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The study of immune response and carcass characteristics in broilers fed with oregano essential oil with multi-enzyme in protein reduced diet

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Abstract
The experiment was conducted to evaluate the effect of oregano essential oil with multi-enzyme in protein reduced diet on carcass traits and immune response in broilers. Randomly the four hundred and eighty day old chicks were equally distributed into eight treatment groups having three replicates of 20 chicks each. The control group (A) received with basal diet as per BIS (2007). Group B received diet with 2% reduction in CP. Groups C and D received basal diet supplemented with oregano essential oil and with multi-enzyme @ 400g/tone, respectively. Group E received basal diet supplemented with oregano essential oil and multi-enzyme. Group F and G received diet with 2% reduction in CP supplemented with oregano essential oil and with multi-enzyme respectively. Group H received diet with 2% reduction in CP supplemented with oregano essential oil and multi-enzyme. The carcass characteristics such as dressing yield, eviscerated yield, giblet yield did not differ significantly among the various treatment groups but immune response was better in group supplemented with oregano essential oil as compared to other groups. It was concluded that oregano essential oil with multi-enzyme supplementation in basal or reduced protein diet has non-significant effect on various carcass characteristics but significantly improves immune response in broiler chicken.

Keywords: Oregano essential oil, Immune response, Carcass traits, Broilers

Introduction
Various pathogenic micro-organisms have developed the resistance against antibiotic used in the poultry sector. Moreover since, last few decades antibiotics growth promoter (AGPs) used for improving growth performance in poultry which may lead to the microbial resistance to antibiotics and its antibiotic residual effect in broiler meat. Essential oils have antimicrobial, antiparasitic, antioxidant, anti-inflammatory, immunomodulatory and antifungal properties [1]. Oregano essential oil can be measured as replacer for AGPs in broiler diet which acts as growth promoters, natural antibiotics, and improvers of broiler meat quality [2]. Some of the chief content of oregano essential oil are carvacrol and thymol [3]. Studies has been done to evaluate the performance and meat quality of broilers given diets supplemented with natural extracts such as Greek (OEO) Silva Vázquez *et al.* [4] and Mexican (MOO) oregano essential oils Méndez-Zamora *et al.* [5] reported their effects on feed intake, growth promotion, blood profile, and meat quality. The use of Mexican oregano essential oils is phytogenic alternative to traditional antibiotics in broiler production. The current study was carried out to evaluate the effects of oregano essential oil with multienzyme in protein reduced diet on carcass characteristics and immune response in broiler chicken.

Materials and Methods
Four hundred eighty day old commercial straight run broiler chicks were placed into 8 treatment groups such as A, B, C, D, E, F, G and H. Each treatment group had 3 replicates of 20 birds each. The dietary treatment groups were A Control - Basal Diet as per BIS (2007), B - Diet with 2% reduction in CP, C - Basal Diet as per BIS (2007) + oregano essential oil @ 200 mg/kg, D - Basal Diet as per BIS (2007) + Multi-enzyme, E - Basal Diet as per BIS (2007) +oregano essential oil @ 200 mg/kg + Multi-enzyme, F - Diet with 2% reduction in CP + oregano essential oil @ 200 mg/kg, G - Diet with 2% reduction in CP + Multi-enzyme and H - Diet with 2% reduction in CP+ oregano essential oil @ 200 mg/kg + Multi-enzyme. Broiler chicks were reared on deep litter system up to 6 weeks. Ad-lib feed was provided as per the treatment. Broiler fed on pre-starter up to 7 days, followed by starter (2 -3 weeks) and finisher

(4-6 weeks). Uniform managemental practices were provided throughout the experimental period for all the treatments groups. Birds from each group were weighed individually on day 0 and at weekly intervals. Total 6 birds from each treatment (2 birds/ replicate) were randomly used for blood collection at 21st day and 42ndday of age to note the antibody titer against the New Castle Disease (ND). On 42 day, 2 birds from each replicate were randomly selected as per the body weight close to the mean. The birds were starved 12 hrs before slaughter, while ad lib access for drinking water was made available. The bird was slaughtered by severing the jugular vein and allowed to bleed for 1 to 2 minutes. Defeathering was done by keeping bird in hot water for 3-4 minutes and feathers were removed manually. Different carcass traits such as dressing %, edible meat yield and giblet yield were recorded and expressed in percentage. The data obtained on various parameters studied during this experimental trial were subjected to statistical analysis as described by Snedecor and Cochran [6].

Results and Discussion

Carcass characteristics

The data of effect of dietary supplementation of oregano essential oil and multi- enzyme alone or in combination in basal or protein reduced diet on carcass characteristic such as dressing yield, eviscerated yield, giblet yield and cut-up part yield like; breast, thigh, drum stick, back, neck and wing are given in % body weight of broilers have been presented in Table 1. Not only the dressing yield, eviscerated yield, giblet yield expressed as percent live body weight in broiler but also breast, thigh, drum stick, back, neck and wing weight expressed as percent live body weight did not differ significantly among the various dietary treatment groups.

Non-significant differences in carcass traits were observed among the dietary treatments in the present experiment. Likewise, some other researchers also found non-significant effect on carcass traits due to supplementation of essential oils in broilers diet [7]. Also supplementation of essential oil has non-significant effect on carcass characteristics in broiler chicken [8]. Our results are in accordance with Alp *et al.* [9] and Kirkpinar *et al.* [10] who reported slaughter weight and carcass yield was not affected by dietary supplementation of oregano essential oil (300 mg /kg feed) in broilers. Also, Mustafa and Mukhtar [11] also reported non-significant difference in dressing %, giblet, commercial cuts up in broilers given mixture anise, clove and caraway herbal essential oils. Though, Cazares-Gallegos *et al.* [12] reported that Mexican oregano essential oil supplementation at 1000 mg/ kg increased slaughter weight, hot carcass yield, and reduced breast meat pH.

Table 1: Average percent carcass yield in broilers fed oregano essential oil with multi-enzyme in protein reduced diet at 6th week of age

Treatments	Dressing %	Eviscerated %	Giblet %	Cuts Up Parts %					
				Breast	Thigh	Drum stick	Back	Neck	Wing
A-Basal diet	72.39 ±1.61	67.92 ±1.48	3.80 ±0.07	26.05 ±0.62	10.50 ±0.29	7.96 ±0.67	11.20 ±0.61	3.40 ±0.07	8.82 ±0.87
B-2% Reduced CP diet	70.19 ±0.34	65.58 ±0.45	3.99 ±0.09	26.89 ±0.63	10.72 ±0.58	8.02 ±0.55	10.12 ±0.49	3.13 ±0.28	6.70 ±0.56
C-Basal diet + OEO @ 200 mg/kg	72.40 ±1.36	68.35 ±1.45	3.83 ±0.07	25.86 ±0.48	11.34 ±0.17	9.43 ±0.54	10.16 ±0.80	3.41 ±0.09	8.14 ±0.97
D-Basal diet + Multi enzyme @ 400 g/T	72.23 ±1.05	68.10 ±1.09	3.98 ±0.04	26.16 ±0.79	10.51 ±0.19	8.42 ±0.15	10.62 ±0.07	3.47 ±0.09	8.93 ±0.12
E-Basal diet Basal diet + OEO + Multienzyme	71.73 ±1.78	67.81 ±1.69	3.86 ±0.06	25.73 ±0.16	10.76 ±0.28	9.10 ±0.49	10.71 ±0.32	3.33 ±0.20	8.18 ±0.90
F-2% Reduced CP diet + OEO @ 200 mg/kg	70.46 ±0.96	66.35 ±1.04	3.86 ±0.20	25.20 ±0.18	10.61 ±0.11	7.36 ±1.15	10.08 ±0.21	3.44 ±0.20	9.66 ±0.23
G- 2% Reduced CP diet + Multienzyme @ 400g/T	71.95 ±1.20	67.80 ±1.13	3.86 ±0.07	26.32 ±1.02	11.22 ±0.28	8.63 ±0.48	9.91 ±0.32	3.62 ±0.10	8.11 ±0.61
H-2% Reduced CP diet + OEO + Multienzyme	70.18 ±1.42	66.08 ±1.39	3.82 ±0.21	26.49 ±0.88	10.24 ±0.62	8.99 ±0.51	10.48 ±0.34	2.85 ±0.15	7.02 ±0.86
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	3.11	3.26	5.38	4.39	5.82	12.73	7.51	8.44	14.96

NS-Non-significant.

Cabuk *et al.* [13] shown carcass yield and dressing percentage were not affected by the addition of the essential oil mixture to the diet. Jamroz *et al.* [14] reported that dressing percentage was on an average 70.60% and no significant improvement was observed in the treatments. Furthermore, Khafaji [15] reported that carcass traits such as eviscerated weight and giblet yield of live body weight were not affected by supplementation of cinnamon oil @ 250 mg/kg in broilers. Also it was reported that, 1.5% of peppermint oil in diet had non-significant effect on carcass traits [16]. There are varied reports in literatures as essential oils comprises diverse group of components with different structures and chemical properties. Edward *et al.* [17] reported that dietary supplementation of oregano essential oil @ 200 ppm in broiler has increased breast yield %.

Alam *et al.* [18] reported that exogenous enzyme supplementation increases dressing yield in broiler chicken. Mahmood *et al.* [19] noted that carcass characteristics like, carcass yield, breast meat yield, liver and heart weight was unaffected by dietary supplementation of exogenous enzyme in broilers. Abdelrahim *et al.* [20] revealed that inclusion of multi-enzyme did not affect the carcass traits in broilers. In the current experiment oregano essential oil with or without multi-enzyme in basal or protein reduced diet could not exert any significant effect on the carcass traits.

Immune response

The immune response was mediated by employing HI test to detect the antibody titer against New Castle Disease (ND) at 21st and 42nd day of age given in Table 2. Antibody titers

against New Castle Disease vaccine on 21st day was non-significant among all the groups but numerically higher in groups supplemented with oregano essential oil as compared to control.

Table 2: Average of antibody titers against ND (log2 values) at 21st and 42nd day of age in broilers fed oregano essential oil with multi-enzyme in protein reduced diet

Treatment	21st day	42nd day
	ND titers	ND titers
A-Basal diet	4.17±0.48	3.00^{b}±0.37
B-2% Reduced CP diet	3.83±0.65	2.83^{b}±0.31
C-Basal diet + OEO @ 200 mg/kg	4.33±0.56	4.83^{a}±0.30
D-Basal diet + Multi enzyme @ 400 g/T	4.00±0.93	4.83^{a}±0.60
E-Basal diet Basal diet + OEO + Multienzyme	5.33±0.61	5.50^{a}±0.43
F-2% Reduced CP diet + OEO @ 200 mg/kg	4.17±0.80	4.67^{a}±0.88
G-2% Reduced CP diet + Multienzyme @ 400 g/T	4.33±0.80	4.17^{ab}±0.48
H-2% Reduced CP diet + OEO + Multienzyme	4.67±0.66	4.83^{a}±0.65
CD	NS	1.532*
CV%	39.418	31.835

Means bearing different superscripts differ significantly within a column. *P< 0.05, NS-Non-significant.

Saleh *et al.* [21] observed that dietary supplementation of thyme and ginger oil @ 100 and 200 mg/kg feed respectively improved antibody production in chicken. Alp *et al.* [22] reported non-significant effect of oregano essential oil on the serum IgG level. Hong *et al.* [23] observed that supplementation of oregano essential oil in broiler diet has non-significant effect on NDV titers.

At 42nd day of age antibody titer against NDV vaccine was significantly higher in group E supplemented with oregano essential oil with multienzyme as compared to other treatment groups. Broiler chicken dietary supplemented with thymol, carvacrol, cinnamaldehyde, capsicum and oleoresin has significantly enhanced immune response [24]. The birds in all treatment groups supplemented with oregano essential oil and multienzyme alone or in combination in basal or protein reduced diet recorded significantly (P< 0.05) higher ND titers compared to other treatments. Between these group E has recorded highest ND titer value. Placha *et al.* [25] reported that addition of thyme oil in broiler chicken positively improves immune response.

Arab-Ameri *et al.* [26] reported that supplementation of peppermint oil enhances immune response in broilers. Witkowska *et al*. [27] found that thyme and peppermint may improve the immune response of birds and increase the level of gamma-globulin concentration. The significant differences in antibody titers was evident in groups fed oregano essential oil and multi- enzyme alone or in combination in basal or protein reduced diet in this experiment is also observed in the available literature. Thus, dietary supplementation of oregano essential oil and multi-enzyme alone or in combination found beneficial to improve immune response in broilers.

Conclusions

Thus, It was concluded that the feed supplemented with oregano essential oil with multienzyme in basal or reduced protein diet have non-significant effect on different carcass characteristics but significantly improve immune response in broilers.

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