Macular Pigment Optical Density Measurement in Healthy Young Patients
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Introduction. Optical and neuron degenerative changes of visual system that influence the steady decrease of visual acuity are observed from approximately 40 years of age [1, 2].

Macular pigments are mainly made up of two oxycarotenoids, lutein and zeaxanthin. Located in the Henle fibers and in the inner plexiform layer, the highest macular pigment (MP) density is found in the fovea [3]. Many factors are known to influence macular pigment optical density (MPOD): age, obesity, smoking and genes involved in the transportation of lutein along the lipid pathway [4]. Humans can not synthesize MPs and dietary intake – i.e., fruits, vegetables and egg yolk – is the only source for the body [5].

The level of macular pigments varies among different populations. MPOD in blacks, for example, has been reported to be 41% lower than in whites [6], although another study did not find such a difference [7]. It should be noted, however, that comparison of MPOD levels among studies are difficult or even impossible because different studies may employ different methodologies or study protocols.

For the first time we evaluated MPOD in healthy young subjects using Visucam 200 in Lithuania.

Methods. Having obtained the permission from the Kaunas Regional Biomedical Research Ethics Committee, the study was conducted in the department of Ophthalmology at Lithuanian University of Health Sciences.

We examined 45 healthy controls. In this study the visual acuity as well as the transparency of the cornea and lens, and the fundus were investigated in the patients. Biomicroscopy was performed in order to assess the corneal and lenticular transparency.

During each examination refraction was performed, the intraocular pressure was measured and the iris color was noted using the slit lamp. Pupils of the
subjects were dilated with tropicamide 1% or cycloglyli 1%. After dilation of the pupils, fundoscopy was performed with an ophthalmoscope of the direct monocular type and the slit-lamp, using a double aspheric lens of +78 diopters. A peripheral retinal examination was performed using an indirect ophthalmoscope. Results of the eye examination were recorded on standartized forms that we developed for this study. Stereoscopic color fundus photographs of the macula were obtained: centered at 45° and 30° to the fovea for a detailed fundus analysis.

Subject inclusion criteria: the age of both gender patients was 20 - 30 years, no other eye disorders were found on detail ophthalmological examination, participation consent.

Subject exclusion criteria: related eye disorders (high refractive error, cloudy cornea, opacity of the lens (nuclear, cortical and posterior subcapsular cataract), keratitis, acute or chronic uveitis, glaucoma, neovascular age-related macular degeneration or geographic atrophy, diseases of the optic nerve); systemic illnesses (diabetes mellitus, oncological diseases, systemic tissue disorders, chronic infectious diseases, conditions after organ or tissue transplantation), color fundus photography non graduate because of the obscuration in the eye optic system or because of fundus photography quality.

The optional macular pigment density module for the Visucam 200 used the reflectance of a single 460 nm wavelength based on a single blue-reflection fundus image to determine MPOD and its spatial distribution. A shading correction is used that approximates the reflectance of the fundus in absence of MP. It is based on a three-dimensional parabolic function automatically fitted to fundus reflectance at peripheral locations. The subject was positioned in front of the fundus camera and instructed to look at a target inside. The fundus was illuminated by a monochromatic blue light. Four MPOD parameters were automatically calculated: maximum optical density (MPOD measured at the peak); mean OD (mean MPOD within the measurement area); area (area where macular pigment could be detected); and volume (sum of all optical densities, as recommended by the manufacturer).

Statistical Analysis. Mean and standard deviation of MPOD were calculated. MPOD levels between males and females were compared using t-test for two independent samples.

Results. Forty five subjects (90 eyes) were included (mean age 24.49 ± 2.58 [range 20 - 30] years). 26 females and 19 were males. The mean age in males was 24.95 ± 2.95, and in females 24.15 ± 2.27. Visual acuity in males and females was 1.0. The mean of MPOD was 0.10 ± 0.015. The mean of MPOD in males was 0.10 ± 0.02, in females −0.10 ± 0.01, p > 0.05.

Discussion. The macula is the center of the posterior retina and can be discerned clinically as the area of yellowish pigmentation. Macular pigment, composed of three carotenoids—lutein, zeaxanthin, and meso-zeaxanthin—is
believed to improve visual performance by reducing chromatic aberration and glare sensitivity [8 - 11]. The age-related decline in MPOD was reported in several previous studies [12, 13] however, there were studies that did not detect this age-related difference in MPOD [14, 15].

The aim of our research was MPOD evaluation in healthy young subjects and comparison difference in males and females. Our results revealed that there were no statistical significant difference between males and females. The association between MPOD levels and sex has been reported in several previous studies, with females having relatively lower levels of MPOD than males [16 - 18]. Given the fact that several studies that did not find this sex-associated difference in MPOD [6, 15], the authors' data indicate that the sex-related difference in MPOD is marginal. The level of MPOD and its distribution in retina may be affected by factors such as genetic background, demographics, or lifestyle characteristics [19]. It has been reported, for example, that females tend to have broader distribution of macular pigment than males [20]. Females therefore are more likely to have higher residual pigment density at the parafoveal reference point, which could lead to a relatively lower MPOD measurement. Moreover, it is thought that females tend to have higher percentage of body fat and adipose tissue than males, which may compete with the retina for uptake of lutein and zeaxanthin [13].

Only one study by Tang et al. (2004) was done, which evaluated MPOD in young persons age 18 - 23, and established that MPOD was 0.48 ± 0.23 [21].

The discrepancy in the age and gender relationship between different studies may be related to differences in sample size, subject selection, or methods of measurement.

References

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Introduction. The aim of our research was to evaluate macular pigment optical density (MPOD) in healthy young subjects, and compare results in males and females.

Methods. Forty-five healthy subjects were included into our study. In this study the visual acuity as well as the transparency of the cornea and lens, and the fundus were investigated in the patients. The optional macular pigment density module for the Visucam 200 used the reflectance of a single 460-nm wavelength based on a single blue-reflection fundus image to determine MPOD and its spatial distribution.

Results. Forty-five subjects (90 eyes) were included (mean age 24.49 ± 2.58 [range 20-30] years). The mean of MPOD was 0.10 ± 0.015. The mean of MPOD in males was 0.10 ± 0.02, in females – 0.10 ± 0.01, p > 0.05.

Conclusion. There was no statistical significant difference of MPOD in males and females.