# Ocular manifestations of Obesity: Beyond what meets the eye

Nitin Kapoor[1,2], Smitha Jasper[3], Sanjay Kalra[4]

## Abstract

Obesity has reached pandemic proportions across the globe. Though much literature is available on the metabolic complications of obesity, their ocular associations are underreported. Visual impairment further contributes to the poor health related quality of life in individuals living with obesity. In this manuscript, the authors have highlighted the key ocular manifestations that have been associated with obesity, the evidence that supports their association and the impact of weight loss on these co-morbidities. Obesity has often been negatively associated with visual acuity. Premature cataract, glaucoma and age-related maculopathy have also been shown to have a strong association with obesity. Furthermore, presence of associated cardiometabolic disorders linked with metabolic syndrome may also have an indirect impact on the eye. Conditions like diabetic and hypertensive retinopathy, have commonly been described in people living with obesity. Given the huge public health impact of obesity, this manuscript highlights the unmet need of comprehensive research on the association of eye disorders and obesity in the South Asian region.

**Keywords:** Obesity, age-related maculopathy, body composition, premature cataract, glaucoma pseudotumor cerebri, retinopathy

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## Introduction

The prevalence of obesity has increased rapidly in both developed and developing countries in the south Asian region.[1] The focus of managing people living with obesity has changed from just reducing numerical indicators to overall improve their quality of life.[2] Compromised vision is an important component affecting the quality of life of a given person living with obesity. Furthermore, the role of micronutrient deficiencies affecting vision in people living with obesity is also an important driver for some of these ocular manifestations and is an area of active research. In this paper we describe some of the common ocular comorbidities associated with obesity (Table).

[1]Department of Endocrinology, Diabetes and Metabolism, Christian Medical College, Vellore, India; [2]Non communicable disease unit, The Nossal Institute for Global Health, Melbourne School of Population and global health, University of Melbourne, Victoria, Australia; [3]Department of Ophthalmology, Christian Medical College, Vellore, India; [4]Department of Endocrinology, Bharti Hospital, Karnal, India

**Correspondence:** Sanjay Kalra. e-mail: brideknl@gmail.com

**Table:** Ocular disorders associated with obesity.

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| • Cataracts – Posterior subcapsular cataracts and cortical cataracts |
| • Glaucoma and glaucomatous optic neuropathy |
| • Age-related macular degeneration |
| • Retinal artery occlusion |
| • Retinal vein occlusion |
| • Papilledoema – associated with Intra cranial hypertension |
| • Floppy eye lid syndrome – associated with obstructive sleep apnoea |
| • Central serous chorioretinopathy – associated with obstructive sleep apnoea |
| • Non-arteritic anterior ischaemic optic neuropathy – associated with obstructive sleep apnoea |
| • Myopia, astigmatism, amblyopia, strabismus & exotropia – associated with syndromic obesity |

### Obesity and Cataract

Several large population-based studies have cited a positive association between cataract and obesity. In the American Physicians' Health Study, it was found that obesity indicators like body mass index, waist-hip ratio and abdominal fat were independent risk factors associated with cataract in 22071 healthy male American physicians.[3] The most commonly associated cataracts in obesity include the posterior subcapsular and cortical cataracts. Hyperleptinaemia, increased oxidative stress, elevated fibrinogen and associated components of metabolic syndrome are the key factors responsible for this association. Several studies have proposed that weight reduction is likely to reduce the occurrence of cataracts, but this needs to be prospectively studied and validated in larger cohorts.

### Obesity and Glaucoma

Ocular hypertension and glaucomatous optic neuropathy have been strongly associated with obesity. In a large population-based study involving 25,216 a positive association was found between obesity and glaucoma after controlling for other confounders like age, gender and blood pressure.[4] Several mechanical and vascular theories have been proposed to explain this association. However, the most accepted hypothesis that is proposed include the oxidative DNA damage in the trabecular meshwork leading to proteasome failure and meshwork degeneration in turn causing outflow resistance. Further studies are needed to explore the impact of weight loss in preventing vision loss related to glaucomatous optic neuropathy.

### Obesity and Age-related macular degeneration

Age-related macular degeneration (AMD), one of the

conditions causing blindness in elderly has been associated with obesity in several longitudinal epidemiological studies. Longitudinal data from the Physicians' Health Study showed that the incidence of sight debilitating AMD was highest in men with obesity as compared to normal BMI men over a period of 15 years. This association remained significant after controlling for age and cigarette smoking.[5] Moreover, central obesity as measured by waist circumference and waist hip ratio, has been more strongly associated with AMD.[6] This bears relevance in the south Asian phenotype where central obesity is widely prevalent.[7,8] Though the association of AMD and obesity has been found together in several studies, its association with different types of AMD and the role of weight loss in preventing or retarding the development of AMD needs to be further studied in the south Asian region.

**Obesity and diabetic retinopathy**

The relationship between body mass index and diabetic retinopathy forms a U-shaped curve. Those who are underweight (BMI<20 Kg/m$^2$) have been found to have a three-fold increased risk of diabetic retinopathy, probably as a reflection of poor control of diabetes. Those with obesity have a higher risk as compared to normal weight individuals. As demonstrated from a longitudinal Swedish cohort it was found that those with a higher BMI developed diabetic retinopathy at an earlier stage of diabetes.[9] In the south Asian phenotype the WHR has shown to have a better association with diabetic retinopathy.

Other less commonly described ophthalmic conditions that have been reported with obesity include retinal vascular occlusions, oculomotor nerve palsy, papilloedema secondary to idiopathic intracranial hypertension and manifestations secondary to obstructive sleep apnoea like floppy eyelid syndrome, papilloedema, normal tension glaucoma, central serous chorioretinopathy and non arteritic anterior ischaemic optic neuropathy.[10] Specific obesity related syndromes like Prader Willi syndrome may have other associations like myopia, astigmatism, amblyopia, strabismus and exotropia. These genetic syndromes associated with obesity are also more commonly reported in the south Asian region due to a higher rate of consanguinity.[11]

Retinal vasculature and the choroid have been shown to be impacted by obesity and manifest as AMD, diabetic retinopathy and glaucoma. Newer modalities of evaluation of the retina and choroid have shown a significant decrease in the choroidal thickness and retinal ganglion cell layer in those with morbid obesity. An improvement in the choroidal thickness has been demonstrated following weight loss following bariatric surgery.[12]

## Conclusion

Though several associations have been found between ocular disorders and obesity, little research has been done to study the impact of weight loss on these comorbidities. This is more relevant in people with morbid obesity, where these ocular manifestations may further compromise the already poor quality of life in these individuals. In this manuscript the authors have summarised the common ocular comorbidities associated with obesity and highlighted the research gaps that need to be addressed, to ascertain the precise impact of managing obesity in relation to these ocular disorders.

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