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Original Research Article

Relationship between Intra Ocular Pressure and Body Mass Index of Diabetics Attending a Diabetic Care Centre in Port-Harcourt

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Abstract: Diabetes mellitus is characterized by sustained elevation of blood sugar, which is the main body energy source derived from the food we eat. In Nigeria, diabetic management revolves around blood glucose control and less attention is given to eye care. The aim of the present study was to establish the relationship between Intra Ocular Pressure and Body Mass Index of Diabetics attending a Diabetes Care Centre in Port Harcourt. The Intra Ocular Pressure of the subjects was determined. Body Mass Index, was also determined. Fasting blood glucose was measured. Uncontrolled blood sugar for males were 30(53.6%), females, 23(52.3%). The relationship between fasting blood glucose and gender was not statistically significant (P<0.00). Most subjects were in over weight category (46%), normal (26%), obese (28%) and underweight (1%). 87% of the subjects had normal intra ocular pressure, 9% elevated intra ocular pressure and 4% had pathological condition. No association existed between Intra Ocular Pressure and Body Mass Index. This occurred because; most of the subjects had their blood sugar level under control. More diabetic care centres should be established and equipped by the government to care, educate and manage diabetic patients, thereby preventing them from developing visual impairment and blindness.

Keywords: Intra ocular pressure; Visual Impairment; Body Mass Index; Diabetes; Obesity.

1.0 INTRODUCTION

Diabetes mellitus (DM) is a condition characterized by sustained elevation of blood glucose or body sugar. Blood glucose is the main source of energy obtained from the food that we eat. Insulin produced by the pancreas enables glucose to pass through the cells of the body and produce energy. When the body is unable to produce insulin, or the insulin produced by the body cells are not enough, glucose is formed in the body but not utilized by the cells [1] Diabetes as a health challenge affects people with its associated secondary systematic disease like hypertension, increase in intraocular pressure (IOP), with its resultant decrease in visual acuity of the eye. When diabetes is out of control, it could affect vision leading to elevated /increased intraocular pressure (IOP) with its resultant- glaucoma and other ocular challenges. Prolonged duration of diabetes, inadequate control of glycaemia and hypertension were identified as the risk factors of Diabetic Retinopathy [2]. Increased Intra Ocular Pressure (IOP) was attributed to hypertension (increase in blood pressure), diabetes (increase in blood glucose), increase in body mass index (BMI) leading to glaucoma, with its resultant visual acuity loss and blindness [3]. All over the world, about 2.2 million deaths were classified to high blood glucose and other risks associated with diabetes [4]. Recently in sub-Saharan Africa, estimated 20 million people are suffering from diabetes. About 620/0 are yet to be diagnosed, this is expected to reach 41.4 million in 2035 which is 109.10/0 increase. According to this report, Nigeria has the highest diabetic patients, evaluated at 3.9 million, with prevalence of about 4.990/0, aged 20-79 years in population. The prevalence of diabetic mellitus in Nigeria indicated that all regions were affected. With South-south geo-political zone recording 9.8%, this is the highest in Nigeria [5]. Body Mass Index has been discovered to be related with obesity. Studies showed the effect of FBS (Fasting Blood sugar) level and BMI. Obesity all over the world is grouped as a serious health concern. BMI (Body Mass Index) mathematically is known as ratio of height to weight, it is attributed to the percentage of body fat. BMI is a vital index of

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cardiovascular health. BMI is linked to different diseases such as ocular defects in diabetic retinopathies. BMI of 25-29.9 was classified to be overweight, while BMI of 30 or above was classified to be obesity [6].

BMI in subjects can be further classified into four categories, using WHO standard of 2003:

i) Under nourished (BMI less than 20 Kg per m^2)
ii) Normal (BMI of 20-24.9 Kg per m^2)
iii) Over nourished (BMI of 25-29.9Kg per m^2)
iv) Obesity (BMI greater than 30 Kg per m^2) [7].

Linear relationship existed between ocular functions and increased BMI, due to effect of obesity in diabetic mellitus which lead to diabetic retinopathy in some patients [8]. BMI leading to obesity indicates independent association with cardiovascular diseases, especially high blood pressure which showed increase in heart states, Intra Ocular Pressure, in relation to ocular function. In 1998, the American Heart Association classified obesity to be a challenging factor for cardiovascular diseases [9]. The beta cells of islets of Langerhans in the pancreas, secrets insulin which functions through some specific cell receptors to facilitate glucose absorption into the cells. Insulin as an anabolic hormone, leads to preservation of energy which triggers the production of fats in the body system [11]. An increase in BMI, results to insulin resistance, leading to glucose level increase in the body system. Obesity, worldwide has facilitated increase in researches, due to its association with high level of cardiovascular diseases [12]. The National Institute for Health and Clinical Excellence declared obesity as an epidemic in developed countries. England for instance has one out of four of her adults obese. Higher percentage of their population were said to be obese. In the United Kingdom (UK) by the year 2005, about 60% of men, women 50% and 25% of the children population will be classified to be obese [13]. In India, their national surveys indicated reduction in mal-nutrition which resulted to increase in obesity especially among urban dwellers [14]. Overweight Indians were attributed to sedentary way of living which resulted to diabetes [15]. People's health in Nigeria has been affected negatively due to different lifestyle and lack of exercise which leads to different diseases such as diabetes, cardiovascular diseases, cancer and other related diseases that cause early death as a result of development in the society [16]. The prevalent rate of about 8 to 22 percent for obesity and overweight among adult Nigerians was recorded [17]. There was a notable relationship which occurred between body sugar levels and change in intra ocular pressure (IOP) of diabetic patients [18]. Few reported studies revealed the association between BMI and increase in IOP [19]. Some stated that orbital pressure resulting from much orbital lipid deposit could cause increased venous episcleral pressure, thereby leading to reduced outflow of aqueous fluid with increased IOP in obese individuals [20]. IOP was considered high in diabetic patients compared to non diabetics, elevated IOP was noted with increased BMI in a study of IOP in off-springs of diabetes mellitus individuals [21]. No relationship existed between body mass index and increased Intraocular pressure in glaucoma patients in a one day screening program at University of Port Harcourt Teaching hospital [22]. This study will access the association between Intra Ocular Pressure and Body Mass Index of diabetics attending a monthly meeting of Diabetic Association (DAN) at Senator Lee Maeba Diabetic Centre University of Port-Harcourt, Choba, Rivers State of Nigeria.

2.0 MATERIALS AND METHOD

2.1 Research Design

The Research was a cross sectional analytical descriptive study, done to establish the Relationship between Intra Ocular Pressure and Body Mass Index of Diabetics attending a Diabetic Care Center in Port Harcourt. The study involved 100 diabetic subjects aged 20-85 years old (both males and females) who had diabetes not less than one year confirmed by a physician. All the patients were invited during the monthly meetings of the diabetic association of Nigeria, Rivers state chapter at the senator Lee Maeba Diabetic Care Center. The study was explained to all the participants and only those that gave their oral consents, filled the questionnaire and the consent forms were recruited for the study. Their demographic details were measured such as, Weight, Height, Hip and waist circumference. Their intra ocular pressure measurement was determined using Schiotz Tonometer (Germany). Fasting Blood Glucose test for each participant was determined using Accu-check Glucometer.

Levels of Nourishment	**Body Mass Index (BMI)**
Under nourished	BMI less than 20 Kg per m^2
Normal	BMI of 20-24.9 Kg per m^2
Over nourished	BMI of 25-29.9 Kg per m^2
Obesity	BMI greater than 30 Kg per m^2

Table showing the classification of Body Mass Index (BMI) based on W.H.O stipulated order [7].

All the required information from the subjects such as their demographic and personal details during enumeration was obtained:

Intra-Ocular Pressure (IOP)

Intra-Ocular Pressure was measured using Improved Schioetz Tonometer (Germany) by the optometrist, using standard methods. The average normal tension was estimated at 15 to 20 mmHg. Tension of more than 20mmHg was considered to be high while tension above 25mmHg indicates pathological condition.

2.2 Method of Data Analysis

Statistical Analysis:

The statistical analysis of this research work will be analyzed using statistical package for social science (SPSS) version 23 and Microsoft Excel. The data

will be represented with tables and graphs while the continuous variables will be represented as mean and standard Error of mean. (i.e. mean ± SEM). Comparison of means will be done using ANOVA test and differences considered significant at P< 0.05.

2.3 Study Area / Location (s)

This study was conducted using diabetic subjects who attended the monthly meetings of the diabetic association of Nigeria at the Senator Lee Maeba Diabetes Care Centre.

Inclusion Criteria:

i) Diabetics 20 years and above, that were members at Diabetic Association of Nigeria, Rivers State branch.
ii) Hypertensive, diabetic subjects.
iii) Non hypertensive, diabetic subjects.
iv) Diabetic subjects with ocular challenges such as glaucoma, cataract, lens opacity, glass wearers and non glass wearers.

Exclusion Criteria:

i) Smokers and drug addicts.
ii) Alcoholics and mental deranged.
iii) Subjects, who did not give their consents and filled the questionnaires.
iv) Non diabetic subjects.

3.0 RESULTS

The following results were obtained from this study;

Table 1: Body Mass Index classification according to gender

		Gender		Total
		Female (%)	Male (%)	
BMI (kg/m2) category	Under Weight	3(6.8)	5(8.9)	8
	Normal	6(13.6)	15(26.8)	21
	Over Weight	21(47.7)	24(42.9)	45
	Obese	14(31.8)	12(21.4)	26
Total		44(100)	56(100)	100

P=0.00*, BMI=Body mass index

Table 2: Descriptive statistics of Intra-Ocular Pressure (IOP) of subjects

	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	87	87.0	87.0	87.0
High	9	9.0	9.0	96.0
Pathological	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Table 3: Gender differences of BMI and IOP of diabetic subjects

Parameters	Total	Male	Female
Age (years)	58.67 ± 1.33	58.23 ± 1.71	59.25 ± 2.13
BMI (kg/m^2)	27.17 ± 0.47	26.55 ± 0.63	27.99 ± 0.69
IOP (mmHg)	16.72 ± 0.46	16.77 ± 0.62	16.64 ± 0.68

*Significant gender difference ($p < 0.05$).

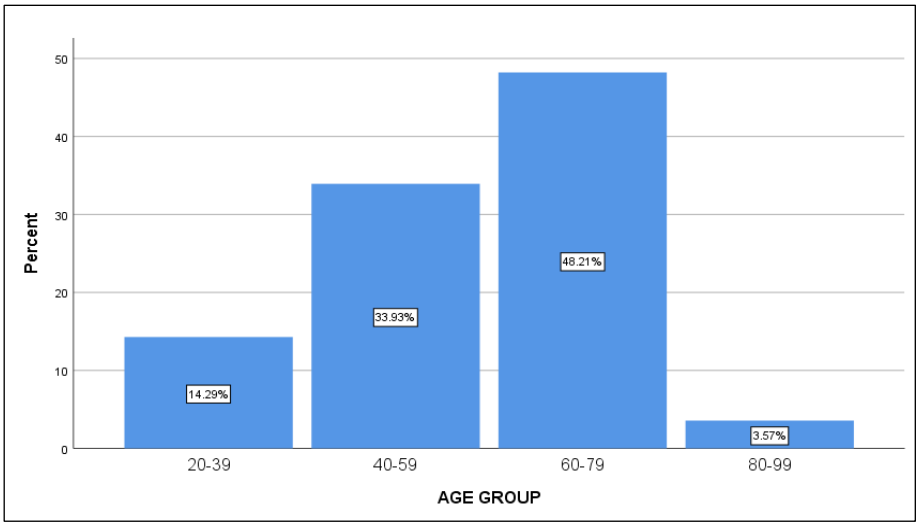

Figure 1: Age group distribution of males

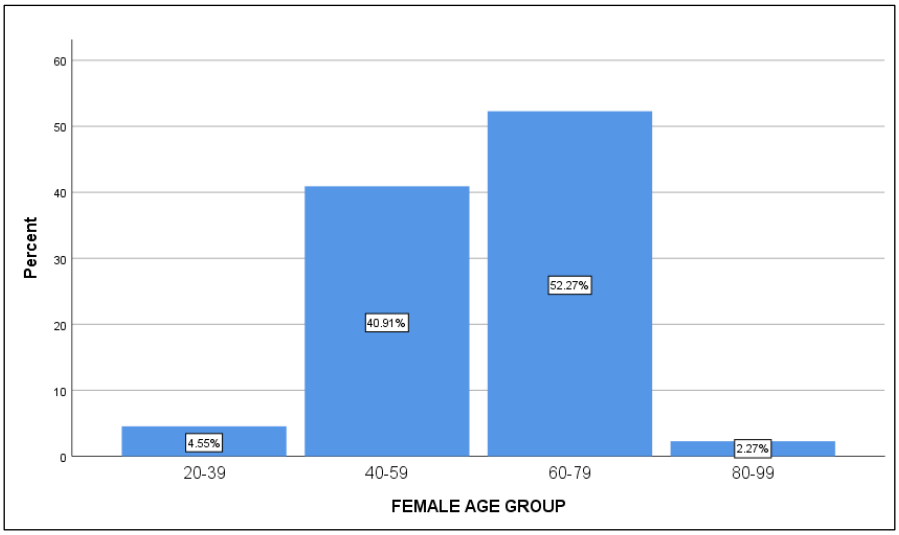

Figure 2: Age group distribution of females

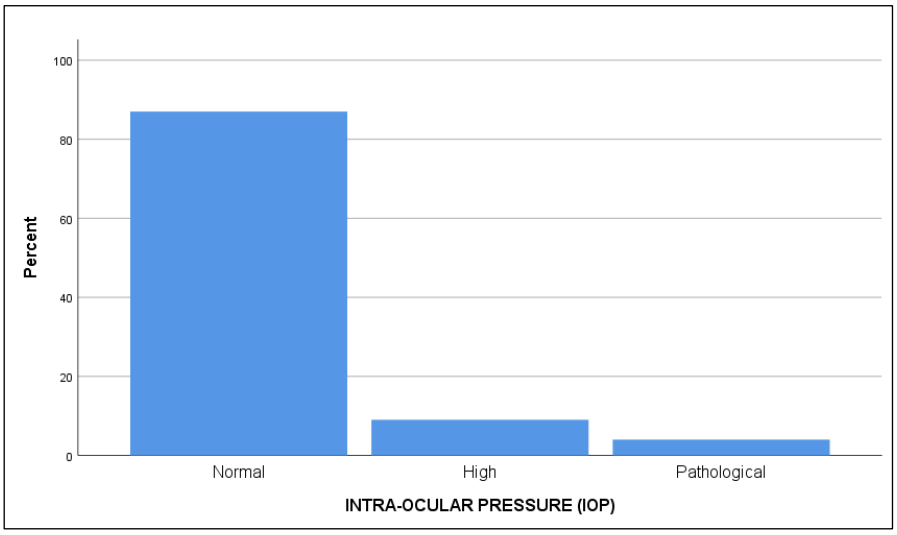

Figure 3: Frequency description of Intra-Ocular Pressure (IOP) of subjects

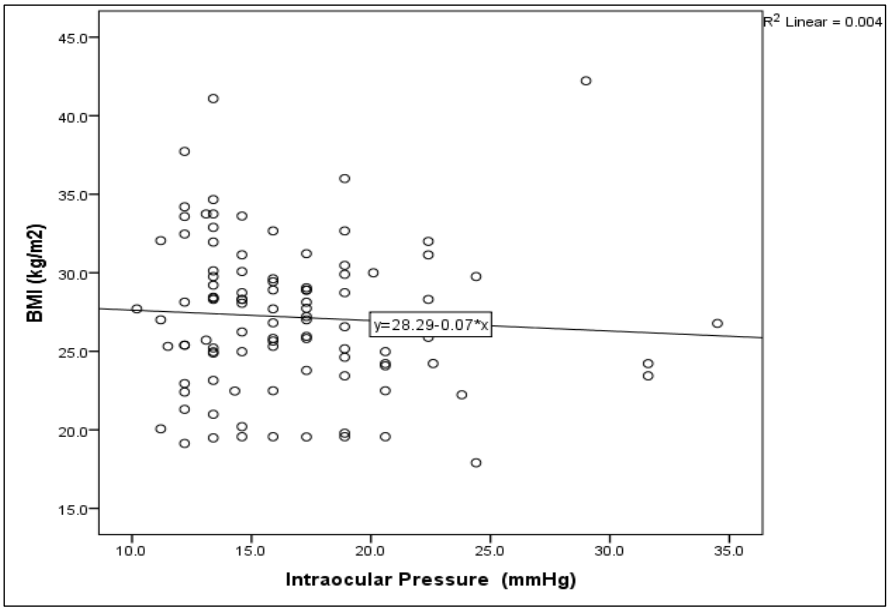

Figure 4: The relationship between intraocular pressure (IOP) and body mass index (BMI)

A total number of 100 diabetic subjects were used for this study. About 64% of the subjects had their blood glucose level under control while 36% of the subjects had uncontrolled blood glucose level. Figure 1 shows the age distribution of males who participated in the study. The table shows that majority of the male participants fall within the age group of 60-79, that is about 48.2% of the total population of males in the study. The lowest male age group is within the range of 80-99, representing about 3.5% of the male population. Figure 2 shows the age distribution of female participants. About 52% of females fall within the age bracket of 60-79. While the lowest age of females who participated in the research fall with the age range of 80-99 years, representing about 2.2% of the female populations in the study. The BMI classification of diabetic patients, according to gender shows that about 47.7% of females and 42.9% of males in the study are overweight. Also, about 31.8% of females and 21.4% of males are obsessed; about 13.6% of females and 26.8% of males have normal weight, while only 6.8% of females and 8.9% of males are underweight. Table 1 shows the body mass index classification according to gender. The descriptive analysis (Table 2) show that majority of the diabetics have a normal IOP. Those with normal IOP represents about 87% of the total population. About 9% of the diabetics had high IOP, while about 4% had pathological IOP. The frequency description (Figure 3) of Intra-Ocular Pressure (IOP) of subjects shows the distribution of diabetics according to the different IOP levels. The gender differences of Body Mass Index and Intra Ocular Pressure of diabetics subjects (Table 3) showed no difference between the mean ages of males and females. Also, there was no difference between the BMI and IOP of males and females. Figure 4 shows the scatter plot of body mass index with intra ocular pressure.

4.0 DISCUSSION

A total number of 100 diabetic subjects were used for this study, aged between 20 years to 85 years, both males and females. The sex distribution of males represented 56% and females 44%. From the findings of this research work, the highest age distribution of subjects increased between 60 to79 years for both males and females. Out of this number, 64% had their blood glucose under control, while 34% had uncontrolled blood glucose level. Fasting Blood Glucose according to gender for control was, male 26 (46.4%) and female 21(47.7%). Uncontrolled Blood glucose for males was recorded as 30(53.6%), while that of females was recorded as 23 (52.3%). These findings indicated that relationship between FBS and gender was not statistically significant (P<0.00). Most of the subjects were in over weight BMI category (46%), followed by normal (26%), obese (28%) and underweight (1%). The descriptive and frequency distribution of intra-ocular pressure (IOP) of the subjects indicated that 87% had normal IOP, 9% elevated IOP and 4% had pathological condition. In a study carried out by Cavdar *et al.,* (2014) [8], They observed that relationship existed between ocular parameters such as visual acuity, intra ocular pressure, cup disc ratio and Body Mass Index of diabetic subjects. Ohwin *et al.,* (2019) [6] in a related study indicated the association of ocular challenges in diabetics to increased Body Mass Index. This study showed that no association existed between ocular parameter (IOP) and Body Mass Index (BMI) of these diabetic subjects. This was due to the fact that: Most of these diabetics were regular at diabetic association monthly meeting and had their blood glucose under control due to good management. Cheung *et al.,* (2007) [20], stated that increase in IOP occurred as a result of too much deposit of lipid which increases venous pressure and decreased outflow of aqueous fluid. Shailaja *et al.,* (2014) [21], reported that intraocular pressure increase was caused by increased in blood pressure and increased BMI with its resultant glaucoma, visual acuity loss and eventually blindness.

CONCLUSIONS

This research work established the relationship between Intra-Ocular Pressure and Body Mass Index of diabetics attending Senator Lee Maeba Diabetic Care Centre in Port Harcourt, Rivers State of Nigeria. The result showed that most diabetic subjects due to their regular monthly tests and check-up activities, received free drugs, interact with their colleagues to share knowledge about the management of diabetes, had reduced ocular implications that could result due to increase in Intra-Ocular Pressure and Body Mass Index.

REFERENCES

1. National diabetes statistics report. (2017). https://dev.diabetes.org/sites/default/files/2019-06/cdc-statistics-report-2017.pdf
2. Yau, J. W., Rogers, S. L., Kawasaki, R., Lamoureux, E. L., Kowalski, J. W., Bek, T., ... & Meta-Analysis for Eye Disease (META-EYE) Study Group. (2012). Global prevalence and major risk factors of diabetic retinopathy. *Diabetes care*, *35*(3), 556-564. Doi: 10.2337/dc11-1909.
3. Shailaja. (2014). International Journal of Medical Resources. *Health science, 3*(3), 566-569.
4. World Health Organization, 2017.
5. Uloko, A. E., Musa, B. M., Ramalan, M. A., Gezawa, I. D., Puepet, F. H., Uloko, A. T., ... & Sada, K. B. (2018). Prevalence and risk factors for diabetes mellitus in Nigeria: a systematic review and meta-analysis. *Diabetes Therapy*, *9*, 1307-1316. Doi: 10.1007/s 13300-018-0441-1.
6. Ohwin, P. E., & Abadon, E. G. (2019). Cardiovascular and Nutritional Changes in ocular parameters. *J Anat Physio study*, 3, 1-6.
7. World Health Organization, 2003.
8. Cavdar, E., Ozkaya, A., Alkin, Z., Ozkaya, H. M., & Babayigit, M. A. (2014). Changes in tear film, corneal topography, and refractive status in premenopausal women during menstrual cycle. *Contact Lens and Anterior Eye*, *37*(3), 209-212.

9. Argueso, P., & Gibson I. K. (2001). Epithelial mucus of the ocular surface: Structure, biosynthesis and function. *Experimental Eye Research*. https://www.sciencedirect.com/science/article/pii/S0014483501910450
10. Hennis, A., Wu, S. Y., Nemesure, B., Leske, M. C., & Barbados Eye Studies Group (2003). Hypertension, diabetes, and longitudinal changes in intraocular pressure. *Ophthalmology*, *110*(5), 908–914. https://doi.org/10.1016/S0161-6420(03)00075-7
11. Conen, D., Ridker, P. M., Mora, S., Buring, J. E., & Glynn, R. J. (2007). Blood pressure and risk of developing type 2 diabetes mellitus: the Women's Health Study. *European heart journal*, *28*(23), 2937–2943. https://doi.org/10.1093/eurheartj/ehm400
12. Argüeso, P., & Gipson, I. K (2012). Assessing mucin expression and function in human ocular surface epithelia in vivo and in vitro. Methods in molecular biology (Clifton, N.J.), 842, 313–325. https://doi.org/10.1007/978-1-61779-513-8_19.
13. Argüeso, P., Spurr-Michaud, S., Russo, C. L., Tisdale, A., & Gipson, I. K. (2003). MUC16 mucin is expressed by the human ocular surface epithelia and carries the H185 carbohydrate epitope. *Investigative ophthalmology & visual science*, *44*(6), 2487-2495. DOI: 10.1167/iovs.02-0862.
14. Hirose, H., & Saito, I. (2003). Trends in blood pressure control in hypertensive patients with diabetes mellitus in Japan. *Hypertension research: official journal of the Japanese Society of Hypertension*, *26*(9), 717–722. https://doi.org/10.1291/hypres.26.717
15. Kelly, T., Yang, W., Chen, C. S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International journal of obesity*, *32*(9), 1431–1437. https://doi.org/10.1038/ijo.2008.102
16. Talley, N. J., Kellow, J. E., Boyce, P., Tennant, C., Huskic, S., & Jones, M. (2008). Antidepressant therapy (imipramine and citalopram) for irritable bowel syndrome: a double-blind, randomized, placebo-controlled trial. *Digestive diseases and sciences*, *53*, 108-115. https://doi.org/10.1007/s10620-007-9830-4
17. Cavdar, E., Ozkaya, A., Alkin, Z., Ozkaya, H. M., & Babayigit, M. A. (2014). Changes in tear film, corneal topography, and refractive status in premenopausal women during menstrual cycle. *Contact lens & anterior eye: the journal of the British Contact Lens Association*, *37*(3), 209–212. https://doi.org/10.1016/j.clae.2013.11.005
18. Luis Guiherme Milesi Pimentel, Carolina P.B. Gracitelli, Leticia Sant-Ana Cardoso da Silvia, Aline Katia Siqueria Souza and Tiago Santos Prata. Department of Ophthalmology, Federal University of Sao Paulo, 04021-oc, Vila Mariana, SP Brazil Glaucoma Unit, Hospital Medicine dos Ihos, 06018-180 Osasco, SP, Brazil.
19. Lee, J. S., Lee, S. H., Oum, B. S., Chung, J. S., Cho, B. M., & Hong, J. W. (2002). Relationship between intraocular pressure and systemic health parameters in a Korean population. *Clinical & experimental ophthalmology*, *30*(4),
20. Cheung, N., & Wong, T. Y. (2007). Obesity and eye diseases. *Survey of ophthalmology*, *52*(2), 180–195. https://doi.org/10.1016/j.survophthal.2006.12.003
21. Shailaja. (2014). International Journal of Medical Resources. *Health science*, *3*(3), 566-569.
22. Pedro-Egbe, C. N., Anoyesuku, E. A., Nathaniel, G. I., & Komolafe, R. O. (2013). Relationship between BMI and Intraocular pressure 2013 University of Port Harcourt Nig. *British Journal of Medicine and Medical Research*, 3131, 589-593.