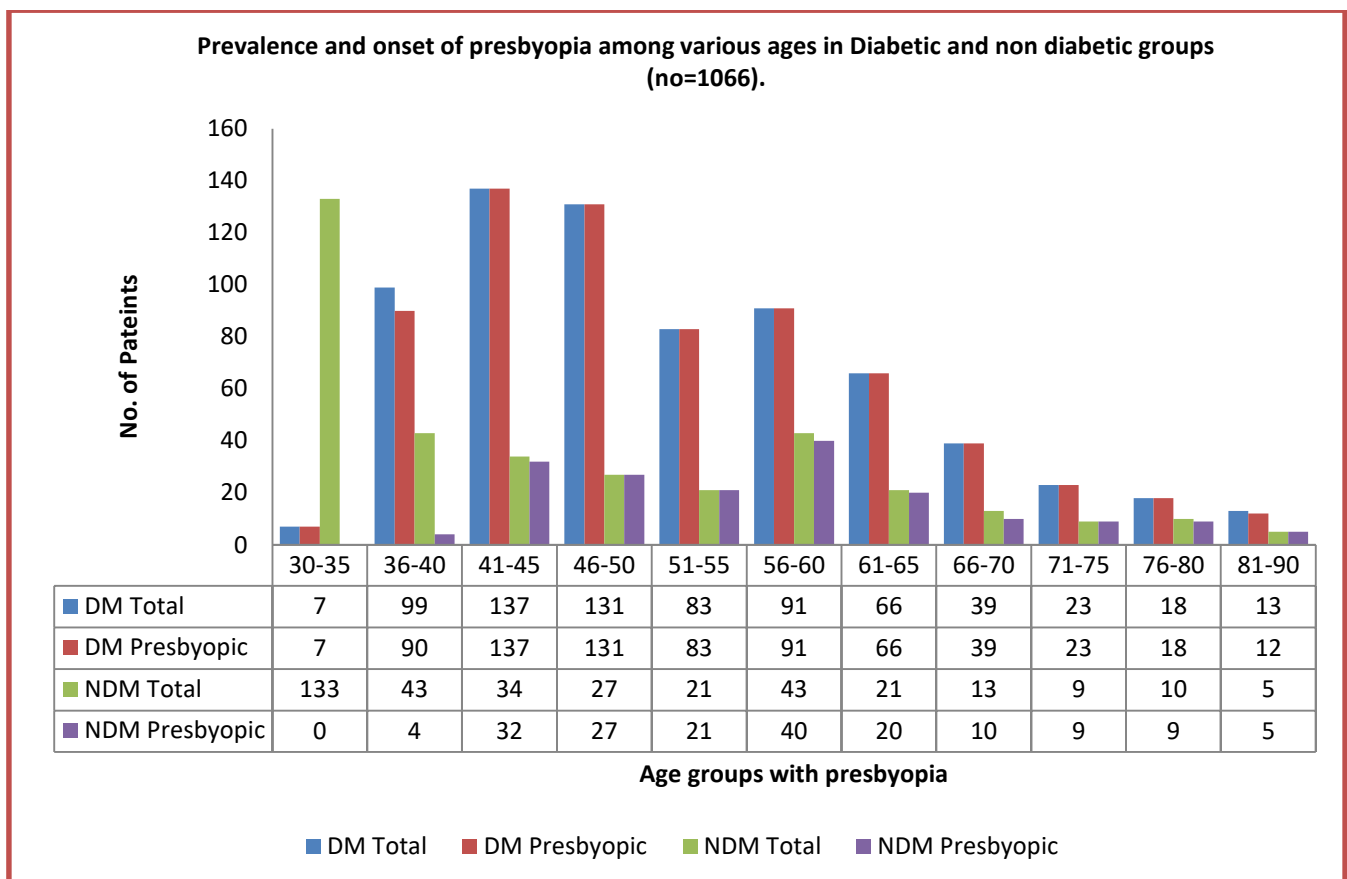


Figure 2:- Prevalence and onset of presbyopia among various ages in Diabetic and non diabetic groups (no=1066).

IV. DISCUSSION

Study indicated the mean intraocular pressure in diabetes was more than in non diabetes and the mean intraocular pressure among both sexes of both groups did not show a significant statistical difference. It may be therefore accomplished that diabetes as a dangerous, prevalent disease which annually increases, may be regarded as a factor effective in, and a basis for the increase of intraocular pressure. This fact necessitates more research on the relationship between diabetes and intraocular pressure changes. It should be noted that ocular outcomes often develop without showing any symptoms. Some tainted people even continue with their normal course of life without paying attention to the disease and referring to the physician, not seeking treatment until the disease has slowed down the every-day life or weakened the eyesight. It may be accordingly concluded that protective measures and better blood sugar control in healthy, pre-diabetics and even diabetic persons, may prevent the increase in prevalence of diabetes, and even the occurrence of intraocular pressure, presbyopia and glaucoma in the society. In this respect, it is desirable to start with education and then with prevention and treatment. As regards factors contributing to glaucoma, it has become evident that glaucoma and intraocular pressure are influenced by a variety of factors. This factor includes genetics and hereditary backgrounds so that glaucoma cases are more prevalent and observed more frequently in close relatives of the patients. In this respect, it is advisable that close relatives of the patients be paid extraordinary attention to and be subject to more specialized study over the course of prevention, treatment, and screening. The intraocular pressure was even reduced to some extent in diabetics as the age increased⁹.

Other highlights of ocular conditions caused by diabetes include refractory errors and amblyopia. According to the statistics, they are more prevalent in diabetics than in non-diabetics^{32, 33}. The study showed presbyopia was more prevalent in the diabetic group (50.5%), compared to the 40% ratio in nondiabetics⁹. Also amblyopia was more prevalent in the diabetic group (16.5%), compared to the 7.5% ratio in non-diabetics⁹.

Diabetes is directly linked to many adverse health effects, such as high blood pressure, heart disease, cancer and also eye diseases. Public awareness about the risk of eye diseases associated with diabetes is very low among large parts of the population in many countries worldwide. The findings in this study evaluated differences in age of onset and progression of presbyopia between diabetes and non diabetes groups. Our study indicated that the age of onset of functional presbyopia among diabetes was earlier compared to non diabetes. Most presbyopias among diabetes group about 91% were reported under ages of 40 years, whereas the most prevalence of presbyopia 94% of normal group were shown between 41 to 45 years of ages. According to this observation estimate, almost all patients older than 40 years have presbyopia globally³⁴. This study estimated that the less/least developed countries of Asia have a prevalence of around 43%, with average age of onset being about 40 years. In another review, from low- and middle-income countries, Patel and West⁴ found that more than half of adults over the age of 30 have presbyopia. Duarte et al., in Brazil estimated the prevalence of presbyopia in 3,000 adults of 30 years and older at 54.7 percent³⁵. In southern India, Nirmalan et al., found a prevalence of 55 percent in subjects aged 30 years and older²⁰. Although some studies reported the prevalence of presbyopia over the age of 30 years but it appears that the highest incidence of presbyopia is among 40 years of age

and older²¹. This finding is consistent with our study that has shown a 75 percent prevalence of presbyopia among participants in normal group. And some studies found that the prevalence of presbyopia in population above 50 years of age was 85.4%³⁶. Moreover diabetes may increase the risk for developing some eye diseases in particular arteriosclerosis, and is a major factor contributing to the early development of age-related macular degeneration (AMD) which may lead to blindness and some forms of cataracts that are a clouding in the lens of the eye which causes blurred vision³⁷⁻³⁹. Among the various risk factors of cataracts, diabetes is a prominent one.

There was no significant difference between two group in onset of presbyopia among patients below 45 years of age. It is important to note that this type of study has become less frequent, at least in the Asia, and is difficult to compare our study with the other population-based studies, but one study reported that of the 800 presbyopes studied, 286 (35.75%) entered presbyopia at or before the age of 38 years. Some factors such as environmental conditions including high average temperature, high of significant ultraviolet radiation, chronic deficiency of essential amino acids, and exposure to toxic factors, particularly hair dye, may play a significant role in precipitating the early onset of presbyopia²³.

V. CONCLUSIONS

In conclusion, this study indicated a strong association between diabetes and the development of presbyopia. Moreover diabetes has a higher risk of the more advanced presbyopia. In this study the age of onset of presbyopia as a result of diabetes is earlier than non-diabetes group. The earlier onset of presbyopia in diabetes group in this study may be a result of diabetes. However, there is no evidence in which, the mechanism by which diabetes causes presbyopia to develop earlier than normal is not fully understood, but we think the destruction of ciliary muscles and the changes in accommodation and its lead pre mature presbyopia.

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