WHEAT GERM OIL ENRICHMENT WITH ALPHA-LIPOIC ACID IN BROILER: ADVANCED APPROACH TO DEVELOP FUNCTIONAL MEAT TO COMBAT HYPERCHOLESTEROLEMIA

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Abstract - Poultry industry looking for sources of natural antioxidants used synthetic antioxidants, which currently is being used in combination with the natural antioxidant by the industry. Current research was directed to define the influence of wheat germ oil, α-LA(lipoic acid), and α-tocophreol in broiler on the content of fatty acid profile, antioxidant enzymes and serum biochemical profile of blood. Six different diets fluctuating in their antioxidant content were fed to the one day old broilers: control, natural α-tocopherol (wheat germ oil), synthetic α-tocopherol, α-LA (lipoic acid), α-LA combination with natural alpha-tocopherol and alpha-lipoic acid combination with synthetic alpha-tocopherol. SFA (saturated fatty acids) and UFA (unsaturated fatty acids) composition in the leg and breast muscles were certainly affected by various dietary additions. The broilers served only wheat germ oil have considerably greater fatty acids in breast and leg muscles while lesser levels of fatty acids were present in the broilers getting feed having alpha-lipoic acid with synthetic alpha-tocopherol in the leg and breast muscles. The group fed natural α-tocopherol and α-LA, have lowest serum total cholesterol and triglycerides. Wheat germ oil with α-LA was more effective than that of synthetic α-tocopherol in rising superoxide dismutase antioxidant enzymes, glutathione reductase and catalase as well as reducing total plasma cholesterol, triglycerides and low density lipoproteins whereas rising the plasma protein and high density lipoproteins considerably. In conclusion, wheat germ oil can improve the lipid profile as well as the antioxidant enzymes.

Key words: α-Lipoic acid, α-Tocopherol, Wheat germ oil, Total phenolic contents, DPPH, Frap

1. INTRODUCTION

The meat and its products are the major parts in the diets of the developed countries. The consumption of meat is affected by different aspects. The most important factors are product characteristics requirement of the consumer and the environment for keeping of the meat products(Jiménez Colmenero et al., 2003).On the other hand, degree of polyunsaturation in meat lipids increases oxidative processes resulting in deterioration of flavored nutritional quality of meat (Mielnik et al., 2006).

The antioxidant application is significant method to prevent the oxidation of lipid as they limit the access of oxygen to the meat, hence retards the flavor development with improved oxidative stability (Nam and Ahn 2003). The use of alpha lipoic acid in feed results in decrease in oxidative stress while antioxidants in decrease levels in vivo. α-lipoic acid is declared to be a possible remedial source for redox-unbalanced diseases Due to its biochemical characteristics, and is used for the energy impair treatment as well. The major sources of α-lipoic acid in animal food are heart, liver and kidney meats while plant food include broccoli, potatoes and spinach as a source of α-lipoic acid (Dong-Yun et al., 2003). Alpha-lipoic acid is not considered to be a vitamin because it can be synthesized by de novo (Bast and Haenen 2003). Alpha-lipoic acid have potential for reactive oxygen species (ROS) to scavenge with the prospective of redeveloping endogenous antioxidants like vitamin C, glutathione trim down tocopherol and

with the metal chelating tendency which results with reduction of reactive oxygen species production (Freitas 2009; Arshad et al., 2013a).

1I. MATERIALS AND METHODS

This research was conducted at National Institute of Food Science and Technology and Research Centre of Animal Nutrition Farm, University of Agriculture, Faisalabad, Pakistan. The wheat germ was collected from Sunny Flour Mills, Lahore, Pakistan. Alpha lipoic acid and synthetic alpha-tocopherol were purchased from Shaanxi Sciphar Hi-Tech Industry Co, Ltd China and from Merck (Merck K Ga A, Darmsladt, Germany) respectively. All the reagents and chemicals for this research were purchased from Sigma Aldrich (Germany) and Merck (Germany). One day old 180 chicks (50±5g body weight) were purchased from Jadeed Chicks Private Limited, Faisalabad, Pakistan. The wheat germ oil was extracted through solvent extraction technique. The feed of chicks was supplemented with alpha-lipoic acid, synthetic alpha-tocopherol and wheat germ oil. One day old broiler chicks were used for this experiment. The broilers were divided in to 6 groups with 3 replicates in each group. Each replicate comprise of 10 birds. Two trials were conducted for this study. The feed supplementation plan is described in the Table 1.

Table 1: Broiler Feed supplementation

	Supplementation per kg feed
T_1	Control
T_2	Wheat germ oil (200 mg natural α-tocopherol)
T_3	Synthetic α-tocopherol (200 mg)
T_4	α-Lipoic acid (150 mg)
T_5	α-Lipoic acid (150 mg) + Wheat germ oil (200 mg natural α-tocopherol)
T_6	α-Lipoic acid (150 mg) + Synthetic α-tocopherol (200 mg)

Natural α-tocopherol was used from wheat germ oil. After the quantification α-tocopherol from wheat germ oil, the wheat germ oil was used as the natural source of α-tocopherol by competing natural α-tocopherol equivalent to syntheticα-tocopherol.

The experiment was conducted for 42 days. After the expiry of experiment, the birds were slaughtered according to the Halal ethical guidelines. The antioxidant contents in raw leg and breast broiler homogenized meat sample were estimated by the following analytical methods as described below. The total phenolic contents in leg and breast meat was determined by following the method described by Senevirathne et al. [6] α-Tocopherol contents were determined by the method described by Asghar et al. [7] and α-lipoic acid contents were determined by the method described by Satoh et al. [8] with some modifications. The data was statistically analyzed by Completely Randomize Design using analysis of variance (ANOVA) by using software (Statistic 8.1). The comparison of means was done by the Duncan Multiple Range test.

III. RESULTS AND DISCUSSION

The arrangement and configuration of fatty acids in breast meat flesh of birds fed control diet added with natural or synthetic α-tocopherol; or their blends is accessible in the Table 2. The configuration of saturated and unsaturated fatty acids in the flesh of the breast is influenced considerably by the various altered feed indicated by the results. Profiles and configuration of different fatty acids i.e., palmitoleic acid (C16:0), margaric acid (C17:0) margaroleic acid (C17:1) in the treatment does not change significantly. However, palmitic acid (C16: 1) were considerably more in the breast muscles from the broilers fed α-tocopherol, as linoleic acid and stearic acids. The influence of wheat germ oil was to increase PUFA and SFA levels by a small quantity (23.9 vs 21.1 of total & 30.9vs37.8 correspondingly. However, SFA (saturated fatty acids) were not altered by other treatments.

Broiler breast meat fed with natural α-tocopherol and α-LA plus natural α-tocopherol has significantly high PUFAs, i.e., oleic acid, linoleic acid and linolenic acid. However, breast muscles of broilers fed α-LA plus synthetic α-tocopherol have not high oleic acid level. Although there is 20% rise in the content of stearic acid (fatty acids), when broiler breast meat fed on T2 and T5 but did not differ from control when fed on T3, T4 and T6 during the repeated experiments.

Wheat germ oil supplemented feed in the current research results showed additional fatty acids were found in the breast muscles of the broiler .wheat germ oil has high saturated and unsaturated fatty acid concentration can be found. The fact that broilers getting synthetic α-tocopherol and α-LA have lowest fatty acids contents in breast muscles, may be due to the fact that α-LA is stated to have a lipid lowering factor (Amom et al., 2008). The results of many scientists show that a diet rich in n-3 PUFAs raise the deposition of fatty acids in muscle growth (Rahimi, Azad & Torshizi, 2011).

Wheat germ oil is measured to be a good source of n-3 PUFAs, and hence may added to the content of n-3 PUFAs in the flesh. Wheat germ oil, in the current study, added to a substantial increase in total unsaturated fatty acids (UFAs) content in breast muscles lipid content, generally due to high levels of monounsaturated fatty acid C18 (oleic). PUFAs enriched diet improved and rise these fatty acids in the muscle of breast of chicken on 42 days of age as found in previous report, which supports the results achieved in the current study (Lopez-Ferrer, Baucells, Barroeta & Grashorn, 1999). In the broiler, Concentration of fatty acids in the leg muscles fed these altered feeds presented that the formation of saturated and unsaturated fatty acids in the muscles of leg was exaggerated correspondingly. Leg meat flesh as compared to the breast meat flesh, have slightly additional fatty acid content. For example, the leg meat flesh have fatty acids levels of palmitoleic acid, margaric acid and margaroleic acid does not differ with different feed behaviors. However, natural α-tocopherol (wheat germ oil), with or without additional α-LA fed to broilers considerably more palmitic acid in the flesh of leg. Arachidonic acid content in the flesh of leg by various nutritional treatments was unchanged. Natural α-tocopherol with and without α-LA fed to broilers have also greater amount of fatty acid especially PUFAs including oleic acid, linolenic acid and linoleic acid, in the flesh of leg. However, broilers fed with α-LA and man-made α-tocopherol thorough repeated experiments, have lower oleic acid content in the flesh of leg meat acid. Broilers fed on T2 and T5 have increased stearic acid in leg flesh, but not in broilers with other nutritional treatment.

The consequences of the current study show that wheat germ oil nourished to broiler have greater content of fatty acids, in both leg and breast meat, both saturated and unsaturated fatty acids is present together in oil (Amom et al., 2008). The lowest level of fatty acids in meat fed man-made α-LA α-tocopherol and constantly has to deal with the statement, that α-LA have a lipid reducing influence is reported (Amom et al., 2008). Wheat germ oil is a noble and good source of necessary and important fatty acids, has higher concentration of PUFA and SFA which was fed to broilers. Wheat germ oil has approximately 81 and 64% total UFA and PUFA content (Hidalgo, Brandolini & Ratti, 2009). Wheat germ oil 120 g/kg in the diet has been included for feed (200 mg/kg of feed chosen to provide α-tocopherol)

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