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Effect of green tea (*Camellia sinensis*) extract feeding on body weight gain, average daily weight gain and FCR of hamster under different dietary treatments

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Abstract
Seventy two weaned Syrian hamsters of either sex were randomly assigned to six treatmentsin single cages (290mm X 220mm X 140mm) in a closed room where the temperature and relative humidity was maintained 24±50C 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 T1, T3 and T5were provided with pure water only. While treatment group T2, T4 and T6were 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. In this study it was found that growth measurements for T2, T4 and T6 were better as compared to other treatment groups. This indicates the beneficial aspect of GTE. At the same time, the growth profile is better for T2 because GTE in association with rice husk acted synergistically. Body weight gain for T2 in which GTE was provided was significantly higher as compared to other groups while it is minimum for T5(11.14gvs 2.78g, $P<$ 0.05). FCR value for T2 is much better as compared to other groups while it is worst for T5 (12.98 vs 45.63).

Keywords: Hamster, green tea extract, rice husk, saw dust, sand, body weight gain, FCR etc.

Introduction
Golden Hamster or Syrian Hamster (*Mesocricetusauratus*) is one such laboratory animal their natural geographical range is limited to the north of Syria and the south of Turkey especially in arid habitats. Their numbers have been constantly declining due to loss of habitat caused by agriculture and deliberate destruction by humans. Though hamsters are the fifth most commonly used animal in research behind mice, rat, rabbit and guinea pigs, there are several reasons why the Syrian hamster is used in research. These are *viz*. availability and ease of reproduction of hamsters, their relative freedom from naturally acquired disease, their susceptibility to many pathogens, their unique anatomic and physiologic feature and their rapid development and short life cycle. Most of hamsters are used in cancer research, infectious disease research, research related to epilepsy, teratology, muscular dystrophy, caries and periodontal diseases and behavioural studies (Gibson, 2014) [1].

Tea, prepared from the leaves of *Camellasinensis*, 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) [2]. 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) [3]. A study found green tea consumption was associated with decreased cholesterol and triglyceride and an increased proportion of HDL (Imai and Nakachi, 1995) [5]. 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) [4]. 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 bedding materials and green tea (*Camellia sinensis*) extract on growth performance and biochemical indices of hamsters.

Materials and Methods

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±50C 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. Additionally, treatment group T2, T4 and T6 were provided with green tea extract (green tea taken was LIPTON, pure and mild). Green tea extract was prepared by inserting green tea bag (1.3g) in boiling water in boiling water of volume 130 ml so that effectively it formed 1 percent w/v solution (Table 2). Feed ingredients used in the concentrate mixture formulation was analysed for proximate nutrients (AOAC, 2005), presented in Table 1. The hamsters under different treatments were fed concentrate mixture having minimum 17.5 percent protein and not less than 2.5 percent fat. 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 green tea in water is provided. Water bottles were located 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 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. Bedding material was changed every week. The hamsters were weighed and different body measurements were taken at the beginning of the experiment after providing an adaptation period of 4 days.

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 were performed using the IBM SPSS statistics 20 software package for windows. The results were analysed 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 as per Snedecor and Cochran (1994). Level of significance was considered at $P< 0.05$.

Body weight gain changes: The recorded data on body weight of hamster under different treatments have been tabulated in Table 3.The means of initial body weights of selected animals at weaning stage under different treatments groups were found statistically similar (Table 4). The means of final body weight, body weight gain and average daily weight gain (g) (Table 4)of hamster provided with 1% green tea extract (GTE) and rice husk as bedding material was found significantly higher at the end of experiment. In this study the difference between the body weight gain between the groups could be caused by synergistic effect of GTE and rice husk as bedding material. However, Lanteigne and Reebs (2005) [6] used pine shavings, aspen shavings and corn cob/wood pellets as bedding materialand found no significant effect of bedding material on body weight gain. Thus, it can be inferred that none of the four bedding materials tested in this study can be judged to be inappropriate. But as they used completely different type of bedding materials thus further research is needed with the bedding materials we used in our study.

Results and Discussion

Table 3: Body weight (g) of hamster under different dietary treatments (fortnightly)

Days	T_1	T_2	T_3	T_4	T_5	T_6
0	39.31±0.67	38.83±0.78	39.10±0.68	38.83±0.59	39.46±0.68	38.78±0.65
14	40.99±0.73	40.90±0.89	40.09±0.68	40.56±0.67	39.59^{a}±0.66	40.30±0.72
28	43.08^{b}±0.75	43.66^{b}±1.08	41.65^{ab}±0.7	42.41^{ab}±0.72	40.40^{a}±0.64	41.81^{ab}±0.76
42	45.06^{bc}±0.69	46.73^{c}±1.12	43.05^{ab}±0.68	44.49^{bc}±0.71	41.34^{a}±0.69	43.97^{b}±0.62
56	47.20^{c}±0.68	49.97^{d}±1.19	44.57^{b}±0.63	47.07^{c}±0.52	42.30^{a}±0.68	45.41^{bc}±0.59

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

Feed intake, fluid intake and FCR

Feed intake was measured weekly and it was found that significantly higher feed intake was observed forT_2 as compared to other treatment groups. Green tea was provided in T_2, T_4 and T_6, while water was provided in T_1, T_3 and T_5. It was deliberately done because if we have been provided both in all the treatments then hamsters would have been preferred water over GTE due to bitter taste of GTE. So by not providing water to T_2, T_4 and T_6 we forced them to drink GTE. We found that water intake was consistently higher for T_1 as compared to T_3 and T_5. Similarly GTE intake was consistently higher for T_2 as compared to T_4 and T_6. Since no

study has been done for these bedding materials either in India or in any other country, it can be inferred by our study that feed intake and water or GTE as the case may be, is significantly higher for T_1 and T_2 because rice husk as a bedding material was more comfortable for hamsters and they consumed more quantity then other treatment groups. However we recommend further research in this regard. Similarly, FCR values for T_2 are better followed by T_1, T_4, T_6, T_3 and T_5.By this observation we can infer that GTE intake and rice husk as a bedding material acted in coherence and consequently FCR improved.

Table 4: Body weight gain, Average daily weight gain and FCR of hamster under different dietary treatments

Attributes	T_1	T_2	T_3	T_4	T_5	T_6
Bodyweight gain	7.95^{c}±0.41	11.14^{d}±0.65	5.53^{b}±0.31	8.18^{c}±0.1	2.78^{a}±0.22	6.62^{b}±0.29
Average daily weight gain	0.14^{c}±0.01	0.20^{d}±0.01	0.10^{b}±0.01	0.15^{c}±0.01	0.05^{a}±0.00	0.12^{b}±0.01
FCR	17.04^{ab}±1.04	12.98^{b}±0.76	23.13^{c}±1.38	16.35^{ab}±1.09	45.63^{d}±3.64	18.50^{bc}±1.01

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

Conclusions

With the results of this study it is concluded that growth performance for T_2, T_4 and T_6 were recorded better as compared to other treatment groups. This indicates the beneficial aspect of GTE. At the same time the growth profile is better for T_2 because GTE in association with rice husk acted synergistically. Body weight gain for T_2 in which GTE was provided was significantly higher as compared to other groups while it is minimum for T_5(11.14g *vs* 2.78g, $P< 0.05$) Also, FCR value for T_2 was significantly lower as compared to other groups while it was worst for T_5 (12.98 *vs* 45.63).

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