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Pattern of eye disease among obese population in Erbil city, Iraq

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Abstract

Background and objective: Obesity is a multifactorial disease. It is a multifactorial pathology that can be related to an altered nutritional behaviour or secondary to genetic, hypothalamic, iatrogenic or endocrine diseases. Obesity and visual acuity are negatively correlated, obesity may be linked to dysfunction of the mechanical and vascular components of the eye. The aim of the study is to find out the impact of obesity on eye health and the pattern of eye disease.

Methods: Across-sectional study was conducted in the Ophthalmology Department/ Erbil Teaching Hospital during the period from 1st of August 2021 to 31st of March 2022. A simple random sampling method was adopted, and a total of 300 participants with an age of more than 18 years old were enrolled.

Results: The percentage of cataract, glaucoma, age-related maculopathy, papilloedema, keratoconus, and retinal vein occlusion was higher in the case group than in the control group. Obesity is a significant risk factor for cataracts, age-related maculopathy, and papilloedema, while it was insignificant regarding keratoconus and retinal vein occlusion. The mean of internal ocular pressure and central corneal thickness was higher in the case group compared to the control group.

Conclusion: The prevalence of ocular disease was higher among the obese population than in those with normal weight. Obesity is a significant risk factor for ocular disease. Age and gender represented additional risk factors in some of the ocular diseases in obese people.

Keywords: Obesity; Eye disease; Cataract; Glaucoma; Age-related maculopathy.

Introduction

Obesity is a chronic disease that has a wide range of complications that can affect many different physiologic functions.[1] It is a systemic disease that manifests as an abnormal and excessive accumulation of body fat that has detrimental health effects.[2]

The main justification for classifying obesity as a chronic illness is distinct pathophysiology in people with obesity resulting in powerful homeostatic mechanisms that hinder weight loss and promote further weight gain. Because of these altered biological processes in obese individuals, short-term behavioural or medical interventions frequently fail to produce long-term weight loss.[3]

Since 1980, the prevalence of overweight and obesity has doubled globally to the point where almost a third of the global population is now considered to be either overweight or obese.[4] In 2016, a study was done by the world health organization (WHO) found that more than 1.9 billion and 650 million people are, respectively, overweight or obeseworldwide.[5]

In the Eastern Mediterranean region, the prevalence of overweight/obesity among adults ranges from 25% to 81.9%. In 2014,

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in Kuwait, the adult (18–69 years) prevalence of overweight was 37% and obesity was 40.3%, while in 2016, in Iran, the prevalence of overweight/obesity was 59.3%. In 2017, in Jordan, overweight or obesity was 77.2% among men and 74.5% among women (≥18 years).[6]

High obesity rates have been noted in a number of regional and clinical population surveys conducted locally in Iraq. In 2017, in a community-based survey in Erbil city, the prevalence of overweight was 33.4% and obesity at 40.9%.[7]

Obesity is strongly linked to higher rates of morbidity and mortality. Additionally, it has a number of negative economic, medical, and psychological effects. These include systemic diseases, financial burdens, social and occupational stigma, and lost productivity.[8]

Obesity may affect both the likelihood of contracting an infection and the course of the infection once it has taken hold. Possible mechanisms include obesity-related immune system dysregulation, reduced cell-mediated immune responses, obesity-related co-morbidities, respiratory dysfunction, and pharmacological problems.[9]

Visual impairment is a main public health problem in 1.3 billion people worldwide, with 36 million being blind.[10] Racial, geographic, socioeconomic, and cultural factors all have an impact on the pattern of ocular disease manifestation throughout the world.[11] The major age-related eye diseases including cataracts, glaucoma, age-related maculopathy (ARM) and diabetic retinopathy (DR) are the causes of visual impairment andblindness.[10]

Obesity has been proposed to be a risk factor for cataract development, though the exact underlying mechanisms are unclear.[12] There are a number of plausible pathophysiological explanations for the association between obesity and cataract.[13]

About 8% of cases of blindness are caused by glaucoma, which is the second most common cause of blindness in the world after cataracts. Open-angle glaucoma may exhibit a differential association with obesity because the condition is affected by hemodynamic risk factors. The relationships between open-angle glaucoma and metabolic risk factors according to obesity status have not been studied, despite their potential clinical significance.[14] Both the mechanical and vascular aetiology theories of glaucoma are related to obesity.[15]

Age-related maculopathy is a multifactorial degenerative macular disease that causes severe visual loss in elderly patients in industrialized countries. Early age-related maculopathy is characterized by hypopigmentation and focal hyperpigmentation. All retinal layers eventually become impacted, particularly the retinal pigment epithelium and photoreceptor layers.[16] Although the pathophysiological mechanisms are not fully understood, obesity has been linked to age-related maculopathy.[13]

Diabetic retinopathy, which has long been known as microvascular disease, is the most frequent complication of diabetes mellitus.[17] The pathophysiological mechanisms of the association between obesity and retinopathy are not understood. The metabolic syndrome, encompassing hyperlipidemia and hypertension, and obesity, is associated with retinopathy.[13]

In a very small number of studies, obesity has been identified as a significant risk factor for retinal vein occlusion. The risk of retinal vein occlusion was found to be nearly four times higher in obese individuals, and there was a significant trend of rising risk across all body mass index quartiles (BMI). Moreover, retinal venous and arterial occlusions are known to be associated with hypertension, diabetes mellitus and hypercoagulability or hyperviscosity syndromes.[13]

The risk of idiopathic intracranial hypertension increases with increasing body mass index and morbidly obese patients with idiopathic intracranial hypertension may have even worse visual

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outcomes. Therefore, those who are morbidly obese may be at an especially high risk of developing severe and permanent vision loss due to idiopathic intracranial hypertension.[18,19]

Aims of the study:

To find out the impact of obesity on eye health and the pattern of eye disease.

Objective:

To find out the most prevalent ocular disease in obese people.

To assess the association between obesity and eye diseases and access the associated risk factors.

To compare the prevalence of the ocular disease in the obese population to those with normal weight and calculate the added risk of increased body mass index.

Methods

Study design and setting:

A cross-sectional study with comparison groups was conducted in the Ophthalmology Department /Erbil Teaching Hospital during the period from 1st of August 2021 to 31st of March 2022.

Sampling method:

A simple random sampling method was adopted, and a total of 300 participants with an age of more than 18 years old were enrolled and included in two groups: the case group (included 150 participants with a BMI of ≥30 kg/m^2) and control group (included 150 participants with a BMI of <30 kg/m^2)

Exclusion criteria:

1- Patients with pre-existing ocular diseases to avoid confounding factors related to pre-existing retinal pathology independent from obesity

2- Patients who were diagnosed with dementia, Parkinson's disease, Alzheimer's disease, multiple sclerosis, or other severe neurological diseases since the ophthalmologic parameters may be altered in these conditions.

3- Patients with opacities that make the posterior segment examination impossible, or with a refractive error ≥+5 or >-8 diopters spherical equivalent.

4- Pregnant women

Data collection:

A structured questionnaire was developed to collect the relevant data from the participants retrieving the following information: Age, gender, past medical history, past surgical history, and past Ophthalmologic history. In addition to the results of medical and ophthalmologic examination.

Medical examination includes the weight (kg) and height (m). The body mass index was measured using this equation: BMI =body weight (Kg) / ((height (m))^2. According to WHO classification, BMI for adults is classified as underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obesity (≥ 30.0).[20]

Ophthalmologic examination: In each eye, the following examinations were done:

• The anterior segment was examined by slit-lamp biomicroscopy, best-corrected visual acuity was recorded as Snellen equivalent, and intraocular pressure was measured with Goldmann applanation tonometry.

• Measurement of central corneal thickness was measured. Optical coherence tomography was done in some patients for optic disc or macula.

Ethical consideration:

The study has been proposed and subsequently approved by the scientific committee of the College of Medicine/ Hawler Medical University.

Fully informed consent was obtained from the patients verbally after explaining the aim of the study thoroughly and clearly. All participants were assured of anonymity and confidentiality of information

Statistical analysis:

The data was entered and analyzed by the statistical package of social sciences (SPSS) version 22. Descriptive statistics were presented as frequencies and were applied to explain the characteristics of participants. The comparison between

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the study groups was done by t-test, Chi-Square test, and Fisher's Exact Test. Pearson correlation coefficient was calculated to show the strength of correlation between two numerical variables. A *P*-value less than 0.05 was considered statistically significant.

Results

A total of 300 participants were enrolled. There was an insignificant difference between the study groups regarding gender and age (*P*-value <0.05), as shown in Table1.

In the case groups, the most prevalent disease was cataract (18%) followed by age-related maculopathy (8.7%), glaucoma (7.3%), and papilloedema (6%) as shown in Figure 1.

Table 1 Distribution of the age and gender according to the study groups

Characteristic		Groups		Total	*P*-value
		Case	Control		
		N (%)	N (%)	N (%)	
Gender	Male	78 (52.0)	68 (45.3)	146 (48.7)	0.248
	Female	72 (48.0)	82 (54.7)	154 (51.3)	
Age (years)	18-30	29 (19.3)	36 (24.0)	65 (21.7)	0.552
	31-40	37 (24.7)	42 (28.0)	79 (26.3)	
	41-50	48 (32.0)	43 (28.7)	91 (30.3)	
	51-60	36 (24.0)	29 (19.3)	65 (21.7)	
Total		150	150	300	

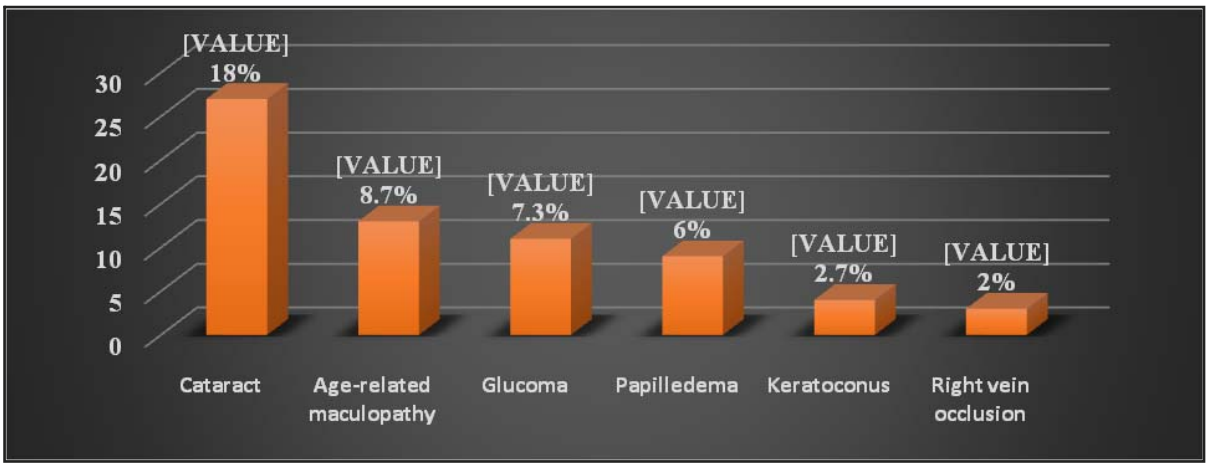

Figure 1 Incidence of ocular disease among obese participants

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There was a significant association between the presence of Papilledema and gender as 88.9% of the participant who had Papilledema were female (*P*-value <0.05), while no significant association was obtained between gender and other ocular manifestations (Table 2).

Regarding age, there was a significant association between age and cataracts as 77.8 % of the participant who had cataracts were older than 50 years (*P*-value <0.05), as shown in Table 3.

Table 2 Association between gender and ocular manifestations

Ocular disease	Groups		*P*-value
	Male	Female	
	N (%)	N (%)	
Cataract	16 (47.0)	11 (33.3)	0.404
Glaucoma	6 (17.6)	5 (15.1)	0.861
Age-related maculopathy	7 (20.5)	6 (18.2)	0.889
Papilledema	1 (2.9)	8 (24.2)	0.011
Keratoconus	2 (6.0)	2 (6.1)	0.935
Retinal vein occlusion	2 (6.0)	1 (3.1)	0.608
Total	34 (100.0)	33 (100.0)	

Table 3 Association between the age and ocular manifestations

Ocular disease	Age groups (years)				*P*-value
	18-30	31-40	41-50	51-60	
	N (%)	N (%)	N (%)	N (%)	
Cataract	0 (0.0)	1 (20.0)	5 (25.0)	21 (58.3)	0.000
Glaucoma	2 (33.2)	1 (20.0)	4 (16.0)	4 (11.1)	0.572
Age-related maculopathy	0 (0.0)	1 (20.0)	5 (25.0)	7 (19.4)	0.020
Papilledema	1 (11.1)	1 (20.0)	5 (25.0)	2 (5.6)	0.437
Keratoconus	2 (33.2)	1 (20.0)	1 (4.0)	0 (0.0)	0.384
Retinal vein occlusion	1 (16.6)	0 (0.0)	0 (0.0)	2 (5.6)	0.224
Total	6 (100.0)	5 (100.0)	20 (100.0)	36 (100.0)	

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The percentage of cataracts, glaucoma, age-related maculopathy, papilloedema, keratoconus, and retinal vein occlusion was higher in the case group than in the control group (Table 4).

The mean intraocular pressure and central corneal thickness were higher in the case group compared to the control group, as shown in Table 5.

Table 4 Difference between the study groups regarding the ocular manifestations

Ocular disease		Groups		*P*-value
		Case	Control	
		N (%)	N (%)	
Cataract	Yes	27 (18.0)	15 (10.0)	0.046
	No	123 (82.0)	135 (90.0)	
Glaucoma	Yes	11 (7.3)	3 (2.0)	0.029
	No	139 (92.7)	147 (98.0)	
Age-related maculopathy	Yes	13 (8.7)	4 (2.7)	0.025
	No	137 (91.3)	146 (97.3)	
Papilledema	Yes	9 (6.0)	2 (1.3)	0.032
	No	141 (94.0)	148 (98.7)	
Keratoconus	Yes	4 (2.7)	1 (0.7)	0.185*
	No	146 (97.3)	149 (99.3)	
Right vein occlusion	Yes	3 (2.0)	1 (0.7)	0.331*
	No	147 (98.0)	149 (99.3)	

* Fisher's Exact Test

Table 5 Distribution of the internal ocular pressure and central corneal thickness according to the study groups

Ocular examination	Groups		*P*-value
	Case	Control	
	Mean (SD)	Mean (SD)	
Intraocular pressure	16.64 (1.9)	14.83 (1.1)	**<0.001**
Central corneal thickness	575.5 (2.7)	569.5 (7.6)	**<0.001**

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There was a significant positive correlation between body mass index and central corneal thickness and intraocular pressure (*P*-value< 0.001). As shown in Table 6 and Figure 2.

Discussion

The first finding of the current study was that cataract was the highest prevalent ocular disease in obese participants. In addition, obesity was a significant risk factor for cataracts with a higher prevalence in obese participants compared to those with normal weight. In comparison, another study that was done in 2021 concluded that obesity was associated with a higher incidence rate of cataracts after adjustment for age, gender, ethnicity, education, income, diet score, physical activity, smoking, alcohol consumption, sleep duration, hypertension, depression, heart disease, stroke, total cholesterol.[21] The same results were obtained in another in Korea in 2013 by Park et al.[22]

A meta-analysis study that was done by Pan et al. with a total of 163,013 subjects aged from six prospective cohort studies concluded that obesity was associated with an increased risk of cataracts.[23]

Regarding the age of the patients, the current study revealed that the prevalence of cataracts was significantly higher in obese participants with an age of more than 50 years. In concordance with this study, Nirmalan et al. concluded a significant association between cataracts

Table 6 Correlation between the central corneal thickness, intraocular pressure and BMI

		Body mass index
Central corneal thickness	Pearson Correlation	0.412**
	Significancy (*P*-value)	<0.001
Intraocular pressure	Pearson Correlation	0.516**
	Significancy (*P*-value)	<0.001

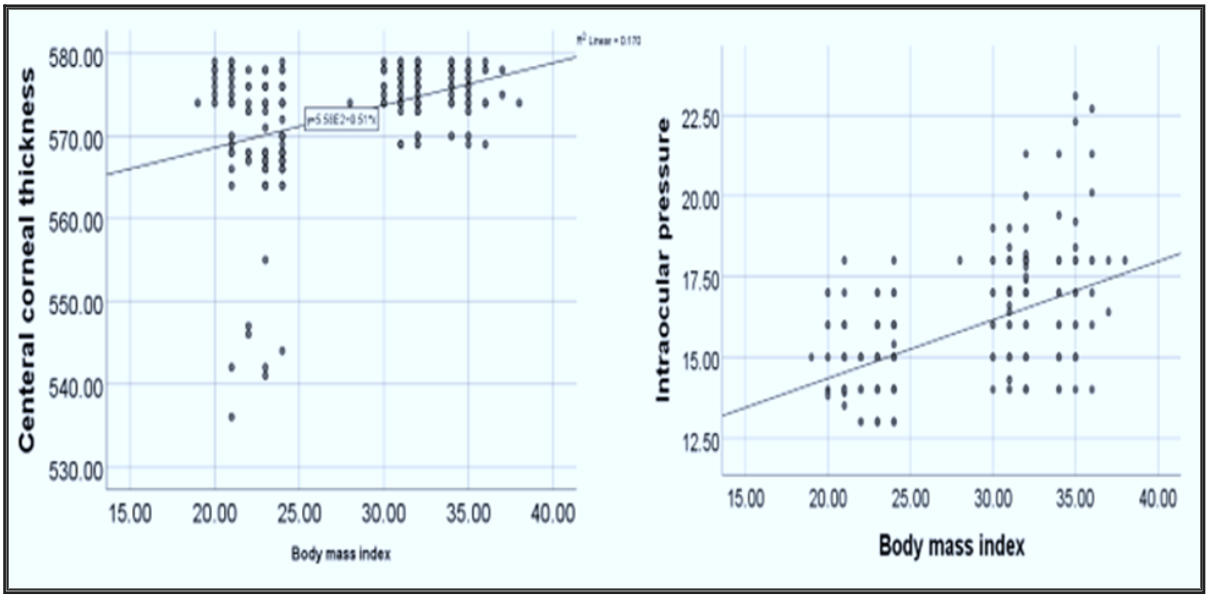

Figure 2 Correlation between the central corneal thickness, intraocular pressure and body mass index

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and age and obesity.[24]

The second most prevalent ocular disease in the current study was age-related maculopathy which was significantly higher in those aged more thane 50 years old. The prevalence in obsess participants was higher than those with normal weight with a significant odds ratio. In agreement with the current study, another study that was done by Qian-Yu revealed that excess body weight was associated with an increase in the risk of age-related maculopathy in a dose-dependent fashion, especially in its late stage, indicating that keeping normal body weight and avoiding further weight gain may confer potential protection against this disease.[25]

Glaucoma was the third most prevalent ocular disease in the current study, the prevalence was higher in obese participants than in those with overweight, with a significant odds ratio. In comparison, Younger et al. concluded that people with a BMI greater than 30 kg/m^2 were more likely to develop glaucoma than those with a normal BMI.[26] The same results were obtained by another study that was done by Wei-Dar Chen in Taiwan and concluded that the risk of glaucoma was significantly higher in obese adults than in non-obese adults after multivariable adjustment.[27]

In the current study, there was a significant association between the presence of papilloedema, which was the fourth most prevalent disease, and gender in obese participants. In addition, obesity was a significant risk factor for papilloedema.

In agreement with the current study, Aimee et al. concluded that patients with BMI ≥40 were more likely to have severe papilledema at the first neuro-ophthalmology encounter than those with a lower BMI. Logistic regression modelling found that ten units (kg/m^2) increases in BMI increased the odds of severe visual loss by 1.4 times.[19] In another study that was done by Olivia et al.,79% of the patients with papilloedema were women, and patients with idiopathic intracranial hypertension had a higher median (range) BMI.[28]

The last two prevalent ocular diseases in the current study were keratoconus and retinal vein occlusion. The prevalence was higher in obese participants than in those with normal weight but without a significant odds ratio. In comparison, another study that was done by Elior et al. concluded that overweight and obese have higher odds of having keratoconus compared with normal weight and BMI should be considered a risk factor for keratoconus.[29] Pihlblad et al. concluded that keratoconus patients had a high prevalence of obstructive sleep apnea and obesity.[30]

Regarding retinal vein occlusion, Dong et al. concluded that a lower BMI was associated with a lower risk for retinal vein occlusion and vice versa in people without diabetes.[31] Another study that was done by Mirko et al. concluded that retinal vein occlusion patients significantly had a higher prevalence of overweight.[32]

An important finding of the current study was a significantly higher mean of central corneal thickness in the obese group than in the normal weight group with a significant correlation between BMI and central corneal thickness. In comparison, the same results were obtained by DOGAN et al. who revealed a significant increase in central corneal thickness in obese compared to normal weight participants.[33]

The last finding of the current study was a significantly higher mean of IOP in the obese group than in the normal weight group with a significant correlation between BMI and IOP. In comparison, Ning et al. reported a strong evidence that obesity is associated with elevated intraocular pressure.[13] In agreement with these results, Remziet al. concluded that obesity had been reported to be an independent risk factor for high IOP and to have a positive relationship with IOP.[34]

The strength of the study was that it discussed an important complication of a prevalent medical disorder in the population, although the current study had a limitation including that it was done in

one city and not generalized to other areas in the Kurdistan region of Iraq.

Conclusion

The prevalence of ocular disease was higher among the obese population than in those with normal weight. Obesity is a significant risk factor for ocular disease. Age and gender represented additional risk factors in some of the ocular diseases in obese people.

Funding

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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