Evaluation of intraocular pressure and retinal nerve fiber layer, retinal ganglion cell, central macular thickness and choroidal thickness using optical coherence tomography in obese children and healthy controls

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OBJECTIVES

Obesity affects many organ systems. Study conducted on the ophthalmological effects of obesity are scarce. The aim of the present study was to evaluate the changes in the ophthalmological parameters in obese children.

PATIENTS AND METHODS

The present prospective cross-sectional observational study included 61 (40 female) obese subjects (age range: 10.3-18) and 35 (20 female) healthy controls (age range: 9.8-17.6) admitted to Health Sciences University Antalya Training and Research Hospital between January 2016 and June 2016.

Exclusion criteria included, systemic diseases which may affect the IOP (such as diabetes, infectious or inflammatory diseases, hypertension, thyroid disorders), sleep apnea, pseudotumour cerebri, family history of glaucoma, pharmacological treatments, orbital and ocular diseases, refractive error more than ±0.5 dioptres of spherical equivalence, cup-to-disc ratio more than 0.5, asymmetry in the excavations more than 0.2 and signal strength of the OCT less than 7.

Obesity was defined as body mass index-standard deviation score (BMI-SDS) >2 SD. All clinical and ophthalmological investigations were performed by a pediatric endocrinologist and an experienced ophthalmologist.

.Body fat content and distribution was assessed using Bioelectrical impedans Tanita body composition analyzer MC-180MA 8-contact electrode system (Tanita Corp. Tokyo, Japan) according to the standardized manufacturer instructions.

Ophthalmological examination and intraoculer pressure (IOP) measurement was performed. The average retinal fiber layer (RNFL), retinal ganglion cell (RGC), central macular thickness (CMT), cup-to disc ratio (C/D) and central choroidal thickness (CT) were measured using Spectral domain optical coherence tomography (SD-OCT). Antropometric, biochemical and ophthalmological parameters of obese and control subjects were compared.

Table 1. Clinical and biochemical data of obese children and controls

	Obese (n=58) (Mean±SD) or Median (Min-max)	Control (n=35) (Mean±SD) or Median (Min-max)	P value
Gender (boy/girl) %	34/66	43/57	0.509*
Age (years)	14.7±1.95	15.46±1.82	0.052†
Height SDS	0.36±0.97	-0.04±1.05	0.067†
BMI-SDS	3.12±0.44	0.005±0.72	<0.001†
WHR	0.84 (0.67-1.26)	0.75 (0.68-0.87)	<0.001‡
Body fat percentage (%)	38.9 (26-66.2)	20.2 (9.5-30.5)	<0.001‡
Body fat mass (kg)	34.2 (22.9-98.1)	10.3 (3.8-19)	<0.001‡
Systolic BP (mm Hg)	120 (100-146)	110 (100-126)	0.004‡
Diastolic BP (mm Hg)	77.5±8.11	69.2±6.43	<0.001†
Triglyceride (mmol L–1)	68.6 (28-337)	73 (12-215)	<0.001‡
Cholesterol (mg/dl)	163.5 (42-228)	139 (74-176)	<0.001‡
LDL (mg/dl)	89.5 (30-155)	65 (16-102)	<0.001‡
HDL-cholesterol (mmg/dl)	45.34±7.78	48.28±12.87	0.228†
Glucose (mg/dl)	88.5 (72-115)	87 (72-113)	0.240‡
Insulin (µlU/ml)	16.4 (3.5-48.7)	6.6 (1.8-21.7)	<0.001‡
HOMA-IR	3.7 (0.7-11.9)	1.4 (0.3-6.5)	<0.001‡

RESULTS

IOP was higher in obese group compared to the controls (p=0.008), while the average RNFL was lower in obese group (p=0.035). There was a negative correlation between the average RNFL and BMI-SDS (p=-0.044) and waist-hip ratio (WHR) (p=0.015). There was no statistically significant difference between the RGC, C/D, CMT, CT of obese and control group. IOP was negatively correlated with HOMA-IR, body fat mass, body fat percentage and diastolic blood pressure.

Table 2. Comparison of ophthalmological evaluation findings of obese children vs.controls

	Obese (n=58) Mean±SD or median (Min-max)	Control (n=35) Mean±SD or Median(Min-max)	p value
IOP	17.08±2,38	15.52±2.84	0.008*
Average RNFL (µm)	94.03±9.26	98.24±9.11	0.035*
RGC (µm)	84.5 (56-94)	85.5 (77-97)	0.560†
C/D	0.37 (0.06-0.67)	0.43 (0.06-0.71)	0.620†
CMT+ (µm)	243 (90.5-303)	244 (198-298.5)	0.653†
CT + (µm)	279 (242-305)	280.3 (262-312.5)	0.170†

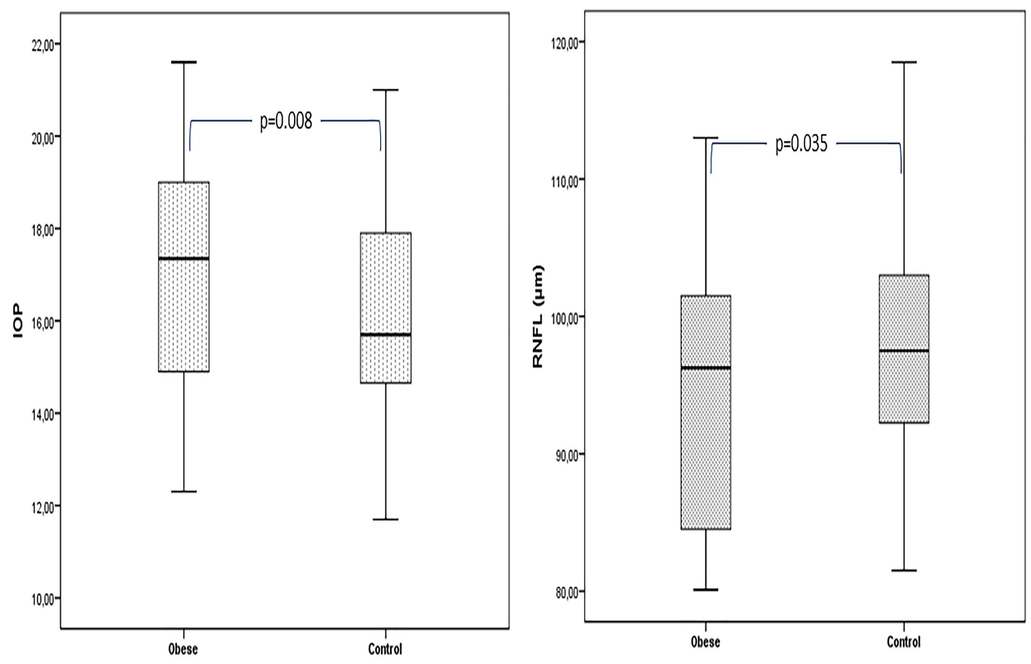

Figure 1: Comparison of IOP and RNFL in obese vs. control subjects

CONCLUSION

Elevated IOP and decreased RNFL thickness detected in obese group may suggest an increased risk of developing glaucoma in younger age later in life. Therefore, a regular opthalmological examination of obese children would provide prompt diagnosis and appropriate management.