

Effect of Organic and Conventional green tea on tear film stability

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Abstract

The purpose of study was to assess and compare the effect of organic and conventional green tea on tear film stability. 60 emmetropes were included in a longitudinal study that was carried out from August 2022 to June 2023. Subjects were divided into two groups of 30 each and Tear breakup time was measured. One group consumed one cup of organic green tea while other had conventional green tea. Post assessment was performed after one hour, than to determine long term effect; one cup of green tea per day for one week was given. Results of this study showed that consumption of organic green tea and conventional green tea significantly decreased tear breakup time ($P < 0.000$, $P < 0.000$) in both follow ups. There was no statistically significant difference At Follow up 1, mean Tear breakup time of organic green tea subjects was 9.7333 ± 1.65567 while mean Tear breakup time of conventional green tea subjects was 10.0500 ± 1.52299 . Follow up 2, Tear breakup time of organic green tea subjects was 7.7833 ± 1.54142

while Tear breakup time of conventional green tea subjects was 8.7333 ± 1.47138 . Organic green tea had more effect on Tear breakup time in comparison to conventional green tea on long term. Organic green tea had more effect on Tear breakup time as compare to conventional green tea.

Keywords

Dry eye, Green tea, Polyphenols

1. INTRODUCTION

Tear film is an ultra-fine coating of tears that covers the eye's surface. The essential function of the tear film is to give refractive properties to the surface of the eye (Koh, S *et al.*, 2018). It is also important for preventing the optical surface and surroundings and also keeps a smooth surface for light refraction (Chang, A.Y *et al.*, 2021). It provides comfort to surface of the eye along with the mechanical, environmental and immune protection. Tear film stability is bala-

ned by homeostasis and provides smoothness and maintains a refractive surface for the ideal visual functioning and give protection to the eye's surface from infection, clear debris and surgical injuries (Pflugfelder *et al.*, 2020). Tear film consists of three components that are lipid layer (oily layer), aqueous layer (water layer), and mucin layer (Findlay *et al.*, 2018). Lipid layer produce by meibomian glands (John F. *et al.*, 2019). Aqueous layer generated by the lacrimal glands (Davidson *et al.*, 2004). The conjunctival goblet cells, lacrimal glands, and corneal and conjunctival epithelium produce the mucin layer (Abelson M *et al.*, 2011). Tear film's instability can be occurred by many factors due to insufficiency of tear film layers, abnormal distribution of tear film and during utilization of some topical medications. Classification of dry eye disease includes evaporative dry eye and aqueous deficient dry eye (O'Brien, *et al.*, 2004). Evaporative dry eye is caused by deficiency of lipid layer, which enhances tear evaporation (Messmer *et al.*, 2015). It is caused due to meibomian gland dysfunction (Sullivan *et al.*, 2002).

The tear film's stability can be impacted by a variety of environmental components such as temperature, pollutants, humidity and video display units, computer screen. Lipid layer of contact lens wearer causes disruption and mold dynamics of whole tear film and lipid layer composition also changes by the combustion products, both outdoors and indoors that causes the tear film instability (Wolkoff, P *et al.*, 2011).

Environmental factors that affect the tear film includes, air flow, ultraviolet rays, airborne particles air movements and temperature. With age, tear production rate also decreases. Certain medications such as beta blockers, antipsychotic

drugs, antihistamines, antidepressants etc can also cause changes in tear film (Yokoi, N. *et al.*, 2015). Environmental factors including humidity and temperature have an impact on DED symptoms among soft contact lens users (Maruyama *et al.*, 2004).

Green tea is strong antioxidants and is utilized for its anti-aging and neuroprotective properties, as well as is beneficial for chronic disease, degenerative diseases, oxidative stress and lipid profile (Malar, D.S *et al.*, 2020). Green tea consists of phytochemicals that have been shown to stimulate the central nervous system and improve overall health in humans. Among all dietary sources, the highest source of catechins is allegedly found in green tea (Prasanth MI *et al.*, 2019). Organic and conventional green tea has a number of benefits, but it has also negative consequences if consumed in excess. Green tea caffeine content per 6 to 8 oz. cup ranges from 30 to 60 mg, which is lower than the standard 100 mg. However, when green tea is utilized to lose weight, it is often consumed in large amounts, which increases caffeine consumption. Caffeine intake can be alarmingly high if more than five cup of tea is consumed every day, increasing the risk of insomnia, restlessness, tremors and stomach distress (Nawab, A. *et al.*, 2015).

Organic and conventional green tea (*Camellia sinensis*) comprises of polyphenols which include flavanols, its components, and phenolic acids. Flavanols, commonly referred to as catechins, make up the majority of the polyphenols (GTPs) in green tea. Green tea contains four different catechins that are mostly known by the acronyms (epigallocatechingallate) EGCG, (epigallocatechin) EGC, (epicatechingallate) ECG, and (epicatechin) EEC. Green tea has 140, 65, 28,

and 17 mg of each of the polyphenols in a 200 ml cup (Smith, T.J. *et al.*, 2011). High Polyphenols content is present in both organic and conventional green tea which is hypothesized to alter tear film stability. It affects lipid layer that makes the tear film unstable through oxidation (Masmali *et al.*, 2019). Lipid layer of the tear film to be disrupted by this, which has an impact on tear production, lowers the stability of tear film, and causes evaporative dry eye.

2. MATERIALS AND METHODS

A longitudinal study was carried out at The University of Faisalabad after obtaining ethical consideration from the department. The study was conducted from August 2022 to June 2023. Sixty emmetropes through Raosoft formula were included through Non probability purposive sampling. Individual with both Gender and Age between 15-25 years were included with one week prior no usage of any other drinks. Individuals with Dry eye, Refractive error, current and previous history of contact lens use, computer usage of more than 5 hours and pregnant as well as breast feeding females were excluded. After taking comprehensive background information and doing appropriate testing the 60 individuals were diagnosed to fit in the criteria of stable tear films, emmetrope individuals, verbal and written

consent was taken. Pre assessment of Tear break up time and slit lamp examination was performed. Pre assessment of TBUT was performed. Patients were distributed into two groups. Each group consisted of 30 subjects, 30 subjects were given 1.5 g of organic green tea in 100 ml hot water and remaining 30 had 1.5 g of conventional green tea in 100 ml. Post assessment was performed after one hour, than one cup of green tea was given daily with same specifications for a week to evaluate the substance's long-term effects.

Statistical analysis

Data analysis was done by repeated measure Anova test and independent sample T test.

3. RESULTS AND DISCUSSION

The study included 60 Emmetropes patient with 120 eyes. In Organic green tea subjects, 26.7% (N=16) were men while 73.3% (N=44) were female. In Conventional green tea subjects, 75% (N=45) were female, whereas 15% (N=15) were male. The age range comprised in this study was 15-25. Mean age and standard deviation of subjects using organic green tea was 20.63 ± 2.584 while Mean age and standard deviation of subjects using conventional green tea was 20.4333 ± 2.54696 . It was observed in Table 1.

Table 1. Descriptive Statistics of Age of Emmetropes intake Organic and Conventional green tea.

	N	Mean	Std. Deviation	Minimum	Maximum
Organic Tea	60	20.63	2.584	16	25
Conventional Tea	60	20.4333	2.54696	16	25

In organic green tea groups, means and standard deviation of baseline data was 11.6667 ± 1.45750 . At 1 follow up mean and standard deviation was 9.7333 ± 1.65567 and at follow up 2 mean and standard deviation was 7.7667 ± 1.53343 . This indicates that short term as well as long-term usage of green tea cause dry eye. P value was <0.000 in both follow ups. It was observed in Table 2 and Figure 1.

Table 2. Test of within the subjects using organic green tea

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial Eta squared
Sphericity Assumed	456.311	2.00	228.156	1280.662	0.000	0.956
Greenhouse-Geisser	456.311	1.992	229.062	1280.662	0.000	0.956

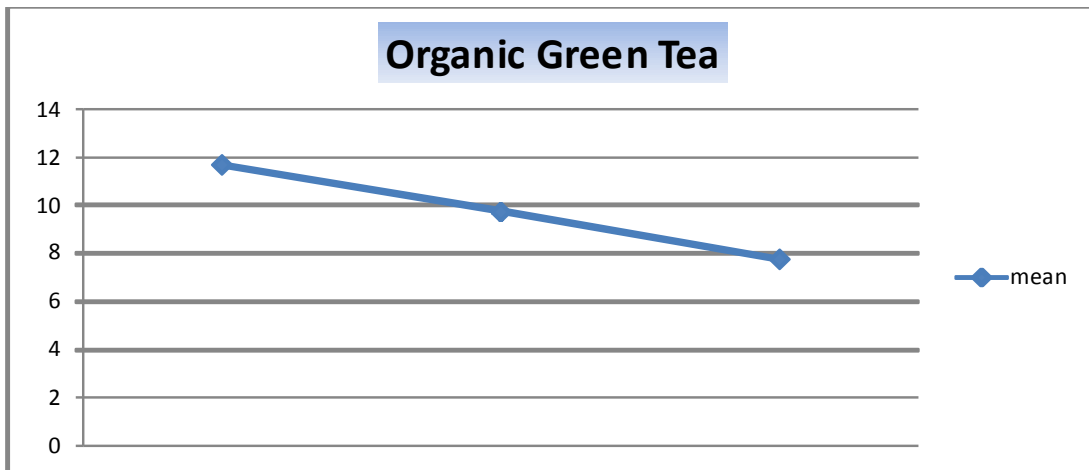


Fig- 1: Mean of subjects using Organic green tea

X axis: Shows follow ups of individual’s intake Organic green tea.

Y axis: Shows Mean TBUT of individual’s intake Organic green tea.

In Conventional green tea, mean and standard deviation of baseline data was 11.5333 ± 1.38352 . At 1st follow up mean and standard deviation was 10.0500 ± 1.52299 and at follow up 2 mean and standard deviation was 8.7333 ± 1.47138 . These

mean indicate that short term as well as long term usage of green tea cause dry eye. P value < 0.000 in every follow ups so it shows that significant difference was present. It was discussed in Table 3 and Figure 2.

Table 3. Test within subjects using conventional green tea

Source	Type III sum of squares	df	Mean square	F	Sig	Partial Eta squared
Sphericity Assumed	235.478	2.00	117.739	532.832	0.000	0.899
Greenhouse-Geisser	235.478	1.916	122.895	532.832	0.000	0.899

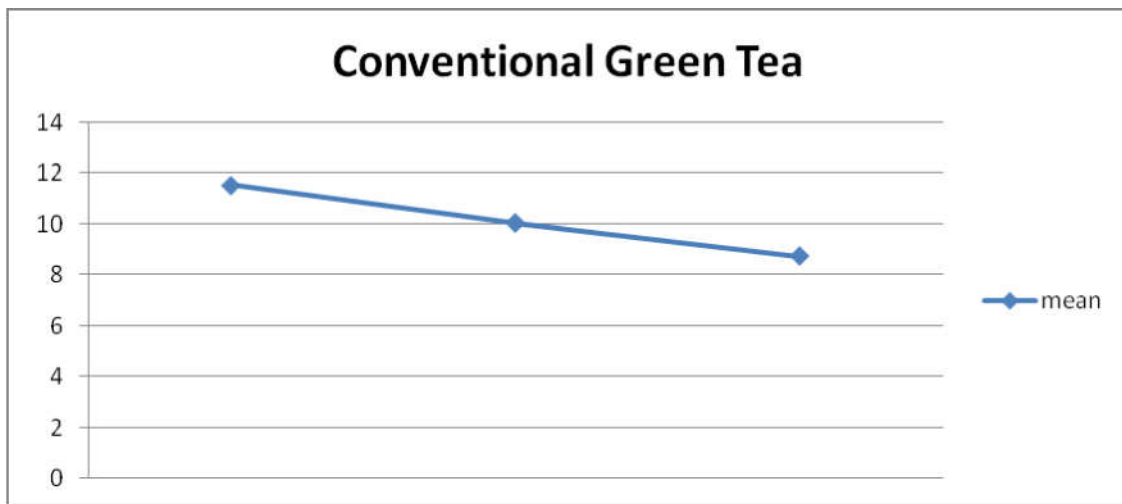


Fig- 2: Mean of subjects using Conventional green tea

X axis: Shows follow ups of individual's intake Conventional green tea

Y axis: Shows Mean TBUT of individual's intake Conventional green tea

At Follow up 1, mean TBUT of subjects using organic green tea was 9.7333 ± 1.65567 while mean TBUT of conventional green tea subjects was 10.0500 ± 1.52299 . There was no statistically significant difference in organic and conventional green tea subjects as $P > 0.05$ ($p = 0.278$) while at Follow up 2 mean TBUT of subjects using organic green tea was 7.7833 ± 1.54142 while mean TBUT of conventional green tea subjects was 8.7333 ± 1.47138 . A statistically significant difference existed in organic and conventional green tea subjects as $P < 0.05$ ($p = 0.001$). Results show that subjects given organic green tea had more effect on TBUT in comparison to conventional green tea on long term but similar effect was seen in both conventional and organic green tea in short term.

A recent research performed by Saeed *et al* in 2022 'Effect of green tea consumption on the stability of tear film and quantity of tear production in normal subjects' evaluated the stability of tear film using tear break up time half an hour before and one hour after consumption of green tea. TBUT at baseline was 14.63 ± 2.006 sec and after 1 hour was 13.06 ± 1.76 sec. This study concluded that short term use of green tea caused dry eye (Saeed, R. *et al.*, 2022). The current study evaluated short term as well as long term effect on tear film stability on consumption of conventional green tea. There was significant difference on tear film stability with usage of conventional green tea. TBUT at baseline before consumption of conventional green tea was 11.53 sec. This decreased to 10.0500 sec ($P = 0.00$) after 1 hour 8.7333 sec ($P = 0.00$) on 1 week follow up. Study indicated that short and long term usage of conventional green tea cause instability of tear film. A previous study conducted by Masmali *et al* in 2019 'Assessment of the tear film in

normal eye subjects after consumption of single dose of hot peppermint drink'. The study showed phenol red thread test showed statistically significant decrease hour later following a single intake of green tea. Red phenol thread scored in 80% of the individuals, reduced ($P < 0.005$) (Masmali, A. *et al.*, 2019). In current study TBUT also decreased significantly one hour after single consumption of organic green tea. TBUT at baseline was 11.6667 sec. This decreased to 9.7333 sec ($P = 0.00$) after 1 hour and 7.7833 sec ($P = 0.00$) on 1 week follow up. This study showed that consumption of organic green tea caused unstable tear film and it causes dry eyes.

4. CONCLUSION

The study concluded that TBUT significantly decreases on consumption of organic and conventional green tea and Organic green tea had more effect on TBUT in comparison to conventional green tea on long term use while similar effect was seen on short term use.

Conflict of interest:

No potential conflicts of interest relevant to this article were reported.

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