

QUALITY IMPROVEMENT OF BROILER MEAT THROUGH DIETARY SUPPLEMENTATION OF CITRUS PROCESSING WASTE

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Abstract – The study was designed to assess the effect of the citrus waste supplementation in broiler's feed on meat quality. The broiler feed was prepared with 5% and 10% citrus waste and fed to the broiler for 21 days in comparison with control. The antioxidant enzymes assessed at slaughter showed that the citrus waste had positive effect on the antioxidant enzymes of the broiler blood. The DDPH radicals scavenging activity of the meat stored at -20°C for 1 month showed that meat of broiler fed 10% citrus waste possessed the highest antioxidant activity. The higher peroxide value was observed for meat of broilers fed on control feed than those of the treated. Water holding capacity of the meat increased as the citrus waste supplementation in the feed increased.

Key Words – Citrus waste, broiler feed, meat quality

I. INTRODUCTION

World production and consumption of the chicken has been increased because of the nutritional characteristics i.e. high protein and low fats (1). Oxidative reactions in the food can cause deleterious effect and may cause major health problems in the humans including arthrosclerosis, and cancer, and can initiate lipid per oxidation in the membrane (2). Many scientist demonstrated correlation between the feed composition and the chemical composition of the broiler meat (3). The antioxidants in the diet of the broilers can be helpful in the reduction of fats oxidation in the meat (4). Tawfeek *et al.* (5) investigated the effect of natural antioxidants on the antioxidant status of the broiler meat which were reared on the heat stressed condition and concluded that the birds which were given the antioxidants in the feed improved blood profile parameters and antioxidant status of the birds. Citrus peel extract is a natural source of antioxidants and

can replace artificial antioxidants (7). The citrus industry is producing large amount of the peel waste. Some parts of which are utilized in the animal ration and the major part is dumped, thereby causing environmental pollution. Therefore, citrus industry is searching for the way to utilize the byproduct (8). The objective of this study was to assess the effect of the citrus waste supplementation in broilers feed on meat quality.

II. MATERIALS AND METHODS

Feed preparation and farm management

Broiler chicken strain Cobb 550 (150, a day old) was purchased from the Big Bird Lahore (Pakistan) and transferred to the Postgraduate Poultry Research Farm, University of Agriculture, Faisalabad, Pakistan. The feed was prepared with the addition of 0% (CW0), 5% (CW5), and 10% (CW10) citrus waste as presented in the Table 1. Feed protein was adjusted to 22.5% and energy at 1.4 MJ/kg and were fed to the chicken in triplicate. Standard conditions of light and ventilation were maintained during 42 days of rearing period.

Sample collection and slaughtering

The blood sample for analysis of antioxidant enzymes were collected at slaughter (42 days), breast meat was separated and stored at -20°C for further analysis.

Antioxidant enzyme activity

Broiler blood serum was analyzed for measuring activity of superoxide dismutase (SOD) (9), catalase (10), and glutathione peroxidase (GPx) (11).

DPPH radical scavenging activity

DPPH radical scavenging activity of broiler meat was determined by following the method of Jung *et al.* (12).

Peroxide value

The fat extraction was performed by mixing ethyl ether:petroleum ether (1:1) and the iodometric test procedure and values were expressed in mEq/kg of fat as described by the method of AOAC (13).

Table 1. Formulation of treatment feed (%)

Ingredients	CW ₀	CW ₅	CW ₁₀
Maize	55	49	43
Wheat bran	5	5	5
Rice polishing	5	5	5
Fish meal	5	5	5
Blood meal	5	5	5
Citrus peel	0	5	10
Cotton seed meal	5	5	5
Soybean meal	5	5	5
Rapeseed meal	7	7	7
Corn gluten	5	5	5
Molasses 5	0.25	0.25	0.25
Iodized salt	0	1	2
Dicalcium Phosphate	1.25	1.25	1.25
Limestone	1.25	1.25	1.25
Vitamin& mineral	1.25	1.25	1.25
Total	100	100	100

Water holding capacity

Water holding capacity of the broiler meat was determined according to the method of Qiao *et al.* (14).

Statistical analysis

The data obtained from each treatment was subjected to statistical analysis to determine the level of significance by the factorial design (2-way interaction) (15).

III. RESULTS AND DISCUSSION

It is obvious from the results that all the antioxidant enzymes in the broilers were enhanced as the citrus waste supplementation in the feed was increased (Table 2). Maximum antioxidants activity has been observed in the meat of broiler fed on 10% citrus waste supplemented feed and lower activity was observed in meat of broiler fed

on control feed. Hosseini-Vashan *et al.* (16) reported increased activity of GPx and SOD in the birds fed on 8 g/kg turmeric powder. Shirzadegan and Falahpour (17) observed that superoxide dismutase activity increased linearly as the composition of the herbal extract in the feed was increased. The activity of the GPx reduced in the broilers on control feed under heat stress conditions but these negative effects were removed when the birds were provided with the antioxidants supplemented feed (5).

Table 2. Antioxidant enzymes (U/mg of protein) in blood serum of broilers fed citrus processing waste in feed

Feed	Superoxide dismutase	Catalase	Glutathione peroxidase
CW0	1.55±0.27	30.22±0.72	2.61±0.13
CW5	1.67±0.31	36.05±0.68	2.78±0.27
CW10	1.80±0.23	45.88±0.52	2.88±0.19

The DDPH radical scavenging activity of the broiler meat increased as the citrus waste percentage increased in the feed and reduces as the storage of the meat proceeds (Table 3).

Table 3. DPPH radical scavenging activity (%) of the broiler meat fed citrus processing waste in feed

Feed	Frozen storage (days)		
	0	15	30
CW0	76.22±0.55	75.88±0.66	73.28±0.51
CW5	79.11±0.59	77.25±0.59	76.21±0.56
CW10	82.88±0.61	80.55±0.69	79.22±0.57

The DDPH radical scavenging activity of the broiler meat fed on the dietary medicinal herbal extract showed 1.79 times higher when compared to the control feed treatment (18). Lee *et al.* (19) observed that DDPH activity of the broiler meat fed gallic and linoleic acid increased as compared to control. However, reduction in activity was observed from 0 to 7 days during refrigerated storage. Moon and Jung (20) revealed higher antioxidant activity in meat of birds fed citrus byproducts- added feed than control. Pakistan is major producer of Kinnow mandarin and its waste has higher DPPH radical scavenging and antioxidant activity than any other fruits residue (21).

The peroxide value of the meat was higher in the broilers fed on the control feed than those supplemented by citrus in feed. Minimum value of the peroxide was observed in the T3 (Table 4). O'Keefe *et al.* (22) found that the peroxide value of the broiler meat increased as the percentage of the fish oil in the feed was increased. Meat which was more in the thigh meat as compared to the breast meat. Simitizis *et al.* (23) observed that hesperidin, a major component of citrus pulp positively affect the meat antioxidative properties and significantly reduced the production of malondialdehyde values.

Table 4. Peroxide value (mEq KOH/kg fat) of the broiler meat fed citrus processing waste in feed

Feed	Frozen storage (days)		
	0	15	30
CW0	0.32±0.002	0.36±0.003	0.41±0.003
CW5	0.30±0.001	0.34±0.002	0.37±0.003
CW10	0.26±0.002	0.29±0.002	0.32±0.002

Water holding capacity of the broiler meat fed citrus supplemented feed increased as the percentage of the citrus in the feed is increased and it also increased as the storage proceeds (Table 5). Dietary bulb and husk in the feed of the broiler increased the water holding capacity of the chicken meat and reduced shear force (24). When oxidized oil was added in the feed of the broiler it resulted lower water holding capacity in the meat and feeding vitamin E improved the water holding capacity (25). Moon and Jung (20) observed significantly higher cooking losses for meat on birds fed -control diet compared to meat of birds fed citrus byproducts added feed.

Table 5. Water holding capacity (%) of the broiler meat fed citrus processing waste in feed

Feed	Frozen storage (days)		
	0	15	30
CW0	39.88±0.22	40.25±0.32	40.75±0.88
CW5	40.55±0.65	41.00±0.55	41.22±0.77
CW10	41.22±2.95	41.88±0.81	42.05±0.99

IV. CONCLUSION

Citrus waste supplementation in broiler feed had positive effects on the antioxidant enzymes of the broiler and positively affected the antioxidant activity of the breast meat.

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