

Research Article



Influence of *Camellia sinensis* on Broilers Performance

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Abstract | Research was performed on 192 broiler chicks at experimental poultry farm, Sindh Agriculture University Tandojam. The birds were distributed into 4 groups A, B, C and D containing 48 chicks in each. Birds of group A were supplemented with 5g/L *Camellia sinensis*, group B with 10g/L, group C with 15g/L, while group D was control. The findings of the current study revealed higher feed intake (4480g/b), water intake (8960ml/b), live body weight (2356.8g/b), weight gain (2322.8g/b), carcass weight (1381.8g/b) in group D (control) and lower feed intake (4006g/b), water intake (8012g/b), live body weight (2081.2g/b), weight gain (2046.5g/b), carcass weight (1199.1g/b) were recorded in group C. Further, better FCR (1.85) was observed in A group followed by B (1.9), D (1.9) and C (1.92) groups, respectively. Maximum relative weight of heart (13.53%), liver (61.1%), spleen (2.26%), proventriculus (58.13%), intestine (102.2%) and fat pad (81.41%) were found in D group (control) and minimum in C group. Mortality percent was equally higher in A group (2%), B (2%) and D (2%) compared to C (1%). Considerable ($P < 0.05$) variation was seen among A, B, C and D groups for feed and water intake. Prominent ($P < 0.05$) variation was also noticed for carcass weight of birds in D group compared to A, B group compared to C. In conclusion live body weight, consumption of water and feed, weight of carcass and overall weight gain were noted to be higher in group D. FCR was found better in the group A. Relative organs weight and mortality rate was found minimum in group C.

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Introduction

Camellia sinensis is one of the delicious refreshment products. This product was discovered in 2737 BC by a Chinese scientist Shen Nung. It is actually a perennial plant though it has white colored flowers, green colored fruits with 2 to 3 seeds. The color and flavor of *Camellia sinensis* is concerned to the method used for the processing of leaves (Perumalla and Hettiarachchy, 2011). *Camellia sinensis* is also notorious by its common name i.e. green tea. It is

unfermented and un-oxidized product of leaves of *Camellia sinensis*. It contains polyphenolic compounds called as flavonoids. Catechins are the main flavonoids found in *Camellia sinensis* (Maron *et al.*, 2003). These compounds have a variety of health benefits including antioxidant, anti-mutagenic, anticancer, antibacterial, antitoxin, antiviral, antifungal and anti-osteoporotic etc (Sommer *et al.*, 2010). In addition to catechins *Camellia sinensis* also contains some other active biological compounds such as caffeine, methylxanthines, theobromine and theophylline.

These all active compounds in *Camellia sinensis* are highly effective against lipid peroxides induced disease like which infect the blood vessels, kidneys and liver (Friedman, 2007).

Camellia sinensis has also been reported as supportive supplement for avian species. In a study supplementation epigallocatechin gallate found to be beneficial in heat stressed Japanese quails (Tuzcu *et al.*, 2008). Positive influence of *Camellia sinensis* was also observed against poultry infections including coccidiosis and influenza (Jang *et al.*, 2007). The leaves as well as by-products of *Camellia sinensis* can be provided to the broilers as a feed supplement in order to reduce mortality and improve performance (Deryabin *et al.*, 2008; Uganbayar *et al.*, 2005). Yang *et al.* (2003) demonstrated that feeding of different levels of *Camellia sinensis* to animals declines the level of fatty acids and cholesterol in muscles and plasma and also improve the meat quality. *Camellia sinensis* in term of leaves, flowers, byproducts, extracts and polyphenols has been used in different poultry species to improve the birds' performance (Kajiya *et al.*, 2004). We hypothesize that *Camellia sinensis* at higher supplementation dose in broilers could be supportive. Therefore, this study was planned whereby the main objective was to assess effects of *Camellia sinensis* on broilers performance.

Materials and Methods

Experimental design and procedures

Total 192 broiler chicks having age of 1 day were purchased and shifted to experimental poultry farm at Sindh Agriculture University Tandojam. Initial weight of chicks were recorded on arrival and then allocated into 4 groups including A, B, C and D, containing 48 chicks in each. Groups were subdivided with 3 replicates containing 16 chicks in each. The same housing and bedding facility was provided to each group. Chicks in group A were given 5g/L *Camellia sinensis*, in group B 10g/L and group C 15g/L in their normal diet, however group D was kept as control and *Camellia sinensis* free diet was provided to birds (Table 1).

Experimental trial was carried out till 36 days and data regarding different study parameters like live body weight, water consumption, feed intake, carcass weight, weight gain, feed conversion ratio (FCR), relative organs weight (% edible and non edible) and

mortality percentage was recorded.

Water consumption and feed intake was computed with below given formula. Supply and refusal of feed and water to the birds/day were recorded and values were put in the following formula for calculating the feed/water consumption:

$$\frac{\text{Feed}}{\text{water consumption}} = \frac{\text{Total amount of offered feed or water} - \text{Total amount of refused feed or water}}{\text{Total number of birds}}$$

For measuring the total initial live body weight, 4 birds/replicate were selected randomly on day 1st and weighed using electric weight balance. Further weight was recorded on day 36th i.e. end of experiment and values were put in the below given formula for computing the weight gain.

$$\text{Weight gain} = \text{Initial weight of bird} - \text{final weight of bird}$$

Wight of carcass was computed following dressing the carcass. The dressing percentage was computed using below given equation.

$$\text{Dressing percentage} = \frac{\text{Weight of carcass (kg)}}{\text{live weight of body (kg)}} \times 100$$

For calculating FCR, aggregate weights all chick and feed intake were recorded on day 36th. Values were fixed in the following formula.

$$\text{FCR} = \frac{\text{Total quantity of feed consumed by chicks}}{\text{Aggregate weight gain of all chicks}} \times 100$$

Relative organs weight was recorded using four slaughtered birds from each group. Edible and nonedible organs including gizzard, heart, liver, proventriculus spleen, feathers, feet, head, and intestines were weighed. The relative organ weight was computed using below given equation.

$$\text{Relative organs weight} = \frac{\text{Wight of organ}}{\text{live weight of body}} \times 100$$

Mortality percentage was calculated by recording total number of live and died birds during experimental period. Values were put in the following formula for computing the final mortality rate.

$$\text{Mortality (\%)} = \frac{\text{Total broiler died}}{\text{Total broiler reared}} \times 100$$

Table 1: Diet composition of proposed rations.

Ingredients	Starter ration				Finisher ration			
	Groups				Groups			
	A	B	C	D	A	B	C	D
Guar meal	2	2	2	2	2	2	2	2
Soybean meal	5	5	5	5	5	5	5	5
Sunflower Meal	9	9	9	9	9	9	9	9
Rice Polish	17.5	17	16.5	18	19.5	19	18.5	20
Canola Meal	10	10	10	10	10	10	10	10
Fish Meal	6	6	6	6	4	4	4	4
Corn meal	20	20	20	20	20	20	20	20
Rice meal	18	18	18	18	18	18	18	18
Cotton gluten 30%	5	5	5	5	5	5	5	5
Cotton gluten 60%	3	3	3	3	3	3	3	3
DLM	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
L-lysine	1.5	1.5	1.5	1.5	1	1	1	1
Dicalcium phosphate	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lime Stone	1.5	1.5	1.5	1.5	2	2	2	2
Camellia sinensis	5	10	15	0	5	10	15	0
Total	100	100	100	100	100	100	100	100
Calculated nutrients composition								
M.E (kcal/kg)	2412	2405	2401	2407	2719	2794	2787	2709
C.P (%)	22.5	22.2	22.6	22.4	19.2	19.4	19.3	19.6
E.E (%)	1.8	1.7	1.9	1.8	2.6	2.8	2.9	2.7
C.F (%)	2.8	3.1	3.2	2.9	2.7	2.9	3.1	2.8

Data analysis

Data was analyzed using statistical software i.e. JMP, SAS 9.0, SAS Institute Inc., Cary, NC. Statistical test namely One Way Analysis of Variance was applied. Difference was considered significant at P < 0.05.

Results and Discussion

Feed intake

Result regarding the feed intake of birds influenced at different levels of *Camellia sinensis* supplementation are shown in Figure 1. Significant (P<0.05) difference was found for feed intake of chicks in group A, B, C and D. Higher values for feed intake (4480g/b) was observed in control group, while feed intake (4006g/b) was found lower in group C, where chicks' diet was supplemented with 15g/L *Camellia sinensis*.

Water intake

The water intake of birds as influenced by different levels of *Camellia sinensis* supplementation is shown in Figure 2. Figure depicts prominent (P<0.05) variation amongst groups A, B, C and D for water

intake of chicks. Maximum water intake (8960 ml/b) was noted in group D (control) and minimum water intake (8012ml/b) was seen in group C (15g/L *Camellia sinensis*).

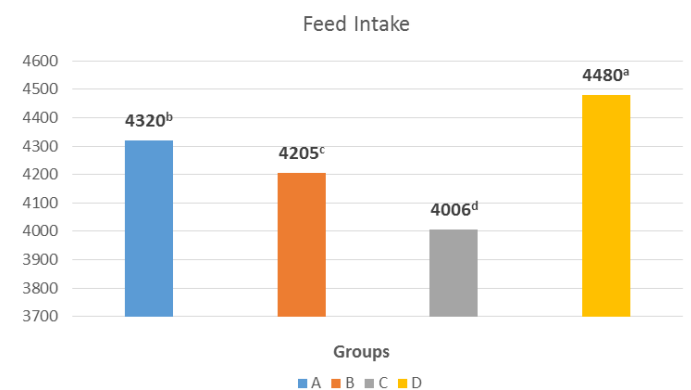


Figure 1: Influence of *Camellia sinensis* supplementation on feed intake (g/b). SE±= 12.377; LSD at 0.05= 24.470; P-value= 0.0001.

Live body weight

Live body weight of chicks as influenced by different levels of *Camellia sinensis* supplementation is shown in Figure 3. There was considerable (P<0.05) difference within A, B and C groups. However, between groups

A and D non-considerable ($P>0.05$) difference was observed. Maximum live body weight (2356.8g/b) was noted in group D (control) and minimum live body weight (2081.2g/b) was recorded in group C (15g/L *Camellia sinensis*).

Weight gain

The weight gain of birds as influenced by different levels of *Camellia sinensis* supplementation is given in Figure 4. Prominent ($P<0.05$) variation was observed for weight gain of chicks in all groups for 1st, 2nd, 3rd, 4th and 5th week. Maximum weight gain (177.6, 498.4, 980.5, 1684.1 and 2322.8g/b) was noted in group D (control) and minimum weight gain (163.8, 476.6, 859.7, 1477.3 and 2046.5g/b) was noticed in group C (15g/L *Camellia sinensis*) for week 1, 2, 3, 4 and 5, respectively.

Carcass weight

The carcass weight of birds as influenced by different levels of *Camellia sinensis* supplementation is shown in Figure 5. There was prominent ($P<0.05$) variation in carcass weight of chicks for group D with A, B and C, while non-significant ($P>0.05$) difference between groups A and B, correspondingly. Higher carcass weight (1381.8g/b) was noted in group D (control) and lower carcass weight (1199.1g/b) was observed in group C (15g/L *Camellia sinensis*).

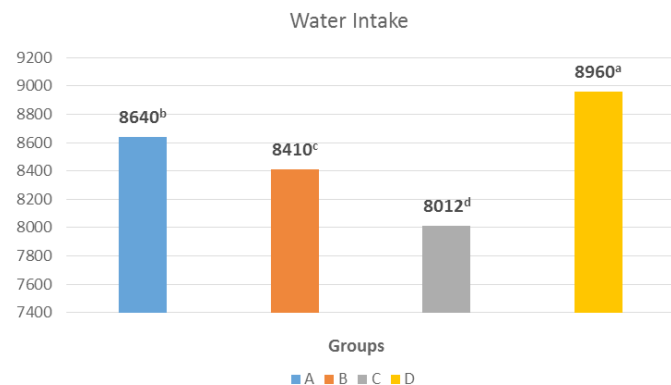


Figure 2: Influence of *Camellia sinensis* supplementation on water intake (ml/b). $SE_{\pm} = 24.460$; LSD at 0.05= 48.358; P -value= 0.0001.

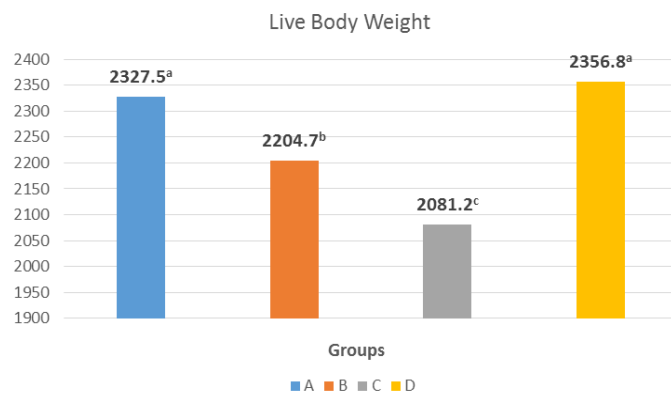
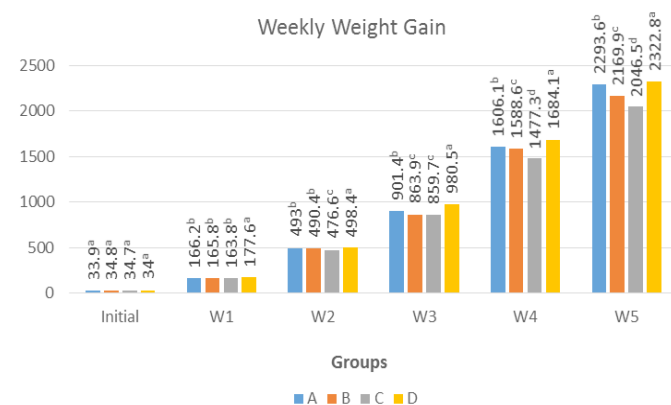


Figure 3: Influence of *Camellia sinensis* supplementation on live body weight (g/b). $SE_{\pm} = 31.981$; LSD at 0.05= 66.712; P -value= 0.0001.



	Initial	Week 1	Week 2	Week 3	Week 4	Week 5
SE_{\pm}	1.5645	6.4357	7.3152	2.2010	38.763	31.981
LSD at 0.05	3.1730	13.052	15.117	5.3070	78.615	66.712
P -value	0.9113	0.1488	0.0074	0.0030	0.0000	0.0001

Figure 4: Influence of *Camellia sinensis* supplementation on weekly weight gain (g/b).

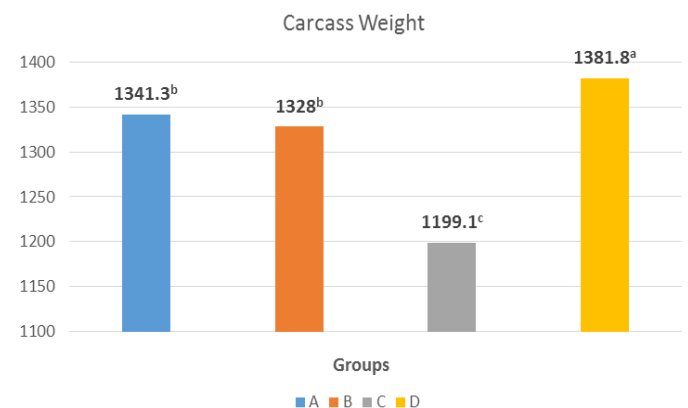


Figure 5: Influence of *Camellia sinensis* supplementation on carcass weight (g/b). $SE_{\pm} = 42.419$; LSD at 0.05= 88.484; P -value= 0.0022.

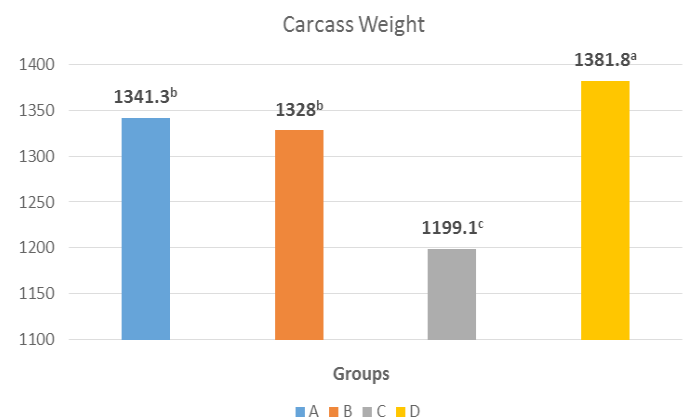


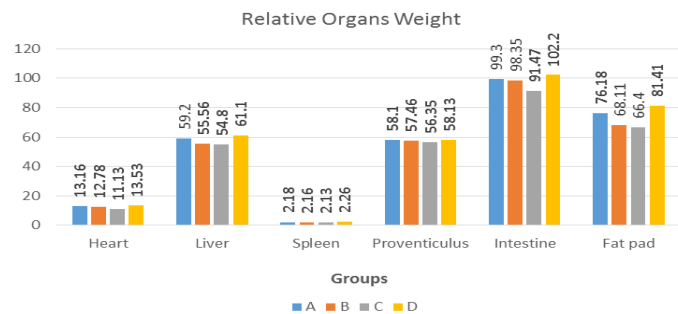
Figure 6: Influence of *Camellia sinensis* supplementation on feed conversion ratio. $SE_{\pm} = 2.8834$; LSD at 0.05= 5.2319; P -value= 0.0384.

Feed conversion ratio (FCR)

FCR as influenced by different levels of *Camellia sinensis* supplementation is shown in Figure 6. Comparatively better FCR (1.85) was noticed in group A (5g/L *Camellia sinensis*) followed by group B, D (1.9) and C (1.92). Statistically there was prominent ($P < 0.05$) variation within A, B, C and D groups.

Relative organs weight

Results concerning relative weights of liver, heart, spleen, proventriculus, intestine and fat pad as influenced by different levels of *Camellia sinensis* supplementation are shown in Figure 7. No considerable ($P > 0.05$) change was seen among relative weights of liver, heart, spleen, proventriculus, intestines and fat pad of groups A, B, C and D.



	Heart	Liver	Spleen	Proventriculus	Intestine	Fat pad
SE±	1.1304	3.1854	0.0938	2.5472	4.9448	10.064
LSD at 0.05	2.3580	6.6447	0.1957	5.3134	10.315	20.993
P-value	0.1880	0.1875	0.5457	0.8854	0.2010	0.4234

Figure 7: Influence of *Camellia sinensis* supplementation on relative organs weight (%).

Mortality

Regarding mortality rate results are depicted in the Figure 8. It is indicated in the figure that the mortality percentage (%) was equally higher among groups A (2%), B (2%) and D (2%) compared to group C (1%).

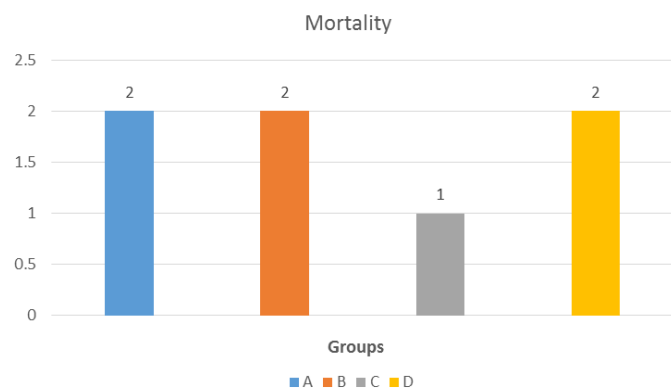


Figure 8: Influence of *Camellia sinensis* supplementation on mortality (%).

Findings of this study shows that broilers managed in control group D (without supplementation of green tea) consumed higher feed and water intake compared to broilers managed in treatment groups A, B and C (supplemented with 5, 10 and 15g/L of green tea). The decrease in feed and water intake are linked with intoxicating of green tea because it contains high level of catechin that possessed an inhibitory influence on absorption in the intestine (Ikeda *et al.*, 1992). Our findings are agree with the study of (Biswas *et al.*, 2000). Biswas and Wakita (2001) reported that supplementation of *Camellia sinensis* powder (0.6%) decreases the feed and water intake.

Current study showed that broilers managed under control group D (without supplementation of green tea) attained higher carcass and live body weight contrast to the broilers managed under treated groups including A, B and C (supplemented with 5, 10 and 15g/L of *Camellia sinensis*). The decreasing pattern in live body weight and carcass weight are associated with the feed intake of broiler. Supplementation of *Camellia sinensis* powder decreased weight gain as well as carcass weight at higher supplementation dose. Kaneko *et al.*, (2001) stated that 1, 2.5 and 5% of *Camellia sinensis* linearly reduce weight gain and carcass weight of the broilers chicks. Likewise, Uganbayar (2004) indicated that 1 to 1.5% green tea supplementation influences the broilers. It reduces the weight gain and carcass weight of chicks. Relevant findings were observed by (Cao *et al.*, 2005) who indicated carcass weight and live weight gain are favored by supplementation of *Camellia sinensis*.

Further, present study indicated that broilers managed in group A (supplemented with 5g/L of *Camellia sinensis*) showed better feed conversion ratio as compared to broilers managed in treatment groups B and C (supplemented with 10 and 15g/L of *Camellia sinensis*) as well as control group D (without *Camellia sinensis* supplementation). Improvement in feed conversion ratio is linked with minimum intake of feed. Findings are supported by Kaneko *et al.* (2001), who revealed that supplemental *Camellia sinensis* powder tended to improve FCR. Shomali *et al.* (2012) stated that *Camellia sinensis* tea powder in broiler ration displayed improvement in FCR.

Although some parts of the carcass were influenced but relative weight of organs was not significantly affected by *Camellia sinensis*. The thigh meat increased

with 1.50 percent supplementation level, while wing meat was reduced among all treated groups. Percentage of abdominal fat significantly decreased by *Camellia sinensis* supplementation. Yang *et al.* (2003) and Guray *et al.* (2011) reported that with the increase of *Camellia sinensis* level, abdominal fat declines in broilers. It is also consistent with present observations about broiler chicks that *Camellia sinensis* powder prominently reduce the quantity of abdominal fat and cholesterol in blood and liver. It is also interesting to note that *Camellia sinensis* feeding enhances the behavioral activity of broilers, which is actually gap in our study (Biswas and Wakita, 2001).

Conclusions and Recommendations

Present study concludes that highest values for feed intake, water intake, live body weight, weight gain and carcass weight was noted in group D. Better FCR was recorded in group A. Least weight of heart, liver, spleen, proventriculus, intestine, fat pad and minimum mortality rate was observed in group C.

Novelty Statement

Application of *Camellia sinensis* in broilers' diet is very unique aspect of our study. It has been first time explored in the world that the *Camellia sinensis* could be a beneficial plant product for broilers. Our study has proved that this plant product supports the performance of broilers and make poultry enterprise much economical.

Author's Contribution

Mohsin Ali Alias Mehran Khan Solangi, Gulfam Ali Mughal and Asad Ali Khaskheli: Conceived the idea, collected data and entered the data in SPSS for analysis.

Maqsood Ahmed Kumbhar: Provided technical input at every step.

Nazeer Ahmed Rajput: Did SPSS analysis.

Asad Ali Khaskheli: Wrote abstract, introduction, methodology, results and discussion, conclusion.

Turab Ali Kaurejo and: Contributed in overall management of the article.

Qurban Ali Memon: Contributed in the references.

Conflict of interest

The authors have declared no conflict of interest.

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