ISSN NO. 2320-5407

Journal homepage:http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Effect of polyphenolic rich, green tea extract as antioxidant on broiler performance during 0-4 weeks

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Manuscript Info

Manuscript History:

Received: 15 October 2013
Final Accepted: 27 October 2013
Published Online: November 2013

Key words:
Polyphenol, green tea extracts, antioxidants, broiler

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Abstract

Conventionally, broiler feed is manufactured by using Vitamin E and synthetic antioxidants like butylated hydroxyl anisole (BHA), butylated hydroxyl toluene (BHT) and ethoxiquine. There is growing concern about ethoxiquine, BHT and BHA residues in broiler meat as researchers claim toxicity of these compounds in liver, lungs and vascular system. So alternative, natural antioxidants are getting appraisal in food and feed industry. Green tea extract provides a rich source of polyphenols which have the capacity to act as powerful antioxidants. An experiment was conducted to study the effect of adding green tea extract (GTE) in broiler feed with or without synthetic antioxidant supplementation. Forty mixed sex, Cob broilers were kept under same managemental conditions during 0-4 weeks. Four groups of 10 birds each, **A, B, C** and **E** fed respective diets with same nutritional profile. Group **A** was fed positive control feed with vitamin E and synthetic antioxidant seldox* (BHT,BHA, Ethoxiquine and citric acid).Group **B** fed negative control feed and had no synthetic antioxidant. Group **C** was positive control+ GTE 2 ml/kg feed and group **E** was fed negative control diet and given GTE 2 ml/kg feed. Weekly weight gain, feed consumption and feed conversion ratio (FCR) were observed. On completion of trial (0-4 weeks), data was compiled and statistical tools were applied to investigate the significance results. Group **A** had better FCR than negative control group **B**. Group **C** which had synthetic antioxidants, enriched by GTE, had best weight gain and FCR .This was statistically significant to all other 3 groups. Group **E** had better results than group **B**, but lower FCR than **C** .There was no significant difference in FCR, among group **A** and **E**. This particular result obtained in birds fed GTE only, is comparable to the control group (having all synthetic antioxidants).The results overall confirm the antioxidant potential of GTE ,even if the synthetic forms are missing in formulations.

Introduction

Oxidation is a natural phenomenon, which affects Lipids, proteins, DNA, pigments, carbohydrates, and vitamins (Hallowell et al., 1995).Even after slaughtering, oxidation continues in muscles and fat tissues, and affects the shelf-life of meat and meat products (Smet,2007. Kanner,1994). Antioxidants are substances which may be present in very low levels in food as endogenous agents or may be added to delay or inhibit the oxidative degradation of foods, increase shelf life and improve the quality of foods (Haworth 2003).

Oxidative stress in poultry is regarded as one of the major causes that leads to biological damage and affects poultry growth. Some disorders like encephalomalacia or nutritional muscular dystrophy are related to per oxidative

dysfunction produced by vitamin E deficiency or free radical increase respectively (Fellenberg 2006, Finley 2011). Oxidative rancidity could result in the deterioration of foods for human consumption i.e. un pleasant odors or loss in flavor, texture, consistency, appearance and nutrition value (Fellenberg 2006).Vitamin E and Vitamin C are usually part of natural food items and considered as well known, effective antioxidants. Synthetic sources of Vitamin E and C are available and are the major constituents of food fortification (Finley et.al 2011). Broiler feeds are produced using synthetic antioxidants like vitamin E, Ethoxiquine, butylated hydroxyl anisole (BHT) and butylated hydroxyl toluene (BHA). In recent years, there are growing concerns of BHA and BHT toxicity in liver, blood, stomach and lungs(forch,1993,Thompson 1988,jayalakshami 1986) so, there have been increasing demands in identifying plant extracts to reduce or retard lipid oxidation in several products (Schwarz et al.,2001, Ahn et al., 1998).Green tea is considered as a natural product, rich in antioxidants. The catechins, present in green tea, commonly called polyphenols, show strong antioxidant potential (Gonzalez-Parama´et al.,2004; Yilmaz and Toledo, 2004; Ruberto et al., 2007). Major catechins present in green tea are epicatechin, epigallocatechin, epicatechin-3-gallate and epigallocatechin-3-gallate. Green tea extraction, yields in a solution rich in polyphenol and consequently a higher antioxidant potential (rabah et al., 2004). Studies carried out in human nutrition and food science, showed that green tea provides several functional activities related to free radicals and reduction in incidence of cancer(Mukhtar and Ahmad, 1999), blood cholesterolMuramattsu et al., 1986), and to blood pressure (Ikeda etal., 1992). Also, green tea has anti-tumor and anti-diabetes effects in the human body (Itaro et al., 1988; Isigai et al.1991.) In poultry there is relatively less research, focusing, green tea as an alternate antioxidant, but in general, green tea inclusion in broiler diets has positive effects on growth, performance and lean meat production of the broilers (Kaneko et al., 2001). Similarly, low grade green tea has been used as an Ingredient in broilers (Kaneko et al., 2001; Cao, 2005).The purpose of current research was to identify the possibility of tea polyphenols to replace synthetic antioxidants in broiler feed. Final objective is to make poultry carcass shelf life free from residual effects of synthetic antioxidants.

MATERIALS AND METHODS

Extract Preparationfrom Green tea

Dried green tea was ground to powder (300 g), extracted with 500 mL of 80% methanol, sonicated for 3 h, filtered, and extracted twice (500 mL each time). The filtrates were transferred to 50 ml tubes for use.

FEED MANUFACTURING

Broiler starter mash rations were prepared using commercially available ingredients in the market. Ration **A** was standard or control diet with synthetic antioxidants, i.e. vitamin E and SELDOX (Ethoxiquine, BHA, BHT and citric acid). Ration **B** had no vitamin E or SELDOX. Ration **C** was positive control with GTE 2ml/kg feed .Ration **E** was negative control diet (no synthetic antioxidant) with GTE, 2 ml/kg feed.

Birds and management

Forty mixed sex, Cob broiler chicks were purchased from local commercial hatchery. Birds were kept in an open house and brooded for one week only because of high humidity (60-70%) and temperature more than 80 degree Fahrenheit. Chicks were kept on floor and four groups of ten birds each were divided by wire mesh. Standard conditions for ventilation, feeding and drinking space were adopted during 0-4 weeks.Groups were named **A, B, C** and **E**, respectively and fed rations accordingly. Growth performance of broiler chickens were evaluated in terms of weekly feed intake, body weight and feed conversion Ratio (FCR) as influenced by dietary Green tea extract.

RESULTS AND DISCUSSION

0-4 WEEKS DATA

GROUP	TYPE OF FEED	TOTAL BIRDS ALIVE		AVERAGE WT. PER BIRD(GRMS)	AVERAGE FEED CONSUMED(GRAMS)	FEED CONVERSION*RATIO
A	positive control	**10**		**950***	**1620**	**1.7***
B	Negative control	**10**		**940***	**1684**	**1.79**
C	positive control+GTE	**9**		**1047**	**1660**	**1.585**
E	Negative control+GTE	**10**		**978***	**1658**	**1.695***
TOTAL	averages			**978.75**	**1655.5**	**1.6925**

FCR= Feed conversion ratio , expressed as feed consumed/weight gain,

*values don't differ among themselves significantly ($p<0.05$)

Table shows lowest weight gain and highest feed consumed in negative control diet (B), without any antioxidant. Group A, consumed less feed and resulted in better F.C.R. which was expected as compared to negative control. Fellenberg in 2006 reported that disorders like encephalomalacia or nutritional muscular dystrophy are related to per oxidative dysfunction produced by vitamin E deficiency or free radical increase respectively. Moure et.al in 2001 reported that free radicals can be bound with antioxidants like BHA, BHT, ethoxiquine or organic acids, which are commercially available and being used in poultry feeds. A comparative study of natural and synthetic antioxidants was carried out by Smet et.al in 2007, while checking lipid and protein oxidation in broiler meat. He reported the significant role of alpha tocopherol acetate and results proved vitamin E as the best antioxidant compared to all other natural antioxidants under study.

Best weight gain and F.C.R was observed in group C, which had vitamin E and Seldox, supplemented by 2ml/kg feed green tea extract. This result is supported by findings of Wang et al in 2008. He got better weight gain and FCR than negative control diet (without vitamin C) by using an antioxidant rich extract of Forsynthiasuspensa plant. Improvement in FCR was also reported by Biswas et al in 2001 while using different levels of green tea powder upto 1.5%.

Interestingly, group E, which was not fed vitamin E or seldox, and had green tea extract of same dose (2ml/kg) as in group C, resulted in almost equal F.C.R to positive control group A. It is a remarkable achievement to have no significant difference in FCR ($p<0.05$) to a diet which is having synthetic antioxidants, considered very important part of feed formulation. There is some supporting evidence of epigallochetichin-3 gallate (part of green tea) potential as antioxidant as observed by K.Sahin et al in 2010. During a trial on heat stressed quail in turkey, he claimed better heat combating response of EGC-3, gallate by enhancing hepatic nuclear transcription in quail liver. The resemblance of this trial may lead us to justify better weight gain obtained on GTE supplemented ration **E.** It is to be noted that our trial was conducted in open house with temperature 30 degree C+ with 65% relative humidity.

Although Green tea is strong antioxidant, however there may be some contributing factors of green tea extract as antimicrobial supplement, compensating bird performance as compared to standard control feed (A). This concept of antibiotic replacement by Green tea was carried out by sarker et al.in 2010 while replacing 30 ppm oxy tetracycline with .5% and 1% green tea. They obtain no significant difference in weight gain suggesting substitution of green tea as an alternate of antibiotics.

These results indicate towards a new concept of using green tea extracts as an antioxidant replacer in broiler rations. The journey towards natural botanical substitutes like green tea in spite of synthetic compounds is safer and ideal for broiler meat consumers. A new series of research describing total assessment of green tea replacement potentials, its standard inclusion levels and economic feasibility during trials on broilers is needed.

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