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# Effect of green tea (*Camellia sinensis*) extract feeding on serum biochemical indices (SGOT, SGPT, ALP, BUN and Total Bilirubin) of hamster under different dietary treatments

**Madhur, Harish Kumar Gulati, Narender Singh, Man Singh, Vishal Sharma and Sandeep**

## Abstract
Seventy two weaned Syrian hamsters of either sex were randomly assigned to six treatments in single cages (290mm X 220mm X 140mm) in a closed room where the temperature and relative humidity was maintained 24±5 $^{0}$C and 60±15%, respectively during the trial of 56 days. The experiment consisted of six treatments. The concentrate mixture of all the groups was formulated using wheat, fish meal, ground nut cake, mineral mixture and common salt. Feed provided to each treatment was same. Treatment $T_1$, $T_3$ and $T_5$were provided with pure water only. While treatment group $T_2$, $T_4$ and $T_6$were provided with green tea extract only. Green tea extract was prepared by dipping green tea bag (1.3g) in 130 ml boiling water so that effectively it formed 1 percent w/v solution. Hemato-biochemical parameters in terms of Total Bilirubin, SGOT, SGPT, Alkaline Phosphates and BUN improved significantly in the treatment groups in which GTE was provided ($T_2$, $T_4$ and $T_6$). It is inferred from the results that $T_2$, $T_4$ and $T_6$ treatment groups (in which green tea was provided) showed better growth profile in comparison to the rest of the treatment groups ($T_1$, $T_3$ and $T_5$). It is also inferred that rice huskas a bedding material proved to be the best as compared to saw dust and sand.

**Keywords:** Hamster, green tea extract, rice husk, saw dust, sand, total bilirubin, SGOT, SGPT, alkaline phosphates and BUN

## Introduction
After realizing importance of laboratory animals in general and hamsters in particular (since this research is conducted on hamsters), there are two routes available to us. First, since we are placed at the top of hierarchy of chain of living beings, it is our right to use other animals for our purpose as argued by Aristotle. They are not capable to reason and therefore not a subject for ethical consideration. Second, though we are using them but we should not forget that even if they are placed at lower rungs of hierarchy they do have “sentience”. They do feel pain and pleasure and they are worthy of being treated ethically. In the eyes of nature all living beings have same moral worth. We should not develop hubris of speciesism and we must invest some part of our life in the welfare of these small yet worthy animals.

Thus, all reasonable human being must accept the second route mentioned above. And here lies the importance of animal welfare studies. Since scientists need animal models for research, as it is inevitable, it would amount to an act of tyranny if we do not take care of their welfare before and after research.

Relatively few animal welfare studies have been conducted on Syrian hamsters (*Mesocricetus auratus*), despite the fact that considerable use is made of these animals in biochemical and behavioural researches. Among the aspects of hamster welfare that have been studied so far are social housing (Arnold and Estep, 1990) [4], cage floor preference (Arnold and Estep, 1994) [5], cage dimensions (Fischer *et al*., 2007) [6], environmental enrichment (Reebs and Maillet, 2003), running wheels (Gebhardt *et al*., 2005; Reebs and St-Onge, 2005) [9, 8] and bedding material requirements for hamsters. Captivity conditions must satisfy the basic needs of laboratory animals and ensure their physical, physiological and psychological welfare.

Tea, prepared from the leaves of *Camella sinensis*, is the most popular beverage in the world except water. Green tea, made from the mild oxidation of green tea leaves, amounts to 80% of world tea production (Graham, 1992) [10]. Flavonoids are a group of polyphenols present in vegetables, fruits and beverages such as tea and wine and green tea is a major source of dietary flavonoids. Flavonoid intake is inversely associated with mortality from coronary artery disease in a cross-cultural seven country epidemiological study (Hertog *et al*., 1995) [11].

A study found green tea consumption was associated with decreased cholesterol and triglyceride and an increased proportion of HDL (Imai and Nakachi, 1995) [12]. Green tea and black tea are both high in catechins. These compounds are powerful antioxidants, capable of rapid reduction of superoxide radical and alkyl peroxy radicals. Catechins may also repair vitamin E radicals (Jovanovic *et al*., 1996) [13]. Such potent antioxidant ability may be important in inhibiting the *in vivo* oxidation of LDL (low-density lipoprotein) and VLDL (very low-density lipoprotein) and the subsequent atherogenesis.

In this backdrop, this experimental study was undertaken to find out the effect of green tea (*Camellia sinensis*) extract on blood biochemical indices of hamsters.

## Materials and Methods

The experimental trial was carried out at Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar to evaluate the effect of green tea extract feeding and bedding material on biochemical indices in hamsters. The hamsters were raised at Disease Free Small Animal House (DFSAH), LUVAS, Hisar. The biochemical parameters of blood were analyzed at Department of Veterinary Physiology and Biochemistry Department (VPB).

### Selection of animals

Seventy two Syrian hamsters of either sex at 21 days of age having average body weights of 39.26 g were selected from Disease Free Small Animal House, LUVAS, Hisar and randomly divided into six treatment groups of twelve hamster each.

### Experimental design, housing and feeding

Seventy two weaned Syrian hamsters of either sex were randomly assigned to six treatments in single cages (290mm X 220mm X 140mm) in a closed room where the temperature and relative humidity was maintained at 24±5 $^0$C and 60±15%, respectively during the trial of 56 days. The room had an exhaust fitting for ventilation and glass fitted windows and 6 CFL's (Chloro-Fluoro lamps) to maintain a light/dark cycle (approx. 14/10). The selected weaned hamsters were shifted to their allotted cages and allowed an adaptation period of 4 days. The concentrate mixture of all the groups was formulated using wheat, fish meal, ground nut cake, mineral mixture and common salt. Feed provided to each treatment was same. Treatment $T_1$, $T_3$ and $T_5$ were provided with pure water only. While treatment group $T_2$, $T_4$ and $T_6$ were provided with green tea extract only. Green tea extract was prepared by dipping green tea bag (1.3g) in boiling water of volume 130 ml so that effectively it formed 1 percent w/v solution. Feed ingredients used in the concentrate mixture formulation were analysed for proximate composition (AOAC, 2005), presented in (Table 1). The hamsters under different treatments were fed concentrate mixture having minimum 18.92 percent protein and not less than 3.27 percent ether extract. The feed and water bottle in $T_1$, $T_3$ and $T_5$ were provided separately to each hamster. Similarly in case of $T_2$, $T_4$ and $T_6$ feed and GTE (green tea extract) is provided separately. Water bottles were hanged in inverted position over the top of cages as they work on negative pressure near to the feeders and they were regularly cleaned to prevent the chance of any contamination. The study was carried out for a period of 56 days on selected hamsters. Feed and water were supplied *ad libitum* throughout the experiment. Bedding material used for hamsters under treatment groups $T_1$and $T_2$ was rice husk, for $T_3$ and $T_4$ was saw dust and for $T_5$ and $T_6$ was sand. Old bedding material was changed biweekly with fresh bedding material.

The hamsters were weighed and different body measurements were recorded at the beginning of the experiment after providing an adaptation period of 4 days.

In a completely randomized design (CRD), 72 Syrian hamsters were assigned to 6 treatment groups: $T_1$, $T_2$, $T_3$, $T_{4,}$ $T_5$ and $T_6$ with each treatment group having 12 hamsters.

**$T_1$:** Rice husk as bedding material + Standard feeding
**$T_2$:** Rice husk as bedding material + Standard feeding + 1% Green tea extract
**$T_3$:** Saw dust as bedding material + Standard feeding
**$T_4$:** Saw dust as bedding material + Standard feeding + 1% Green tea extract
**$T_5$:** Sand as bedding material + Standard feeding
**$T_6$:** Sand as bedding material + Standard feeding + 1% Green tea extract

**Table 1:** Proximate composition (% DM basis) of the feed ingredients

| Sr. No | Name of Ingredient | Dry matter (%) | Total ash (%) | Ether Extract (%) | Crude protein (%) | Crude fiber (%) |
|---|---|---|---|---|---|---|
| 1 | Wheat | 91.01 | 2.45 | 2.67 | 10.40 | 2.34 |
| 2 | Fish meal | 90.10 | 9.09 | 7.78 | 41.65 | 3.32 |
| 3 | GNC | 89.89 | 7.58 | 4.60 | 46.32 | 6.01 |

**Table 2:** Ingredient composition of concentrate mixtures prepared for feeding different treatment groups of Hamsters(g/kg)

| Ingredients | Amount |
|---|---|
| Wheat | 740 |
| Ground nut cake | 200 |
| Fish meal | 50 |
| Common salt | 5 |
| Mineral mixture* | 5 |

*Mineral mixture (salt free), Ca (32%), Cu (100 ppm), Zn (0.26%), Iodine (0.01%), P (6%), Mn (0.27%), Fe (1000 ppm) and Co (50 ppm).

Statistical analysis Statistical analyses were performed using the IBM SPSS statistics 20 software package for windows. The results were analyzed using the One-way analysis of variance and it was employed to determine the means along with standard error. Significant differences among the treatments means were determined using Duncan's test. Level of significance was considered at $P< 0.05$.

## Result and Discussion

The mean corresponding initial values for SGOT in treatment groups $T_1$, $T_2$, $T_3$, $T_{4,}$ $T_5$ and $T_6$ were 24.17, 24.83, 24.50, 24.83, 24.50 and 24.50(IU/L) respectively. The final values were 25.83, 23.17, 25.67, 23.50, 25.67 and 24.00(IU/L) respectively (Table 3). For SGPT the initial mean values were 27.17, 27.33, 27.17, 27.17, 27.17 and 27.17(IU/L) respectively. The mean final mean values were 28.00, 24.83, 28.00, 25.33, 28.00 and 25.33(IU/L) respectively (Table 3). This indicate that SGOT and SGPT level in treatment group $T_2$, $T_4$ and $T_6$ are significantly lower than treatment group $T_1$, $T_3$ and $T_5$. These results show that in case of treatment $T_2$, $T_4$ and $T_6$ SGOT and SGPT values are reduced as compared to control. So green tea had beneficial effect in case of these parameters also.

The mean corresponding values for alkaline phosphatase in treatment groups $T_1$, $T_2$, $T_3$, $T_{4,}$ $T_5$ and $T_6$ were 32.17, 31.67, 32.00, 31.50, 32.00 and 31.50 (IU/L) respectively. While the final mean values were 32.33, 28.67, 32.00, 28.67, 31.67 and 28.83(IU/L) respectively (Table 3). For blood urea nitrogen (BUN) these initial values were 22.50, 22.67, 22.50, 22.33, 22.33 and 22.33(mg/dl) respectively. The final mean values were 22.33, 19.33, 22.17, 19.67, 22.17 and 20.17(mg/dl) respectively (Table 3). For total bilirubin, the mean initial values in treatment groups $T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ were 0.625, 0.62, 0.627, 0.62 and 0.62 respectively. While the final mean values were 0.655, 0.628, 0.657, 0.632, 0.658 and 0.635 respectively. This indicate that ALP and BUN level in treatment group $T_2$, $T_4$ and $T_6$ are significantly lower than treatment group $T_1$, $T_3$ and $T_5$. These results again depict the improved blood profile of those treatments in which green tea was provided (in $T_2$, $T_4$ and $T_6$).

**Table 3:** Serum biochemical indices (SGOT, SGPT, ALP, BUN and Total Bilirubin) of hamster (bi-weekly)

| Days | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ |
|---|---|---|---|---|---|---|
| **SGOT** | | | | | | |
| 0 day | 24.17±0.31 | 24.83±0.31 | 24.50±0.22 | 24.83±0.31 | 24.50±0.22 | 24.50±0.22 |
| 14 day | 24.83±0.31 | 23.83±0.31 | 24.67±0.33 | 23.83±0.31 | 24.83±0.31 | 24.00±0.37 |
| 28 day | 25.00$^{b}$±0.37 | 23.67$^{a}$±0.21 | 25.00$^{b}$±0.37 | 23.83$^{a}$±0.31 | 24.83$^{b}$±0.31 | 23.83$^{a}$±0.31 |
| 42 day | 25.33$^{c}$±0.42 | 23.83$^{a}$±0.31 | 25.17$^{bc}$±0.4 | 24.00$^{a}$±0.26 | 25.17$^{bc}$±0.4 | 24.17$^{ab}$±0.31 |
| 56 day | 25.83$^{b}$±0.31 | 23.17$^{a}$±0.31 | 25.67$^{b}$±0.49 | 23.50$^{a}$±0.43 | 25.67$^{b}$±0.42 | 24.00$^{a}$±0.37 |
| **SGPT** | | | | | | |
| 0 day | 27.17±0.4 | 27.33±0.33 | 27.17±0.31 | 27.17±0.4 | 27.17±0.31 | 27.17±0.31 |
| 14 day | 27.33$^{ab}$±0.42 | 26.33$^{a}$±0.21 | 27.50$^{b}$±0.43 | 26.33$^{a}$±0.21 | 27.50$^{b}$±0.43 | 26.33$^{a}$±0.21 |
| 28 day | 27.50$^{b}$±0.6 | 25.67$^{a}$±0.21 | 27.50$^{b}$±0.43 | 25.67$^{a}$±0.21 | 27.50$^{b}$±0.43 | 25.67$^{a}$±0.21 |
| 42 day | 28.17$^{b}$±0.48 | 25.67$^{a}$±0.33 | 28.17$^{b}$±0.48 | 25.50$^{a}$±0.34 | 28.17$^{b}$±0.48 | 25.67$^{a}$±0.33 |
| 56 day | 28.00$^{b}$±0.52 | 24.83$^{a}$±0.31 | 28.00$^{b}$±0.45 | 25.33$^{a}$±0.42 | 28.00$^{b}$±0.45 | 25.33$^{a}$±0.21 |
| **ALP** | | | | | | |
| 0 day | 32.17±0.79 | 31.67±0.33 | 32±0.82 | 31.50±0.22 | 32±0.73 | 31.50±0.43 |
| 14 day | 32±0.45 | 30.83±0.31 | 32±0.45 | 30.83±0.31 | 31.83±0.48 | 30.83±0.31 |
| 28 day | 32.17$^{b}$±0.65 | 29.83$^{a}$±0.48 | 31.83$^{b}$±0.54 | 29.67$^{a}$±0.42 | 32.00$^{b}$±0.58 | 30.00$^{a}$±0.37 |
| 42 day | 32.67$^{b}$±0.33 | 29.17$^{a}$±0.48 | 32.67$^{b}$±0.33 | 29.33$^{a}$±0.42 | 32.67$^{b}$±0.33 | 29.50$^{a}$±0.43 |
| 56 day | 32.33$^{b}$±0.42 | 28.67$^{a}$±0.33 | 32.00$^{b}$±0.37 | 28.67$^{a}$±0.21 | 31.67$^{b}$±0.42 | 28.83$^{a}$±0.17 |
| **BUN** | | | | | | |
| 0 day | 22.5±0.43 | 22.67±0.42 | 22.50±0.43 | 22.33±0.42 | 22.33±0.56 | 22.33±0.49 |
| 14 day | 22.83$^{b}$±0.31 | 21.50$^{a}$±0.43 | 22.83$^{b}$±0.31 | 21.17$^{a}$±0.31 | 22.83$^{b}$±0.31 | 21.17$^{a}$±0.31 |
| 28 day | 22.67$^{b}$±0.21 | 20.67$^{a}$±0.49 | 22.50$^{b}$±0.22 | 20.67$^{a}$±0.49 | 22.67$^{b}$±0.21 | 20.50$^{a}$±0.43 |
| 42 day | 22.83$^{b}$±0.31 | 20.33$^{a}$±0.61 | 22.83$^{b}$±0.31 | 20.17$^{a}$±0.48 | 22.83$^{b}$±0.31 | 20.17$^{a}$±0.48 |
| 56 day | 22.33$^{b}$±0.49 | 19.33$^{a}$±0.42 | 22.17$^{b}$±0.6 | 19.67$^{a}$±0.42 | 22.17$^{b}$±0.4 | 20.17$^{a}$±0.4 |
| **Total Bilirubin** | | | | | | |
| 0 day | 0.625±0.008 | 0.62±0.007 | 0.627±0.006 | 0.627±0.006 | 0.62±0.004 | 0.62±0.005 |
| 14 day | 0.652±0.007 | 0.637±0.006 | 0.652±0.007 | 0.635±0.006 | 0.652±0.007 | 0.632±0.003 |
| 28 day | 0.635±0.004 | 0.632±0.005 | 0.635±0.004 | 0.632±0.00 | 0.635±0.004 | 0.632±0.005 |
| 42 day | 0.652$^{bc}$±0.007 | 0.632$^{a}$±0.004 | 0.652$^{bc}$±0.007 | 0.633$^{ab}$±0.004 | 0.653$^{c}$±0.007 | 0.635$^{abc}$±0.005 |
| 56 day | 0.655$^{b}$±0.007 | 0.628$^{a}$±0.005 | 0.657$^{b}$±0.007 | 0.632$^{a}$±0.005 | 0.658$^{b}$±0.007 | 0.635$^{a}$±0.005 |

Means with different superscripts row wise differ significantly ($P < 0.05$).

In an experiment conducted by Pezeshki (2016) [14] in human explained the logic behind drop in liver function parameters such as SGPT, SGOT and ALP. Epigallocatechin gallate (EGCG), the main catechin in green tea is believed to not only improve lipid metabolism in liver but also reduce liver oxidation stress. Low stress on liver means less release of liver enzymes in the blood stream and hence we can infer that due to this the values of SGPT, SGOT and ALP plummeted because these liver enzymes are released in blood stream by liver whenever there is any kind of stress on liver.

## Conclusion

It is inferred from this study that Hemato-biochemical parameters in terms of SGOT, SGPT, ALP, BUN and Total Bilirubin improved significantly in the groups in which GTE was provided ($T_2$, $T_4$ and $T_6$). However, from economical perspective, green tea and saw dust were found to be more expensive than the other treatments.

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