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Impact of 12 weeks vestibular stimulation on olfactory sensitivity and Pupil to Limbus Diameter (PLD) ratio.

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ABSTRACT

The present study aimed to explore the impact of vestibular stimulation on olfactory sensitivity and PLD ratio. A total of 32 apparently healthy male (n=16) and female (n=16) students were recruited from various courses conducted our institute after obtaining written informed consent. Vestibular stimulation was administered by making the participants to swing on a swing in back to front direction (according to comfort), as standardized by previous methods. Olfactory sensitivity was measured by using the olfactometer. PLD ratio is measured by two-box method. Significant decrease in the olfactory sensitivity was observed followed by intervention. PLD ratio was not altered followed by vestibular stimulation. Our study highlights the need of future studies in this area for better understanding of vestibular influences on olfaction and pupillary responses.

Keywords: Vestibular stimulation, Olfactory sensitivity, Pupil, Limbus.

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INTRODUCTION

Olfaction is the function whereby odours are perceived. Olfactory sensitivity is the response of the olfactory system to a particular chemical substance [1]. The pupil, an aperture located in the center of the iris of the eye regulates the entry of light into the retina. The limbus, which constitutes the border between the white opaque sclera and transparent cornea [2]. Pupil diameter changes increases during sympathetic stimulation [3]. Vestibular apparatus is known as membranous labyrinth and is enclosed in bony labyrinth of temporal bone. Vestibular apparatus consists of otolith organs and semicircular canals [4]. Anatomical connections exist between vestibular and autonomic nuclei. Vestibular stimulation play a role in perception and informative action of the sense organs, however, the change depends on the intensity of stimulation [5, 6]. Literature on vestibular influences on olfaction and PLD ratio is sparse. Hence, the present study aimed to explore the impact of vestibular stimulation on olfactory sensitivity and PLD ratio.

MATERIALS AND METHODS

Research design

The present experimental study was conducted at Department of physiology, Little Flower Institute of Medical Science And Research, Angamaly from October 2016 to January 2017. After recording the baseline values, vestibular stimulation was administered for 12 weeks. After 12 weeks, post intervention values are recorded.

Participants

A total of 32 apparently healthy male (n=16) and female (n=16) students were recruited from various courses conducted our institute after obtaining written informed consent. A detailed medical history was obtained from all participants to exclude individuals involved in drug/alcohol abuse, and those taking any kind of medication or suffering from any somatic or mental disorders. Students with a history of use of corticosteroids in the past year, students with a history of antidepressant medication, and students on hormone supplements including oral contraceptives and ear/vestibular diseases and olfactory disorders were excluded from the study. Unwilling students were excluded from the study. After recruiting, the participants were grouped into four groups randomly by random numbers generated by computer.

Vestibular Males (MV) (n=8): Vestibular stimulation was administered for 12 weeks.
Vestibular Females (FV) (n=8): Vestibular stimulation was administered for 12 weeks.
Control Males (MC) (n=8): vestibular stimulation was not administered.
Control females (FC) (n=8): vestibular stimulation was not administered.

Vestibular stimulation

Vestibular stimulation was administered by making the participants to swing on a swing in back to front direction (according to comfort), as standardized by previous methods [7].

Olfactory sensitivity

Olfactory sensitivity was measured by using the olfactometer, as standardized by previous studies [8].

Assessment of PLD ratio

PLD ratio is measured by two-box method as described in the literature [3].

Statistical analysis

Data was analyzed by SPSS 20.0. One-way analysis of variance followed by Bonferroni's Multiple Comparison Test was used to analyze demographic data. Two-way ANOVA followed by Bonferroni posttests was used to analyze outcome variables. P value less than 0.05 was considered as significant.

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Ethical consideration

The present study was approved by the institution ethical committee of Little flower Hospital And Research Centre, Angamaly, No; EC27/1/16.

RESULTS

Figure 1 presents demographic data of the participants. Significant decrease in the olfactory sensitivity was observed followed by vestibular stimulation (P<0.05). Decrease in the olfactory sensitivity was highly significant in females (P<0.001). In males, though there is decrease, it is not statistically significant (figure 2). PLD ratio was not significantly altered followed by vestibular stimulation (figure 3,4).

Figure 1: Demographic data of the participants (data was presented as mean ± SD) (*P<0.05 is significant, **P<0.01 is significant,*P<0.001 is significant)**

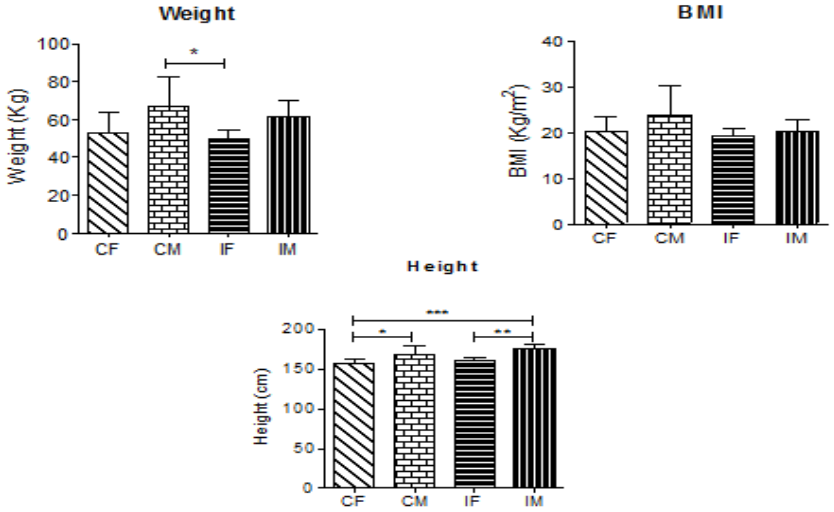

Figure 2: Olfactory sensitivity of the participants before and after vestibular stimulation (data was presented as mean ± SD) (*P<0.05 is significant, **P<0.01 is significant,*P<0.001 is significant)**

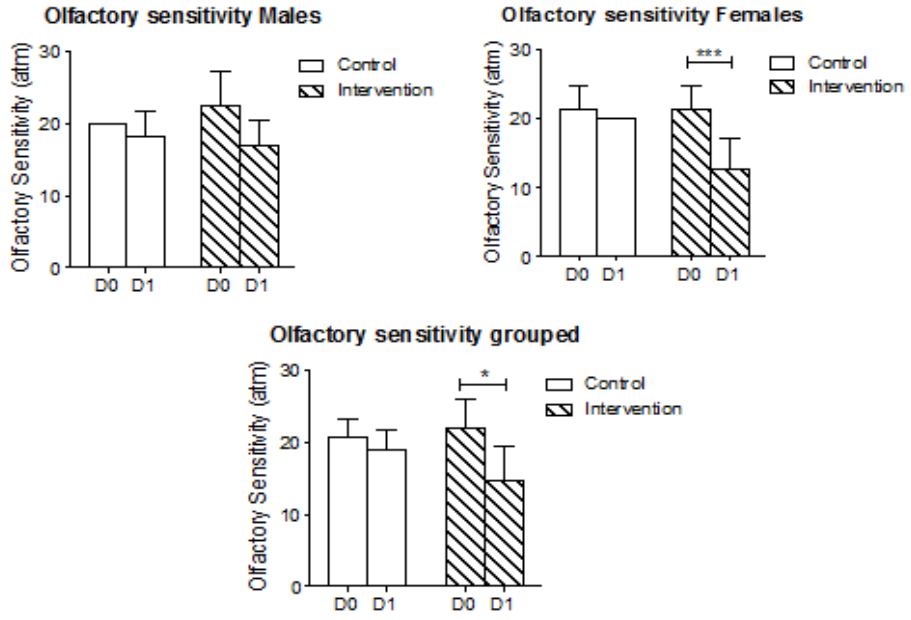

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Figure 3: PLD ratio (left eye) of the participants before and after vestibular stimulation (data was presented as mean ± SD) (*P<0.05 is significant, **P<0.01 is significant,*P<0.001 is significant)**

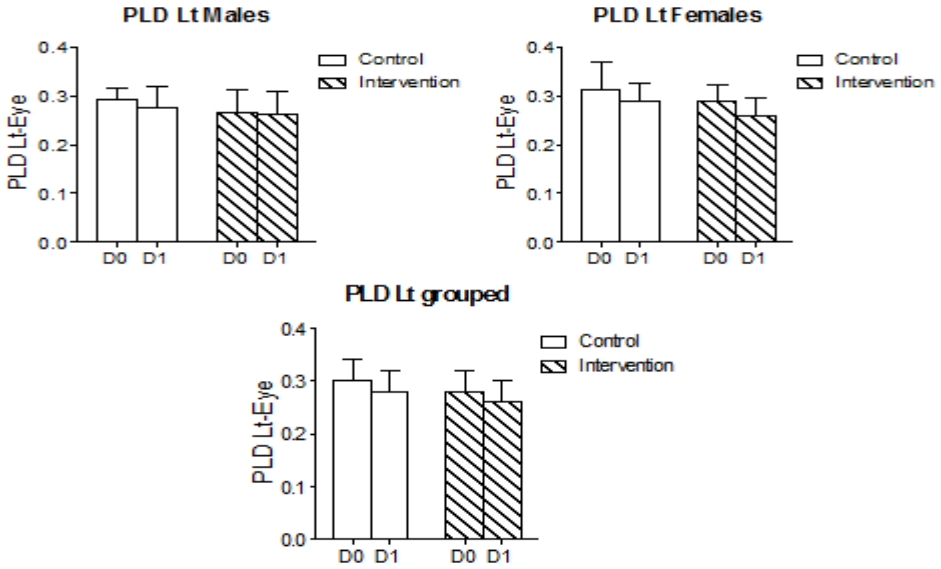
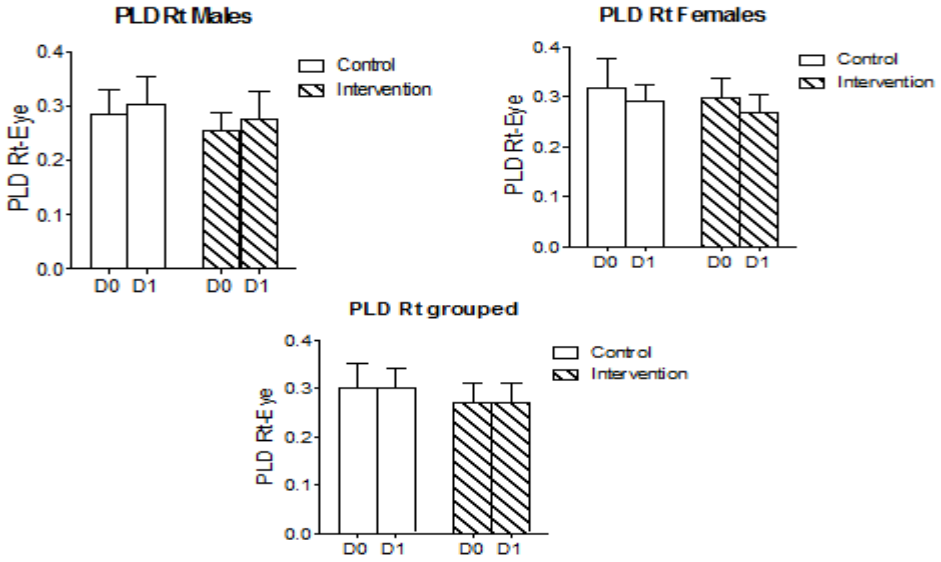


Figure 4: PLD ratio (right eye) of the participants before and after vestibular stimulation (data was presented as mean ± SD) (*P<0.05 is significant, **P<0.01 is significant,*P<0.001 is significant)**



DISCUSSION

The current study aimed to explore the impact of vestibular stimulation on olfactory sensitivity and PLD ratio. We have observed significant decrease in olfactory sensitivity followed by intervention in females. It was reported that the brain areas activated due to olfactory stimuli can influence vestibular function [9]. Followed by vestibular stimulation, there was a dilatation occurred during the fast phase and constriction during the slow phase was reported by earlier studies. [10] Vestibular stimulation modulates pupil size through its connections with pretectal area and the Edinger-Westphal nucleus, the sites from where sympathetic and parasympathetic fibers takes their origin [11]. These experiments testified existence of vestibulo-pupillary reflex [11]. It was proposed that assessment of auditory pupillary response is useful for evaluating vestibule-autonomic responses [12]. In the present study no significant difference was observed in PLD ratio followed by intervention.

Limitation: The major limitation of our study was less sample size.

CONCLUSION

Significant decrease in the olfactory sensitivity was observed followed by intervention. PLD ratio was not altered followed by vestibular stimulation. Our study highlights the need of future studies in this area for better understanding of vestibular influences on olfaction and pupillary responses.

REFERENCES

[1] Y.Soudry, C.Lemogne, Malinvaud, S.M. Consoli, P.Bonfils. Olfactory system and emotion: Common substrates. Journal of European Annals of Otorhinolaringology, Head and Neck diseases, 2011, 18-23.

[2] Deb Kumar Mojumder, Saumil Patel, Kenneth Nugent, John Detoledo, Jongyyeol Kim, Nabeel Dar, Henrik Wilms. Pupil to limbus ratio: Introducing a simple objective measure using two-box method for measuring early aniscoria and progress of papillary change in the ICU. Journal of Neurosciences in Rural Practice. 2015 Apr-Jun; 6(2): Pages 208-215.

[3] Stuart R Stainhauer, Greg J.Siegle, Ruth Condray, Misha Pless. Sympathetic and parasympathetic innervations of papillary dilation during sustained processing. International Journal Of Psychophysiology. March 2004; 52(1): Pages 77-86.

[4] Kumar Sai Sailesh, Archana R, Antony NJ, Mukkadan JK. Controlled vestibular stimulation: Supplementary Treatment For Hypothyroidism. Research Journal of Pharmaceutical and Biological and Chemical Sciences. 2014; 5(3): Pages(1842-1845).

[5] Jan Wersall, Ake Flok, and Per-G. Lundquist. Structural basis for directional sensitivity in cochlear and vestibular sensory receptors, Journal of Ann Otol Rhinol Laryngol. 2003. 112:574-582.

[6] Sai Sailesh Kumar, Archana Rajagopalan, Joseph Kurien. Vestibular stimulation for stress management in students. Journal of clinical and diagnostic research. 2016 february; 10(2): pages CC27-CC31.

[7] Kumar Sai Sailesh, Archana R and Mukkadan J.K. Controlled Vestibular stimulation :A Physiological Method of Stress Relief.Journal of clinical and diagnostic research.2014. Dec;8(12):BMO1-BM02.

[8] Ayana Joy, Kumar Sai Sailesh, Mukkadan J. K. Comparison of olfactory sensitivity for black pepper, lemon, camphor and Jasmine in healthy females of kerala, India. International Journal of Research in Ayurveda and Pharmacy. 2016. Sep;7(5):pages1-3.

[9] Mi-Na Gim, Sang-bin Lee, Kyung-Tae Yoo, Ji-Young Bae, Mi-Kyoung Kim, and Jung-Hyun Choi. The effect of olfactory stimuli on the balance ability of stroke patients. J Phys Ther Sci. 2015 Jan; 27(1): 109–113.

[10] Mark DeSantis, Bo E. Gernandt. Effect of vestibular stimulation on pupillary size. Experimental Neurology. 1971;30(1):

[11] H.W Kortschot, H A A De Jong, W J Oosterveld. Pupil size and microgravity: A study in parabolic flight. 1990;10(1): 45-51.

[12] Naoharu Kitajima, Koji Otsuka, Yasuo Ogawa, Shigetaka Shimizu, Mami Hayashi, Akihide Ichimura, Mamoru Suzuki. Auditory-pupillary responses in deaf subjects. 2010;20(5):373-380.