

# Effect of Green Tea and Black Tea Aqueous Extract on Histomorphology of Precentral Gyrus of Cerebral Cortex of Albino Rats

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## ABSTRACT

**Aim:** To compare the histomorphological changes in the precentral gyrus of cerebral cortex of albino rats by taking green tea and black tea aqueous extract.

**Study design:** Experimental Study

**Duration of study:** 30 days study conducted in Animal Experimental Research Laboratory of PGMI and Department of Anatomy, King Edward Medical University, Lahore.

**Methodology:** 90 albino rats were divided into three groups of 30 animals each. Rats in the group I were given distilled water, while group II and group III received green tea and black tea aqueous extract respectively. At the end of 30 days of experiment, brains were removed and studied for histological changes.

**Results:** When comparison among all the three groups was made at 30 days time, p-value was significant for gliosis i.e.  $p < 0.01$ . However, experimental group III revealed more gliosis among all the three groups. Necrosis was absent in all the groups and was not statistically analyzed.

**Conclusion:** Gliosis caused by black tea is highly significant as compared to green tea.

**Key words:** Cerebral Cortex, Green tea, Black tea, Gliosis, Necrosis.

## INTRODUCTION

The teas are classified according to non-oxidized (green tea), oxidized (black tea) and semi oxidized (oolong tea)<sup>1</sup>. About three million metric tons of dried tea is produced annually and 20% of which is green tea, 2% is oolong tea and 78% is black tea<sup>2</sup>.

The main chemical difference between green and black tea is that the green tea contains catechins and in the black tea, many of these have been oxidized and condensed to larger, dark-colored molecules including theaflavins (Mol. Wt. 500-1000Da) and thearubigins (Mol. Wt. >1 kDa)<sup>3</sup>.

Green tea has beneficial effects on human health i.e. decrease in obesity, cardiovascular diseases, cancer, cholesterol and blood glucose levels. It also enhances antibacterial, antiviral and antioxidant activity<sup>4</sup>. Green tea has also been studied in inflammatory bowel disease, skin diseases, hair loss and iron overload<sup>5</sup>. One study showed significant decrease in weight and systolic blood pressure in subjects of type II diabetes mellitus<sup>6</sup>.

Green and black tea has side effects with high consumption i.e. acute cytotoxicity in liver cells, oxidative DNA damage to liver and change in serum thyroid hormone levels<sup>7</sup>.

## METHODOLOGY

The randomized control trial consisted of ninety adult albino rats weighing 100-150gm, held under appropriate

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environment at animal experimental research laboratory of PGMI, Lahore. Commercially prepared feed was fed and were divided into three groups I, II and III with 30 animals each. Group I was control group given distilled water, group II and III (experimental groups) were given green tea and black tea aqueous extract respectively for 30 days. 2gm of either green tea or black tea was dissolved separately in 100 ml of boiling water for ten minutes. A rat of 100 gm was given a dose of 1 ml of green or black tea aqueous extract and a rat of 150gm was given a dose of 2ml once daily by oral gavage. On microscopic examination, gliosis i.e. proliferation and hypertrophy of astrocytes was noted.

## RESULTS

The detail of results is given in tables 1, 2. After 30 days, H&E stained sections of the cerebral cortex of all the 30 rats of group I (control) showed normal histology of cerebral cortex i.e. absence of gliosis and necrosis. However, 12(40%) animals of group II (green tea group) and 27(90%) animals of group III (black tea group) showed proliferation of astrocytes as compared to control. The difference among the three groups was highly significant statistically ( $p < 0.01$ ).

Table 1: Proliferation of astrocytes at the end of 30 days

Groups	Present		Absent		Total	
	n	%	n	%	n	%
I	0	0	30	100	30	100
II	12	40	18	60	30	100
III	27	90	3	10	30	100

Statistical analysis: Chi-square-test: 49.68  $p = 0.000$

Fig1: Cross section of brain of albino rat showing no proliferation of astrocytes (Control group 1)

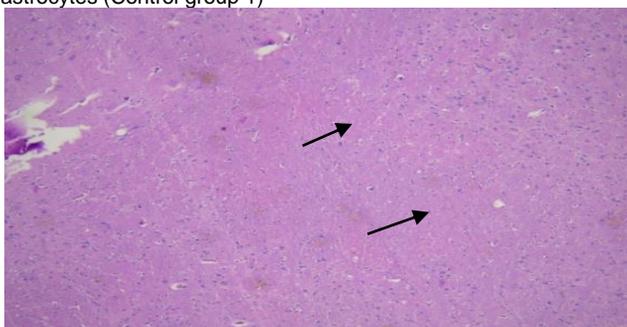
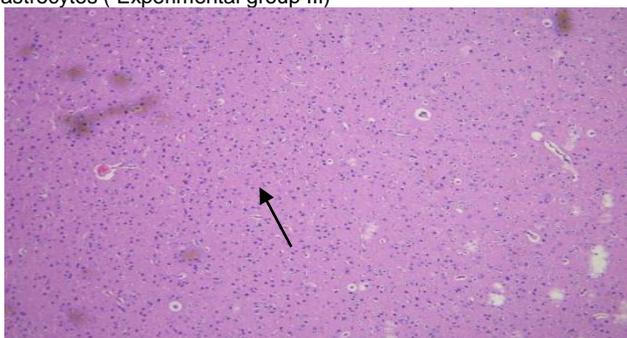


Fig 2: Cross section of brain of albino rat showing proliferation of astrocytes ( Experimental group III)



## DISCUSSION

In our study, there is increase in the size and proliferation of astrocytes in groups II and III when comparing with control group I and difference was highly significant statistically. This study is consistent with the results of Pekny M et al<sup>8</sup> in 2016 who documented reactive gliosis indicated by hypertrophy and proliferation of astrocytes in the pathogenesis of CNS diseases like brain trauma, stroke or neurodegenerative diseases. We noted statistically significant results in terms of gliosis produced by black tea in experimental group III.

It can be safely stated that presence of gliosis indicates injury to brain tissue. In the present study, gliosis can be taken as an indicator of cerebral cortical damage induced by black tea aqueous extract in a dose of 200mg/kg body weight. The gliosis noted in our study can be related to an important constituent present in black and green tea i.e. fluoride. Hence we can say that gliosis can be attributed to fluoride present in green and black tea.

Yan N et al<sup>9</sup> also reported in 2016 that excessive exposure to fluoride results in structural and functional damage to the central nervous system (CNS).

Jiang C et al<sup>10</sup> in 2014 reported neuropathological lesions in chronic and high dose of fluoride treated brain, e.g. chromatolysis of Purkinje neurons, damage to the neurons and neuroglial cells and neurodegenerative changes in rat brain-

The amount of fluoride in green tea and black tea used in our study should also be determined because

varying fluoride concentrations can contribute to the findings of gliosis noted in our study. Necrosis was not observed in our study. It could possibly be due to high amount of antioxidants present in green tea and black tea.

Although there was no direct evidence of necrosis in the present study but the end result of neurodegeneration is gliosis. Wherever neurons are damaged, they are replaced by glial tissue. Gliosis is the only finding seen in our study and can be taken as an indirect evidence of a reactive response to neurodegeneration caused by green tea and black tea aqueous extract. However, presence of antioxidants in green tea contributes to less gliosis as compared to black tea.

Moreover, the minerals present in teas especially fluoride is a known element to cause neurodegenerative changes. Therefore, the results of present study clearly indicate that excessive use of tea should be avoided as it causes damage to cerebral cortex. Green tea is a better choice in comparison to black tea in this regard.

## CONCLUSION

Gliosis caused by black tea is highly significant as compared to green tea.

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