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Influence of Prebiotic and Two Herbal Additives on Interior Organs and Hematological Indices of Broilers

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Abstract: This experiment was conducted for investigation, the influence of prebiotic, garlic powder and turmeric powder on interior organs and hematological indices of broilers. Based a randomized completely design, 240 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 prebiotic Biolex-MB, garlic powder and turmeric powder, resulting 4 dietary treatments were prepared including control group. Each dietary treatment was fed *ad-libitum* to 4 replicates group of 15 birds at the bigining of rearing period. The lowest ($p<0.05$) abdominal fat percent and serum cholesterol and triglycerides levels were recorded for broilers fed the diet supplemented with Biolex-MB and garlic powder, While, the highest High Density Lipoprotein (HDL) was recorded for birds fed diet supplemented with garlic powder. Inclusion of Biolex-MB and garlic powder into the diets significantly decreased concentration of Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL) in serum ($p<0.05$).

Key words: Broiler, Biolex-MB, garlic, turmeric, cholestrol, triglycerides

INTRODUCTION

Research on poultry genetics, feeding and management for body weight gain, feed conversion ratio, etc. resulted in fast growth but decreased the quality of poultry products as modern fast growing broilers have been found to contain higher amount of abdominal fat (Chambers *et al*., 1981). Most recently, considerable attention has been paid to test the potency of growth promotants on altering lipid metabolism, because, World Health Organization suggested that excess fat deposition is undesirable in human body, which ended in fatal diseases like atherosclerosis. Now-a-days, consumers are also well aware of this fact and prefer lean meat. On the other way, excess fat is an economic burden to poultry producers, because fat is lost during processing of the carcass resulting in lower meat yields and further more, the discarded abdominal fat and visceral fat increases waste management problems. It's reported that some feed growth promoter additives can reduce the serum cholesterol and abdominal fat of broiler chicken (Yusrizal and Chen, 2003; Prasad *et al*., 2009). Biolex-MB is a commercial prebiotic of the mannan-oligosaccharides family, which is obtained by extraction from the outer cell wall of the yeast *Saccharomyces cerviciae* (Ashayerizadeh *et al*., 2009). Garlic (*Allium sativum*) is one of the oldest cultivated plant (Moyers, 1996) and its virtues, as a medicinal plant are known to most cultures of the world. Garlic has been shown to have several effects in the body. These include inhibition of platelet aggregation (Apitz-Castro *et al*., 1983), reduction in arterial blood pressure (MacMohan and Vargas, 1993) and prevention of fat infiltration of liver (Sand *et al*., 1995). Previously, attention has also been focused on garlic's ability to lower cholesterol levels in humans (Adler and Holub, 1997) and animals (Aouadi *et al*., 2000). Turmeric (*Curcuma longa*) is a medicinal plant widely used and cultivated in tropical regions. In recent years, much attention has been focused on the apoptotic action of curcumin (Han *et al*., 1999; Khar *et al*., 1999; Kuo *et al*., 1996) with respect to lipid metabolism. The aim of this study was comparing the effects of Biolex-MB, garlic powder and turmeric powder on interior organs and hematological indices of broiler chickens.

MATERIALS AND METHODS

Bird and diet: In this study, 240 broiler chickens of the commercial Ross 308 strain were used in a randomized completely design with 4 treatment and 4 replicates in

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Table 1: Ingredient composition (dry matter (%)) and calculated analysis of the basal diets

Ingredients	Starter (0-21 days)	Grower (22-42 days)
Corn	58.7	61
Soybian meal	30	29
Wheat bran	5	5
Fish meal	2	0
Soybian oil	1	2
Oister shell meal	1.2	1
DCP	1.07	1
Vitamin and mineral perimix	0.5	0.5
DL-methionine	0.13	0.1
L-lysine	0.15	0.25
Salt	0.25	0.1
Coccidiostat	0	0.05
Total	100	100
Nutrient content ME (kcal kg^{-1})	2850	2950
Crude protein (%)	20.48	18.44
Crude fiber (%)	3.89	3.81

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 B1, 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 chloraid, 200000 mg, Manganeze, 40000 mg, Iron, 20000 mg; Zinc, 40000 mg, coper, 4000 mg; Iodine, 400 mg; Selenium, 80 mg

each treatment and 15 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 growth stimulating additives under study was added to the basal diet so that in addition to the control treatment, four dietary experimental treatments containing prebiotic Biolex-MB (2000 g ton^{-1}), garlic powder (1000 g ton^{-1}) and turmeric powder (1000 g ton^{-1}) were prepared (Table 1). During the experiment, water and feed were given to the birds *ad-libitum*.

Sample collection: On 42nd day of experimental feeding 5 mL of blood was collected from wing vein from 4 birds in each treatment. At the end of the experiment, 2 birds from each replicate of treatments were slaughtered for separation of carcasses (Perreault and Leeson, 1992).

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 bloodparameters (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 formula: LDL cholesterol = Total cholesterol-HDL cholesterol-VLDL cholesterol.

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

RESULTS AND DISCUSSION

Carcass composition: The effects of experimental treatments on some interior organs of broiler chickens are reported in Table 2. The experimental treatments had no significant effect on the percent of heart, liver and gizzard ($p>0.05$). These findings supported the reports made by Kannan *et al*. (2005), Durrani *et al*. (2006) and Javandel *et al*. (2008). The birds under Biolex-MB and garlic powder treatments had the lowest abdominal fat percent than other groups ($p<0.05$). In the study by Ammerman *et al*. (1989), adding 0.375% oligofructose to the birds ration, on day 47, decreased the percent of abdominal fat. However, our findings on abdominal fat percent were in contrast to those of Yusrizal and Chen (2003), Emadi and Kermanshahi (2006) and Javandel *et al*. (2008).

Blood parameters: The effect of experimental treatments on blood parameters are given in Table 3 and 4. As Table 3 and 4 shown all blood parameters not affected by treatments, with exception cholesterol, triglycerides, HDL, LDL and VLDL. In this experiment, the serum cholesterol content and triglycerides of the birds under Biolex-MB and garlic powder treatments was lower as compared whit other groups ($p<0.05$). Dietary supplementation of Biolex-MB and garlic powder was found to cause a significant ($p<0.05$) increase in the mean values of HDL as compared whit control group. Also, in the birds under Biolex-MB and garlic powder treatments, the serum LDL and VLDL were lower than those under the control and turmeric powder treatments ($p<0.05$). In agreement with this results, it is reported that the prebiotic and garlic powder supplementation significantly reduces the serum cholesterol level, triglycerides, LDL and VLDL of broiler chickens (Kannan *et al*., 2005; Ashayerizadeh *et al*., 2009; Prasad *et al*., 2009). Emadi *et al*. (2007) reported that the use of turmeric rhizome powder in broiler's diet could significantly increased total cholesterol, HDL and decreased LDL, VLDL at 42 days of age. Synthesis of bile acids from cholesterol in the liver, is the most important way of cholesterol excretion (Wilson *et al*., 1998). The use of prebiotics can, by the activity of lactic acid bacteria, production of enzymes disintegrating bile salts and deconjugating them, as well as reduction of the pH in the intestinal tract, can be effective in reducing the cholesterol connect ration. Solvability of non-conjugate bile acids is lowered at a low pH and consequently, they

Table 2: The effect of Biolex-MB, garlic powder and turmeric powder as feed additives on carcass composition of broiler chickens

	Treatments					
Variables	Control	Biolex-MB	Garlic	Turmeric	SEM	p-value
As (%)						
Abdominal fat	1.51[a]	0.86[b]	0.96[b]	1.30[a]	0.09	0.007
Heart	0.63	0.59	0.62	0.68	0.02	0.640
Liver	2.41	2.07	2.06	2.42	0.08	0.280
Gizzard	2.53	1.89	2.48	2.44	0.11	0.140

[a,b]: Means in each row with different superscripts are significantly different ($p<0.05$)

Table 3: The effect of Biolex-MB, garlic powder and turmeric powder as feed additives 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	2.84	1.10	1.74	258.5
Biolex-MB	2.90	1.11	1.60	252
Garlic	2.85	1.15	1.53	252
Turmeric	2.95	1.30	1.65	249.5
SEM	0.03	0.06	0.04	3.61
p-value	0.61	0.42	0.51	0.87

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

Table 4: The effect of Biolex-MB, garlic powder and turmeric powder as feed additives on serum lipid concentrations 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	156.5[a]	100.59[a]	65.64[c]	70.75[a]	20.11[a]
Biolex-MB	116[b]	68[b]	73.55[ab]	28.85[b]	13.6[b]
Garlic	127.53[b]	75.04[b]	78.3[a]	34.23[b]	15[b]
Turmeric	155.04[a]	106.95[a]	66.65[bc]	67[a]	21.39[a]
SEM	6.22	5.74	1.84	6.35	1.14
p-value	0.01	0.009	0. 01	0.003	0.009

[a,b,c]: Means in each column with different superscripts are significant different ($p<0.05$)

are absorbed less from the intestine and are excreted more in the feces (Klaver and Van der Meer, 1993). Consequently, the liver, for re-establishment of the hepatic cycle of bile acids, coverts more cholesterol concentration into the tissues and therefore, their concentrations in the blood is reduced (Ros, 2000). In the growing birds, VLDL is the most important triglycerides carrier. The reduction in the serum triglycerides level, by using of Biolex-MB, may be due to an increase in the population of lactic acid bacteria in the GI tract.

The changes in the mean values of serum cholesterol and HDL in the brid fed garlic powder may be due to the possible mechanism of hypocholesterolaemic and hypolipidemic action of garlic products (such as Allicin), which depresses the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6-phosphatase dehydrogenase (Chi *et al*., 1982; Qureshi *et al*., 1983a) and 3-Hydroxyl-3-Methyl-Glutaryl-CoA (HMG-CoA) reductase (Qureshi *et al*., 1983b, 1987). Also, allicin is a specific inhibitor of the acetyl CoA synthetase enzyme necessary for fatty acid biosynthesis. Binding of allicin to the enzyme is non-covalent and reversible in nature (Focke *et al*., 1990). The effect of garlic in reduction of LDL level may probably be due to the possible mechanism of antioxidant and antiperoxide lowering action of garlic products i.e., S-allyl Cysteine Sulfoxide (SAC) on LDL or decrease in hepatic production of VLDL, which serves as the precursor of LDL in the blood circulation (Grundy, 1986). The possible mechanism of lowering in VLDL by garlic products is unclear. But probably it may due to increase in the esterified cholesterol by garlic supplementation may be due to either decreasing the production or increasing the excretion of esterified cholesterol through the bile (Kumar *et al*., 1998).

CONCLUSION

The present results shown that the Biolex-MB and garlic powder supplementation in feed are effective in reduce of lipid metabolism. Further, it was concluded that the administration of Biolex-MB and garlic powder can improve some of the components of the chicken's blood and possibly improve the health status of the chickens.

REFERENCES

Adler, A.J. and B.J. Holub, 1997. Effect of garlic and fishoil supplementation on serum lipid and lipoprotein concentrations in hypercholesterolemic men. Am. J. Nutr., 65: 445-450. http://www.ajcn.org/cgi/content/abstract/65/2/445.

Ammerman, E., C. Quarles and P.V. Twining, 1989. Evaluation of fructooligosaccharides on performance and carcass yield of male broilers. Poult. Sci., 68 (Suppl.): 167.

Aouadi, R., A. Aouidet, A. Elkadhi, M.C. Ben Rayana, H. Jaafoura, B. Tritar and K. Nagati, 2000. Effect of fresh garlic (*Allium sativum*) on lipid metabolism in male rats. Nutr. Res., 20: 273-280. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TB1-40318YM-C&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=b4214f9368f648b29a942688a5bfffbb.

Apitz-Castro, R., S. Cabrera, M.R. Cruz, E. Ledesma and M.K. Jain, 1983. Effects of garlic extracts and of three pure components isolated from it on human platelet aggragation, arachidonate metabolism, release reaction and platelet ultrastructure. Throm. Res., 32: 155-169.

Ashayerizadeh, A., N. Dabiri, O. Ashayerizadeh, K.H. Mirzadeh, H. Roshanfekr and M. Mammoee, 2009. Effect of dietary antibiotic, probiotic and prebiotic as growth promoters, on growth performance, carcass characteristics and hematological indices of broiler chickens. Pak. J. Biol. Sci., 12 (1): 52-57. http://scialert.net/fulltext/?doi=pjbs.2009.52.57.

Chambers, J.R., J.S. Gavora and A. Fortin, 1981. Genetic changes in meat type chickens in the last 20 years. Can. J. Anim. Sci., 61: 555-563.

Chi, M.S., E.T. Koh and T.J. Stewart, 1982. Effects of garlic on lipid metabolism in rats fed cholesterol or lard. J. Nutr., 112: 241-248.

Durrani, F.R., M. Ismail, A. Sultan, S.M. Suhail, N. Chand and Z. Durrani, 2006. Effect of different levels of feed added turmeric (*Curcuma longa*) on the performance of broiler chicks. J. Agric. Biol. Sci., 1 (2): 9-11. http://www.arpnjournals.com/jabs/research_papers/jabs_0806_12.pdf.

Duncan, D.B., 1955. Multiple range and F-tests. Biometrics, 11: 1-42.

Emadi, M., H. Kermanshahi and E. Maroufyan, 2007. Effect of varying levels of turmeric rhizome powder on some blood parameters of broiler chickens fed corn soybean meal based diets. Int. J. Poult. Sci., 6 (5): 345-348. http://www.pjbs.org/ijps/6(5).htm.

Emadi, M. and H. Kermanshahi, 2006. Effect of turmeric rhizome powder on performance and carcass characteristics of broiler chickens. Int. J. Poult. Sci., 5 (11): 1069-1072. http://www.pjbs.org/ijps/5(11).htm.

Focke, M., A. Feld and K. Lichtenthaler, 1990. Allicin: A naturally occurring antibiotic from garlic, specifically inhibits acetyl CoA synthetase. FEBS-Lett., 261: 106-108.

Friedewald, W.T., R.I. Levy and D.S. Fredrickson, 1972. Estimation of the concentration of LDL cholesterol in plasma, without use of the preparative ultracentrifuge. Clin. Chem., 18: 499-504. http://www.clinchem.org/cgi/reprint/18/6/499?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&volume=18&firstpage=499&resourcetype=HWCIT.

Kumar, G.V., K.P. Jayaprakash, Surendranathan and R. Narendranath, 1998. Effect of *Allium cepa* Linn. and *Allium sativum* Linn. on plasma free, esterified and lipoprotein cholesterol in Japanese quails (*Coturnix coturnix* japonica). Indian J. Poult. Sci., 33: 142-148.

Grundy, S.M., 1986. Cholesterol and coronary heart disease: A new era. J. Am. Med. Assoc., 256: 2849-2859. PMID: 3534335.

Gordon, T., W.P. Castelli, M.C. Hjortland, W.B. Kannel and T.R. Dawber, 1977. High density lipoprotein as a protective factor against coronary heart disease: The framingham study. Am. J. Med., 62: 707-714.

Gowenlock, A.H., J.R. McMurray and D.M. McLauchlan, 1988. Varley's Practical Clinical Biochemistry. 6th Edn. CAS Publishers and Distributors, New Delhi, pp: 477-549.

Han, S.S., S.T. Chung, D.A. Rabertson, D. Ranjan and S. Bondada, 1999. Curcumin causes the growth arrest and apoptosis of B cell lymphoma by down regulation of egr-1, c-myc, bcl-xl, NF-KB and p53. Clin. Immunol., 93: 152-161. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6WCJ-45GWBRW-W&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=81374d2c063e0251165756e0575f6c75.

Javandel, F., B. Navidshad, J. Seifdavati, G.H. Pourrahimi and S. Baniyaghoub, 2008. The favorite dosage of garlic meal as a feed additive in broiler chickens ratios. Pak. J. Biol. Sci., 11 (13): 1746-1749. http://www.scialert.net/qredirect.php?doi=pjbs.2008.1746.1749&linkid=pdf.

Kannan, M., R. Karunakaran, V. Balakrishnan and T.G. Prabhakar, 2005. Influence of prebiotics supplementation on lipid profile of broilers. Int. J. Poult. Sci., 4 (12): 994-997. http://www.pjbs.org/ijps/fin501.pdf.

Khar, A., A.M. Ali, B.V.V. Pardhasaradhi, Z. Begum and R. Anjum, 1999. Anti-tumor activity of curcumin is mediated through the induction of apoptosis in AK-5 tumor cells. FEBS Letter, 455: 165-168.

Klaver, F.A.M. and R. Van der Meer, 1993. The assumed assimilation of cholesterol by lactobacilli and Bifidobacterium bifidum is due to their bile salt-deconjugating activity. Applied Environ. Microb., 59: 1120-1124. http://aem.asm.org/cgi/reprint/59/4/1120?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&searchid=1&FIRSTINDEX=0&volume=59&firstpage=1120&resourcetype=HWCIT.

Kuo, M.L., T.S. Huang and J.K. Lin, 1996. Curcumin and antioxidant and anti-tumor promoter, induces apoptosis in human leukaemia cells. Biochim. Biophys. Acta, 1317: 95-100. PMID: 8950193.

MacMohan, F.G. and R. Vargas, 1993. Can garlic lower blood pressure? A pilot study. Pharmacotherapy, 13: 406-407.

Moyers, S., 1996. Garlic in Health, History and World Cuisine. Suncoast Press St. Petersburg, FL, pp: 1-36.

National Research Council (NRC), 1994. Nutrient Requirements of Poultry. 9th Edn. National Academy Press, Washington, DC. http://books.nap.edu/openbook.php?isbn=0309048923.

Perreault, N. and S. Leeson, 1992. Age-related carcass composition changes in male broiler chickens. Can. J. Anim. Sci., 72: 919-929.

Prasad, R., M.K. Rose, M. Virmani, S.L. Garg and J.P. Puri, 2009. Lipid profile of chicken (*Gallus domesticus*) in response to dietary supplementation of garlic (*Allium sativum*). Int. J. Poult. Sci., 8 (3): 270-276. http://www.pjbs.org/ijps/current.htm.

Qureshi, A.A., N. Abuirmeileh, Z.Z. Din, C.E. Elson and W.C. Burger, 1983a. Inhibition of cholesterol and fatty acid biosynthesis in liver enzymes and chicken hepatocytes by polar fractions of garlic. Lipids, 18: 343-348. http://www.springerlink.com/content/dh56150m4lh48g62.

Qureshi, A.A., N. Abuirmeileh, Z.Z. Din, Y. Ahmad, C.E. Elson and W.C. Burger, 1983b. Suppression of avian hepatic lipid metabolism by solvent extracts of garlic: Impact on serum lipids. J. Nutr., 113: 1746-1755. http://jn.nutrition.org/content/vol113/issue9.

Qureshi, A.A., T.D. Crenshaw, N. Abuirmeileh, D.M. Peterson and C.E. Elson, 1987. Influence of minor plant constituents on porcine hepatic lipid metabolism: Impact on serum lipid. Atherosclerosis, 64: 109-115.

Ros, E., 2000. Intestinal absorption of triglyceride and cholesterol. Dietary and pharmacological inhibition to reduce cardiovascular risk. Atherosclerosis, 51: 357-379. DOI: 10.1016/S0021-9150(00)00456-1.

SAS Institute Inc., 1998. SAS/STAT User's Guide: Edn. SAS Institute Inc., Cary, North Carolina.

Sand, J.K., S.Y. Nam, H.C. Chung, S.Y. Hongand and K.H. Jung, 1995. Enhanced effectiveness of dimethyl-4,4dimethoxyl,5,6,5',6'-dimethylinedioxybiphenyl-2,2dicarboxylate in combination with garlic oil against experimental hepatic injury in rats and mice. J. Pharmacol., 7: 678-682.

Wilson, T.A., R.J. Nicolosi, E.J. Rogers, R. Sacchiero and D.J. Goldberg, 1998. Studies of cholesterol and bile acid metabolism and early atherogenesis in hamsters fed GT16-239, a novel Bile Acid Sequestrant (BAS), Atherosclerosis., 40: 315-324.

Yusrizal, D. and T.C. Chen, 2003. Effect of adding chicory fructans in feed on broiler growth performance, serum cholesterol and intestinal length. Int. J. Poult. Sci., 2: 214-219. http://www.pjbs.org/ijps/fin92.pdf.