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Research Article

DIETARY INCORPORATION OF PHYTO FLAVONOID, FAT SOURCE AND ITS COMBINATION: EFFECT ON BODY PARTS, ORGAN INDICES AND IMMUNE RESPONSE IN BROILERS

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Abstract: The present experiment was conducted to assess the effect of dietary incorporation of phyto-flavonoid, fat source and its combination on body parts, organ indices and immune response in broilers. Cob 400 broilers birds were distributed amongst the treatments, control, flavonoid (quercetin), vegetable oil (as fat source) and its combination, as T_1, T_2, T_3 and T_4 groups, respectively. The corn soya based basal diet was formulated supplemented in all the groups. The treatment groups were supplied quercetin (@1g/kg), vegetable oil (>10% ME than the recommendation) and quercetin (@1g/kg) and vegetable oil (>10% ME than the recommendation) in combination for the duration of 35 days (7 days age onward). The birds were euthanized at end of experiment 42nd days of age. Results concluded that the flavonoid and vegetable oil incorporation not having adverse effect on absolute weight of body parts and organs, however its combination reduced the dressing percentage and small intestine weight. The hypersensitivity reaction in terms of cell mediated immune response (CMI) was not shown any effect at 12, 24, and 48 hrs, however, at 72 hrs was greater ($p<0.05$) in flavonoid without oil supplemented group. Thus, it is concluded that vegetable oil and flavonoid (quercetin) supplementation have no adverse impact on body parts and organ. Further, flavonoid supplementation had positive impact on cell mediated immune response in broilers.

Keywords: *Broilers, Dressing, Flavonoid, Hypersensitivity, Vegetable oil*

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Introduction

Nutrition is the clue factors in poultry industry. Broilers are rearing for shorter duration economic benefits through meat production. Concerning it, common practices of inclusions of fat sources in the broiler ration, for getting early growth. The fatty acids profile of various vegetable oils plays a crucial role for its impact in broilers as well as layer production. The types of polyunsaturated fatty acids (PUFA) or saturated fatty acids (SFA) of dietary oils can influence the immune functions of cells in birds [1]. Poultry is the most sensitive for the various stresses imparted from environment, metabolic as well as physical activities. Antioxidants are the agents that alleviate the lipid peroxidation led by various stresses, improving gut health as well as improve the organoleptic characteristics, nutritional value of eggs and meat and can extend shelf life, thus it has an essential compound for poultry nutrition [2].

Flavonoid is a strong antioxidant compound densely avails in the plant sources. Specifically, quercetin is the major flavonoid found all most all plant sources and has multiple biological actions, *viz*., antioxidant, growth enhancer, immune modulating, anti-inflammatory and gut health enhancer [3]. Previous in vitro trails and animal model studies reported anti-inflammatory actions by modulating the pro and anti-inflammatory molecules production by immune cells (macrophages and T cells) of innate and adaptive immune system responsive of inflammatory stimuli [4, 5]. Thus, the present study has shown the effect of dietary incorporation of flavonoid, fat source and its combination on body parts and organ indices in broiler chickens.

Materials and Methods

For the study, 192 days old Cob 400 broiler chickens were assigned in to four equal groups. Each groups comprised four replicates (12 birds/replicates).

The experimental treatments were started from 7th days onwards up to 42nd days of age, with supplemented flavonoid, quercetin (@1 g /kg of feed) in T_2 group, vegetable oil (higher than 10% of BIS recommendation), as a fat source in T_3 group and its combination (quercetin@ 1g/kg of feed + vegetable oil higher than 10% of BIS recommendation) in T_4 group. The control as T_1 group was fed basal diet without any supplementation. The basal diet was formulated with standard recommendation [6] and supplied to all treatment groups. The treatment feed was analyzed for its chemical composition following the standard methods of feed analysis [7].

Eight birds from each group (2 birds/replicate) were selected randomly and euthanized as per standard protocols at the end of experiment. Birds were fasted for approximately 12 hrs (overnight) with availability of drinking water before euthanized. The live weight of the birds was recorded prior to slaughter. The birds were euthanized by cervical dislocation and bled completely. Abdomen was opened for evisceration and carefully different organs were excised and separated. The organs were collected and weighted individually by using electronic balance to arrive at their weight. Eviscerated carcass along with giblet was weighted for calculating dressing percentage. The phytohaemagglutinin (PHA-P) skin test was performed on skin inoculation of PHA-P in toe web of broiler chicken. PHA-P test produce a hypersensitivity reaction indicated a cell mediate immune response (CMI) [8] and the skin thickness was measured at 12, 24, 48 and 72 hrs at 40th day of age.

Result and Discussion

The mean live body weight (kg) before slaughter of birds from different treatments were 2.28±0.15, 2.35±0.12, 2.50±0.07, 2.29±0.10 for T_1, T_2, T_3 and T_4 groups, respectively ($p>0.05$) [Fig-1].

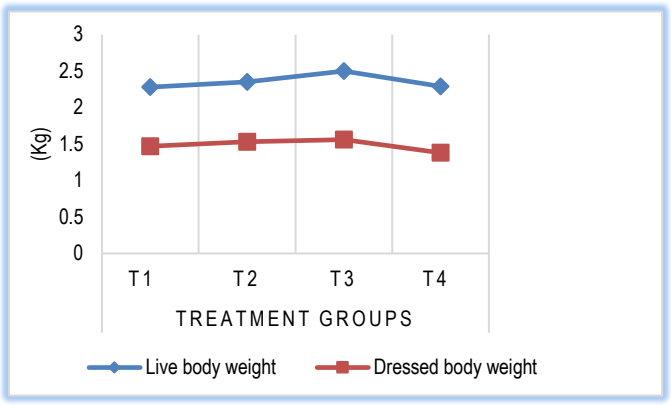

Fig-1 The effect of phyto-flavonoid and vegetable oil inclusion in the diet on live body weight and dressed body weight of broilers

The findings of dressed body weight were found comparable among dietary treatments. However, the dressing percentage was varied with dietary treatments ($p<0.05$) [Fig-1]. In accordance with these, [9] also revealed ($p<0.05$) higher dressing percentages in broilers supplemented with Moringa oleifera leaf meal (MOLM) as flavonoid source at the dose rate of 0.5, 1.0 and 1.5 % in the treatment groups of T_2, T_3 and T_4, respectively. Dietary supplementation of 20 g Grape seed powder (GS) as flavonoid source found significantly increased ($p<0.05$) dressing % in the broilers reported by Abu Hafsa and Ibrahim, (2018) [10]. Dietary fat supplementation has significance influenced on carcass weight in broilers [11].

The weight (g) of different body parts including head, legs and organs weight were found comparable except small intestine weight ($p<0.05$) [Fig-2] and [Fig-3]. The absolute weight (g) of small intestines revealed significant difference among treatment groups [Fig-3]. There values (g) were T_1 (41.48±2.75), T_2 (47.06±2.12), T_3 (47.82±1.85) and T_4 (29.15±6.90), respectively. While, the absolute weight (g) of large intestines amongst different treatment groups were, T_1 (32.55±8.97), T_2 (34.42±8.46), T_3 (35.58±9.99) and T_4 (33.63±9.10). It was found comparable in all treatment groups. The mean absolute weight (g) of heart for T_1, T_2, T_3 and T_4 were 13.79±0.95, 13.21±0.91, 15.22±0.53 and 14.15±1.31, respectively, with having non-significance differences ($p>0.05$) [Fig-3]. Dietary high energy with or without flavonoid did not exert any impact on cardiac muscles. Though, contrast results were noted by Soomro, *et al*., (2016) [12] whom stated absolute heart weight was significantly ($p<0.05$) higher for chickens supplied with quercetin in comparison with the controls. They suggested that increased heart weight have due to the analogues effect of quercetin on cardiovascular function.

The hypersensitivity reaction indicated in terms of cell mediated immune response of broiler chicken and is presented in [Table-1]. The cell mediated immune response was improved with flavonoid (quercetin) supplementation in T_2 group; however, it was not differed significantly. Similar pattern was observed for the flavonoid + oil supplemented group (T_4). However, on oil supplementation 10% more than the recommendation of [6] there were slight decreases in CMI at 12, 24 and 48 hrs. At 72 hrs flavonoid supplementation revealed highest ($p<0.05$) CMI amongst all treatments. Whereas, birds in high vegetable oil supplementation lower CMI was recorded over the other groups.

On flavonoid supplementation along with higher oil supplementation showing trend for improvement ($P>0.05$) in CMI over the higher oil without flavonoid supplemented group. Cutaneous basophil hypersensitivity reaction stimulated through injecting intradermal Phytohemagglutinin-P (PHA-P) in broiler chickens is a thymus dependent response facilitated by thymic cells [13]. Rafiei-Tari, *et al*., (2020) [1] found no difference on hypersensitivity reaction of CMI in broiler birds fed flaxseed oil and corn oil which is in line with present findings, however, greater ($p<0.05$) hypersensitivity reaction was observed when bird supplemented palm oil and lowest ($p<0.05$) hypersensitivity reactions was observed on inclusion of olive oil in the diet of broiler chickens which is contrary to present outcome. Similar to present study, soybean oil supplementation in the diet of broiler birds shown lower cellular response to PHA-P, which was elevated when, supplied soybean oil in combination with vitamin E as antioxidant and shown higher cellular immune response [14].

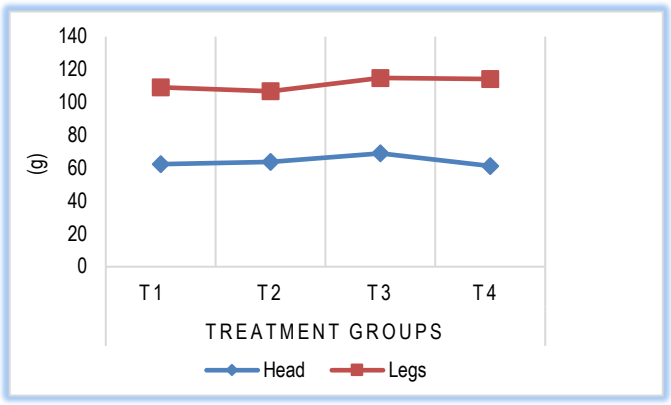

Fig-2 The effect of phyto-flavonoid and vegetable oil inclusion in the diet on body part weight of broilers

The quercetin exhibited linear increased in immune response in broilers recorded by Zhang and Kim (2020) [15]. The increased in immune response in present study in on flavonoid supplementation (T_2 group) might be due to the strong antioxidant activity of quercetin which might be play a role in protecting the immune cells against the oxidative stress and lipid peroxidation. In contrast to present study PHA stimulation was unaffected with dietary quercetin (@0.5 and 1.0 g/kg feed) supplementation in broiler birds [5].

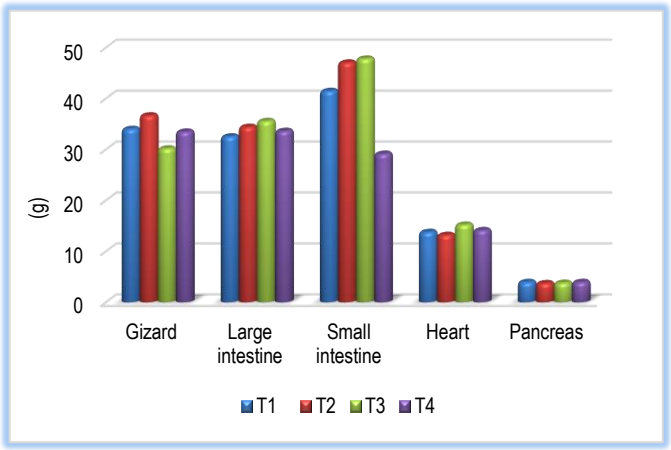

Fig- 3 The effect of phyto-flavonoid and vegetable oil inclusion in the diet on splanchnic and cardiac organ weight of broilers

Table-1 *The effect of phyto-flavonoid and vegetable oil inclusion in the diet on hypersensitivity reaction (mm) (Cell mediate immune response) in broilers*

Particular	Dietary groups			
	T_1	T_2	T_3	T_4
12 hrs	0.54±0.07	0.58±0.04	0.51±0.08	0.57±0.06
24 hrs	0.92±0.09	0.95±0.04	0.85±0.07	0.91±0.04
48 hrs	0.43±0.04	0.48±0.073	0.40±0.05	0.45±0.07
72 hrs	0.28^{b}±0.04	0.36^{a}±0.05	0.19^{ab}±0.03	0.29^{ab}±0.06

Conclusion

Based on the study, it is concluded that dietary flavonoid as a quercetin and vegetable oil as fat source shown better dressing percentage and organ weight, without any adverse effect. Though, its combination reduced the dressing percentage and weight of small intestine of broiler birds. Further, its flavonoid (quercetin) supplementation increased the cell mediated immune response which directed that flavonoid supplementation can boosted the immune capacity of broilers.

Application of research: Phyto-flavonoids can beneficially be impacted in poultry birds.

Research Category: Animal Sciences, Phytoadditive

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Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Navsari Agricultural University, Navsari

Breed name: COB-400 *(Gallus gallus domesticus- Boriler* chicken)

Conflict of Interest: None declared

Ethical approval: Ethical approval taken from C.V.Sc, Navsari Agricultural University, Navsari, Gujarat, India
Ethical Committee Approval Number: IAEC/065-VCN-ANN-2018 (Reg.no. 1631/GO/Re-SL/Bi-S/12/CPCSEA)

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