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ORIGINAL ARTICLE

Effect of Different Beverages on Intraocular Pressure

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ABSTRACT

Purpose: Young individuals regularly consume a wide range of drinks with caffeine content. In this study, healthy young subjects' intraocular pressure (IOP) was evaluated in relation to energy drinks, tea,coffee and water.

Methodology: A prospective longitudinal, multi-centered study was conducted from March 2022 to August 2022. Data was collected through non-probability consecutive sampling technique. A total of 100 subjects of both genders (male and female) age ranging between 15 to 30 years were included. A thorough ophthalmic examination was required for subjects to satisfy a set of study protocol, that included not suffering any ocular diseases, intraocular pressure of 10-20 mmHg, absence of systemic diseases. Exclusion criteria included patient who had undergone anterior and posterior segment ophthalmic surgeries. The participants were randomized into four groups at random. Each group comprises of 25 subjects. IOP was measured before as baseline and after 60 min of intake. SPSS was used for data analysis.

Results: Out of 100 subjects 77 were female and 33 were male. The first group consumed tea, the second group coffee, the third group energy drinks, and the fourth group water. Baseline IOP on average in each group water, tea, coffee and energy drink intake was 15.58 ± 1.79, 15.49 ± 1.87, 15.23 ± 1.05, 15.68 ± 1.32 respectively. While IOP was 14.89±2.01, 15.01 ± 1.23, 15.67±1.98 and 16.01 ± 2.33 after 60 minutes of consuming water, tea, coffee, and energy drinks. IOP fluctuations between before and after consuming water, tea, coffee, and energy drinks were 0.69, 0.48, -0.75, and -1.29.

Practical Implication: This study has important clinical implications since it may help people realise they should limit their intake of certain beverages in order to lower their intraocular pressure (IOP). No research on the impact of beverages on intraocular pressure (IOP) has been done in Pakistan, as far as we are aware. This led to the formulation of the current investigation.

Conclusion: Two groups demonstrated an increase in IOP, whereas the IOP in the other two groups declined. Compared to tea consumption, which has a modest quantity of caffeine, consuming coffee and energy drinks raises intraocular pressure. This study suggested avoidance of coffee and energy drinks intake should be emphasized prior to IOP measurement to avoid any potential error.

Keywords: intraocular pressure, beverages, energy drinks, tea, coffee, water

INTRODUCTION

Caffeine (1,3,7-trimethylxanthine) is found in a variety of beverages, including coffee, tea, and colas, as well as in a variety of foods, including cakes and chocolates. The amount of caffeine in a typical cup of coffee (236 mL) is 135–150 mg.[1] Caffeine intake, such as that found in coffee or tea, is a prevalent practice all over the world.[2] Caffeine consumption is being studied whether it has an effect on intraocular pressure (IOP), while even influence in ocular pressure can increase the chance of developing glaucoma.[3,4] Optic nerve damage could affect a greater number of individuals as a result of even minor changes in the population's distribution of ocular pressure.

Many researches have looked at the acute effects of caffeine-containing drugs on IOP in healthy people[5], glaucoma suspects[6], and glaucoma patients[7] have investigated the instant effect on IOP of numerous caffeine-containing medications. Most investigation revealed mild acute IOP elevations following intake, ranging from 0 to 4 mmHg, during a 1- to 4-hour timeframe. The relationship between coffee consumption and IOP or the risk of glaucoma has received little attention in studies. For instance, consuming coffee can change the way that acute caffeine consumption affects IOP.[8] Studies on the link between coffee consumption and the risk of glaucoma it has shown mixed findings and even the link may be driven by a history of glaucoma in the family.[9-11]

The findings suggests that glaucoma tests and patient education should be extended, especially in areas where caffeine consumption—such as that found in coffee, tea, and energy drinks—is widespread and long-term.[12] Caffeine's pathophysiological effects in the eye have been studied only just few instances. Coffee consumption, on the other hand, has been linked to a momentary increase in intraocular pressure (IOP) in glaucoma patients. An hour after drinking coffee, such pressure spikes have an amplitude of 1 to 2 mmHg.[13] Considering that a normal IOP ranges from 14 to 22 mmHg, the relevance of this little rise is unclear, especially given the findings of other investigations that did not find any evidence of such an impact.[14] Additionally, it is well known that equivalent volumes of water, between 250 and 1000 mL, can cause such an increase.[15]

The effects of caffeine on IOP are considerable in different groups of people, according the research. With the development of new beverages such as energy drinks, energy shots, and caffeinated beverage consumption among university students has increased over time. The goal of this research was to see if there was a direct caffeine influence on IOP. As a consequence, coffee, tea, and energy drinks were used in this investigation.

METHODOLOGY

From March 2022 to August 2022, a prospective longitudinal multi-centered study was carried out. Students participated in the research. The technique of non-probability consecutive sampling was used to acquire the data. There were 100 individuals in all, 100 of each gender (male and female), with best corrected visual acuity (BCVA) 6/6 and ages ranging from 15 to 30.

The subjects' verbal informed consent was granted after a thorough explanation of the study's objectives. The inclusion criteria for the subjects were as follows: no ocular disease, IOP of 10–20 mmHg, no systemic diseases (such as hypertension, diabetes, or vascular disease), confirmation of abstinence from caffeine or caffeine-containing beverages, and abstinence from any systemic medicines and/or alcohol. Patients who had experienced anterior and posterior segment ophthalmic surgery were eliminated. Any participant who disclosed a personal or family history of glaucoma was precluded from the study.

All patients underwent detailed history and best corrected visual acuity as part of an eye examination, slit lamp biomicroscopy and automated applanation tonometry. BCVA was done by using projection-type Snellen chart. To rule out ocular

diseases, a comprehensive fundus examination using a slit lamp was done. Intraocular pressure (IOP) was measured with Air Puff tonometer (Non-Contact Tonometer NT-530/510 NIDEK) for baseline IOP measurement. IOP was recorded between noon and 2 pm using an Air Puff tonometer to reduce the impact of diurnal fluctuations in IOP. Caffeine's acute effect on intraocular pressures in healthy subjects aged 15 to 30 years was investigated.

The study was performed in accordance with the Declaration of Helsinki, which regulates scientific research human participants. The participants were randomized into four groups at random. Each group comprises of 25 subjects. One group drank tea; the other drank coffee, while the third group drank energy drinks and fourth group intake water. Each person in the group had a glass of tea, coffee, or energy drink (equivalent to 250 mL of beverage with 85 mg of caffeine). IOP readings were taken after intake for 60 minutes. IOP measurements were taken over the same time period while As a control, 250 mL of water was instructed to be consumed by 25 of the subjects. A satisfactory result was defined as a set of three consecutive readings with an averaged fluctuation of less than 3 mmHg.

The results for all subjects in each group were averaged up, and means were presented to facilitate in statistical comparison (standard deviation). Gender and age group demographic information was represented by mean, Standard deviation (SD), frequencies, and percentages. Comparative quantitative variables were compared using the paired sample t-test (pre and post one hour IOP variation). The statistical package for social sciences (SPSS, version 22.0) was used to analyze the data and determine statistical significance. Statistics were considered significant if the P value was less than 0.05.

RESULTS

The research study included 100 participants in total. Table 1 presents the demographic information of age and gender distribution. The spectrum of ages was 15 to 30, with a mean age of 22.5 ±2.89. The socio-demographic demographics of the study's participants showed that there were 23 males and 77 females. (Figure 1).

Table 1: Frequency of Demographic Data

Demographic Data	(n=100)
Age (years)	22.5 ± 2.89
Gender (F:M)	77:23

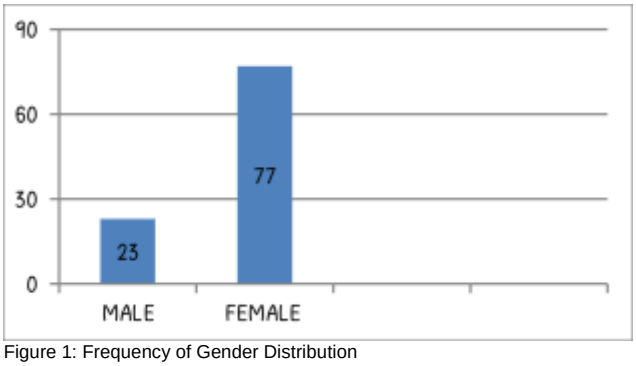

Figure 1: Frequency of Gender Distribution

The range of ages was 15 to 30 years, and the group was further separated into three age ranges: 15-20, 20-25, and 25–30 years, each group comprises 16 , 71 and 13 subjects, respectively (Figure 2).

Overall, there were 100 participants. The participants were divided randomly into four groups. Each group has 25 participants. The first group consumed tea, the second group coffee, the third group energy drinks, and the fourth group water (Figure 3).

Results were expressed as the difference between baseline IOP and measurements taken 60 minutes after drinking tea, coffee energy drink or water. Baseline IOP on average in each group water, tea, coffee and energy drink intake was 15.58 ± 1.79, 15.49 ± 1.87, 15.23 ± 1.05, 15.68 ± 1.32 respectively. While IOP was 14.89±2.01, 15.01 ± 1.23, 15.67±1.98 and 16.01 ± 2.33 after 60 minutes of consuming water, tea, coffee, and energy drinks (Table 2).

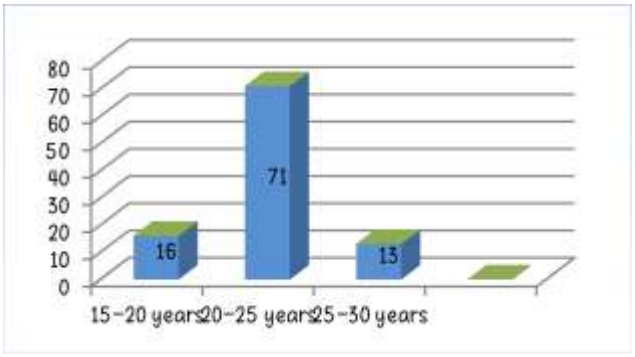

Figure 2: Frequency of Age Distribution

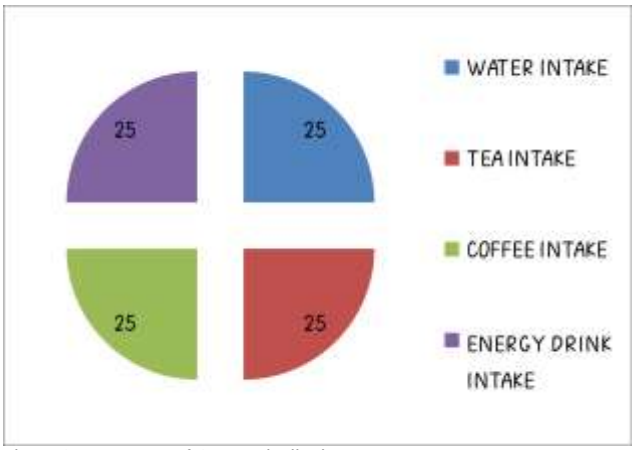

Figure 3: Frequency of Group Distribution

Table 2: Analyzing Intraocular Pressure Among Various Groups

IOP Measurement	Group Distribution	Time		P value
		Baseline	After 60 Minutes	
	Water intake	15.58 ± 1.79	14.89±1.01	0.056
	Tea intake	15.49 ± 1.87	15.01 ± 1.23	0.031
	Coffee intake	15.23 ± 1.05	15.98±1.18	0.004
	Energy drink intake	15.68 ± 1.32	16.97 ± 1.89	0.000

IOP fluctuations between before and after consuming water, tea, coffee, and energy drinks were 0.69, 0.48, -0.75, and -1.29 (Figure 4). The current study found that IOP significantly decreased after drinking water and just slightly varied between baseline and after consuming tea for 60 minutes. According to the results of the current investigation, IOP dramatically increased between baseline and after taking an energy drink and barely changed between baseline and 60 minutes of coffee consumption.

In the current study, there were 4 groups. Two groups demonstrated an increase in IOP, whereas the IOP in the other two groups declined. Compared to tea consumption, which has a modest quantity of caffeine, consuming coffee and energy drinks raises intraocular pressure. Whether these alterations are also clinically significant, it is required to compare the optic nerve head before and after caffeine consumption.

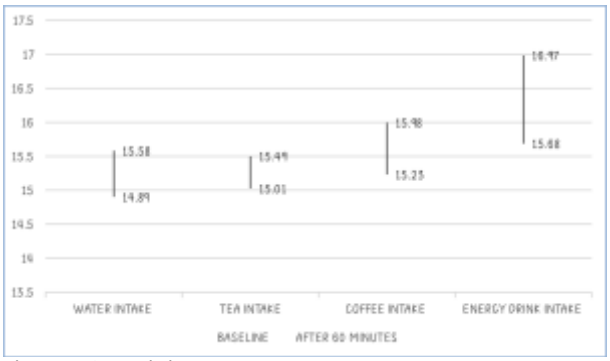

Figure 4: IOP Variation

DISCUSSION

Caffeine's impact on human IOP has been reported in a variety of ways, with some researchers detecting an increase [16] and others found no any change[17]. Bae JH et al.,[10] conducted research to look into the connection between drinking coffee, tea, or soft drinks and the possibility that Koreans may get open-angle glaucoma (OAG). The sample for analysis included participants who were at least 19 years old. When numerous factors were taken into consideration, coffee consumption was highly linked to OAG, however tea or soft drink consumption had no such connection. Coffee drinkers had a higher chance of acquiring OAG compared to non-drinkers. The findings imply that coffee consumption may influence OAG risk, particularly in men. Nonetheless, the gap between these studies was An earlier study involved individuals with open angle glaucoma; the current study involved healthy patients. According to this study, increased intraocular pressure is more closely associated with coffee than with tea and soft drinks. These findings are relevant to the current study because they show that the coffee intake group significantly raised intraocular pressure while the tea intake group only slightly decreased it.

Chandrasekaran S et al., [18] carried out a research study to investigate the association between caffeine and coffee consumption and intraocular pressure (IOP). 3654 individuals aged 49 or older were evaluated as part of the Blue Mountains Eye Study. Average daily consumptions of coffee and tea were included in a thorough medical history questionnaire. Automated perimetry and Goldmann applanation tonometry were used in the eye examination. Participants who were taking glaucoma medication or had undergone cataract or glaucoma surgery in the past were excluded. In individuals with open-angle glaucoma, the study found a strong cross-sectional association between coffee consumption and higher caffeine intakes and elevated intraocular pressure. Due to the fact that caffeine consumption was linked to elevated IOP, this study is relevant to the current investigation.

Avisar R et al., [19] conducted research to see how drinking coffee affects eye pressure (IOP). The difference between the change in IOP from baseline in each group at 60 and 90 minutes after drinking normal versus decaffeinated coffee was statistically significant. IOP increased more in regular coffee drinkers, and this increase may have therapeutic significance. For individuals who have glaucoma or ocular hypertension, caffeine-containing beverages could not be suggested (those containing less than 180 mg of caffeine). This work is pertinent to ongoing research because of the link between caffeine intake and increased IOP.

Gasiunas K et al., [20] conducted a study in 2022 to evaluate how variations in intraocular pressure (IOP) may be impacted by green tea and catechins. The study involved 43 young volunteers in total. The study employed two extracts: green tea and epigallocatechin gallate (EGCG, 400 mg capsules), as well as a placebo (400 mg capsules). IOP was measured before to, 30 minutes, one and two hours after each extract and a placebo were consumed. The findings of the study suggested that people with elevated IOP or glaucoma risk factors could gain significant improvements from consuming green tea or its concentrated extracts. According to a prior study that is consistent with the current study, IOP drops after drinking tea. Although, was that the present study only focused on the consumption of tea, whereas the prior study's focus was on green tea.

Kim J et al., [21] conducted a study investigated if a genetic tendency for higher IOP affected the correlations between frequent caffeine consumption and intraocular pressure (IOP) and glaucoma. Researchers also investigated the relationship between IOP and genetic propensity for increased coffee consumption. The connection between habitual caffeine use and decreased IOP was marginal, and there was no correlation between caffeine consumption and glaucoma. However, among those who had the strongest genetic predisposition to raised IOP, higher coffee consumption was linked to a greater IOP and a higher prevalence of glaucoma. This study provides evidence that, in addition to coffee drinking raising the IOP, there are additional risk factors, such as genetics, for developing glaucoma.

Avisar R et al., [22] did an investigation to determine whether consuming coffee would influence the intraocular pressure in the eyes (IOP). This crossover trial included patients with normotensive glaucoma or ocular hypertension to examine the effects of drinking standard coffee (180 mg of caffeine in a 200 mL beverage) and decaffeinated coffee (3.6 mg caffeine in a 200 mL beverage). Following intake of regular versus decaffeinated coffee, the difference in IOP change from baseline in each group was statistically significant at 60 and 90 minutes. Regular coffee drinkers had a larger increase in IOP, which could have therapeutic implications. Consuming caffeinated beverages with less than 180 mg of caffeine may not be advised for people with ocular hypertension or normotensive glaucoma. This study's results correspond the current study's finding that use of an energy drink increased IOP.

The current study provides initial information on the effect of coffee,tea ,energy drinks and water intake on intraocular pressure variation of healthy young subjects. A more detail questionnaire are needed to further verify the potential effect of different beverages ingredients on IOP. This study suggested avoidance of coffee and energy drinks intake should be emphasized prior to IOP measurement to avoid any potential error.

CONCLUSION

This study concluded that two groups demonstrated an increase in IOP, whereas the IOP in the other two groups declined. Compared to tea consumption, which has a modest quantity of caffeine, consuming coffee and energy drinks raises intraocular pressure. This study suggested avoidance of all type of beverages prior to IOP measurement to avoid any potential error.

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