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Amrapali Kothare
M.V.Sc. Scholar, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Suneet Wankhede
Assistant Professor, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Vitthal Munde
Assistant Professor, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Yogeshwari Sirsat
M.V.Sc. Scholar, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Rahul Mogale
M.V.Sc. Scholar, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Corresponding Author:
Amrapali Kothare
M.V.Sc. Scholar, Department of Animal Nutrition, College of Vetrinary and Animal Sciences, Parbhani, MAFSU, Maharashtra, India

Effect of supplementation of multi-enzyme in low energy diet on the carcass traits and hematobiochemical parameters of broiler birds

Amrapali Kothare, Suneet Wankhede, Vitthal Munde, Yogeshwari Sirsat and Rahul Mogale

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Abstract
The experiment was conducted to study the effect of multi-enzyme on carcass trait and hemato-biochemical parameters of broiler birds (Vencobb-430). A total number of 300 birds were reared for a period of 42 days with dietary treatments; T_0-Control diet as per BIS (2007), T_1- T_0+multi-enzyme, T_2-standard broiler diet with 2.5% reduction in energy than BIS, (2007) + multi-enzyme, T_3- standard broiler diet with 5% reduction in energy than BIS, (2007) + multi-enzyme and T_4-standard broiler diet with 7.5% reduction in energy than BIS, (2007) + multi-enzyme. Results showed that no significance difference for dressing, edible and giblet percent but the abdominal fat percentage was low in T_4 and breast meat percentage was ($P<0.05$) significantly higher in T_2 groups. There was no significant difference observed for the blood parameters. Blood glucose, Triglyceride and BUN was low in decreased energy treatment groups. It was concluded that multi-enzyme supplementation recommended in case of decreasing dietary ME level.

Keywords: multi-enzyme, energy, carcass, blood, hematobiochemical

1. Introduction

India is having one of the world's largest and fastest growing poultry industries. Corn contributes 60% of the total compound feed in poultry ration as main source of energy in India (2018). Feed prices and availability of feed are very crucial in sustainable operation of poultry industry in developing countries like India.

Nutritional management is one of the most important factors in poultry production. The level of metabolizable energy of diets based on maize-SBM depends on the digestibility of starch and protein. Starch is the key source of energy in maize. Corn-soya contains some anti-nutritional factors and non-starch polysaccharides (NSP) i.e., structural carbohydrate such as cellulose, hemicellulose, beta glucans, arabinoxylans and pectin. For better digestion and to explore the nutrients from NSP, dietary strategies can be used. Dietary supplementation with multi-enzyme as feed additives in broiler, to enhance the productive performance and better utilization of nutrients is a well feeding strategy now a days that is used in broiler diets. Supplementation of multi-enzyme also inactivate the anti-nutritional factors present in corn-soya based diet.

Multi-enzyme supplementation in ration break down fibrous cell wall, reduces digesta viscosity and increases availability of nutrients (Choct, 1996) [10]. Multi-enzyme addition to corn-SBM diets are frequently reported to increase ideal nutrient digestibility and feed efficiency (Meng *et al*., 2005; Cowieson and Ravindran, 2008; Zhou *et al*., 2009) [5, 13, 31].

Multi-enzyme have great contribution to environmentally adopted clean and green technology due their biodegradable nature. Addition of multi-enzyme was found to be helpful to exploited complete utilization of nutrients in the diet of broiler chicks (Cowieson, 2010) [11]. It was proved by nutritionist that diet containing multi-enzyme with low energy level improved the performance and nutrients digestibity in broiler chickens (Gitoee *et al*., 2015) [14]. Multi-enzyme in low energy diet improved the performance and economic efficiency like a control group (Youssef *et al*., 2011) [27].

Broiler chicken showed economically beneficial results with the supplementation of multi-enzyme in low energy diet (Salami and Odunsi, 2019) [20]. On the contrary, other studies reported that supplementing multi-enzyme in the maize-SBM diet did not affect broiler chicken performance and reduced the feed cost (Alagawany *et al*., 2018) [3].
Therefore, the present study was designed to evaluate the effect of inclusion of different levels of dietary energy with multi-enzyme preparation in a corn soy-bean based diet on the carcass trait and blood profile of broiler chicken.

2. Materials and Methods

The experiment was conducted to study the effect of multi-enzyme in low energy diets on carcass traits and blood hematobiochemical parameters of broiler birds. A total 300 day old chicks were reared for sixth weeks with dietary treatments, T_0 - (Standard broiler diet as per the BIS Standards, 2007), T_1- T_0+multi-enzyme, T_2-standard broiler diet with 2.5% reduction in energy than BIS, (2007) + multi-enzyme, T_3- standard broiler diet with 5% reduction in energy than BIS, (2007) + multi-enzyme and T_4-standard broiler diet with 7.5% reduction in energy than BIS, (2007) + multi-enzyme as shown in the Table 1. Each treatment groups consisted of sixty birds with four replicates containing fifteen birds in each replication. The birds were reared on deep litter system and proper managemental practices were followed during the entire experimental period. The birds from the experimental trial were assessed for the carcass trait & haemato-biochemical parameters at 42 days of age. The weight of different part of carcass taken and blood samples from eight birds of each treatment (two from each replicate with avg. body weight) were collected towards the finish of test. The blood sample collected via jugular vein from each bird and serum was isolated by centrifugation at 3000 RPM for 10 minutes and kept at -20ºC till further investigation. Biochemical parameters included estimation of total protein, albumin, triglycerides, total cholesterol, blood glucose and BUN by utilizing biochemicals kits.
The collected data during the study was analysed statistically as per Snedecor and Cochran (1994) [25] by utilizing SPSS Version 23.0.

Table 1: Percent ingredient composition of broiler pre-starter

Ingredients	Pre-starter				
	T0	T1	T2	T3	T4
Maize	50.91	50.91	52.50	54.55	53.04
Soyabean meal	40.95	40.95	40.76	40.2	42.62
Vegetable oil	3.88	3.88	2.48	0.99	0.08
Limestone	1.93	1.93	1.93	1.93	1.93
MCP	1.4	1.4	1.4	1.4	1.4
Salt	0.5	0.5	0.5	0.5	0.5
Di-methionine	0.13	0.13	0.13	0.13	0.13
Lysine	0.05	0.05	0.05	0.05	0.05
Trace Mineral Mixture	0.05	0.05	0.05	0.05	0.05
Vitamin Premix	0.05	0.05	0.05	0.05	0.05
Choline chloride	0.05	0.05	0.05	0.05	0.05
Toxin Binder	0.05	0.05	0.05	0.05	0.05
Coccidiostat	0.05	0.05	0.05	0.05	0.05
Multi-enzyme (350 gm/ton)	-	+	+	+	+
Total	100.00	100.00	100.00	100.00	100.00
CP (%)	23.00	23.00	23.07	23.00	23.95
ME (Kcal/Kg)	3000.06	3000.06	2925.20	2849.77	2775.88
LYSINE (%)	1.3	1.3	1.28	1.3	1.29
METHIONINE (%)	0.49	0.49	0.5	0.5	0.48

Table 2: Percent ingredient composition of broiler starter

Ingredients	Starter				
	T0	T1	T2	T3	T4
Maize	50.90	50.90	53.00	55	56.01
Soyabean meal	39.44	39.44	38.84	38.34	38.69
Vegetable oil	5.40	5.40	3.9	2.4	1.04
Limestone	1.93	1.93	1.93	1.93	1.93
MCP	1.4	1.4	1.4	1.4	1.4
Salt	0.5	0.5	0.5	0.5	0.5
Di-methionine	0.13	0.13	0.13	0.13	0.13
Lysine	0.05	0.05	0.05	0.05	0.05
T.M. Mixture	0.05	0.05	0.05	0.05	0.05
Vitamin Premix	0.05	0.05	0.05	0.05	0.05
Choline chloride	0.05	0.05	0.05	0.05	0.05
Toxin Binder	0.05	0.05	0.05	0.05	0.05
Coccidiostat	0.05	0.05	0.05	0.05	0.05
Multi-enzyme (350gm/ton)	-	+	+	+	+
Total	100.00	100.00	100.00	100.00	100.00
CP (%)	22.33	22.33	22.25	22.20	22.45
ME (Kcal/Kg)	3098.15	3098.15	3022.35	2945.09	2867.52
LYSINE (%)	1.3	1.3	1.28	1.3	1.29
METHIONINE (%)	0.49	0.49	0.5	0.5	0.48

Table 3: Percent ingredient composition of broiler finisher

Ingredients	Finisher				
	T0	**T1**	**T2**	**T3**	**T4**
Maize	56.00	56.00	57.39	58.08	60
Soyabean meal	33.55	33.55	33.61	34.28	33.87
Vegetable oil	6.19	6.19	4.74	3.38	1.87
Limestone	1.93	1.93	1.93	1.93	1.93
MCP	1.4	1.4	1.4	1.4	1.4
Salt	0.5	0.5	0.5	0.5	0.5
Di-methionine	0.13	0.13	0.13	0.13	0.13
Lysine	0.05	0.05	0.05	0.05	0.05
T.M. Mixture	0.05	0.05	0.05	0.05	0.05
Vitamin Premix	0.05	0.05	0.05	0.05	0.05
Choline chloride	0.05	0.05	0.05	0.05	0.05
Toxin Binder	0.05	0.05	0.05	0.05	0.05
Coccidiostat	0.05	0.05	0.05	0.05	0.05
Multi-enzyme (350gm/ton)	-	+	+	+	+
Total	100.00	100.00	100.00	100.00	100.00
CP (%)	20.14	20.14	20.28	20.65	20.64
ME (Kcal/Kg)	3200.65	3200.19	3120.10	3039.46	2961.00
LYSINE (%)	1.3	1.3	1.3	1.3	1.3
METHIONINE (%)	0.43	0.43	0.45	0.45	0.45

3. Result and Discussion

3.1 Carcass trait

The effects of dietary treatments on carcass characteristics of 42 days old broilers fed different energy diet with multi-enzyme are shown in Table 4. There were no significant differences detected for the dressing meat, edible meat and giblet percentage, but abdominal fat & breast meat percentage were significant (P>0.05) for the different treatment groups. The mean value observed for dressing percentage for the respective treatment groups were T_0 (71.58 ± 0.44), T_1 (71.91 ± 0.73), T_2 (71.97 ± 0.17), T_3 (71.51 ± 0.40) and T_4 (71.28 ± 0.79). The treatment group T_2 showed numerically higher edible meat percentage as compared to the T_1, T_0, T_3 and T_4 respectively. The edible meat percentage for the different treatment groups were 67.70 ± 0.42, 68.06 ± 0.74, 68.11 ± 0.20, 67.59 ± 0.40, 67.35 ± 0.77 for T_0 T_1, T_2, T_3, and T_4 group. The giblet percentage (%) remained comparable among all treatments group 3.89 ± 0.03, 3.86 ± 0.01, 3.86 ± 0.04, 3.92 ± 0.01 and 3.92 ± 0.02 respectively. The mean average abdominal fat percentages were 1.86 ± 0.04, 1.70 ± 0.06, 1.61 ± 0.06, 1.33 ± 0.02, 1.22 ± 0.05, for the T_0, T_1, T_2, T_3 and T_4 respectively. The breast meat percentage was recorded significantly highest in ($P<0.01$) the T_2 group (27.57 ± 0.20) and T_1 (27.50 ± 0.17) as compared to T_0 (26.51 ± 0.15), T_3 (26.40 ± 0.10) and T_4 (25.58 ± 0.19) respectively.

The current experimental findings were in line with Bharathidhasan *et al*., (2009) [5] who observed that dressing percentage did not differ significantly (P>0.05) when energy levels were reduced by (ME- 1.25, 2.5, 3.75 and 5%) with addition of enzymes. Zakaria *et al*., (2010) [29] found same results of non-significant effect on the dressing weight percentage. Youssef *et al*., (2011) [27] and Wafa *et al*., (2013) [26] recorded that dressing yield did not differ significantly (P>0.05) with supplementation of multi-enzyme in different energy density diet. Narasimha *et al*., (2013) who reported that there was no significant effect on dressing yield among broiler fed standard diet and 225 kcal/kg less energy than standard diet with enzymes and prebiotics. The result of dressing percentage was in disagreement with the findings of Abudabos (2012) [2] who recorded negative impact on dressing yield when energy level was reduced by 180 kcal in diet with enzymes incorporation.

Giblet percentage (%) are in collaborate to the results of Bharathidhasan *et al*., (2009) [5] who reported giblet percent among the treatments group did not differ significantly in energy reduced diet (ME - 1.25, 2.5, 3.75 and 5%) with enzymes supplementation. Cho *et al*., (2012) [8] who recorded that relative organ weight of liver, heart and gizzard were non significantly differed from each other when supplemented with multi-enzyme and emulsifier in low energy diet, which indicated that supplementation of multi-enzyme and emulsifier had increased the energy utilization in low energy diet and reached the same level as like a control group. Similarly, Narasimha *et al*., (2013) observed non-significant effect of supplementation of enzymes and prebiotics alone or in combination in low energy diet.

Table 4: Carcass traits of experimental birds fed different energy diets supplemented with multi-enzyme

Parameter	`Treatments					SEM	P
	T0	**T1**	**T2**	**T3**	**T4**		
Dressing (%)	71.58 ± 0.44	71.91 ± 0.73	71.97 ± 0.17	71.51 ± 0.40	71.28 ± 0.79	0.228	0.892
Edible Meat (%)	67.70 ± 0.42	68.06 ± 0.74	68.11 ± 0.20	67.59 ± 0.40	67.35 ± 0.77	0.228	0.846
Giblet (%)	3.89 ± 0.03	3.86 ± 0.01	3.86 ± 0.04	3.92 ± 0.01	3.92 ± 0.02	0.012	0.166
Abdominal Fat (%)	1.86c ± 0.04	1.70b ± 0.06	1.61b ± 0.06	1.33a ± 0.02	1.22a ± 0.05	0.058	0.001
Breast Meat (%)	26.51b ± 0.15	27.50c ± 0.17	27.57c ± 0.20	26.40b ± 0.10	25.58a ± 0.19	0.183	0.001

**Means bearing different superscripts a, b and c differ significantly ($P<0.01$), * Means bearing different superscripts a, b and c differ significantly ($P<0.05$)

Excessive deposition fat decreased the carcass value which is not economical for the poultry production (Youssef *et al*., 2011) [27]. Findings of present study are in agreement to the Zaman *et al*., (2008) [30] who observed that abdominal fat was increased significantly in high energy diet group than low energy diet group. Similarly, Shirmohammad and Mehri (2011) [24] found abdominal fat was significantly (P<0.05) more, in high energy diet with multi-enzyme as compared to reduced metabolizable energy diet with multi-enzyme. Abdominal fat was increased in birds received normal density diet, but supplementation of multi-enzyme in low energy diet reduced the deposition of fat in broiler birds was (Youssef *et al*., 2011 and Abudabos, 2012) [2, 27].

In against to present finding Gitoee *et al*., (2015) [14] noticed that abdominal fat was not affected significantly (P>0.05) with multi-enzyme and energy level interaction in broiler birds. Similarly, Lee *et al*., (2010) [17], Zakaria *et al*., (2010) [29], Cho *et al*., (2012) [8], Wafa *et al*., (2013) [26] and Hussein *et al*., (2020) [16] observed non-significant effect in abdominal fat among the treatment groups with multi-enzyme supplementation in different levels of metabolizable energy in broiler chickens.

A higher percentage of breast weight in standard broiler diet with 2.5% energy reduced than BIS (2007) with multi-enzyme supplementation treatment group might be due to the higher deposition of protein on that part (Abudabos, 2012) [2].

The present study is similar with Sims *et al*., (2001) who mentioned that breast meat yield was highest in the low metabolizable energy diet (2964 Kcal/Kg less than recommended). Similarly, Shirmohammad and Mehri (2011) [24] found breast muscle weight of low energy diet with multi-enzyme supplementation birds were significantly higher than that of high energy group (P<0.05). Goli and Shahryar (2015) [15] reported that breast weights were significantly increased by multi-enzyme addition (P<0.05) in broiler chickens. Abudabos (2012) [2] and Gitoee *et al*., (2015) [14] found similar results in their experiment.

In contrast to current experimental finding the results of (Cafe *et al*., 2002) [7], Zakaria *et al*., (2010) [29], Cho *et al*., (2012) [8] and Hussein *et al*., (2020) [16] reported non-significant effect on breast meat percentage in low energy diet with multi-enzyme addition.

3.2 Haematological parameters

The haematological parameters of control and experimental groups were showed in Table 5. The haemoglobin (g/dl), TEC ($x10^6$/µl), TLC ($x10^3$/µl) and PCV (%) values are presented in table. 4.6.1. Results indicated that there was no significant (P>0.05) effect of multi-enzyme and dietary energy levels among treatments for all blood haematological parameters. Haemoglobin (g/dl) was found non-significantly higher in T_1 (10.45 ± 0.07) as compared to T_4 (10.41 ± 0.08). Whereas, TEC ($x10^6$/µl) values were T_0 (2.53 ± 0.07), T_1 (2.54 ± 0.04) T_2 (2.53 ± 0.06) T_3 (2.52 ± 0.02) and T_4 (2.51 ± 0.04) respectively. The TLC ($x10^3$/µl) was numerically high in T_0 (21.49 ± 0.61) as compared to T_1 (21.40 ± 0.72), T2 (21.33 ± 0.53), T_3 (20.81 ± 0.59) and T_4 (20.79 ± 0.94). PCV (%) was non significantly higher in T_0 (35.71 ± 0.35) as compared to T_1 (35.59 ± 0.43), T_2 (34.90 ± 0.72), T_3 (34.59 ± 0.55) and T_4 (34.40 ± 0.19) accordingly.

Table 5: Blood haematological parameters of experimental birds fed different energy diets supplemented with multi-enzyme

Parameters	Treatments					SEM	P
	T0	T1	T2	T3	T4		
Hb (g/dl)	10.44 ± 0.06	10.45 ± 0.07	10.43 ± 0.06	10.42 ± 0.05	10.41 ± 0.08	0.026	0.994
TEC (x106/µl)	2.53 ± 0.07	2.54 ± 0.04	2.53 ± 0.06	2.52 ± 0.02	2.51 ± 0.04	0.191	0.984
TLC (x103/µl)	21.49 ± 0.61	21.40 ± 0.72	21.33 ± 0.53	20.81 ± 0.59	20.79 ± 0.94	0.283	0.914
PCV (%)	35.71 ± 0.35	35.59 ± 0.43	34.90 ± 0.72	34.59 ± 0.55	34.40 ± 0.19	0.226	0.251

The current experimental findings are in accordance to the Cho *et al*., (2012) [8] who reported that there were no differences observed on RBC and WBC count with addition of emulsifier and multi-enzyme in different energy density diet. Similarly, Mohammadigheisar *et al*., (2018) [19] recorded that birds received low energy diet with multi-enzyme and lysolecithin showed lower count of WBC and RBC than control diet in broiler chickens. Hb, PCV, RBCs and WBCs were not affected by the different density diet in multi-enzyme supplemented groups (Attia *et al*., 2019) [4].

3.3. Biochemical parameters

Blood biochemical parameters study included Plasma total protein, Serum albumin, Serum globulin, Total cholesterol, HDL, LDL, Serum triglyceride, Blood glucose and Blood Urea Nitrogen (BUN) which were analysed and presented in Table 6. From the table it was explored that the all-blood biochemical parameters were non-significant (P>0.05) among the different treatment groups. Multi-enzyme and metabolizable energy interaction did not give any negative impact on the values of biochemical constituents.

The results of total protein (g/dl), albumin (g/dl) and globulin were almost comparable among the experimental groups. Multi-enzyme and different energy diets did not show significant interaction might be due to protease and phytase improved the retention of nitrogen and improved the more absorption of nutrients through the endogenous digestive tract (Cowieson and Adeola, 2005) [12].

The current experimental findings are in tune with the findings of Saleh *et al*., (2018) [21] who mentioned non-significant (P>0.05) change for the total protein and albumin levels for the different treatment groups supplemented with multi-enzyme in different energy level (ME: 3151 and 3102 Kcal/Kg) diets. Similarly, Attia *et al*., (2019) [4] who recorded no significant (P>0.05) effect of different levels of multi-enzymes on the concentration of total protein, albumin and globulin in standard and low density diets fed to broiler birds. However, in antithesis to the present results Abudabos (2012) [2] recorded that concentration of total protein was significantly affected by the levels energy and multi-enzyme interaction in broiler birds. Sanhoury and Ahmed (2017) [23] observed significantly (P<0.01) increased the levels of total protein and globulin level with multi-enzyme supplementation in broiler birds.

Table 6: Blood biochemical parameters of experimental birds fed different energy diets supplemented with multi-enzyme

Parameters	Treatments					SEM	P
	T0	T1	T2	T3	T4		
Total protein (g/dl)	4.38 ± 0.02	4.40 ± 0.04	4.39 ± 0.02	4.38 ± 0.03	4.36 ± 0.03	0.118	0.934
Albumin (g/dl)	2.24 ± 0.03	2.26 ± 0.02	2.25 ± 0.03	2.24 ± 0.02	2.23 ± 0.02	0.099	0.925
Globulin (g/dl)	2.13 ± 0.03	2.14 ± 0.05	2.14 ± 0.05	2.14 ± 0.04	2.13 ± 0.01	0.061	0.933
Total cholesterol (mg/dl)	125.75 ± 1.65	123.25 ± 1.38	122.90 ± 4.04	122.25 ± 1.03	121.14 ± 4.19	1.170	0.827
HDL (mg/dl)	53.03 ± 1.58	55.98 ± 1.47	56.48 ± 1.01	55.50 ± 0.96	54.99 ± 1.39	0.586	0.417
LDL (mg/dl)	45.52 ± 1.79	40.52 ± 2.78	39.82 ± 2.46	40.37 ± 1.91	40.06 ± 1.78	0.996	0.349
Triglyceride (mg/dl)	136.05 ± 3.25	133.78 ± 2.72	132.94 ± 1.88	131.88 ± 2.08	130.43 ± 3.46	1.174	0.676
Blood glucose (mg/dl)	190.91 ± 1.59	190.05 ± 2.35	188.11 ± 1.19	187.95 ± 3.16	186.63 ± 3.18	1.029	0.734
BUN (mg/dl)	3.57 ± 0.02	3.51 ± 0.04	3.49 ± 0.05	3.48 ± 0.06	3.48 ± 0.05	0.021	0.678

Total cholesterol was non-significantly (P>0.05) higher in control group as compared to multi-enzyme supplemented groups. The average mean values of serum total cholesterol were (125.75 ± 1.65) (123.25 ± 1.38) (122.90 ± 4.04) (122.25 ± 1.03) (121.14 ± 4.19) from T_0 to T_4. The HDL (mg/dl) was numerically higher in T_2 (56.48 ± 1.01) as compared to T_1 (55.98 ± 1.47), T_3 (55.50 ± 0.96) T_4 (54.99 ± 1.39) and T_0 (53.03 ± 1.58). However, LDL (mg/dl) was non-significantly lower in T_2 (39.82 ± 2.46) as compared to T_3 (40.37 ± 1.91), T_4 (40.06 ± 1.78), T_1 (40.52 ± 1.78) and T_0 (45.52 ± 1.79). The results showed that triglyceride was non-significantly (P>0.05) but statically lower in T_4 (130.43 ± 3.46) as followed T_3 (131.88 ± 2.08), T_2 (132.94 ± 1.88), T_1 (133.78 ± 2.72), and T_0 (136.05 ± 3.25) respectively. The reasoned behind, why there was no difference between the levels of cholesterol, HDL, LDL and triglyceride in between low energy diets and control diet because, dietary fiber and multi-enzyme up take the values in between the ranges of control diet.

The findings of present study are in agreement to the findings of Saleh *et al*., (2019) [22] who mentioned that concentration of triglyceride, blood glucose and LDL was non-significant with xylanse and arabinofuranosidase supplementation in low energy diet level (90 Kcal/Kg reduced energy) but, the level of HDL and plasma globulin was significantly increased than the control group. Reduction in the cholesterol level suggested that enzyme play certain role in lipid metabolism Sanhoury and Ahmed (2017) [23].

In contrary to present finding Cho *et al*., (2012) [8] recorded significant effect for blood triglyceride for different density diet with multi-enzyme and emulsifier interaction. Similarly, Goli and Shahryar, (2015) [15] found significantly (P<0.05) decreased concentration of triglyceride, cholesterol and LDL at 21, 42 and 49 d of age and increased the concentration of blood HDL in enzymes supplemented treatment groups.

Blood glucose level was non significantly (P>0.05) higher in control group as compared to other dietary treatment groups supplemented with multi-enzyme. The average mean values pertaining to blood glucose were T_0 (190.91 ± 1.59), T_1 (190.05 ± 2.35), T_2 (188.11 ± 1.19), T_3 (187.95 ± 3.16) and T_4 (186.63 ± 3.18) respectively. Results showed decreasing trend for the blood glucose levels for the decreasing energy levels for respective treatment groups. Blood glucose values were non-significant (P>0.05) when diet was supplemented with multi-enzyme and emulsifier in different density diet, but numerically values showed that level of blood glucose decreased as the energy level was reduced in diet for the broiler birds (Cho *et al*., 2012) [8]. On contrary to this result of Yuan *et al*., (2008) expressed that blood glucose levels showed significant effect (P<0.05) for commercial multi-enzyme supplementation. Cho and Kim (2013) [9] recorded significantly (P>0.05) increased levels of blood glucose in negative energy with enzyme (Mannanase + Xylanase) incorporation in pig diets.

The blood urea nitrogen concentration was T_0 (3.57 ± 0.02), T_1 (3.51 ± 0.04), T_2 (3.49 ± 0.05), T_3 (3.48 ± 0.06), T_4 (3.48 ± 0.05) treatment groups respectively. The results of the present study in terms of BUN are in agreement to the Cho and Kim (2013) [9] who recorded non-significant effect throughout the experiment for pig, received (90 Kcal/Kg less ME than standard) with Mannanase and Xylanase addition in the diet but it was numerically lower than the control group. Saleh *et al*., (2018) [21] recorded significantly lower value for treatment group as compared to control.

4. Conclusion

It can be concluded that broiler chicken fed diet having 2.5 % low energy than BIS (2007) standard with multi-enzyme supplementation to 2.5 % low energy diet improved the breast meat and reduced the abdominal fat. Haematological and blood biochemical parameters were not affected by variation in energy levels, supplemented with multi-enzyme in the diet.

5. References

1. AOAC. Association of Official Analysis Chemist. Official method of analysis. 18Th edition. Washington D.C. Published by A.O.A.C., Washington D.C.
2. Abudabos AM. Effect of enzyme supplementation to normal and low-density broiler diets based on corn-soybean meal. Asian Journal of Animal and Veterinary Advances 2012;7(2):139-148.
3. Alagawany M, Elnesr SS, Farag MR. The role of exogenous enzymes in promoting growth and improving nutrient digestibility in poultry. Iranian Journal of Veterinary Research 2018;19(3):157-164.
4. Attia YA, Khalaifah H, Hamid HS, Harthi MA, Shafey AA. Effect of different levels of multi-enzymes on immune response, blood haematology and biochemistry, antioxidants status and organs histology of broiler chicks fed standard and low-density diets. Frontiers in Veterinary Science 2012;6:1-15.
5. Bharathidhasan A, Chandrasekaran D, Natarajan A, Ravi R, Ezhilvalavan S. Effect of enzyme supplementation on carcass quality, intestinal viscosity and ideal digestibility of broilers to nutrient reduced diet. Tamil Nadu Journal of Veterinary and Animal Sciences 2009;5(6):239-245.
6. Bureau of Indian Standards. Poultry feed - specification (5th revision) 2007, 3-5.
7. Cafe MB, Borges CA, Fritts CA, Waldroup PW. A*vizyme* improves performance of broilers fed corn soyabean meal-based diets. Journal of Poultry Research 2002;11:29-33.
8. Cho JH, Zhao P, Kim IH. Effects of emulsifier and multi-enzyme in different energy density diet on growth

performance, blood profiles, and relative organ weight in broiler chickens. Journal of Agricultural Science 2012;4(10):161-168.
9. Cho JH, Kim IH. Effects of beta mannanase and xylanase supplementation in low energy density diets on performances, nutrient digestibility, blood profiles and meat quality in finishing pigs. Asian Journal of Animal and Veterinary Advances 2013;8(4):622-630.
10. Choct M, Hughes RJ, Wang J, Bedford MR, Morgan AJ, Annison G. Increased small intestinal fermentation is partly responsible for the anti-nutritive activity of non-starch polysaccharides in chickens. British Poultry Science 1996;37(3):609-621.
11. Cowieson A. Strategic selection of exogenous enzyme for corn/soy-based poultry diets. The Journal of Poultry Sciences 2010;47(1):1-7.
12. Cowieson AJ, Adeola O. Carbohydrates, protease and phytase have an additive beneficial effect in nutritionally marginal diets for broiler chicks. Poultry Science 2005;84:1860-1867.
13. Cowieson AJ, Ravindran V. Sensitivity of broiler starter to three doses of an enzyme cocktail in maize-based diet. British Poultry Science 2008;49(3):340-346.
14. Gitoee A, Janmohammadi H, Taghizadeh A, Rafat SA. Effects of a multi-enzyme on performance and carcass characteristics of broiler chickens fed corn-soybean meal basal diets with different metabolizable energy levels. Journal of Applied Animal Research 2015;43(3):295-305.
15. Goli S, Shahryar HA. Effect of enzymes supplementation (Rovabio and Kemin) on some blood biochemical parameters, performance and carcass characterizes in broiler chickens. Iranian Journal of Applied Animal Science 2015;5(1):127-131.
16. Hussein EOS, Suliman GM, Alowaimer AN, Ahmed SH, Abd El-Hack ME, Taha AE *et al*. Growth, carcass characteristics, and meat quality of broilers fed a low-energy diet supplemented with a multi-enzyme preparation. Poultry Science 2020;99:1988-1994.
17. Lee SY, Kim JS, Kim JM, An BK, Kang CW. Effects of multiple enzyme (Rovabio® Max) containing carbohydrolases and phytase on growth performance and intestinal viscosity in broiler chicks fed corn-wheat-soybean meal-based diets. Asian-Australasian Journal of Animal Sciences 2010;23(9):1198-1204.
18. Meng X, Slominski BA, Nyachoti CM, Campbell LD, Guenter W. Degradation of cell wall polysaccharides by combinations of carbohydrase enzymes and their effect on nutrient utilization and broiler chicken performance. Poultry Science 2005;84(1):37-47.
19. Mohammadigheisar M, Kim HS, Kim IH. Effect of inclusion of lysolecithin or multi-enzyme in low energy diet of broiler chickens. Journal of Applied Animal Research 2018;46(1):1198-1201.
20. Salami RI, Odunsi AA. Performance of broiler chickens fed 8% crude fibre diets at three energy levels with or without enzyme during the starter and finisher phases. Poultry Sciences 2019;8(9):423-430.
21. Saleh AA, El-Far AH, Abdel-Latif MA, Emam MA, Ghanem R, Abd El-Hamid HS. Exogenous dietary enzyme formulations improve growth performance of broiler chickens fed a low-energy diet targeting the intestinal nutrient transporter genes. PLoS One 2018;13(5):e0198085.
22. Saleh AA, Kirrella AA, Abdo SE, Mousa MM, Badwi NA, Edeid TA *et al*. Effects of dietary xylanase and arabinofuranosidase combination on growth performance, lipid peroxidation, blood constituents and immune response of broilers fed low energy diets. Animals 2019;9(7):467.
23. Sanhoury MHS, Ahmed AMH. Broiler performance, enzymes activity and histological observations affected by multi enzymes complex (Zado®). Egyptian Journal of Nutrition and Feeds 2017;20(2):309-320.
24. Shirmohammad F, Mehri M. Effects of dietary supplementation of multi-enzyme complex on the energy utilization in rooster and performance of broiler chicks. African Journal of Biotechnology 2011;10(38):7541-7547.
25. Snedecor GW, Chochran WS. Statistical methods. 8th Edition. New Delhi: Oxford and IBH Publication 1994, 591.
26. Wafa AS, Shalash SM, Selim NA, Abdel-Khalek AM, Radwan AM, Abdel-Salam AF. Response of broiler chicks to xylanase supplementation of corn/rye containing diets varying in metabolizable energy. International Journal of Poultry Science 2013;12:705-713.
27. Youssef AW, Hassan HMA, Ali HM, Mohamed MA. Performance, abdominal fat and economic efficiency of broilers fed different energy levels supplemented with xylanase and amylase from 14 to 40 days of age. World Journal of Agricultural Sciences 2011;7(3):291-297.
28. Yuan J, Yao J, Yang F, Yang X, Wan X, Han J *et al*. Effects of supplementing different levels of a commercial enzyme complex on performance, nutrient availability, enzyme activity and gut morphology of broilers. Asian Journal Animal Science. 2008;21(5):692-700.
29. Zakaria HAH, Mohammad ARJ, Majdi A. The influence of supplemental multi-enzyme feed additive on the performance, carcass characteristics and meat quality traits of broiler chickens. International Journal of Poultry Science 2010;9(2):126-133.
30. Zaman QUT, Mushtaq H, Nawaz MA, Mirza S, Mahmood T, Ahmad ME *et al*. Effect of varying dietary energy and protein on broiler performance in hot climate. Animal Feed Science Technology 2008;146:302-312.
31. Zhou Y, Jiang Z, Lv D, Wang T. Improved energy-utilizing efficiency by enzyme preparation supplement in broiler diets with different metabolizable energy levels. Poultry Science 2009;88(2):316-322.