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The Effects of Different Levels of Dried Tomato Pomace on Broilers Chicken Hematological Indices

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Abstract: This study was designed to evaluate the effect of Dried Tomato Pomace (DTP) on hematological indices of broiler chickens. Based a randomized completely design, 160 days old Ross 308 broilers were distributed into 16 floor pens and reared for 42 days. A basal diet was formulated according to NRC recommendations for starter (0-21 days) and grower (22-42 days) periods. The basal diet was also supplemented with 8, 16 and 24% dried tomato pomace, resulting 4 dietary treatments were prepared including control group. Each dietary treatment was fed *ad-libitum* to 4 replicates group of 10 birds at the beginning of rearing period. Inclusion of 24% DTP into the diet significantly decreased concentration of total protein, cholesterol and Low Density Lipoprotein (LDL) in serum ($p<0.05$). The highest High Density Lipoprotein (HDL) were recorded for birds fed diets supplemented with 16 and 24% DTP ($p<0.05$).

Key words: Broiler, tomato pomace, hematological indices, cholesterol, HDL, LDL

INTRODUCTION

There is an increasing demand in engineering food process wastes to reduce their pollution effects and to increase their value by conversion into useful by-products. Tomato processing wastes, or pomace, have been used in animal feeds or as fertilizer (Al-Betawi, 2005; Persia *et al*., 2003). Tomato pomace is a mixture of tomato peels, cores culls, pulp, crushed seeds and unprocessed green tomatoes that remain after the processing of tomato for juice, paste, puree, soups and/or ketchup. About 10-30% of the raw tomato weight becomes waste.

Tomato pomace constitutes the major part of the waste that comes from the pulper. The wet pomace contained 33% seed, 27% skin and 40% pulp, while the dried pomace contained 44% seed and 56% pulp and skin. Elloitt *et al*. (1981) demonstrated that tomato pomace is a good source of protein and the chemical composition of tomato cannery wastes suggests that they have the potential to be a good source of protein, but may be limited in energy due to the high fiber content. Seeds, the major part of pomace, contain 22.2-33.9% protein, 20.5-29.6% fat, 3.9-9.6% ash and 35.1% total dietary fiber (Carlson *et al*., 1981; Latlief and Knorr, 1983; Liadakis *et al*., 1995, 1998; Sogi *et al*., 2002; Persia *et al*., 2003). Geisman (1981) noted that tomato seeds lacked antinutritional factors, which are often present in other unconventional protein sources. The seed protein is rich in lysine and can supplement products that are deficient in this amino acid like cereals (Tsatsaronis and Boskou, 1975; Carlson *et al*., 1981; Latlief and Knorr, 1983; Liadakis *et al*., 1998). Also, Bordowski and Geisman (1980) reported that tomato seeds protein contains approximately 242 parts million^{-1} (ppm) of α-tocopherol (vitamin E). In the recent years, people are becoming more and more health conscious and are preferring meat and egg with low cholesterol content. Efforts are being made to reduce the cholesterol content of egg and meat by feeding poultry with fiber rich diets and never feed ingredients with hypocholesterolemic activity. Tomato pomace is fiber rich feed resource and thought can be act as cholesterol reducing feedstuff in poultry product (Brodowski and Geisman, 1980). Manifold studies available about effect of DTP on performance and carcass characteristic broiler chickens (Dotas *et al*., 1999; King and Zeidler, 2004; Al-Betawi, 2005; Jafari *et al*., 2006), but there are limit information about effect of DTP on hematological indices of broiler chickens.

Therefore, the purpose of this study was investigate the effect of using dried tomato pomace as unusual feedstuff in broiler diets on hematological indices of broiler chickens.

MATERIALS AND METHODS

Bird and diet: In this study, 160 broiler chickens of the commercial Ross 308 strain were used in a randomized

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Table 1: Ingredient composition and calculated analysis of the basal diets

	DTP (%)							
	Starter diets				Grower diets			
Ingredients	0	8	16	24	0	8	16	24
Corn	57.20	56.70	50.00	44.10	62.60	63.6	58.00	49.00
Soybean meal	29.90	27.8.0	25.00	24.00	24.20	19.5	14.00	15.00
Tomato pomace	0.00	8.00	16.00	24.00	0.00	8	16.00	24.00
Wheat bran	5.00	0.00	0.00	0.00	5.00	0	0.00	0.00
Fish meal	3.00	3.00	3.00	3.00	5.10	6.1	6.80	5.10
Soybean oil	1.20	1.00	2.20	3.50	1.70	1	2.00	3.80
Ouster shell meal	1.00	1.10	1.10	1.10	1.30	1.3	1.30	1.40
DCP	1.30	1.10	0.90	0.73	0.86	0.39	0.00	0.00
Vit and min perimix	0.50	0.50	0.50	0.50	0.50	0.5	0.50	0.50
DL-methionine	0.16	0.17	0.20	0.26	0.09	0.07	0.07	0.15
L-lysine	0.26	0.16	0.14	0.16	0.22	0.08	0.03	0.11
$NaHCO_3$	0.14	0.17	0.00	0.00	0.11	0	0.00	0.00
Salt	0.13	0.18	0.20	0.20	0.14	0.18	0.20	0.19
Coccidiostat	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nutrient content								
ME (kcal kg^{-1})	2850.00	2850.00	2850.00	2850.00	2950.00	2950.00	2950.00	2950.00
Crude protein (%)	20.48	20.48	20.48	20.48	18.44	-	-	-
Crude fiber (%)	3.88	5.38	7.21	9.04	3.60	4.9	6.7	8.6

Vitamin and mineral provided per kilogram of diet: vitamin A 360000 IU; vitamin D3 800000 IU; vitamin E 7200 IU; vitamin K3 800 mg; vitamin B, 720 mg; vitamin B9 400 mg; vitamin H2 40 mg; vitamin B2 2640 mg, vitamin B3 4000 mg; vitamin B5 12000 mg; vitamin B6 1200 mg; vitamin B12 6 mg; Choline chloride 200000 mg, Manganese 40000 mg, Iron 20000 mg; Zinc 40000 mg, Copper 4000 mg; Iodine 400 mg; Selenium 80 mg

completely design with 4 treatment, 4 replicates in each treatment and 10 birds/replicates and reared on the floor pens for 42 days. A basal deit was formulated as control according to NRC (1994) recommendations for starter (0-21 days) and grower (22-42 days) periods. The required amount of unusual feedstuff under study was added to the basal diet so that in addition to the control treatment, three dietary experimental treatments containing 8, 16 and 24% dried tomato pomace were prepared (Table 1). During the experiment, water and feed were given to the birds *ad-libitum*. About 5 mL of blood was collected from wing vein from 4 birds in each treatment on 42th day of experimental feeding.

Blood parameters assay: Blood samples were centrifuged (at 2,000×g for 10 min) and serum was separated and then stored at -20°C until assayed for measuring blood parameters (glucose, total protein, albumin, cholesterol, triglycerides and HDL) using appropriate laboratory kits (Friedewald *et al*., 1972; Gordon *et al*., 1977; Gowenlock *et al*., 1988). The serum globulin was calculated by subtracting serum albumin from serum total protein levels. VLDL cholesterol was calculated from triglyceride by dividing the factor 5. The LDL cholesterol was calculated by using the equation:

LDL cholesterol = Total cholesterol-HDL cholesterol-VLDL cholesterol

Statistical analysis: All data were analyzed using the One-Way ANOVA procedure of SAS® (SAS, 1998) for analysis of variance. Significant differences among treatments were identified at 5% level by Duncan (1955) multiple range tests.

RESULTS AND DISCUSSION

The effect of experimental treatments on blood parameters are given in Table 2 and 3. Table 2 and 3 shown all blood parameters not affected by treatments, with exception total protein, cholesterol, LDL and HDL. In this experiment, the serum cholesterol content, LDL and total protein of the birds under 24% DTP treatment was lower as compared with other groups ($p<0.05$). Also, dietary supplementation of 16 and 24% DTP were found to cause a significant ($p<0.05$) increase in the mean values of HDL as compared with other treatments. Kavitha *et al*. (2004) reported that the DTP inclusion up to 15% without enzyme supplementation in broiler diets reduce the serum cholesterol content. As mentioned above, the DTP contain high level of crude fiber. Mouundras *et al*. (1997) reported that the plasma cholesterol lowering effect of crude fiber may be due to its ability to enhance fecal excretion of cholesterol and bile acids. Burr *et al*. (1985) reported a negative correlation between dietary fiber content and serum cholesterol. Also, tocopherols and tocotrienols in DTP lowers serum cholesterol by

Table 2: The effect of different levels of DTP on serum total protein, albumin, globulin and glucose of broiler chickens

Parameters	Total protein (g dL^{-1})	Albumin (g dL^{-1})	Globulin (g dL^{-1})	Glucose (mg dL^{-1})
Control	3.00[a]	1.250	1.750	258.500
08% DTP	2.85[ab]	1.300	1.550	264.500
16% DTP	2.8[ab]	1.200	1.600	242.000
24% DTP	2.65[b]	1.150	1.500	231.500
SEM	0.05	0.030	0.040	6.520
p-value	0.121	0.316	0.330	0.276

[a,b]Mean values in each column with different superscripts are significant different ($p<0.05$)

Table 3: The effect of different levels of DTP on serum total protein, albumin, globulin and glucose of broiler chickens

Parameters	Cholesterol (g dL^{-1})	Triglycerides (g dL^{-1})	HDL (mg dL^{-1})	LDL (mg dL^{-1})	VLDL (mg dL^{-1})
Control	152.500[a]	96.500	64.000[b]	69.200[a]	19.300
08% DTP	150.500[a]	91.500	66.000[b]	66.200[ab]	18.300
16% DTP	146.500[ab]	94.500	71.500[a]	56.100[bc]	18.900
24% DTP	140.500[b]	83.000	74.000[a]	49.000[c]	16.600
SEM	1.630	2.370	1.350	2.710	0.420
p-value	0.014	0.193	0.003	0.010	0.193

[a-c]Mean values in each column with different superscripts are significant different ($p<0.05$)

suppressing the posttranscriptional action of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase, the rate-limiting enzyme in the mevalonate pathway of endogenous cholesterol synthesis by the liver (Song-Hae *et al*., 1999).

CONCLUSION

The administration of DTP may improve some of the components of the chicken's blood and possibly improve the health status of the chickens. Further studies with different doses of DTP would be helpful to clarify the nutritional and therapeutic importance of DTP.

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