

## Analysis of the Effects of Cynarin and Choline Chloride on the Metabolic Processes of Broilers

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**Abstract:** One of the important modifications that have been made in animal feeding is the usage of the natural feeds and the feed supplements having any negative impact on human health. Therefore, there has been an increase in the usage of vegetable extracts together with the feeds in the broiler feeding. It is indicated that the vegetable extracts ameliorates the feed consumption and the benefitting from the feed and consequently have the positive impact on the live weight. This study is carried out in order to ascertain the usage opportunities of the artichoke extract (*Cynara scolymus*) that has positive productive effects on broilers' feed and the vegetable extract named Bedqen40 that includes choline chlorite and their metabolic impacts on liver enzymes. The study was conducted while using 100 Ross 308 hybrid chicks for 42 days as control and experimental groups. In terms of the live weight at the end of the experiments, there is a significant statistical difference between the groups ( $p = 0.0425$ ). In respect to the daily increase of live weight, the difference between the experimental group and the control group is statistically negligible ( $p \geq 0.1104$ ). There is no difference in terms of the liver enzymes between the experimental group and the control group both at the start and the end of the experiment ( $p \geq 0.1792$ ).

**Key words:** Broiler, cynarin, choline chlorite, liver enzymes, live weight

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### INTRODUCTION

Now a days, many types of anabolic substances are used in order to maintain the animal health and the productiveness. These anabolic substances used usually have negative effects on the digestive system and the immune system. For this reason, there have been researches for many years on the supplementary products for the development in the poultry farming. Even if the antibiotics and such chemical substances were used in low doses, they caused the resistance on the bacteria. As the animal products that are provided for the edible consumption are risky, thereby they expose residues and cause the death of animals; the usages of these substances have been prohibited (Kutlu and Gorgulu, 2001).

Despite the aromatic vegetables and their extracts are used as medicines in the treatment of diseases their stimulative effects on the growth in animal feeding are not taken into consideration. Due to the prohibition of the antimicrobials as stimulants, however, the vegetable extracts as alternative feed supplements have gained importance (Alcicek *et al.*, 2004).

The prohibition of antibiotics as stimulants also increased the attention particularly to the phytogetic feed

supplemental substances. Obtaining the cynarin substance from artichoke extract and its usage in the medical science as hepatoprotective triggered the area of utilization particularly in the poultry farming. The motivation of keeping the liver functions within the intended level in the broilers where intensive farming is dealt has on the other hand increased the importance of such supplements.

It is alleged that the phenols and polyphenols in the artichoke leaves are highly effective in increasing the bile secretion and this has positive effects on the digestion of fats (Speroni *et al.*, 2003; Kraft, 1997).

The leaves of artichoke contain the phenolic acids and the cynarin which is the main isomer of this extract (Moglia *et al.*, 2008). Cynarin in general makes the liver work normally while directly impacting on the synthesis and secretion functions of the liver (Gebhardt, 1997; Kraft, 1997; Llorach *et al.*, 2002; Zhu *et al.*, 2004).

Chlorogenic acid, caffeic acid and cynarin which are the most important substances that artichoke contains, have cholagogue, choleretic and hepatoprotective affects. Moreover, the flavonoids have diuretic features due to their synergic effects.

Choline, which is also known as vitamin B<sub>4</sub>, has become an irreplaceable feed supplemental substance for the poultry in the recent years as a consequence of the researches conducted. Choline plays an important role in the prevention of the cases such as perosis and hepatosplenomegaly particularly in the arthrosis of the chicks. Furthermore, choline also plays an important role in the maturation of the hyaline cartilages through penetrating in the cellular structure together with chlorite or citrate and in the transmission of the stimulus throughout the sympathetic neural system making synthesizing the acetyl choline (Emmert *et al.*, 1996).

Artichoke contains bioactive substances such as apigenin and luteolin and it is also reported that it has bifidogenic effect on useful bacteria (Costabile *et al.*, 2010) that the extract of the artichoke leaves is beneficial for the functional dyspepsia diseases (Holtmann *et al.*, 2003) and that it mitigates the symptoms of bowel syndrome and dyspepsia (Walker *et al.*, 2001).

It is also pointed out that the extract of artichoke leaves shows antioxidative features (Schutz *et al.*, 2004) and that this feature takes its effects through the prevention of the oxidative modification of the blood lipoproteins and the minimization of the existing oxidation risk (Gebhardt, 1997). Besides that it decreases the blood urea concentration as well as the level of cholesterol and fat level in the blood inhibiting the biosynthesis of hepato cholesterol. It has a significant effect on liver increasing the bile secretion (Stoev *et al.*, 2002).

It is attested that the addition of artichoke leaves extract to broiler rations stimulates the bile secretion and the total bile acid concentrations (Rodriguez *et al.*, 2002) the increase in the bile secretion enables more efficient digestion and helps to more effective usage of ration energy through emulsifying the fats and having positive impacts on the digestion of fats and fat metabolism (Kraft, 1997).

As a consequence of the researches on the broilers, Abdo *et al.* (2007) indicated that the 4% addition of the flour of artichoke leaves to the outset and augmentation ratios containing low energy values remedies the fat and energy usage. It was also claimed in the same research that the observed remedy in the digestion of fat might be caused by the increasing effect of artichoke leaves in bile salts in chicks.

In another research conducted with the laying hens, the artichoke extract and the flour of artichoke leaves were added to the rations and it was detected that 8% addition of the artichoke leaves increases the egg productivity that it ameliorates the feed conversion ratios that the digestion of fat is high in the experimental groups in comparison

with the control group and moreover that all the experimental groups are economically more effective than the control group (Radwan *et al.*, 2007).

Furthermore, choline also plays an important role in the maturation of the hyaline cartilages through penetrating in the cellular structure together with chlorite or citrate and in the transmission of the stimulus throughout the sympathetic neural system making synthesizing the acetyl choline (Emmert *et al.*, 1996).

Fatty liver (steatohepatitis) is resulted from the putrefaction of the apoprotein within lipoprotein or the inhibition of lipoproteins from lipid and protein synthesis or the inadequacy of secretion mechanism. This inhibition is usually resulted from the lack of substance called lipotropic factors. The lack of lipotropic substance triggers the accumulation of triglycerides even if the synthesis ratios of the fatty acids and free fatty acids are normal. This fatty liver type arises from the choline deficiency because this deficiency is in essence resulted from the insufficiency of the methyl groups received from the methionine as it is synthesized with the labile methyl groups received from choline transmethylation and methionine. Thusly, the choline has an influence as lipotropic substance in the treatment of fatty liver that is resulted from the deficiency of methionine and betaine. Inversely, the biochemical incidents using the overdose of methyl groups or a poor diet in terms of protein (containing methionine) or lecithin (containing choline) conduce to the fatty liver (Aras *et al.*, 1971).

As lipoidosis also increase together with the selection conducted toward the increase of live weight in broilers, it is seen that the sole remedy is the amelioration of the factors regarding the nutrition and the adjustment of lipotropic factors such as methionine, lysine and choline that decrease the lipoidosis in animals (Demir, 1989).

Choline is completely a colamine with methyl. It is the structural component of choline-phosphatides and the metabolism of lipids. It evolves into acetylcholine which is important for axons with acetylation. The requirement of choline is dependent on several factors provided that the ration is rich enough in terms of folic acid and vitamin B<sub>12</sub>, the metabolism is capable of synthesizing choline sufficiently and therefore, the non-existence of this substance would not emerge in its absence in the food and feed. The retrogression in the growth of chickens and the decrease in the rate of ovulation and hatching are observed in the deficiency of choline. The insufficiency of choline and vitamin E plays especially an additional role in emergence of perosis depending on the deficiency of manganese (Ozturkcan *et al.*, 1993).

## MATERIALS AND METHODS

**Ethical Committee of the University of Canakkale Onsekiz Mart, Decision No: 2012/05-06:** The research has been conducted in the Poultry Research Unit of the Zootechnics Department of the Faculty of Agriculture in the University of Canakkale Onsekiz Mart. 100 Ross 308 hybrid broiler chicks that were procured from a commercial company were used in the research. The research was conducted in the cages that are separated in to 2 groups, one of which were the control group including 50 chicks while the other one is the experimental group. The experimental chicks were given the broiler starter feed from the 1st day until the 21 days and the finish feed from the 22nd day until the 42nd days which is the slaughtering day, their drinking water was always kept available in front of them. Bedgen 40 substance was mixed homogenously to the chicks' feed in the experimental group in the proportion of 150 g ton<sup>-1</sup>. The feeds used in the research were procured from a private feed factory. The live weights of the animals were measured in the 1st-6th weeks. Blood samples were also collected in the 3rd and 6th weeks and these samples were rapidly brought to the Central Laboratory of the University of Canakkale Onsekiz Mart after being located into a cool box in order to extract the syneresis afterwards. Serum was obtained after centrifuging the entire blood in 2500 rpm for 10 min. Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT) and Alkaline Phosphatase (ALP) levels in the serum that belong to the liver functions were completed in the blood in Roche Cobas 501 automatic analyzer system and AST, ALT, ALP and Gamma-Glutamyl Transferase (GGT) enzyme levels were analyzed by using the Enzymatic Measurement Method.

## RESULTS AND DISCUSSION

The increase of the live weights of the chicks which were used in the research, after their 42 days of nutrition and the values of the liver enzymes in the 3rd and 6th weeks were given in Table 1.

In terms of the live weight at the end of the experiments, there is a significant statistical difference between the groups ( $p = 0.0425$ ). In respect to the daily increase of live weight, the difference between the experimental group and the control group is statistically negligible ( $p \geq 0.1104$ ).

There is no difference in terms of the liver enzymes between the experimental group and the control group both at the start and the end of the experiment ( $p \geq 0.1792$ ).

In the research conducted to observe the effects of choline and betaine which were added to the chick rations in different levels on carcass quality and blood serum composites, it was stated that the level of albumin within the blood serum increases and it has no effect on cholesterol and AST and ALT which are the liver enzymes (Hassan *et al.*, 2005).

In the research conducted to observe the effect of the addition of cynarin, which is the vegetable extract substance to the broiler diets in different feed forms, to bone structure and some blood parameters, it was also stated that the rate of serum triglyceride decreases depending on the addition of cynarin to the ration that this decrease is statistically important and that the serum ALP level in the 3rd and 6th weeks of the experiment are not significant (Yargeldi and Abas, 2013).

In the research conducted on the broiler chicks, it was reported that 4% addition of artichoke leaves to the rations increases the total protein rate in the blood from the days 0-28 and decreases the level of blood lipid and total cholesterol however this effect is statistically negligible (Abdo *et al.*, 2007).

In the research conducted on the laying hens, it was further stated that the addition of artichoke leaves extract and dried artichoke leaves to the ration does generally not affect to the blood parameters, however, 10% addition of artichoke leaves decreases the level of blood lipid and cholesterol pointedly (Radwan *et al.*, 2007).

It was stated that the addition of artichoke leaves extract stimulates the bile secretion and increases the total bile acid concentration (Rodriguez *et al.*, 2002) and the increase in the bile secretion enables a better digestion (Kraft, 1997).

In the 42 days of research by Roozbeh *et al.* (2013), conducted on the effects of 1.5% addition of artichoke extract to the broiler rations on the immunity cells and blood biochemical parameters, they indicated that the values of blood urea, cholesterol and triglyceride decreased, however, there was no statistical difference between the HDL and LDL values on the control and experimental groups.

In the research by Deniz *et al.* (2006), conducted on the effects of the commercial product (Hepabial carnitine) which is added to the drinking water of the broilers in different stress conditions and contains the artichoke extract on the growth performance, on the body weight, the feed consumption and feed conversion rate, they discovered that the carcass efficiency, the body weight, the weight gain and the hot carcass weight were found important when the control and the experimental group were scaled at the end of the 42 days.

Table 1: Live weight and liver enzyme means ( $\bar{X}$ ) its Standard Errors (SE) and p-values

Parameters	Trial (T)		Control (C)		p-values
	Means ( $\bar{X}$ )	Standart error	Means ( $\bar{X}$ )	Standart error	
<b>Live weight</b>					
Start of experiment	86.6	13.65	77.80	13.38	0.6434
Week 1	225.4	13.65	217.80	13.38	0.6908
Week 2	482.0	13.65	492.40	13.38	0.5902
Week 4	973.7	13.65	961.20	13.38	0.5124
Week 6	1976.2	13.65	1937.20	13.65	0.0425
<b>Daily live weight increase</b>					
Week 1	19.7	1.07	20.00	1.04	0.8678
Week 2	36.7	1.07	39.20	1.04	0.1104
Week 4	35.2	1.07	33.40	1.04	0.2297
Week 6	71.6	1.07	69.60	1.04	0.1872
<b>Start of experiment</b>					
AST	224.4	11.10	212.40	12.41	0.4785
ALP	1669.1	219.32	2123.70	245.21	0.1792
GGT	22.4	1.57	22.20	1.76	0.9278
ALT	3.6	0.33	3.40	0.37	0.7197
<b>End of experiment</b>					
AST	317.4	15.70	316.20	17.55	0.9615
ALP	1241.4	151.47	1018.58	169.34	0.3361
GGT	24.3	1.67	24.30	1.87	1.0000
ALT	3.7	0.45	3.90	0.50	0.7907

In the research of Abdo *et al.* (2007), conducted for the usage of artichoke leaves as the source of energy in the broiler rations, it was pointed out that there are significant decreases in the biosynthesis on cholesterol and the blood components and that 4% addition of artichoke leaves to the rations causes an increase in the blood proteins and a decrease in the total blood lipids.

Rao *et al.* (2001) researched about the addition of choline to the breeding broilers' rations that are fed with different sources of energy and their effects on their performances and they proved that the content of fat in the liver might be decreased through adding 760 mg kg<sup>-1</sup> more choline to the rations based on different sources of energy.

When the total liver lipid contents of the slaughtered animals were analyzed at the end of the experiment which was conducted to research the effects of choline, methionine and mezzos-inositol on the fatty liver (Gul, 2009), it was ascertained that despite of the differences among the groups in terms of total liver lipid contents as absolute value, these differences are statistically negligible ( $p > 0.05$ ).

### CONCLUSION

It is ascertained in this research that the additive containing 159 g ton<sup>-1</sup> cynarin and choline chlorite to the rations of broilers causes statistically significant difference between the groups only in terms of the live weight at the end of the experiment ( $p = 0.0425$ ) that the difference between the experimental group and the control group is statistically negligible in respect to the daily

increase of live weight ( $p \geq 0.1104$ ) and that there is no difference in terms of the liver enzymes between the experimental group and the control group both at the start and the end of the experiment ( $p \geq 0.1792$ ).

### REFERENCES

- Abdo, Z.M.A., N.L. Radwan and N.A. Selim, 2007. The effect of artichoke leaves meal on the utilization of dietary energy for broiler chicks. *Int. J. Poult. Sci.*, 6: 973-982.
- Alcicek, A., M. Bozkurt and M. Cabuk, 2004. The effect of a mixture of herbal essential oils, an organic acid or a probiotic on broiler performance. *S. Afr. J. Anim. Sci.*, 34: 217-222.
- Aras, K., S. Baglum and G. Ersen, 1971. Medical biochemistry ivbiochemistry of lipids, metabolism in normal and pathological. Sevinc Printing House, Ankara, pp: 1-219.
- Costabile, A., S. Kolida, A. Klinder, E. Gietl and M. Bauerlein *et al.*, 2010. A double-blind, placebo-controlled, cross-over study to establish the bifidogenic effect of a very-long-chain inulin extracted from globe artichoke (*Cynara scolymus*) in healthy human subjects. *Br. J. Nutr.*, 104: 1007-1017.
- Demir, E., 1989. Influence of methionine and lizin added to finishing rations of female broilers on abdominal fat. M.Sc. Thesis, Institute of Natural and Applied Sciences of Cukurova University, Adana, Turkey.
- Deniz, G., I.I. Turkmen, F. Orhan and H. Biricik, 2006. Effect of hepabial carnitine<sup>®</sup> supplemented to drinking water on the performance of broilers under different stress conditions. *Revue Med. Vet.*, 157: 115-120.

- Emmert, J.L., T.A. Garrow and D.H. Baker, 1996. Hepatic betaine-homocysteine methyltransferase activity in the chicken is influenced by dietary intake of sulfur amino acids, choline and betaine. *J. Nutr.*, 126: 2050-2058.
- Gebhardt, R., 1997. Antioxidative and protective properties of extracts from leaves of the artichoke (*Cynara scolymus* L.) against hydroperoxide-induced oxidative stress in cultured rat hepatocytes. *Toxicol. Applied Pharmacol.*, 144: 286-297.
- Gul, C., 2009. The comparing effects of the meso inozito on fatty liver and stomach in the presence of methionine and choline in broilers. Ph.D. Thesis, Cukurova University, Adana, Turkey.
- Hassan, R.A., Y.A. Attia and E.H. El-Ganzory, 2005. Growth, carcass quality and serum constituents of slow growing chicks as affected by betaine addition to diets containing 1. Different levels of choline. *Int. J. Poult. Sci.*, 4: 840-850.
- Holtmann, G., B. Adam, S. Haag, W. Collet, E. Grunewald and T. Windeck, 2003. Efficacy of artichoke leaf extract in the treatment of patients with functional dyspepsia: A six-week placebo-controlled, double-blind, multicentre trial. *Aliment. Pharmacol. Ther.*, 18: 1099-1105.
- Kraft, K., 1997. Artichoke leaf extract: Recent findings reflecting effects on lipid metabolism, liver and gastrointestinal tracts. *Phytomedicine*, 4: 369-378.
- Kutlu, H.R. and M. Gorgulu, 2001. Alternatives for growth promoters as antibiotic additives in poultry feeding stuffs. *Feed Mag. J.*, 27: 45-62.
- Llorach, R., J.C. Espin, F.A. Tomas-Barberan and F. Ferreres, 2002. Artichoke (*Cynara scolymus* L.) byproducts as a potential source of health-promoting antioxidant phenolics. *J. Agric. Food Chem.*, 50: 3458-3464.
- Moglia, A., S. Lanteri, C. Comino, A. Acquadro, R. de Vos and J. Beekwilder, 2008. Stress-induced biosynthesis of dicaffeoylquinic acids in globe artichoke. *J. Agric. Food Chem.*, 56: 8641-8649.
- Ozturkcan, O., E. Demir and M. Gorgulu, 1993. The effects of methionine, choline and lysine in the diet on broilers performance and the amount of abdominal fat. *Nat. J. Agric. For.*, 17: 213-220.
- Radwan, N.L., Z.M.A. Abdo and R.A. Hassan, 2007. Effect of feeding artichoke leaves meal on productive and reproductive performance of Mandarrah hens. *Int. J. Poult. Sci.*, 6: 826-830.
- Rao, S.V.R., G.S. Sunder, M.R. Reddy, N.K. Praharaj, M.V.L.N. Raju and A.K. Panda, 2001. Effect of supplementary choline on the performance of broiler breeders fed on different energy sources. *Br. Poult. Sci.*, 42: 362-367.
- Rodriguez, T.S., D.G. Gimenez and R.D.L.P. Vazquez, 2002. Choleretic activity and biliary elimination of lipids and bile acids induced by an artichoke leaf extract in rats. *Phytomedicine*, 9: 687-693.
- Roosbeh, F., A. Kiani and A. Azarfar, 2013. Effect of artichoke leaves meal and mentha extract (*Mentha piperita*) on immune cells and blood biochemical parameters of broilers. *Global Vet.*, 10: 99-102.
- Schutz, K., D. Kammerer, R. Carle and A. Schieber, 2004. Identification and quantification of caffeoylquinic acids and flavonoids from artichoke (*Cynara scolymus* L.) heads, juice and pomace by HPLC-DAD-ESI/MS<sup>n</sup>. *J. Agric. Food Chem.*, 52: 4090-4096.
- Speroni, E., R. Cervellati, P. Govoni, S. Guizzardi, C. Renzulli and M.C. Guerra, 2003. Efficacy of different *Cynara scolymus* preparations on liver complaints. *J. Ethnopharmacol.*, 86: 203-211.
- Stoev, S.D., D. Djuvinov, T. Mirtcheva, D. Pavlov and P. Mantle, 2002. Studies on some feed additives giving partial protection against ochratoxin A toxicity in chicks. *Toxicol. Lett.*, 135: 33-50.
- Walker, A.F., R.W. Middleton and O. Petrowicz, 2001. Artichoke leaf extract reduces symptoms of irritable bowel syndrome in a post-marketing surveillance study. *Phytother. Res.*, 15: 58-61.
- Yargeldi, K. and I. Abas, 2013. The effects of cynarin, a plant ingredient, supplementation on bone structure and some serum indicens in broilers fed different feed forms. *J. Fac. Vet. Med. Istanbul Univ.*, 39: 9-19.
- Zhu, X., H. Zhang and R. Lo, 2004. Phenolic compounds from the leaf extract of artichoke (*Cynara scolymus* L.) and their antimicrobial activities. *J. Agric. Food Chem.*, 52: 7272-7278.