Explor Anim Med Res,
Vol.11, Issue - 1, 2021, p. 131-134
DOI : 10.52635/EAMR/11.1.131-134

ISSN 2277- 470X (Print), ISSN 2319-247X (Online)
Website: www.animalmedicalresearch.org

Short Communication

SUPPLEMENTING POMEGRANATE PEEL INFUSION IN DRINKING WATER ENHANCES ANTIOXIDANT QUALITY OF BROILER MEAT

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Received 09 April 2020, revised 27 January 2021

ABSTRACT: Pomegranate peel contains substantial amount of phenolic acids responsible for its remarkable *in vitro* antioxidant activities. Objective of the present study was to evaluate the effect of supplementing pomegranate peel infusion on antioxidant quality of broiler meat. Present study showed that supplementation of infusion can increase the antioxidant activity in meat in dose dependent manner. It is concluded that pomegranate peel infusion might be used to extend self-life of poultry meat.

Key words: Antioxidant activity, Broiler meat, Pomegranate peel.

Broiler industry in India has recently witnessed a phenomenal growth rate of about 10 % per year (FAOSTAT 2014). Market for processed chicken meat is even more growing at the rate of 15% per annum with huge scope in export. Oxidative stability of the meat is an important factor for processing industry to supply quality meat and meat products to consumers. Broiler meat is quickly oxidized due to abundance of long chain polyunsaturated fatty acids in it (Sohaib *et al*. 2015, Mir *et al.* 2017) and become rancid. Oxidation of meat, however, can effectively be reduced by use of dietary manipulation of herbs (Pastsart and Pimpa 2018), fruit peels (Saleh *et al*. 2017) and pomace (Saleh *et al.* 2018). Pomegranate peel contains vast array of antioxidants (Yan *et al.* 2017) that could strategically be used for protection of meat against oxidative rancidity. Present investigation was carried out to understand influence of pomegranate peel infusion through drinking water on antioxidant quality of broiler chicken meat.

Preparation of pomegranate peel infusion (PPI): Pomegranate peel (including albedo and membranes) were collected from a fruit juice processing center located at Narendrapur, West Bengal, India. Hot water infusion of pomegranate peel was prepared as described in Indian Ayurveda (Frawley and Ranade 2000). Briefly, fifty grams (50g) of shade dried and subsequently grinded pomegranate peel was put in a glass container, wherein, one liter of double distilled hot water with initial temperature of 70°C was poured.

Immediately after it, the container was tightly capped and placed in a dark place for 12 h at room temperature. Finally, the infusion was filtered using a Büchner funnel fitted with Whatman no 1 filter paper with a vacuum pump. The infusion was placed in dark coloured bottle in refrigerator and used within 48 h.

Birds and their management

The experiment was carried out in experimental farm of West Bengal University of Animal & Fishery Sciences, Belgachia, Kolkata, West Bengal. Two hundred (200) numbers of day-old broiler chicks (Cobb 400) were divided into four (4) identical groups randomly with five (5) replicates in each (each replicate is having 10 birds). All the groups along with replicates were housed in a brooder cum grower house randomly with standard and identical management and environmental conditions. Dietary requirements were followed as per NRC (1994) standard. Proximate composition of basal diet is given in Table 1. All the birds were humanely treated during trial

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period and the experiment was carried out with the due approval of Institute Animal Ethics Committee (IAEC).

Supplementation of PPI in drinking water

Experimental birds received *ad libitum* drinking water mixed with graded dose of PPI. The dose rate of PPI was 50 ml /L, 100 ml/L and 150 ml/L in drinking water for T2, T3 and T4 groups respectively. The birds of control group (T1) received only plain drinking water without any extract.

Measurement of antioxidant indices in meat

Breast and thigh muscle samples were collected on 42 d from representative birds (two birds per replicate). TBARS values of the meat samples were analyzed as per Witte *et al.* (1970). Analyses of Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Ferric Reducing Antioxidant Power (FRAP) and 2,2-diphenyl-1-picrylhydrazyl Test (DPPH) assay from meat sample extracted with pre-cooled methanol were done as per Sukisman *et al*. (2014).

Statistical Analysis

Data were partitioned by One Way ANOVA using SPSS computer program (v. 16.0). Means were compared by Duncan Multiple Range Test (Duncan 1955). Correlogram using Pearson correlation coefficients were drawn using R programing language.

Discussion

TPC

Total phenolic content describes the antioxidant potential of a biological substance that can scavenge free radicals through redox reactions. In the present experiment, TPC of thigh muscles in control and PPI supplemented groups were measured and significant ($p<0.01$) difference was noted between treatment and control groups (Table 2). Highest TPC was observed in T4 group of birds followed by T3, T2 and T1 (control). Results indicated that supplementation of PPI in broilers has positive influence on antioxidant quality of meat. This observation is in line with previous investigations (Mir *et al.* 2017, Sharma *et al.* 2017) on phenolic contents of fresh meat and meat products supplemented with natural extracts.

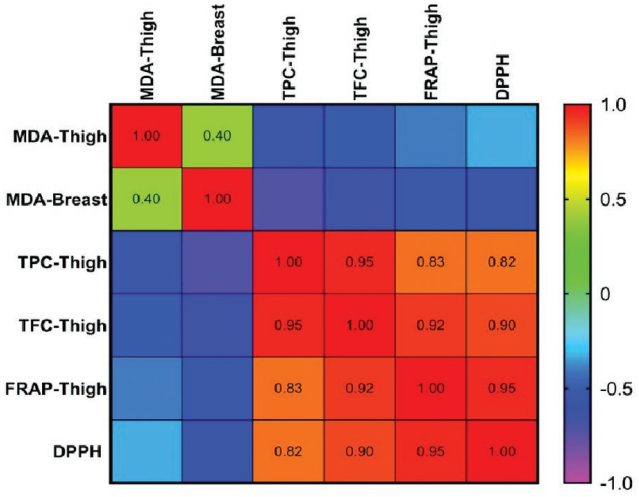

Fig. 1. Correlogram among different meat.

Table1. Proximate composition (% of DM) of basal diet.

Chemical composition	Pre-Starter	Starter	Finisher
CP	22.05	21.34	20.04
EE	3.84	4.56	5.76
AIA	0.83	0.74	0.68
CF	3.94	3.88	3.73
Ca	0.80	0.81	0.75
P	0.42	0.41	0.38
ME (Kcal/Kg)	2902	2943	3037

TFC

Flavonoids are secondary plant metabolites and well known for their antioxidant properties. Higher flavonoid content in the meat sample not only extends the shelf life of the product, but also may render special aroma or color in it. Present study showed TFC significantly ($p<0.01$) varied among the control and treatment groups (Table 2). Highest TFC was observed in T4 group followed by T3, T2 and T1 (control). Results indicated that PPI supplementation has the ability to produce broiler meat with better antioxidant quality.

Correlogram (Fig. 1) revealed strong correlation ($r=0.953$; $p<0.01$) between TPC and TFC in the meat sample.

2,2-diphenyl-1-picrylhydrazyl Test (DPPH) assay

DPPH test is a great tool for evaluating antioxidant activity which is based on transfer of hydrogen atom from antioxidants to DPPH radical. In the present study, radical scavenging activity of meat sample from T4 group was highest ($p<0.01$). Radical scavenging activity increased with increasing supplementation of PPI in the order of: T4>T3>T2>T1. This result was also in agreement with Saleh *et al.* (2017), who studied on broiler performance supplemented with pomegranate peel extract in feed.

Ferric Reducing Antioxidant Power (FRAP) test

FRAP assay is widely known for accurately testing antioxidant potential based on electron transfer reaction. In the present study, significant ($p<0.01$) difference in

Table 2. Antioxidant profile in meat sample.

Parameters	Control (T_1)	Treatments T_2	T_3	T_4	SEM	p-value
TPC (mg GAE/100 g)						
Thigh Muscle	56.22^{c}	60.98^{b}	64.40^{a}	65.63^{a}	1.709	0.000
TFC (mg QE/100 g)						
Thigh Muscle	9.26^{d}	10.95^{c}	12.31^{b}	13.49^{a}	0.431	0.000
FRAP (μM Fe (II)/mg)						
Thigh Muscle	0.62^{d}	0.74^{c}	1.01^{b}	1.48^{a}	0.076	0.000
DPPH (% RSA)						
Thigh Muscle	11.43^{d}	15.86^{c}	20.35^{b}	29.15^{a}	4.877	0.000
Thio-barbituric acid-reactive substances (mg MDA/Kg)						
Thigh Muscle	0.34^{a}	0.33^{a}	0.24^{b}	0.29^{ab}	0.065	0.007
Breast Muscle	0.33^{a}	0.25^{b}	0.24^{b}	0.22^{b}	0.089	0.021

FRAP values was observed among the experimental groups (Table 2). Supplementation of PPI showed profound positive influence on reducing ability of poultry meat. The FRAP values in the present study were in the order of: T4>T3>T2>T1. This effect is probably due to accumulation of polyphenols in the meat. Lee *et al.* (2012) in a similar study observed enhanced antioxidant potential of thigh meat of broilers supplemented with 1% gallic acid.

Fig. 1 showed a strong correlation ($r=0.828$, $p<0.01$) between FRAP values and TPC. Positive correlation with FRAP and TPC was also reported by Sricharoen *et al.* 2015. This could be explained by the presence of powerful reducing phenolic compounds in the meat sample that showed significant dose dependent increase in FRAP values.

Thiobarbituric acid-reactive substances (TBARS) Lipid peroxidation greatly damage meat quality by peroxyl radicals and generate lipid hydroperoxide (Estévez, 2015). TBARS values denote lipid peroxidation levels in tissues. In the present experiment, breast muscle of all the birds that received PPI through drinking water showed significant ($p<0.05$) decrease in peroxidation levels (Table 2). The decreasing order of TBARS values in the breast muscle were: T1>T2>T3>T4. Thigh muscles also showed decreasing values (T1>T2>T4>T3) of TBARS. TBARS value of thigh muscles were negatively correlated ($r= -0.534$; $p<0.05$) with TPC (Fig.1). Saleh *et al.* (2017) reported that pomegranate peel extract (PPE) supplemented feeding significantly ($p<0.05$) reduced lipid peroxidation of breast meat of broilers. They further showed that increasing level of PPE linearly diminished TBARS values in meat. In a separate experiment, Saleh *et al*. (2018) showed that supplementation of pomegranate pomace also significantly reduced lipid peroxidation in fresh and refrigerated thigh meat. Polyphenolic compounds from pomegranate peel infusion might be responsible for reduction and scavenging of peroxide radicals due to their strong antioxidant activities and thereby stabilize the meat from oxidative damage.

ACKNOWLEDGEMENT

Authors gratefully acknowledge the contribution of Dr. Arun Kumar Das, Scientist, ICAR-IVRI (Eastern Regional Station) for fruitful discussion on the above results.

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***Cite this article as:** Ghosh S, Chatterjee PN, Chatterjee J (2020) Supplementing pomegranate peel infusion in drinking water enhances antioxidant quality of broiler meat. Explor Anim Med Res 11(1): 131-134. DOI : 10.52635/EAMR/11.1.131-134