Hypocholestrolic effect of spent black tea leaves replaced with wheat bran in broiler ration

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Abstract: Black tea leaves (*Camellia sinensis*) have been known for many years in lowering cholesterol level. The purpose of the present study was to find the effects of spent black tea leaves as a substitute of wheat bran on cholesterol reduction in broiler chicks. For this purpose a total of hundred & fifty (150), day old broiler poultry chicks were purchased from the local market. The spent black tea leaves were collected from tea stalls. Chicks were randomly distributed into 5 main groups according to spent black tea leaves and wheat bran supplementation. Group R_0 was kept as control, containing 120g/kg wheat bran but no spent black tea leaves supplementation; group R_{30} received spent black tea leaves supplemented feed at the rate of 30g/kg plus 90g/kg wheat bran; group R_{60} received spent black tea leaves supplemented feed at the rate of 60g/kg plus 60g/kg wheat bran, group R_{90} received spent black tea leaves supplemented feed at the rate of 90g/kg plus 30g/kg wheat bran and group R120 received the spent black tea leaves supplemented feed at the rate of 120g/kg plus 0 g/kg wheat bran respectively. Each group was carrying three replicate (10 chicks/replicate). The data was statistically analyzed, using completely randomized design. Mean liver cholesterol per chick on diet R_{30}, R_{60}, R_{90}, and R_{120} was 102.22, 93.55, 76.22, 60.78 and 51.55mg/100g. Breast cholesterol per chick on diet R_{30}, R_{60}, R_{90}, and R_{120} was 61.89, 51.33, 44.78, 37 and 32.77mg/100g. It was concluded that the addition of spent black tea leaves at the rate of 120g/kg has significant effect on cholesterol reduction and over all performance of broiler chicks and recommended that expensive wheat bran can be effectively replaced by these spent black tea leaves in broiler poultry ration.

Keywords: Cholesterol, effect, tea, W. bran, broiler.

INTRODUCTION

Tea is a product made from *Camellia sinensis* (family *Theaceae*) which is a native plant cultivated in Asian countries, Southeast Asia and China, but now a day it also cultivated in subtropical and tropical regions across the world. Tea is mostly produced and consumed all over the world is black tea (78%) green tea (20%) and oolong teas (2%) respectively (Trevisanato and Kim 2000). Black tea is liked in the United States, England and other European countries while green tea is consumed mostly in Asian and North Africa, and oolong tea is famous in Taiwan and China (Trevisanato and Kim 2000). Fat and cholesterol intake in diet is an important issue now a day for consumer. Decreasing the fat in meat was performed commercially by removing external fat from the meat in fresh condition. In the beverage industry, tea is used to produce soft drink, which is very popular to the people. Tea is composed of varieties of flavonoids, including the Catechins, which are found predominantly. Wide range of biological activities along with their effects for the promotion of health and prevention of disease in humans has been studied for many years (Pietta and Simonetti, 1999; Peterson *et al*., 2005). Tea extracts have antimicrobial activity against disease causing bacteria. By product from tea beverage is tea waste/spent tealeaves. The little amount of spent tea is used for raw compost material; most of them are usually dumped into landfills. Due to economic and environmental concern the requirements are increasing to use local by products efficiently. Spent tea is a good protein supplement containing 22-35% protein in crude form (Kondo *et al*., 2004). Leaves of tea, their by-products and tea polyphenols can be offered to broilers in feed for decreasing death ratio (Cao *et al*., 2005). It was reported that catechins found in tea has activity against tumor (Itaro *et al*., 1988; Mukhatar and Ahmad, 1999a), anti-oxidant (Mayumi *et al*., 1987), reduction in blood sugar and anti-angiogenesis (Matsuzaki and Hara, 1985). In addition to human consumption, low-grade tea has been used as an ingredient in feed for broilers (Kaneko *et al*., 2001; Cao *et al*., 2005); hence the positive effects of tea on broiler performance have already been described. Bureenok *et al*. (2007) reported the positive effects on the increase of lactic acid bacteria and aerobic bacteria counts.

Wheat bran is a by-product of flourmill that is obtained from wheat grains. Wheat bran may contain up to 15.2% crude protein, 12% crude fiber, which limit its use to less than 5% as a feed ingredient in broiler rations (NRC USA, 1994). Dale (1996) suggests that metabolizable energy value of wheat by-products is directly proportional

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to their fiber content. Wheat bran has high phytase activity, which improves the absorption of phosphorus from cereals when given to non ruminants (Leeson and Summers, 2008). therefore there is a need to explore ways to produce low cost feed stuff. Spent black tea leaves might be an attempt to evaluate the effects on gain in body weight, feed intake, feed efficiency and cholesterole level in broiler chicks. Therefore, the present study is designed to conduct the effect of spent black tea leaves replaced with wheat bran on the performance as well as cholesterole level of broiler chicks.

MATERIALS AND METHODS

The present experiment was carried out in The University of agriculture Peshawer. A 36kg of spent black tea leaves was collected from tea stalls. Wheat bran and feed were purchased from the local market and three hundred day old chicks from a commercial hatchery and vaccinated (intra-ocular) with Newcastle disease vaccine (NDV). Chicks were floor raised in a brooder house for 10 days on commercial pelleted chick starter diet. The Spent black tea-leaves were dried in an oven at 100^{o}C for 24h. Feed and water was provided ad-libitum. On day-10 birds were divided into groups for the experimental treatments, they were individually weighed randomly on 30% sample size. The birds were then transferred to experimental room. Each main group was consisting of 3 sub groups. Each sub group was containing 10 chicks (table 1). The main groups were called as R_0, R_{30}, R_{60}, R_{90} and R_{120}, while the 5 experimental rations were designated as I, II, III, IV and V containing spent black tea leaves at @ 0, 30, 60, 90 and 120g/kg of feed, respectively (table 2) and were fed to the broiler chicks.

Parameters

During the experiment the following parameters were studied.

Weekly weight gain

The mean body weight gain for every sub group of 10 broilers were noted on weekly period at day seventh of each week.

GW (g) = FW (g) - IW (g)

Where, GW = gain in body weight, FW = final body weight and IW = initial body weight

Daily feed consumption

The feed was given ad-libitum once daily and the remaining feed were weighted and collected on the next coming morning. Consumed feed was measured for every sub groups of 10 chicks by subtracting the refused amount of feed from the feed given. The mean feed intake by each chick was measured by dividing the whole feed intake by every sub cluster with the present number of birds in that sub cluster.

FC (g) = FO (g) - FR (g)

Where, FC = feed consumed, FO = feed offered and FR = feed refused

Feed efficiency ratio

The feed efficiency ratio for each replicate on weekly basis was calculated by dividing the mean weekly total quantity of feed consumed by the mean weekly total gain in body weight.

FER = FC/GW Where, FER = feed efficiency ratio, FC = feed consumed and GW = gain in body weight

Cholesterol determination assay

For the determination of cholesterol in the meat sample was taken at the end of experiment. The detection of cholesterol was done through spectrophotometric method described by (Osman *et al*. 2006). Just like other chemical techniques this method has no particularity for single sterol. It was found very helpful for the detection of cholesterol in micro gram quantity in plasma or cellular lipid extract. Before cholesterol detection saponification is performed for the removal of free lipids to get reliable results.

The meat samples were fine ground. After grinding, saponification was performed by adding KOH to remove free fatty acids. For the preparation of stock reagent 100ml volumetric flask was used by dissolving 10g of $FeCl_3.6H_2O$ in glacial acetic acid. Before use 1.0ml of the stock reagent was transferred into a 100ml flask and strong H_2SO_4 was added to volume. 3ml of glacial acetic acid and 2mL of $FeCl_3$ was added to the samples a, b and c.

Resultant colour was examined at 565nm (Spectrophotometer) after the addition of coloring solution. Comparison of the absorption was performed against an external cholesterol standard. The calculation of cholesterol amount was done with the help of the following formula:

$$\text{Cholesterol (mg/100g)} = \frac{W \times DF \times 20 \times C}{100 \times 4}$$

Where:

W = weight of sample; C = cholesterol concentration from the standard curve; DF = dilution factor.

STATISTICAL ANALYSIS

Experimental trail was laid out in completely randomized design. The data of each parameter was statistically analyzed by the method of Steele and Torri (1981). The least significance differences value for each parameter was also calculated by the procedure of Steele and Torri, (1981). For computing ANOVA and LSD values for each parameter, the computerized statistical package SAS (2000) was used.

$Yij = \mu + \alpha i + Cij$

Table 1: Experimental layout

Main Groups	Sub Group			Total Birds
	I	II	III	
Spent black tea leaves 0 g/kg	10	10	10	30
Spent black tea leaves 30 g/kg	10	10	10	30
Spent black tea leaves 60 g/kg	10	10	10	30
Spent black tea leaves 90 g/kg	10	10	10	30
Spent black tea leaves 120 g/kg	10	10	10	30
Total	50	50	50	150

Table 2: Experimental treatments

Main Groups	Rations	Wheat bran g/kg of feed	Spent black tea leaves g/kg of feed
Spent black tea leaves 0 g/kg	I	120	0
Spent black tea leaves 30 g/kg	II	90	30
Spent black tea leaves 60 g/kg	III	60	60
Spent black tea leaves 90 g/kg	IV	30	90
Spent black tea leaves 120 g/kg	V	0	120

Yij = The effect of ith ration on body weight gain, feed efficiency, feed intake, economics and cholesterol changes.
μ = Population constant common to all observation
αi = The effect of ith ration I=1,2,3,4,5
Єij = Residual term related with each Yij assume to be normally, separately and identically related with zero mean and unit variance.

RESULTS

This experiment was carried out to explore the outcome of spent black tea leaves as a feed ingredient to replace wheat bran in broiler feed. The results obtained are presented below.

Table 3: Nutrient composition of wheat bran verses spent black tea leaves (Konwar *et al*. 1987)

Nutrients	Wheat bran	Spent black tea leaves
DM	88.57%	90.52%
CP	15.52%	25%
EE	4.08%	3.53%
CF	4.34%	8.60%
Ash	4.70%	5.87%
Ca	0.89%	1.5%
P	0.13	0.53%

Weekly gain in body weight

Data concerning to the weekly gain in body weight of broiler chicks allowed to different level of spent black tea leaves is presented in table 4. The gain in body weight at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were significantly different at P<0.001 (table 4). Mean gain in body weight in group R_0 at 1st, 2nd, 3rd, 4th, 5th and 6th week were 76.33, 200, 275.67, 346.33, 449.33 and 503g respectively. For group R_{30} mean gain in body weight at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 82.33, 214, 289, 376, 467.67 and 525g respectively. Mean gain in body weight in group R_{60} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 90.67, 228.67, 296.33, 388.67, 483.33 and 535g respectively. Mean gain in body weight in-group R_{90} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 95, 245.67, 318.33, 406, 500 and 550.33g respectively. Whereas mean gain in body weight in group R_{120} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 106.33, 265, 349.33, 423, 516.67 and 562g respectively. The highest gain in body weight was found in-group R_{120} while the lowest gain in body weight was found in-group R_0.

Weekly feed intake

Outcome of different level of spent black tea leaves on feed intake of broiler chicks were highly significant (P<0.001) in (table 5). The feed consumption was improved with increasing spent black tea leaves level in ration of broiler chicks. Mean feed consumption in group R_0 at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 96, 265, 448, 686, 920, and 1052g respectively. For group R_{30} mean feed intake at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 102, 274, 463, 734, 945 and 1064g respectively. Mean feed consumption in group R_{60} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 107, 286, 469, 746, 956 and 1071g respectively. Mean feed consumption in group R_{90} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 113, 301, 483, 767, 978 and 1085 g respectively. While Mean feed consumption in-group R_{120} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were 120, 308, 510, 782, 990 and 1094g respectively. Maximum feed consumption was recorded in-group R_{120} while the lowest feed consumption was found in-group R_0.

Feed conversion ratio

Result of different levels of spent black tea leaves on feed conversion ratio was intentional in broiler chicks (table 6). The feed conversion ratio was enhanced by means of increasing spent black tea leaves levels. Dissimilar levels of spent black tea leaves significantly outcome feed conversion ratio of broiler chicks at different age groups vary from 1st to 7th weeks of age. The average feed

Table 4: Ingredient composition of the experimental ration

Ingredient	Feed I	Feed II	Feed III	Feed IV	Feed V
Spent black tea (g)	0	30	60	90	120
Wheat bran (g)	120	90	60	30	0
Corn (g)	500	500	500	500	500
Fish meal (g)	60	60	60	60	60
Corn oil cake meal (g)	100	100	100	100	100
Rice broken (g)	26	31	35	39	44
Vegetable oil (g)	50	50	50	50	50
Blood meal (g)	44	39	35	31	26
Corn gluten meal (60%) (g)	96	96	96	96	96
Di-calcium Phosphate (g)	2.0	2.0	2.0	2.0	2.0
Lime stone (g)	1.00	1.00	1.00	1.00	1.00
Salt (g)	0.30	0.30	0.30	0.30	0.30
Vitamin Minerals Premix (g)	0.50	0.50	0.50	0.50	0.50
Lysine (g)	0.10	0.10	0.10	0.10	0.10
Methionine (g)	0.10	0.10	0.10	0.10	0.10
Total	1000	1000	1000	1000	1000
Nutrient composition					
ME (Kcal/kg)	2895.5	2895.5	2895.5	2895.5	2895.5
Crude protein %	22.82	22.82	22.82	22.82	22.82
Crude fiber %	7.72	7.72	7.72	7.72	7.72

The ration (table 3.4) was formulated to meet nutrient requirements (NRC, 1994).

Table 5: Effects of different level of spent black tea leaves on gain in body weight of broiler chicks.

Ration	Mean body weight (g)						
	1st week	2nd week	3rd week	4th week	5th week	6th week	Total
R *$_0$	76.33^{d}	200.00^{e}	275.67^{e}	346.33^{e}	449.33^{e}	503.00^{e}	1850^{e}
R_{30}	82.33^{c}	214.00^{d}	289.00^{d}	376.00^{d}	467.67^{d}	525.00^{d}	1950^{d}
R_{60}	90.67^{b}	228.67^{c}	296.33^{c}	388.67^{c}	483.33^{c}	535.00^{c}	2020^{c}
R_{90}	95.00^{b}	245.67^{b}	318.33^{b}	406.00^{b}	500.00^{b}	550.33^{b}	2110^{b}
R_{120}	106.33^{a}	265.00^{a}	349.33^{a}	423.00^{a}	516.67^{a}	562.00^{a}	2210^{a}
LSD	5.005	7.504	5.179	6.207	4.075	5.058	0.017
P-value	**	**	**	**	**	**	**

Means with different superscript in columns are significantly different at α=0.05; **, P<0.001; CV=2.31; *, Ration containing spent black tea leaves in g/kg

conversion ratio of group R_0 at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were 1.25, 1.32, 1.64, 1.98, 2.05 and 2.10 respectively. The average feed conversion ratio of group R_{30} at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were 1.22, 1.28, 1.60, 1.95, 2.02 and 2.02 respectively. For group R_{60} feed conversion ratio at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were 1.16, 1.25, 1.57, 1.92, 1.98 and 1.98, respectively. For group R_{90} feed conversion ratio at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were 1.12, 1.22, 1.50, 1.89, 1.95 and 1.95 respectively while for group R_{120} feed conversion ratio at 4th, 5th, and 6th weeks were 1.04, 1.20, 1.46, 1.85, 1.91 and 1.90 respectively.

Cholesterol

The level of cholesterols was reduced significantly (P<0.001). Maximum cholesterol level in liver muscles (102.223 mg/100g) was observed in-group R_0 (chicks fed with ration having no spent black tea leaves supplementation). Minimum cholesterol level in liver muscles (51.553mg/100g) was observed in-group R_{120}. Maximum cholesterol level in breast (61.89mg/100g) was observed in-group R_0 (chicks fed with ration having no spent black tea leaves supplementation). Minimum cholesterol level in liver muscles (32.77mg/100g) was observed in-group R_{120} (table 7). The chicks of group R_0, R_{30}, R_{60}, R_{90} and R_{120} give us an idea about cholesterol levels in liver 102.223, 93.557, 76.220, 60.777 and 51.553 mg/100g respectively. The chicks of group R_0, R_{30}, R_{60}, R_{90} and R_{120} give us an idea about cholesterol levels in breast 61.89, 51.33, 44.78, 37 and 32.77mg/100g respectively.

DISCUSSION

This experiment was carried out to explore the outcome of spent black tea leaves as a feed ingredient to replace

Table 6: Effects of different level of spent black tea leaves on feed consumption of broiler chicks.

Ration	Mean Feed consumption (g)						
	1st week	2nd week	3rd week	4th week	5th week	6th week	Total
R *$_0$	96.00^e	256.00^e	448.00^e	686.00^e	920.00^e	1052.00^e	3470^e
R $_{30}$	102.00^d	274.00^d	463.00^d	734.00^d	945.00^d	1064.00^d	3580^d
R $_{60}$	107.00^c	286.00^c	469.00^c	746.00^c	956.00^c	1071.00^c	3620^c
R $_{90}$	113.00^b	301.00^b	483.00^b	767.00^b	978.00^b	1085.00^b	3700^b
R $_{120}$	120.00^a	308.00^a	510.00^a	782.00^a	990.00^a	1094.00^a	3770^a
LSD	3.141	6.884	4.024	9.442	10.432	4.009	0.018
P-value	**	**	**	**	**	**	**

Table 7: Effects of different level of spent black tea leaves on feed conversion ratio of broiler chicks.

Ration	Mean Feed conversion ratio					
	1st week	2nd week	3rd week	4th week	5th week	6th week
R *$_0$	1.25^a	1.32^a	1.64^a	1.98^a	2.05^a	2.10^a
R $_{30}$	1.22^b	1.28^b	1.60^b	1.95^b	2.02^b	2.02^b
R $_{60}$	1.16^c	1.25^c	1.57^c	1.92^c	1.98^c	1.98^c
R $_{90}$	1.12^d	1.22^d	1.50^d	1.89^d	1.95^d	1.95^c
R $_{120}$	1.04^e	1.20^e	1.46^e	1.85^e	1.91^e	1.90^e
LSD	0.019	0.022	0.016	0.017	0.016	0.023
P-value	**	**	**	**	**	**

Means with different superscript in columns are significantly different at α=0.05; **, P<0.001; CV=2.31; *, Ration containing spent black tea leaves in g/kg

wheat bran in broiler feed. The results obtained are presented below. Data concerning to the weekly gain in body weight of broiler chicks allowed to different level of spent black tea leaves is shown in table 4. The gain in body weight at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were significantly different at P<0.001. Mean gain in body weight in group R_0 at 1st, 2nd, 3rd, 4th, 5th and 6th week were 76.33, 200, 275.67, 346.33, 449.33 and 503g respectively. For group R_{30} mean gain in body weight at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were observed 82.33, 214, 289, 376, 467.67 and 525g respectively. Mean gain in body weight in-group R_{60} at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were found 90.67, 228.67, 296.33, 388.67, 483.33 and 535g respectively. Mean gain in body weight in-group R_{90} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were found 95, 245.67, 318.33, 406, 500 and 550.33g respectively. Whereas mean gain in body weight in group R_{120} at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were found 106.33, 265, 349.33, 423, 516.67 and 562g respectively. The highest gain in body weight was found in-group R_{120} while the lowest gain in body weight was found in-group R_0. Similar results were also observed from the experiment of Erener *et al.* (2011), found significantly (p<0.05) high body weight gain, carcass weight and dressing percentage by adding spent black tea leaves at the rate of 0.1 or 0.2 g/kg in feed.

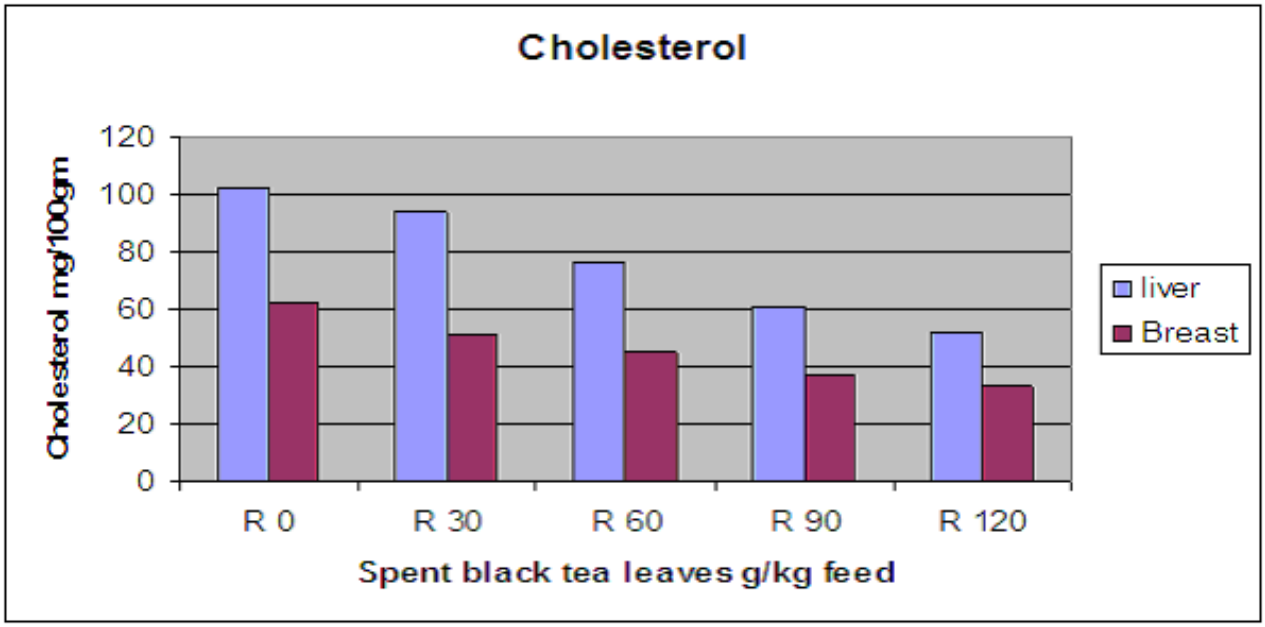
Outcome of different level of spent black tea leaves on feed intake of broiler chicks were highly significant (P<0.001) in (table 5). The feed consumption was improved with increasing spent black tea leaves level in ration of broiler chicks. Mean feed consumption in-group R_0 at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were observed 96, 265, 448, 686, 920, and 1052g respectively. For group R_{30} mean feed intake at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were observed 102, 274, 463, 734, 945 and 1064g respectively. Mean feed consumption in-group R_{60} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were observed 107, 286, 469, 746, 956 and 1071g respectively. Mean feed consumption in-group R_{90} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were observed 113, 301, 483, 767, 978 and 1085 g respectively. While Mean feed consumption in-group R_{120} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were observed 120, 308, 510, 782, 990 and 1094g respectively. Maximum feed consumption was recorded in-group R_{120} while the lowest feed consumption was found in-group R_0. Similar results can be derived from the experiment of Erener *et al.* (2011) they found significantly (p<0.05) high body weight gain, carcass weight and dressing percentage by adding spent black tea leaves at the rate of 0.1 or 0.2g/kg in feed.

Result of different levels of spent black tea leaves on feed conversion ratio was intentional in broiler chicks (table 6). The feed conversion ratio was enhanced by means of increasing spent black tea leaves levels. Dissimilar levels of spent black tea leaves significantly outcome feed conversion ratio of broiler chicks at different age groups vary from 1st to 7th weeks of age. The average feed conversion ratio of group R_0 at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were found 1.25, 1.32, 1.64, 1.98, 2.05 and 2.10 respectively. The average feed conversion ratio of group R_{30} at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were found 1.22,

Table 8: Effects of various levels of spent black tea on cholesterol in liver and breast muscles.

Ration/groups	Mean	
	Liver	Breast
R *$_0$	102.22^a	61.89^a
R $_{30}$	93.55^b	51.33^b
R $_{60}$	76.22^c	44.78^c
R $_{90}$	60.78^d	37.00^d
R $_{120}$	51.55^e	32.77^e
LSD	2.434	1.290
P-value	**	**

Means with different superscript in columns are significantly different at α=0.05; **, P<0.001, CV=2.31; *, Ration containing spent black tea leaves in g/kg



1.28, 1.60, 1.95, 2.02 and 2.02 respectively. For group R_{60} feed conversion ratio at 1st, 2nd, 3rd, 4th, 5th and 6th weeks were found 1.16, 1.25, 1.57, 1.92, 1.98 and 1.98, respectively. For group R_{90} feed conversion ratio at 1st, 2nd, 3rd, 4th, 5th, and 6th weeks were found 1.12, 1.22, 1.50, 1.89, 1.95 and 1.95 respectively while for group R_{120} feed conversion ratio at 4th, 5th, and 6th weeks were found 1.04, 1.20, 1.46, 1.85, 1.91 and 1.90 respectively. Results of the current study are in agreement with Richards (2003) who reported that improvement in the body weight and feed efficiency of birds fed with diets containing the tae extract determine that utilize of these yield is a realistic substitute to antimicrobial feed additives used as growth enhancer. Our findings are also supported by Bis was and Wakita (2001) observed the feeding tea powder is responsible to minimize the feed intake and body weight gain by offering of large amount of tea powder, but better feed efficiency ratio was observed. Konwar *et al.* (1985) reported that spent tea at high dose above five percent has negative result on the routine of broiler chicks and feed efficiency because of increase amount of tannin in acidic form.

The level of cholesterols was reduced significantly (P<0.001). Maximum cholesterol level in liver muscles (102.223mg/100g) was observed in-group R_0 (chicks fed with ration having no spent black tea leaves supplementation). Minimum cholesterol level in liver muscles (51.553mg/100g) was observed in-group R_{120}. Maximum cholesterol level in breast (61.89mg/100g) was observed in-group R_0 (chicks fed with ration having no spent black tea leaves supplementation). Minimum cholesterol level in liver muscles (32.77mg/100g) was observed in-group R_{120} (table 7). The chicks of group R_0, R_{30}, R_{60}, R_{90} and R_{120} resulted about cholesterol levels in liver 102.223, 93.557, 76.220, 60.777 and 51.553 mg/100g respectively. The chicks of group R_0, R_{30}, R_{60}, R_{90} and R_{120} resulted cholesterol levels in breast 61.89, 51.33, 44.78, 37 and 32.77mg/100g respectively. Similar results were obtained by Yang *et al.* (2000) high content of cholesterol was decreased by *Camellia sinensis* drink. Plasma High Density L-cholesterol content was not altered by any *Camellia sinensis* extracts. The authors observed that maximum amount of the triglyceride amount in the heart and liver given sucrose concentrated

feed was decreased and was return to normal by all varieties of tested *Camellia sinensis* drink. Similarly tea extract contain similar content of catechin and his study conform that tea have more hypolipidemic effect as compare to oolong tea lipid adsorption in the heart and liver. Our findings are supported by Katiyar & Mukhtar, (1995) that tea catechins are a group of polyphenols originate in fresh tea (*Camellia sinensis)* leaves, and have in recent times paying attention and great importance because of their anticancer belongings. Similar results can be derived from the experiment of Ishikawa *et al*., (1997) that tea catechins have capability to decrease plasma cholesterol level.

CONCLUSION

Based on the findings of the present study, It was concluded that Spent black tea leaves was an efficient feed ingredient in broiler feed for better weight gain, feed efficiency and feed intake as well as over all performance of chicks and decreased cholesterol in liver and breast muscles of broiler chicks. Therefore it is recommended that spent black tea leaves be added at the amount of 120 g/kg of feed to get better performance of the chicks.

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