African Multidisciplinary
Journal of Sciences and Artificial Intelligence

ISSN : 3434-9871

Index: Harvard, Boston, Sydney University, Dimensions, Lens, ResearchGet Scilit, Semantic, Google Scholar, Base etc

https://doi.org/10.58578/AMJSAI.v2i2.5138

The Effect of Alcohol Consumption on Tear Production in Young Adults: Using Smirnoff Ice as a Case Study

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Article Info:

Submitted:	Revised:	Accepted:	Published:
Feb 7, 2025	Feb 22, 2025	Mar 6, 2025	Mar 11, 2025

Abstract

Alcohol is a depressant that interferes with tear production, disrupting its balance and leading to insufficient eye lubrication and gradual onset of dry eyes. To determine the effect of alcohol on tear production. Eighty (80) eyes of 40 healthy subjects between 18-30 years. The baseline measurement of the mean tear production was taken with Schirmer tear strip before the commencement of the work. The subject ingested a bottle of Smirnoff ice drink (33 cl volume with 5.5% alcohol). The mean tear production was then measured at 30, 60 and 90-minutes intervals. The mean value before the intake of alcohol and 30, 60, and 90-minutes intervals after the intake in both eyes (OD and OS) were measured. The baseline value for OD was 24.05±6.41, which increased to 26.88±7.43 in 30 minutes. Thereafter, the value decreased to 25.93±6.64 and 25.58±6.22 respectively at 60 and 90 minutes intervals. The baseline value for OS was 23.13±6.62 and this also increased to 26.13±7.45, 30 minutes after intake; and 24.78±6.65 and 24.88±6.51 respectively at 60 and 90 minutes intervals. Alcohol intake has an effect on tear production leading dry eyes syndrome.

Keywords: Alcohol, Tear Production, Young Adults, Smirnoff Ice, Case Study

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INTRODUCTION

Alcohol is classified as a depressant because it slows down the neuro-activities of the central nervous system (CNS); leading to a decrease in motor coordination and reaction time; disruption of tear production which lead to dry eye syndrmoe and blurry vision [1, 2, 3]. The impact of alcohol is carried to the liver where it is exposed to enzymes and metabolised [4, 5].

The tear film is a clear watery fluid secreted by the lacrimal gland. These ensure that the conjunctiva and cornea are moist and healthy at all times [6, 7, 8]. It also provides nutrient and oxygen to the avascular cornea. Periodic involuntary blinking spreads the tears over the cornea and conjunctiva and causes a pumping action of the lacrimal drainage system, through the lacrimal puncta into the nasolacrimal duct. The tear film has a thickness of approximately 7-10 mill microns [9, 10, 11].

Alcohol can cause visual impairment, and in tears it is found to associate with tear osmolality, resulting in dehydration and consequently leading to dry eyes and irritation [6]. It can induce inflammation throughout the body including the eye [3]. This inflammation can contribute to the development or exacerbation of dehydration and dry eye syndrome.

MATERIALS AND METHODS

The study was a prospective experimental design that involved the use of convenient sampling technique to recruit the participants for the study. One hundred (100) questionnaire were distributed to undergraduates of the University of Benin and forty (40) of them who met the selection criteria were selected for the study. All selected participants are healthy non-habitual alcohol consumers with no form of ocular or systemic diseases. There was no history of dry eyes syndrome and they all expressed the willingness to participate in the study by signing the consent form. Ethical clearance was obtained from the Departmental Research and Ethics Committee of the Department of Optometry, University of Benin, Benin City, in accordance with the tenets of the Declaration of Helsinki. The study was carried out within a period of 6 months (February 2022 to August 2022).

Study Population

The study population consisted of 40 undergraduate students of the University of Benin. The subjects were made up of 16 males representing (40%) of the study population and 24 females representing (60%) of the study population. They were aged between 18-30years with mean age of 24.90±2.60 years. The subjects weighed between 60 -- 75kg and were selected with the use of a standard well-structured questionnaires for dry eye and alcohol ingestion. Ethical letter were approved with ethical number LS21938 from the ethical communittee of Life Sciences to certified the use of human forthis study

Materials used for the study.

- Schirmer's Tear strip; Smirnoff ice; Stopwatch; Snellen Visual Acuity Chart.
- Penlight; Disposable Hand-gloves; Face masks; Recording book and pen;
- Keeler direct Ophthalmoscope.
- Disposable graduated medical grade plastic measuring cups;
- A detailed questionnaire for dry eyes.

Research procedures;

Standard questionnaire on dry eye and alcohol intake were distributed among the subjects to provide answers from which eligible subjects for the research was selected. The purpose of the study was explained to the subjects before the commencement of each stage of the exam to ensure maximum cooperation. Eligible subjects for the study were also advised not to eat any form of food before the assessment [12]. A detailed case history was taken and the following eye examination conducted. Ethical letter were approved with ethical number LS21938 from the ethical communittee of Life Sciences to certified the use of human forthis study

1. The visual acuity measurement was carried out monocularly on each eye the OD (right) and OS (left), using the literate Snellen,s chart at both distance (6M) and near (40cm) and readings were recorded.
2. External eye examination was performed on each eye to rule out any form of external ocular anomaly with the aid of penlight.
3. Schirmers tear test was carried out on each eye after the external eye examination' to determine the rate of tear production. This was by inserting schirmers strip into the lower conjunctival cul-de-sac at the junction of the mid-temporal thirds of the

lower lid. The moistened portion of the strip was measured 5 minutes after insertion. Subjects with less than 10mm of wetting without anaesthesia were considered unsuitable and were ruled out from the experiment [13, 14]..

After taking the initial reading with the Schirmers strip, each of the subjects were given Smirnoff ice (33cl volume with 5.5% alcohol) concentration to ingest. Thereafter,'the strip was inserted after which measuerement were taken at interval of 30, 60 and 90 minutes. The test procedure was repeated on each of the subjects and the readings were recorded [15, 13].

Data analysis

The data obtained from the measurement were analyzed using Statistical package for Social Sciences version 22.0. The Komogorov Smirnov-Z and T test with standardized skewness and kurtosis (measurement of central spread) was used to test for normality of the distribution of data.

Limitation of the study

1. The difference in body weight within the age range chosen for the study.
2. The lack of full co-operation from the subjects.

RESULTS

The study population who were made up of 40 subjects (80) eyes were non-habitual alcohol drinkers aged between 18-30 years; mean age: 24.90±2.60 years. The study population consisted of 16 males (40%) and 24 females (60%).

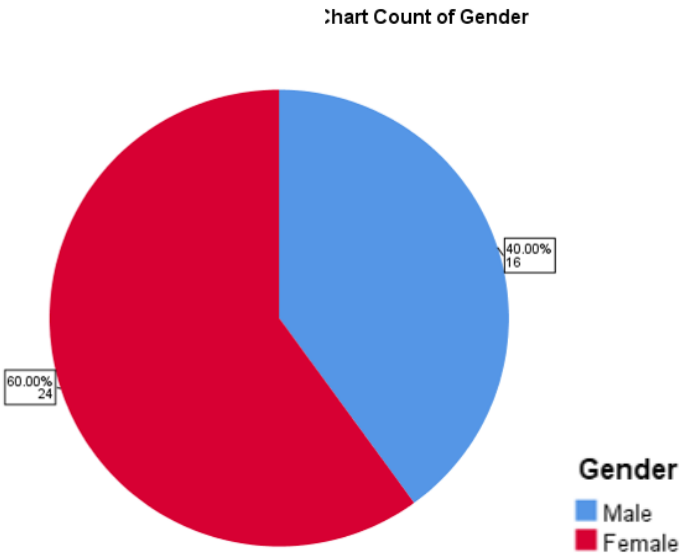


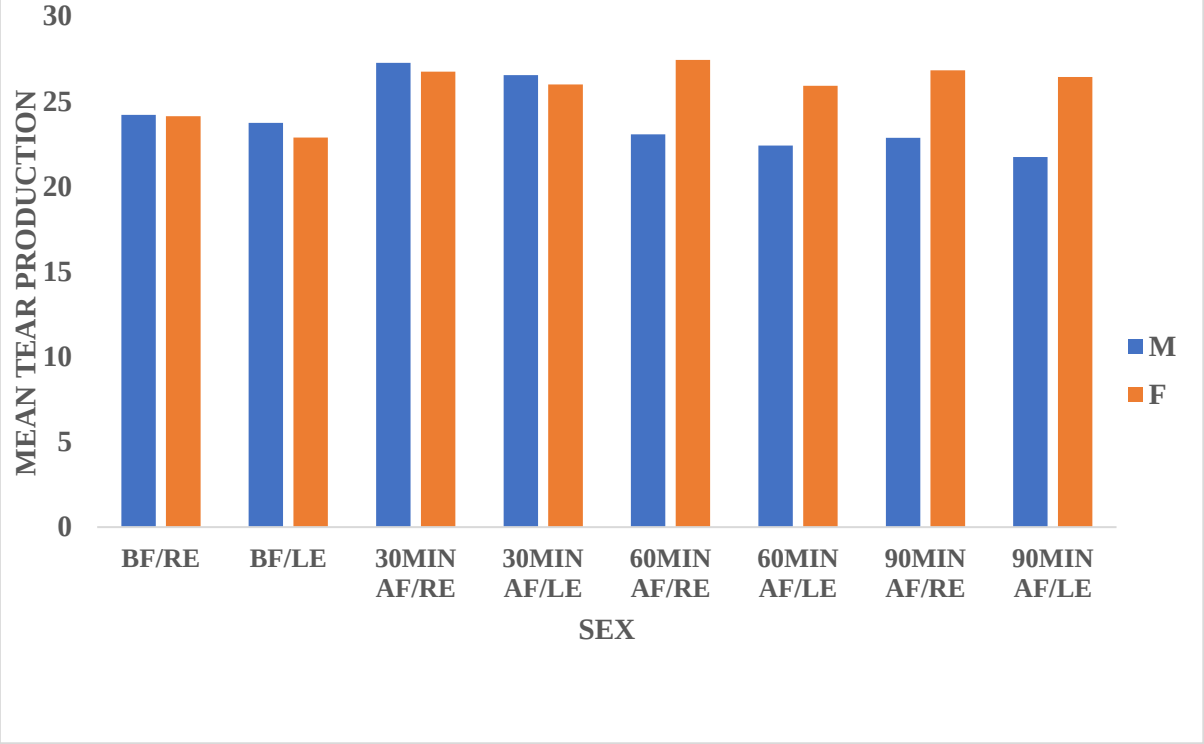
Figure 1: Distribution of gender participants in the study population

The result showed that 16 males representing (40%) and 24 females representing (60%) of the study population participated in the chart, indicating that more females than males participated in the study.

Table 1: Distribution of Age amongst participants in the study population

Age range (years)	Frequency	Percentage (%)
21.-22	08	20.0
23.-24	11	27.5
25-26	09	22.5
27-28	09	22.5
29-30	03	7.5
Total	40	100

Table 1 showed that the highest number of participants were between ages 23-24years, with 11 (27-5%), followed by 25-26 years and 27-28years with 9 (22.5%) each, then 21-22 years with 8 (20%), and the least was between 29-30years with3 (7.5%) of the study population. The highest was between the ages of 23-23years because this is the age at which adults indulge in taking alcohol and as they grow older and become more matured their decision to continue is influenced by many factors.

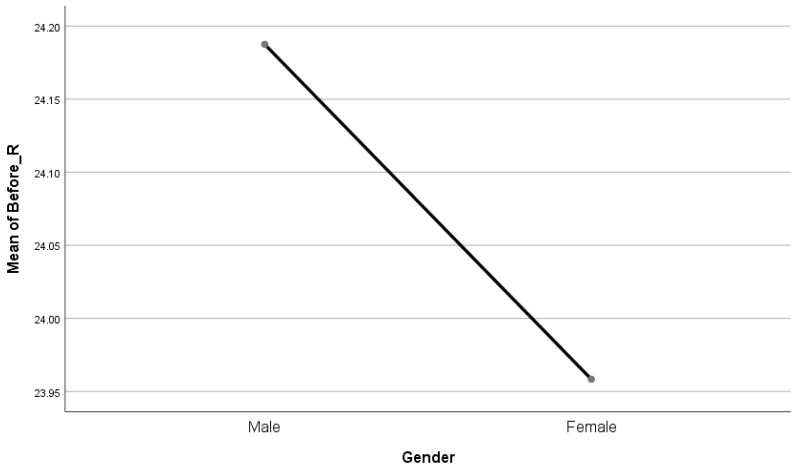


Key: BF (Before); RE (Right eye); LE (Left eye); AF (After)

Figure 2: The distribution of tear production before and after alcohol intake between male and female in both eyes

Figure 2 shows that the mean tear production of the right eye (OD) before alcohol intake was 24.05±6.41 and the left eye (OS) was 23.13±6.62 while 30mins after intake of alcohol, the mean tear production for OD was 26.88±7.43 and OS was 26.13±7.45; 60mins after, OD was 25.93±6.64 and OS 24.78±6.65; 90mins after intake OD was 25.58± 6.22, OS 24.88±6.51.

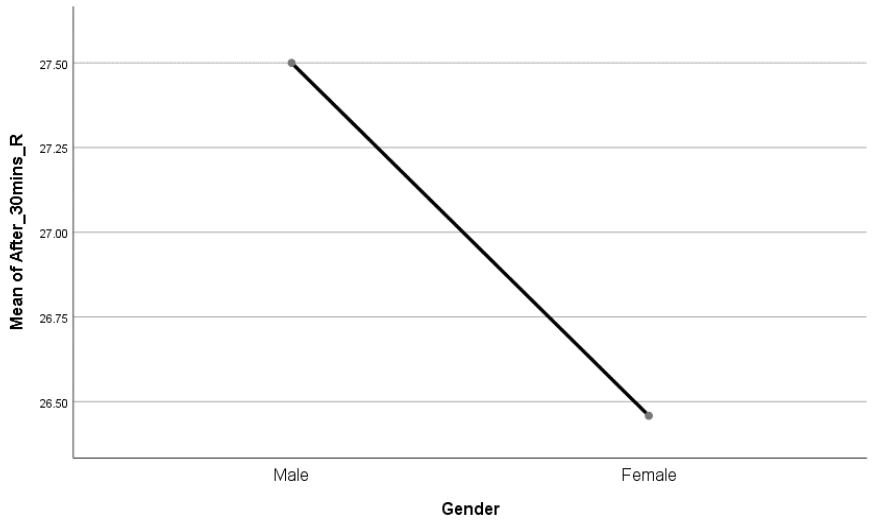
The figure also showed that the males mean tear production for the OD before intake was 24.19 ±8,97, females 23.96± 4.133, while 30mins after intake the mean tear production increased to 27.50± 8.59 for males and 26.46±6.71 for the females, thereby indicating an increase in both males and females.



Key: Mean tear production before right eye

Figure 3: Gender distribution of mean tear production before intake of alcohol.

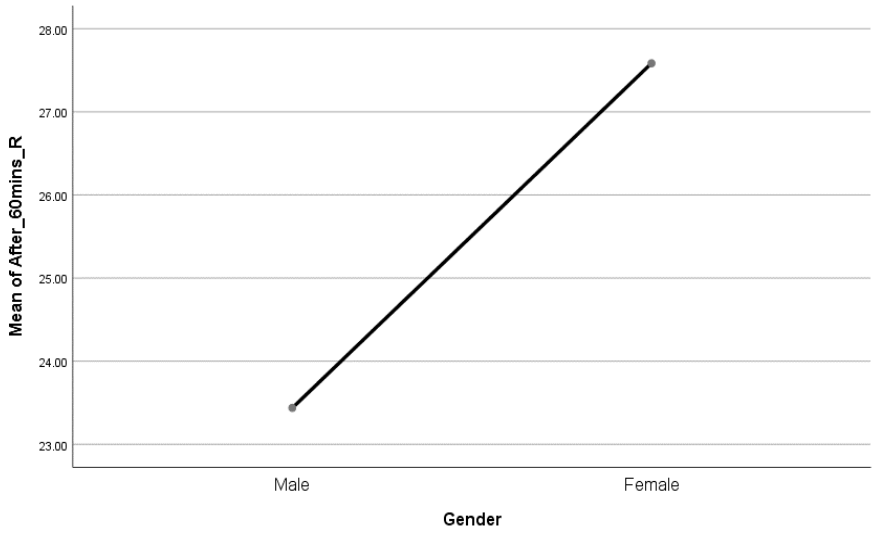
The result in the line chart showed that the mean tear production, in the right eye 30 minutes before intake of alcohol had an increase in males than the females respondents in the studied population.



Key: Mean tear production after 30 mins in right eye

Figure 4: Gender distribution of mean tear production 30 minutes after alcohol intake

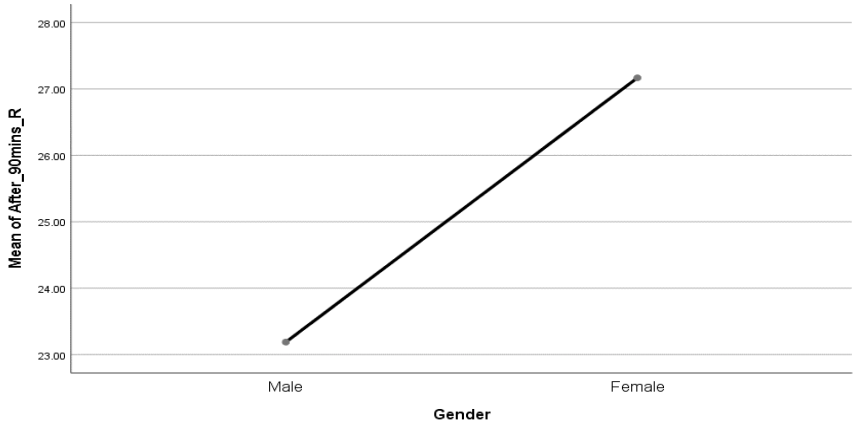
The result in the line chart showed that the mean tear production, in the right eye 30 minutes after intake of alcohol had an increase in males than the females respondents in the studied population.



Key: Mean tear production after 60 mins in right eye

Figure 5: Gender distribution of mean tear production 60 minutes after alcohol intake

The result in the line chart showed that the mean tear production, in the right eye 60 minutes after intake of alcohol had an increase in females than the males respondents in the studied population.



Key: Mean tear production after 90 mins in right eye

Figure 6: Gender distribution of mean tear production 90 minutes after alcohol intake

The result in the line chart showed that the mean tear production, in the right eye 90 minutes after intake of alcohol had an increase in females than the males respondents in the studied population.

DISCUSSION

The result of the study indicated in Table 4.1 showed the gender distribution among the participants with a total sample size of 40 subjects (80eyes) consisting of 16 males (40%) and 24 Females (60 %) of the sample population. The higher percentage of Females in the study could be as a result of their general willingness to ingest Smirnoff ice due to its moderate alcoholic content. This was as opposed to their male counterpart who were less attracted as was represented in the [16, 17]. According to Harvard medical school males metabolises alcohol more easily than females because males have a larger amount of dehydrogenase enzymes in their liver which enables them to easily break down the alcohol ingested. This makes them have more capacity than females in withstanding the impact of alcohol. Thus, to feel the effect of alcohol, males would have to ingest a drink with higher concentration of alcohol than Smirnoff ice. On the other hand, women had a higher increase in mean tear production possibly because women have a higher percentage of body fats with less water content than men of the same body weight. Another possible reason is that because alcohol is dispensed faster in body water, females tend to reach higher peak of blood concentration of alcohol than males with smaller body water content [16, 17].

The distribution of age among the participants in (Table 1), showed that the highest group was within the ages of: 23-24years; while the lowest group was within 29-30 years [18]. Also, the distribution of tear production before and 30mins after intake of alcohol in males and females showed that the ingestion of alcohol caused an increase in the mean tear production. This could be due to reflex tearing which occurred as a result of the Shimmer strip placed in the eye that acted as the presence of a foreign body. This stimulated the tear gland to increase production of tears as a defensive mechanism to protect the eye. The females however, had a lower increase as compared to the males and this could possibly be as a result of the greater water content and lesser tissue fats in males than the female. This helps to increase the quantity of the tears in males than in the females. Also, other factors

such as hormonal variation in females influences alcohol absorption, assimilation and metabolism in the body [16, 19].

Also, in comparing the difference before and 30mins after alcohol intake using the paired T-test, the difference was significant in both eyes ($p<0.005$). This as earlier explained could be as a result of the reflex tearing due to the presence of the Shirmmer strip placed in the eye. However, 60 and 90 mins after there was a decrease in the mean tear production though this was not significant in both eyes ($p > 0.005$). This could also be due to the fact that after adaptation of the eye to the presence of the strip the production of tear decreased with reduced stimulation of tear production. However, comparing the mean tear production in males and females before and after intake using the unpaired T-test, the difference between before and 30 mins after intake of alcohol was significant ($p<0.005$) while at intervals of 60 and 90 mins after intake the difference in mean tear production was not significant ($p> 0.05$) This result was similar in both eyes. This was similar to the findings of Magno et al. [20] relationship between alcohol and dry eye and Lui et al. [21] whose work was on gender and tear film

The mean tear osmolarity level increased in the alcohol group at midnight as compared with that in the control group ($P < 0.001$) [22].

Similarly, Fig. 1 to 6 illustrated a plot of Paired t-test of tear production in gender before and after intake of alcohol. This compared the mean between the different intervals. The difference in the means between tear production before intake of alcohol and 30 minutes after was significant both in the Right eye and Left eye. The intake of alcohol increased tear production in the participants 30 minutes after. There was also no significantly different in the Means after 60 and 90 minutes.

CONCLUSION

In conclusion, there was a correlation of the alcohol and its effect on tear production at different intervals. The values showed a positive correlation at 0.621. The percentage of male to female used for this research was 40% to 60%. This was because of the willingness of the females to take the drink more than the males because Smirnoff ice was considered a female drink.

Acknowledgement

Our sincere gratitude goes to the head of Department of optometry Prof. Faustina Idu and other staff members for their sincere support and made available of the equipment used.

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