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Correlation of pupil to limbus diameter ratio (PLD ratio) with blood pressure and pulse rate in underweight females

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Abstract---There are no studies where the pupil to limbus diameter ratio was assessed in the underweight individuals. Hence, the present study was undertaken to observe the correlation of pupil to limbus diameter ratio (PLD ratio) with blood pressure and pulse rate in underweight females. A total of 30 underweight females were included in the present study after obtaining voluntary informed consent by convenient sampling. PLD ratio was measured manually by the two-box method. There was a positive correlation between the PLD ratio of the right eye with the blood pressure and pulse rate. However, it was not statistically significant. There was a negative correlation between the PLD ratio of the left eye and pulse rate but it was not statistically significant. There was a positive correlation between the PLD ratio and systolic blood pressure. However, it was not statistically significant. There was a positive correlation between the PLD ratio and diastolic blood pressure. However, it was not statistically significant. The study

results suggest the correlation between the PLD ratio and the blood pressure and pulse rate. The insignificant of results may be due to less sample size. The study recommends further detailed studies with a higher sample size to understand the relationship between these parameters.

Keywords--pupil limbus diameter ratio, autonomic functions, blood pressure, pulse rate.

Introduction

Autonomic functions play a major role in many disease conditions. The balance between the sympathetic and parasympathetic nervous systems is essential to maintain autonomic functions. When there is a disturbance in the autonomic functions, it leads to the disturbance of homeostasis and causes many diseases [1]. As autonomic functions are associated with multiple system functions, disturbance in the functions of the autonomic system causes dysregulation of the systemic functions [2]. Disturbance in the autonomic functions is associated with cardiovascular disorders and hence, there is a strong need to evaluate the autonomic functions as a routine test [3]. There exist multiple methods to assess autonomic functions [4]. One of the simple and affordable methods to assess the autonomic functions is the assessment of pupil to limbus diameter ratio [5-7]. It depends on the principle that the diameter of the pupil alters with the alteration of the autonomic activity whereas the limbus diameter is constant. So obtaining the diameter of the pupil and limbus and taking the ratio will give an idea about the autonomic activity. Earlier studies reported a positive correlation between the pupil to limbus diameter ratio and blood pressure and pulse rate [8]. However, there are no studies where the pupil to limbus diameter ratio was assessed in the underweight individuals. Hence, the present study was undertaken to observe the correlation of pupil to limbus diameter ratio (PLD ratio) with blood pressure and pulse rate in underweight females.

Materials and Methods

Study design: The present study was an observational study.

Study setting: The present study was conducted at the Department of Physiology, R.D.Gardi Medical College, Ujjain, Madhya Pradesh, India in collaboration with the Department of Physiology, Faculty of Medicine, Northern Border University, Arar, Kingdom of Saudi Arabia.

Study participants: A total of 30 underweight females were included in the present study after obtaining voluntary informed consent by convenient sampling. The following criteria were used for recruiting underweight females.

Inclusion criteria: Willing participants with BMI less than 18.5, within the age group of 18-24 were included in the study.

Exclusion criteria: Participants with eye disorders, any severe complications were excluded from the study.

Pupil to limbus diameter ratio: This was recorded by capturing the photograph of eye using the Motorola edge 20 mobile with the 108-megapixel camera. All the

photographs were taken in the research lab of the department of physiology. The illumination was kept constant for all the photographs. All the photographs were recorded at 11 am in the morning to avoid diurnal variations. After recording the photographs, they will be transferred to the PowerPoint slides and the diameter was measured manually by the two-box method [8]. Luxmeter was used to measure the illumination.

Measurement of blood pressure and pulse rate: Blood pressure and pulse rate was observed by using Dr Trust (USA) Fully Automatic Comfort Digital Blood Pressure BP Monitor Machine with Mdi Technology (Black).

Ethical consideration: The study protocol was approved by the institutional human ethical committee. (IEC Ref no 99/2021). Informed consent was obtained from all the participants. Confidentiality of data was maintained.

Statistical analysis: Data was analyzed using SPSS 20.0. Pearson correlation coefficient was used to analyze the data. A t-test was used to observe the significance of correlation. Data was expressed as mean and SEM.

Results

Table no 1 presents the correlation of the PLD ratio of the right eye with pulse rate, and systolic and diastolic blood pressure in the study participants. There was a positive correlation between the PLD ratio of the right eye with the blood pressure and pulse rate. However, it was not statistically significant. Table 2 presents the correlation of the PLD ratio of the left eye with pulse rate, and systolic and diastolic blood pressure in the study participants. There was a negative correlation between the PLD ratio of the left eye and pulse rate but it was not statistically significant. There was a positive correlation between the PLD ratio and systolic blood pressure. However, it was not statistically significant. There was a positive correlation between the PLD ratio and diastolic blood pressure. However, it was not statistically significant.

PLD ratio right eye	Pulse rate (beats/min)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
0.3097±0.0146	87.16±4.47	129±3.29	77.6±3.07
	R=0.0016	R=0.2917	R=0.1125
	P=0.933	P=0.1178	P=0.5539

Table-1: Correlation of PLD ratio of right eye with pulse rate, systolic and diastolic blood pressure in the study participants. (Data was presented as mean and SEM) (**P<0.01 is significant). Pearson correlation coefficient was used to calculate the r-value.

PLD ratio left eye	Pulse rate (beats/min)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
0.3224±0.0161	86.5±4.96	131.3±2.85	75±3.2.51
	R=-0.1964	R=0.1419	R=0.2951
	P=0.2982	P=0.4544	P=0.1133

Table-2: Correlation of PLD ratio of left eye with pulse rate, systolic and diastolic blood pressure in the study participants. (Data was presented as mean and SD) (**P<0.01 is significant). Pearson correlation coefficient was used to calculate the r-value

Discussion

There are no studies where the pupil to limbus diameter ratio was assessed in the underweight individuals. Hence, the present study was undertaken to observe the correlation of pupil to limbus diameter ratio (PLD ratio) with blood pressure and pulse rate in underweight females. There was a positive correlation between the PLD ratio of the right eye with the blood pressure and pulse rate. However, it was not statistically significant. There was a negative correlation between the PLD ratio of the left eye and pulse rate but it was not statistically significant. There was a positive correlation between the PLD ratio and systolic blood pressure. However, it was not statistically significant. There was a positive correlation between the PLD ratio and diastolic blood pressure. However, it was not statistically significant. The diameter of the pupil depends on the autonomic activity. It was well known that during the activation of the sympathetic nervous system, the pupil will dilate and when the parasympathetic system is activated, the pupil will constrict. The limbus diameter is always constant. As the diameter of the pupil is directly linked with the activity of the autonomic system, measuring the pupil diameter will correlate with the blood pressure and pulse rate. Blood pressure and pulse rate also depend on the autonomic activity. Hence, the pupil to limbus diameter ratio can be considered one of the autonomic function tests which is simple and cost-effective. However, there is a need for extensive studies with a higher sample size to establish the correlation between these parameters. The limitation of this study is less sample size and we planned further studies with a higher sample size for a better understanding of the relation between the PLD ratio and blood pressure and pulse rate.

Conclusion

The study results suggest the correlation between the PLD ratio and the blood pressure and pulse rate. The insignificant of results may be due to less sample size. The study recommends further detailed studies with a higher sample size to understand the relationship between these parameters.

Conflicts of interest: None declared

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