Research Article

Effects of Dietary Fat Supplementation on Hematology and Growth Trait in Broiler Chickens

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Abstract | A study was conducted to evaluate the effects of dietary fat supplementation in broiler diet and analyze the effects on blood cholesterol levels and growth traits. A total of 240 broilers, equally divided in four groups A, B, C and D (n=60 chicks in each group) and fed on diet with 3.5%, 4.5%, 5.5% and 6.5% of fat, respectively. The completely randomized block design was used to perform this experiment from day first to 6 week. The results revealed that average feed intake of broiler in groups A, B, C and D was 4527.80, 4378.87, 4335.88 and 4298.76 g/b; average water intake about 17.63, 17.10, 18.38 and 19.39 liter/b; live body weight- 1926.81, 2182.26, 2228.86 2267.94 g/b; FCR-2.32, 1.99, 1.94 and 1.89; carcass weight-1117.45, 1318.82, 1354.81 and 1387.83 g/b; dressing percentage-58.17, 60.53, 61.21 and 61.29, respectively. The blood cholesterol level was 49.85, 104.45, 81.60 and 95.12 mg/dL; the fat % in muscles was 5.69, 6.09, 7.32 and 7.83 % respectively. The increasing level of fat, the feed consumption was decreased, but water intake was increased and broiler gained more weight as compared to lower dietary fat levels. The FCR improved simultaneously with increasing dietary fat levels (P<0.002). The carcass weight and subsequent dressing percentage increased with increasing fat level, but differences were non-significant (P>0.05) when fat level used beyond 4.5%. The weight of internal edible and non-edible organs increased with increasing dietary fat levels. It was demonstrated that ration containing 6.5% fat fed to broiler for better growth performance and production.

Keywords | Dietary fat supplementation, Cholesterol level, Growth performance, Economic or profit, Broiler

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INTRODUCTION

Feed formulation in animal nutrition and especially in poultry production as a key component to enhance productivity. Birds feed formulation is based on the concept that poultry birds eat primarily to meet their energy requirements and sustain their life's (Aguiar et al., 2016). Weather is directly influenced on poultry birds especially on hot seasons; feed intake of birds is substantially reduced because of more heat production in the body. The adjustment of these hot days need to be made a new and advanced in feed formulation by using more dietary fat as energy source instead of carbohydrates (Wang et al., 2016). The bird's diets containing high fat content deposit 10-15% more energy in their body compared with similar diets low in fat. Its desire if high fat is used in poultry diets, it may increase energy deposition in the body. The high fat contents diet can minimize the apparent energy requirements of the birds due to the fact that fats have low specific dynamic action.

The new researchers are introduced that use of fats for animal feed has many advantages. It is a concentrated source of energy and the main method of increasing the energy content of diets (Danicke et al., 1997). Moreover, other benefits of fat addition include: increased growth rates, increased feed efficiency, decreased feed intake, a source of linoleic acid, decreased dustiness of feeds and reduced dust losses, lower heat increment in hot seasons birds need more intake of dietary caloric which increased digestibility and feed utilization (Aguiar et al., 2016). The supplementation of dietary fat increases energy level and metabolism in birds, which results metabolizable energy will raise the intake of feed and water to maintain thermo regulatory system. So it's a serious concerned to formulate a required feed as desired by birds requirements. The dietary fat supplementation is a perfect mixing to formulate an optimized diets for birds. There are various sources used in feed such as animal fat and plant fat sources which are increased energy and nutritive values of diets. A number of different fat sources are available in poultry feed formulation. In poultry diet the animal fate including fish oil is an ideal for supplementation and replacement for other fat sources, because it's having omega 3 and omega 6 fatty acids. These fatty acids are reduced LDL (low density lipoprotein) and increased HDL (high density lipoprotein) which increases growth performance and productivity. Dietary fatty acid profile can affect carcass and abdominal fat deposition. Skrivan et al. (2000) found less abdominal fat in broilers fed fish oil than in those fed tallow or lard.

Fish oils are a most important energy source of broiler rations. In order to get the optimum productivity from chickens, the protein and fat energy levels of ration should be high. The composition of energy requirements of chickens with oils as a substitute of carbohydrates, a better performance was recorded (Rossi and Corino, 2016). It was suggested that the performance was different according to the amount of the oil and there supplementation. The live weight of broilers fed ration containing fish oils replacement of corn and sorghum consuming was 3353.52 g, the feed conversion was 1.85 kg, (Danicke et al., 1997). Oils supplementation to the rations of animal is very effective on the fatty acid composition and amount of abdominal fat.

The importance of fat source is to measure the saturated-unsaturated fatty acids, which have been determined by different researchers for productivity of the fat which was supplemented in poultry ratios (Ghasemi et al., 2016). It was reported that When the researches linked to single or mixed fat on the feeding performance and body fat accumulation of broilers was summarized, the adding fat to diets increased the performance (Danicke et al., 1997), there are also some works which determine that the composition of the fatty acids in which fat were supplemented to feed affected the feeding performance indirectly and it affects the body fat and carcass composition directly (Boguslawska-Tryk et al., 2016).

The animal and vegetable fats are being used since long and fed in the poultry ration as well feed formulations, which are over or approximately 20 kinds of saturated fats present in nature. Presently, Carmona et al. (2016) reported in poultry feed formulation there are used plant based saturated fats such as palm oil, coconut oil, soybean oil and sunflower oil. Whereas, in animal based fat sources such as beef fat, butter, egg yolk, lard, and fatty meat. In present study we designed animal fat (Fish oil) supplementation in diet fed to broiler chickens. Moreover, monounsaturated fat always comes in a liquid form and is very good for health because it lowers the bad cholesterol and increases the good cholesterol, fish oil is in liquid form and desired to use in proposed experiment. On the consideration of importance of fat levels, the present study was therefore carried out to determine the effect of dietary fat supplementation on hematology and growth trait in broiler chickens.

MATERIALS AND METHODS

Experimental Design

The experiment was carried out to determine the effect of dietary fat supplementation on the growth, performance and hematology of broiler chickens. A total of two hundred and forty (n=240) day-old chicks were purchased from Hyderabad local market, keep the experiment at Department of Poultry Husbandry, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam. The procedure was followed by (Siyal et al., 2016) such as housing, and managements of broilers till end of experiments. All day-old broiler chickens were initially weighed by using digital weighing scale and randomly divided into four groups with various treatments *i.e.* A, B, C and D having 60 chicks in each group. The following fat % levels were supplemented in feed of broilers ration with 3.5%, 4.5%, 5.5% and 6.5% of fat, respectively.

Housing

The experimental all birds were keep in deep litter housing system, where one square feet space was provided to each chick. Experimental house was entirely cleaned, washed with fresh water and disinfectant. Before housing the chicks, entire shed was coated with limestone and allowed to dry over 24 hours. The recommended temperature and humidity was maintained throughout the experimental period and recorded. The wooden dust was used as litter; before spreading it on the floor, the litter was dried under sunlight over 12 hours and checked and taken out its thick material to maintain litter quality. Litter was used at 2-4 inches depth for each group of broiler. The lime stone was mixed with litter to check the infection and litter turning

was practiced 2-3 times a day to minimize the gas production in the shed to ground level.

Table 1: Various rations along with chemical composition were formulated by adding fish oil as fat supplementation as fed

Ingredients %	3.5 % fat (A)	4.5 % fat (B)	5.5 % fat (C)	6.5 % fat (D)
Rice	27.4	24.9	15.1	10.1
Maize	20.1	20.6	28.2	32.1
R. Polish	5.7	7.3	9.1	10.2
Fish Meal	11.1	10.7	10.5	12.7
Soya Bean	5.1	5.1	5.1	2.2
Rap Seed	3.5	3.8	3.7	3.6
Sunflower	5.7	6.1	6.1	5.6
Blood Meal	0.2	0.2	0.2	0.2
Guar	5	5	5	5
Limestone	0.5	0.5	0.5	0.5
Corn Glutane 30 %	4	4	4	4
Corn Glutane 60 %	2	2	2	2
Canola	10	10	9	10
Fish Oil	0.3	0.5	2	2.6
Total	100	100	100	100
CP	21.86	22.38	22.36	22.29
ASH	6.81	6.72	6.51	6.64
CA	1.08	1.2	1.45	1.68
P	0.65	0.69	0.98	1.21
kcal	2829	2818	2826	2768
Fat	3.5	4.5	5.5	6.5
Lr	1.06	1.07	1.08	1.07
N	0.48	0.49	0.48	0.47
C M	0.75	0.74	0.75	0.76

*: Calculated according to NRC (1994)

Managements

The artificial brooding preparation was completed two days before the arrival of day old chicks, where one brooder was provided to each group. During first week, brooding temperature was maintained between 90 to 95 °F and later reduced weekly at the rate of 5 °F till the house temperature reached 70 °F. During brooding 40/60 watt electric bulbs were fitted in the electric brooder and placed in the centre of each allocated area. One thermometer was placed at the height of 6-12 inch near the brooder to maintain the brooding temperature. The lighting was provided by using 40/60 watt bulbs fitted with ceiling at the height of 8 feet. However, florescent tube light/charger or florescent tube was used at the time of light failure to maintain the 24 hours light. The body temperature of all birds was checked by using thermometer on weekly basis. Feed was provided to the broiler twice daily and refusal of feed was calculated from feeders of each group and weighed and finally consumed feed was noted daily. For this practice, the following formula was used:

$$\text{Feed intake (g/b/d)} = \frac{\text{Total feed offered} - \text{Total feed refused}}{\text{Total broiler (number)}}$$

Meat Quality and Cholesterol Levels

The level of blood cholesterol was performed by the method of ANCEP. Firstly, 2 ml of blood sample was taken and then centrifuge and put 1 ml of blood plasma on kit the reagent was used manually on an analyzer, one 1 ml plasma serum and ten micro liter (10 µl) reagent put, mixed and read the absorbance (A) after a five 5 minute. The final colour was stabled for at least 1 hour. After slaughtering of 5 broilers from each group, the liver, heart, gizzard, abdominal fat and intestine were removed / separated with the help of scalpel and scissor and were weighed by electric weighing balance separately and recorded. On the completion of experimental period of 42 days, 5 broilers from each group were weight and slaughtered. After dressing, the carcass weight was recorded and its dressing percentage was calculated by the following formula:

$$\text{Dressing (\%)} = \frac{\text{Total Carcass weight (kg) X 100}}{\text{Total Live body weight (kg)}}$$

Total fat content (TF) was extracted in Soxhlet Extraction Unit as described by AOAC (2000). Soxhlet Extraction was set with efflux condenser and distilled flask which has been previously dried and weighed. Dried meat sample (2 g) was taken in to fat free extraction thimble, and placed in extraction apparatus (Soxhlet). Then ether (150 ml) was poured in to extraction flask and condenser was joined and placed on electric heater in order to boil the solvent gently. Extraction was carried out for 6 hour. The solution was removed and fat content was calculated by using procedure formula.

Data Analysis

The collected data were tabulated and subjected to statistical analysis by using standard statistical computer package.

RESULTS

Feed and Water Intake

The feed intake of broiler in groups A, B, C and D was 4527.80 g/b, 4378.87 g/b, 4335.88 g/b and 4298.76 g/b ($P<0.05$), respectively. The highest feed intake was recorded in group A ($P<0.05$), statistically the differences for feed intake were highly significant ($P<0.05$) between groups and weeks which indicated that feed intake of broilers reduced with increasing fat content in the feed. The LSD

test showed that differences in feed intake between groups C and D were non-significant (P>0.05), while significant (P<0.05) when compared with group A and B (Table 2).

Table 2: Feed consumption (g/b) of broiler chickens fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	152.53	159.64	148.66	146.87
2	306.44	292.66	287.57	278.69
3	604.59	587.57	579.98	569.98
4	987.67	948.67	965.56	988.67
5	1107.68	1087.45	1075.53	1107.68
6	1368.89	1302.88	1278.58	1206.87
Average	4527.80 a	4378.87 b	4335.88 c	4298.76 c
	S.E.±	LSD 0.05	LSD 0.01	P-Value
Groups	16.972	35.042	48.063	0.0035
Weeks	45.5281	125.659	158.433	0.0000

Total water intake of broiler in groups A, B, C and D was 17.63 liter/b, 17.10 liter/b, 18.38 liter/b and 19.39 liter/b (P<0.05), respectively. The highest water intake was recorded in group D (P<0.01), statistically the differences for water intake were highly significant (P<0.01) between groups. The water intake of broiler showed a simultaneous increase with increasing age of broiler. The LSD test indicated that differences in water intake among all groups were significant (P<0.05), which indicates that increasing fat levels developed the broiler thrust and they consume more water as compared to those reared on low fat supplemented levels (Table 3).

Table 3: Water intake (liter/b) of broiler fed ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	0.549	0.589	0.638	0.669
2	1.197	1.18	1.219	1.266
3	2.357	2.296	2.449	2.569
4	3.855	3.705	4.096	4.467
5	4.328	4.244	4.569	4.988
6	5.35	5.089	5.421	5.439
Average	17.63c	17.10d	18.38b	19.39a
	S.E.±	LSD 0.05	LSD 0.01	P-Value
Groups	81.909	173.48	239.42	0.0016
Weeks	148.6715	389.1506	518.7762	0.0000

Body Weight

Dietary supplementation of different fat levels on the live body weight of broiler was highly significant (P<0.05). The data (Table 4) showed that live body weight was highest 2267.94 g/b in group D, followed by live body weight of 2228.86 g/b in group C. Then live body weight in group B was 2182.26 g/b, while the lowest live body weight of 1926.81 g/b was recorded in group-A. The LSD test suggested that differences amongst all the treatment means were statistically significant (P<0.05) showing a linear association of fat levels with the live body weight of broilers.

Table 4: Body live weight (g/b) of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	74.66	86.67	77.99	82.57
2	132.86	152.68	163.59	165.89
3	267.67	283.68	291.68	294.67
4	404.67	464.56	482.36	497.59
5	472.27	536.68	548.68	558.69
6	574.67	657.99	664.56	668.53
Average	1926.81a	2182.26b	2228.86c	2267.94d
	S.E.±	LSD 0.05	LSD 0.01	P-Value
Groups	11.387	23.147	29.616	0.0005
Weeks	18.3525	44.65825	62.9879	0.0000

FCR (Feed Conversion Ratio)

FCR in broiler chickens fed dietary different fat % levels supplemented was affected significantly (P<0.05) in positive direction; and the data (Table 5) showed that feed efficiency was relatively better (1.89) in group D, group C was (1.94), groups B was (1.99) and finally in group A was calculated (2.32). The LSD test showed that differences between groups B-C were non-significant (P>0.05) while significant (P<0.05), when these groups were compared with groups A and D.

Table 5: Feed conversion ratio (FCR) of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	2.08	1.89	1.97	1.88
2	2.35	1.94	1.79	1.74
3	2.29	2.07	1.99	1.95
4	2.46	2.05	2.02	1.98
5	2.37	2.05	1.97	1.99
6	2.39	1.99	1.95	1.83
Average	2.32b	1.99ab	1.94a	1.89a
	S.E.±	LSD 0.05	LSD 0.01	P-Value
Groups	0.0447	0.0947	0.1308	0.0002
Weeks	0.0529	0.1168	0.1636	0.0089

Body Temperature (°F)

Average body temperature was calculated in broiler chickens fed on ration containing different fat levels was recorded and found that the body temperature was significantly (P<0.05) affected by various fat levels in ration. The results (Table 6) indicated that body temperature of broiler in group D was highest (106.98 °F), while body temperature of broiler in group C, B and A was 106.21 °F, 105.91 °F, and 105.26 °F, respectively. The LSD test suggested that differences in body temperature between groups B and C were non-significant (P>0.05), while significant (P<0.05), when these groups were compared with groups A and D.

Table 6: Body temperature (°F) of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	104.39	104.78	104.84	105.45
2	104.99	105.17	105.49	106.46
3	105.27	105.85	106.19	106.85
4	105.39	106.85	106.27	107.68
5	105.66	106.29	107.23	107.47
6	105.87	106.48	107.27	107.99
Average	105.26c	105.91b	106.21b	106.98a
	S.E.±	LSD 0.05	LSD 0.01	P-Value
Groups	0.1679	0.3572	0.4947	0.0000
Weeks	0.2389	0.6158	0.9449	0.0000

Carcass Weight

The carcass weight were recorded on the basis of five slaughtered birds and the data (Table 7) showed that the carcass weight significantly (P<0.05) influenced by dietary fat supplementation and highest carcass weight of 1387.83 g/b was recorded in group D, 1354.81 g/b, 1318.82 g/b and 1117.45 was in C, B, and A groups respectively. The LSD test suggested that statistically the differences in carcass weight between group B, C and D were non-significant (P>0.05), while significant (P<0.05) when compared with group-A.

Table 7: Carcass weight (g/b) of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	1177	1368	1369	1438
2	1169	1292	1349	1383
3	1162	1338	1381	1351
4	1011	1277	1359	1349
5	1068	1319	1316	1418
Average	1117.45b	1318.82ab	1354.81a	1387.83a

S.E.±: 24.514; **LSD 0.05:** 52.228; **LSD 0.01:** 72.813; **P-Value:** 0.0000

Dressing Percentage

Dressing percentage is directly associated with the carcass weight, the randomly selected five slaughtered broilers are presented in Table 8. The results showed that dressing percentage was highest 61.29 % in group D, 61.21 % in group-C, 60.53 % in group-B and 58.17 % was in group A, respectively. LSD test indicated that the differences in dressing percentage between broiler groups B, C and D were non-significant (P>0.05), while significant (P<0.05) when these groups were compared with group A.

Table 8: Dressing percentage of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	58.28	63.61	61.69	61.23
2	61.21	59.87	59.99	61.41
3	58.11	61.69	63.02	59.73
4	56.12	57.61	57.55	59.96
5	57.17	59.88	63.81	64.13
Average	58.17b	60.53a	61.212a	61.292a

S.E.±: 1.1345; **LSD 0.05:** 2.4761; **LSD 0.01:** 3.4701; **P-Value:** 0.0096

Hematology (Blood Cholesterol)

Blood cholesterol levels in broiler fed dietary supplementation of different fat levels was determined and noted that the blood cholesterol was significantly (P<0.05) influenced by increasing fat levels in diets. Table 9 indicated that blood cholesterol of broiler in group B was highest (104.03 mg/dL), while in D, C and A groups was 95.12 mg/dL, 81.60 mg/dL and 49.85mg/dL, respectively. The LSD test showed that among all treatment groups, the differences for blood cholesterol were statistically significant (P<0.05).

Table 9: Blood cholesterol (100-200 mg/dL) of broiler fed on ration dietary Supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	49.19	70.14	78.27	89.29
2	50.11	72.18	81.72	97.34
3	49.54	67.85	83.57	95.27
4	50.55	69.97	84.26	98.43
5	49.86	70.17	80.19	95.27
Average	49.85d	104.45a	81.60c	95.12b

S.E.±: 1.1653; **LSD 0.05:** 2.5424; **LSD 0.01:** 3.5627; **P-Value:** 0.0000

Fat % in Meat

In broiler meat fat % was indicated significant (P<0.05)

which showed in Table 10. The Data indicated that fat in meat of broiler in group D was highest 7.83 %, while fat in broiler meat of groups C, B and A was 7.32 %, 6.09 % and 5.69 %, respectively. The LSD test indicated that statistically the differences in fat % in meat between group A and group-B were non-significant (P>0.05), while significant (P<0.05) when these groups were compared with rest of the treatment groups.

Table 10: Fat % in meat of broiler fed on ration dietary supplemented with different fat levels

Weeks	Groups			
	A	B	C	D
1	5.18	6.15	7.36	7.77
2	5.79	5.83	7.36	7.99
3	5.22	5.93	7.62	7.47
4	5.97	6.72	7.57	8.65
5	6.31	5.84	6.72	7.31
Average	5.69a	6.09b	7.32c	7.83d

S.E.±: 0.2045; **LSD 0.05:** 0.4544; **LSD 0.01:** 0.6326; **P-Value:** 0.0000

Weight of Internal Organs

The weight of internal edible and non-edible organs were recorded on the basis of five slaughtered broiler showed in Table 11. The heart weight in groups A, B, C and D was 11.49, 11.88, 14.34 and 16.98 g/bird, weight of gizzard 52.68, 54.69, 57.89 and 60.99 g/bird, weigh of liver 37.81, 41.78, 42.97 and 45.69 g/bird and intestine weight 128.89, 138.78, 142.95 and 148.97 g/bird, respectively. The LSD test suggested that the differences in heart weight, gizzard weight, liver weight and intestinal weight while significant (P<0.05) when these groups were compared with group A.

Table 11: Weight of edible and non-edible parts (g/b) of broiler fed on ration dietary supplemented with different fat levels

Groups	Heart	Gizzard	Liver	Intestine
A	11.49c	52.68d	37.81c	128.89b
B	11.88c	54.69c	41.78b	138.78a
C	14.34b	57.89b	42.97b	142.95a
D	16.98a	60.99a	45.69a	148.97a
SE±	0.7767	0.9369	0.7688	4.4899
LSD 0.05	1.6879	2.0411	1.6789	9.7854
LSD 0.01	2.3666	2.8672	2.2358	12.0549
P-Value	0.0004	0.0003	0.0005	0.0063

Mortality Rate

Average mortality in groups A, B, C and D was 4, 4, 4 and 2 birds per group, and the rate of mortality remained 6.666, 6.666, 6.666 and 3.333 percent, respectively (Table 12).

Table 12: Average mortality (%) of broiler of broiler fed ration dietary supplemented with different fat levels

Parameters	Groups			
	A	B	C	D
Broiler reared	60	60	60	60
Dead broiler (#)	4	4	4	2
Mortality (%)	6.666	6.666	6.666	3.333

Economics

The economics of rations formulated by supplementing various fat levels was calculated and the outcome is presented in Table 13. It was noted that the total income from the birds in groups A, B, C and D was Pak Rs. 227.32, Rs. 258.53, Rs. 264.78 and Rs. 267.79/b, against the total production cost of Rs. 209.38, Rs. 213.90, Rs. 217.02 and Rs. 216.09/b, is generating the net profit of Rs. 17.91, Rs. 44.33, Rs. 47.16 and Rs. 51.66/b, respectively. It was noted that broiler in group-D was economically more profitable due to low production cost over rest of the groups.

Table 13: Economics net profit (Rs.) of the experimental rations

Particulars	Groups			
	A	B	C	D
Day-old chicks	59	59	59	59
Feed consumed	4.51	4.36	4.32	4.29
Rate of feed	28	30	31	31
Feed cost (Rs)	127.28	131.8	134.92	133.99
Medication	5	5	5	5
Litter cost	2.11	2.11	2.11	2.11
Limestone	1	1	1	1
Labour cost	10.1	10.1	10.1	10.1
Misc.	5.5	5.5	5.5	5.5
Total cost	**209.38**	**213.9**	**217.02**	**216.09**
Final LBW (kg)	1.92	2.18	2.23	2.26
Marketing price	119	119	119	119
Total Income Rs	227.32	258.53	264.78	267.79
Net profit	**17.91**	**44.33**	**47.16**	**51.66**

DISCUSSION

The study was hypothesized to evaluate the effect of dietary fat supplementation on the growth performance, body temperature and blood cholesterol level broiler chickens. It has been reported (Al-qayim et al., 2016) that the use of fat for broiler feed has many advantages; it is concentrated source of energy and the main method of increasing the energy content of diets; fat addition in feed increase growth rates, increased feed efficiency, decreased feed intake, a source of linoleic acid, decrease dustiness of feeds and reduce dust losses, increase palatability of feeds and increase rate of gain.

When birds are fulfill their energy requirement, they are stopping more feed intake that's why feed intake will be reduced. The results of present study were in agreement of the findings reported by Fathi et al. (2015). He observed that the broilers fed on high supplemental fat diet 6% consumed significantly more feed than those fed 1% or 3% supplemental fat diets. Similarly in another study (Cabahug et al., 1999), it was reported that with the high fat supplementation 8% the feed intake was decreased. While, the findings of present study were not agreed with of the study of Carmona et al. (2016). They evaluated the effects of fat on the performance of broiler and found that there were no significant differences in feed intake.

Fat having more energy molecules, it is increased the metabolic activities and thrust, by decomposition of energy in the form of ATP. That's why birds taken more water intake and increased thrust. Similarly, the results of Ferrini et al. (2008) showed that fat irrespective its levels gave significantly heavy body weight and addition of fat at 8 or 12% on unsexed broiler chicks significantly increased live body weight when compared to control.

The FCR in all groups were significant respectively. Because more fat intake having deposited body in the form of Lipogenasis in adipose tissues. Birds FCR increased by low feed intake and high weight gain because fat is two (2) time greater energy supply as compared to other one. It fills all the gaps of energy requirements. That's why FCR of birds was good. In a similar study, Jackson et al. (2008) reported broiler body weight from 1887.30 to 2197.20 g/bird under similar fat levels using fish oil; hence, there was close conformity of these studies with the findings of the present research. With increasing dietary fat levels the feed consumption was decreased, while water intake was increased and broiler grained more weight as compared to lower dietary fat levels. These results are partially supported by Fathi et al. (2015) who used 3% to 6% fat increased significantly ($P<0.01$) body weight compared to fed diets supplemented with 1% in broilers. Liu et al. (2015) supplemented diets with 0, 1.5, 3, or 6 % fish oil, the FCR were improved in the which fed 6 % fish oil.

Blood cholesterol and Fat% in meat of broiler were significantly increased with increasing dietary fat levels. Fat increased blood cholesterol because fat having HDL & LDL. These are major components of fat. When HDL increased it does not produced effect on blood cholesterol, but when LDL increased its also increased blood cholesterol levels (Jesse et al., 2016). The results of present study were in agreement of the findings reported by Rai et al. (2015). He gives diet supplemented vegetable and animal fat, the blood cholesterol and fat% in broiler meat were higher than control groups. Study shows supplemented fat in ration it increases blood cholesterol and fat% in meat. The mortality was within the range in broiler group receiving high dietary fat level. Mortality does not produced adverse effect on the growth of broiler. There is does not found microscopic degeneration or fatty infiltration of liver of broiler hence birds did not show any significant mortality.

The body temperature of broiler was significantly increased with increasing dietary fat levels. Fat increased temperature because it having more energy level. When it decomposed it produced more ATP molecules and increased metabolic actives by increasing energy levels, that's why bird's temperature, were raised. Similarly, Rossi and Corino (2016) supplemented broiler ration with 2, 3 and 4% fat and reported improvement in broiler performance, when increasing fat % the temperature was increased. Our results are fully supported by the findings of (Ferrini et al., 2008) who supplemented broiler diets with 3.24, 3.54, 7.9, 8.13, 12.05 and 12.23 % fat levels and obtained significantly heavy body weight, with 8% fat and this fat level decreased feed intake and improved feed conversion ratio.

Carcass weight in all groups was finding significant because fat increased weight by depositing itself and also increased energy values. This energy increased weight gain, so that's why bird's carcass and dressing% was improved. These results are further supported by Salarpour et al. (2015) who found significant differences in values of carcass weight and dressing percentage when broiler were fed diets with different fat levels. The studies carried out by Viveros et al. (2009) fully supported our results regarding carcass weight and dressing percentage and reported that 8% fat affected dressing percentage of chicks, but 12% fat level did not show positive effect on dressing percentage and carcass characteristics. Smink et al. (2010) used broiler diets containing 4% fish oil which showed a significantly significant interaction on performance traits and carcass fat concentration.

It was observed that the heart weight of broiler increased considerably when dietary fat levels were increased, which indicates that in broiler fed on fat levels beyond recommendations the disorders and ailments associated with heart enlargement may occur. Moreover, liver, gizzard and intestine weights were also markedly higher under higher fat levels. In a similar study Soliman et al. (2016), found positive but non-significant effect of different dietary fat levels on liver, gizzard and heart weights. There were significant differences for average values weights of carcass, liver, gizzard, heart and abdominal fat due to fat levels. Liu et al. (2015) used fat 0, 2 and 4% and 4% fat levels remained optimally better in their studies for broiler performance as well as in relation to weight of giblets. These results are in contradiction to those of Cabahug et al. (1999) who reported non-significant effect of 0, 5, 10, 15 and 20% full fat sunflower seed on weight gain.

Economically, dietary fat level of 6.5% was superior as compared to rest of the fat levels, because in high fat levels (fish oil) the cost of production markedly increased and remained economical,

In the present study high dietary fat improved more weight gain as compared to low fat levels it's, due to fat supply two time greater energy as compared to protein and carbohydrates. This energy utilizes body and not only it but also storage energy itself, when huge energy storage in the body the body will automatically weight gain due to use the energy in the form of ATP.

CONCLUSION

It was concluded from the present study that broilers on ration containing 6.5 fat %, supplementation up to 6 weeks of age, for better growth performance, body normal temperature, in hematology (blood Cholesterol) level and per bird net profit. It was also concluded that Increasing of fat level in feed gives better results in terms of FCR and economics. The dietary fat supplementation full fills the requirement of energy in hot seasons without any adverse effects on growth.

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CONFLICT OF INTEREST

The authors have no conflict of interests in contents of this manuscript.

AUTHORS' CONTRIBUTION

All authors equally contributed to design the experiment, conducting research, analyzing data and writing manuscript. Finally read all contents for this article and then approved.

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