International Journal of Agriculture Innovations and Research
Volume 4, Issue 3, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 01/11/2015 | Accepted on : 08/12/2015 | Published : 16/12/2015

Impact of Feeding Dried Rumen Content and Olive Pulp With or Without Enzymes on Growth Performance, Carcass Characteristics and Some Blood Parameters of Molar Ducks

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Abstract – **Different unconventional feed stuffs are used recently in poultry production to decrease ration cost and competition between human and animals on maize. This study was established to assess the effect of feed partially replaced by olive pulp and dried rumen content supplemented with or without enzyme complex on growth performance responses, carcass traits and some blood and serum parameters in Molar ducks. A total of 240 (Molar) 4 weeks old ducks were divided into eight groups of 30 birds each. The treatments were: a control group received no supplement, basal diet with 0.3 % Zado (T1), 12% DRC diet (T2), 12% DRC diet with 0.3% Zado (T3), 12% OP diet (T4), 12% OP diet with 0.3% Zado (T5), 6% DRC + 6% OP diet (T6), and 6% DRC + 6% OP diet with Zado (T7). Higher significant values of final BWG were observed in birds on T7. Dietary inclusions of DRC 6% and OP 6% supplemented with or without enzymes improved the cumulative FCR of birds compared with control. birds fed on12% DRC with or without enzyme recorded the lowest feed intake(FI) among groups. The dressing percentage and edible giblets were not influenced by dietary treatments, while higher significant values of relative weight of the gizzard were recorded in (T3-T7) compared to control. Higher significant PCV value was recorded in control group compared to all other diets. No significant effects were determined due to dietary treatments on hemoglobin(HB) content serum total protein, albumin, globulin and glutamate oxaloacetate transaminase (GOT). However all dietary treatments revealed insignificant decrease in glutamate pyruvate transaminase (GPT) compared to control group. It is concluded that dietary inclusion DRC and OP in duck diets up to 12% with enzyme supplementation or in a mixture of both of them up to 6% after 4 weeks of age, not only has no deleterious effect on birds health status but also improve growth performance and carcass characteristics.**

Keywords – **Rumen Content, Olive Pulp, Duck, Growth Performance, Carcass, Blood.**

I. Introduction

A major problem facing the development of animal production is the availability and high cost of feedstuffs. Feed accounts for 55 – 70% of the cost of poultry production [1]. High cost of feedstuffs has contributed to the poor performance or productivity on many poultry farms and this has led to a shortage in the availability of protein to the citizenry. There is also competition between man and poultry for conventional feedstuffs like maize. shortage and volatility in price of feed ingredients motivated to search for alternative feed source to solve this problem. Farhat et al.[2] demonstrate that industrial food wastes represent a valuable resource capable of replacing conventional feedstuffs, such as corn and soybean, in duck diets.

Here feed ingredients of interest are dried rumen contents and olive seed cake.

Rumen content is substantial wastes generated daily at abattoirs [3]. It is a material from the rumen of cattle which is the first stomach compartment of the ruminants. It is account for about 80% of the capacity of the adult ruminant stomach [4].It is plant material at various stage of digestion rich in protein and other micro-flora such as fungi, protozoa and bacteria [5]-[6]. It's important source of energy and vitamins especially vit.(B) complex. Its utilization as animal feed will also alleviate and max the economic environmentally benign disposal of slaughter house byproducts [7]-[5].

Olive pulp is the remainder of olive cake (the raw material resulting from extraction of olive oil) after the removal of the seed fractions. It can be achieved by sieving the dry olive cake to separate most of the seeds. About 0.3 of cell wall fraction will be removed by sieving [8]. Indeed, the olive mill waste could be of particular interest in poultry for at least two reasons. On the one hand, for its level of residual oil (6.8%), this can constitute a complementary energy source. Secondly, for its particular composition of unsaturated fatty acids (62.4%of oleic acid, 18.2% of linoleic acid, 1.1% of linolenic acidand 2.7% of palmitoleic acid) which could influence the accumulation of fatty acid in the various body compartments during the animal's life and as such could have a certain impact on the quality of meat [9].Several research studies were conducted to investigate the feasibility of utilizing OP in poultry rations. Abo Omer [10] and Rabayaaet al.[11] reported that level of OP had no significant effects on visceral organ mass, gastrointestinal tract weight, carcass cuts, carcass composition and dressing percent.

A xyloglucan, one of the non-starch polysaccharides (NSP) which present in olive pulb has anti-nutritive effects on monogastrics such as poultry and pigs.Coimbra et al. [12] indicating that enzyme complex of cellulose, hemicellulase, amylase and protease supplementation may increase nutrient availability and improve the performance of poultry; partially replacing conventional energy-providing feed such as corn in poultry diets with low-cost olive pulb can be economically attractive. Enzyme supplementation might improve broiler performance by at least two mechanisms: increasing feed intake and improving nutrient digestibility [13]. Consequently, the objective of the present study was to determine the performance responses, carcass traits and some blood and serum parameters in Molar ducks to an enzyme complex consisting of cellulose, hemicellulase, amylase and protease in diets where the corn was partially replaced by olive pulp and dried rumen content.

II. Materials and Methods

Experimental ingredients

Fresh rumen content was collected from local cattle abattoir in Menoufia governerate The material was first conveyed over a screen to separate liquids and solids. Solids were then spread (distributed in a 3 cm thickness layer) over a concrete surface and allowed to sun air-dry to reduce the moisture content to less than 10% (90% DM) [14]. The sun dried material was milled using hammer mill to produce finely ground dried rumen content (DRC). Olive pulp (OP) as obtained in dried form from Misr Alarabia Poultry Group Companies. ZADO® (patent on: 22155) is a biotechnical product made from natural sources to elevate level of cellulase enzyme from anaerobic bacteria which convert the polysaccharide into monosaccharide by specific enzymes (cellulase, 8.2 u/gm; hemi-cellulase, 6.2 u/gm; amylase, 64.4 u/g and protease, 12.3 u/gm) according to Gadoo [15] at the biological laboratory of Animal production Department, Faculty of Agriculture, Ain-Shams University.

Samples of DRC and OP together with samples of experimental diets were subjected to proximate analysis using standard methods [16]. The chemical composition of DRC and OP is shown in table (1).

Birds, experimental design and husbandry

This study was carried out in strict accordance with the recommendations in the Guide for the Care and Use of Laboratory Animals of the National Institutes of Health. The protocol was approved by the Committee on the Ethics of Animal Experiments of Sadat City University, Egypt. A total of 240 four weeks old Molar ducks of mixed sex were weighed (1414± 7.2) and randomly assigned to 8 treatments, each treatment comprised 3 replicates with 10 birds each. Ducks were reared under similar environmental and managerial conditions during period from 4-9 weeks of age. Eight experimental diets were formulated according to nutrient specifications of the standards published by National Research Council [17] with 3 levels of DRC and OP (0, 6, 12 %) with or without enzymes. The 8 treatment diets were were 1) basal diet (CON), 2) basal diet with 0.3 % Zado (T1), 3) 12% DRC diet (T2), 4) 12% DRC diet with 0.3% Zado (T3), 5) 12% OP diet (T4), 6) 12% OP diet with 0.3% Zado (T5), 7) 6% DRC + 6% OP diet (T6), and 8) 6% DRC + 6% OP diet with Zado (T7). All birds were reared in the floor pens using wood shavings as litter. Temperature was adjusted at 32 ºC ± 2 in the first wk then lowered 2 ºC each successive week, and then maintained at 28 ºC ± 2. Relative humidity was about 60 to 80%. The chicks were vaccinated against Newcastle disease (ND). Access to feed (pellet form) and water was provided on an *ad libitum* basis. Ingredients and proximate composition of experimental diets are shown in table (2).

Performance Measurements

Body weight (BW) and feed intake were monitored on a pen basis weekly, while weight gain (BWG) and feed conversion ratio (FCR) values were consequently calculated. Mortality was also recorded on a daily basis in each pen (two birds died in CON, T2 and T4). There was no effect of treatment on the mortality rate.

Carcass traits

At the end of the trial six birds per treatment group (2/replicate) were randomly selected and slaughtered by severing the carotid artery and jugular veins. They were defeathered, eviscerated and dressed to determine some carcass traits including dressed carcass, liver gizzard and heart.

Blood sampling and analysis

At beginning and end of the experiment 6 birds from each treatment (2/replicate) were randomly selected for blood analysis. Blood samples were obtained from wing vein and directly aliquoted into 2-mL sterile vialsand allowed to clot for 4 h. then centrifugation (20 min, 1500 rpm), the serum was aliquoted into 1-mL vials and stored at −20 °C for serum antibody measurements using haemagglutination inhibition test as described in Abou-Elkhair et al. [18] The serum samples were used for total serum protein, albumin, globulin concentrations, glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT) using commercially available kits (Biosystem S.A, Costa Brava, 30, Barcelona, Spain) according to manufacturer’s instructions. Another blood samples were aliquoted into 2 mL sterile vials containing anti-coagulant for measuring hemoglobin content (Hb) and packed cell volume (PCV).) Hb was measured by spectrophotometer Hb kit. Packed cell volume was determined according to the procedure of Feldman et al. [19] .

Statistical analysis

Data obtained in this study were statistically analyzed for variance (ANOVA) with confidence limits set as 95 % (significance at p<0.05 probability level) described by Duncan . The results were reported as mean ± standered error, multiple range tests should be performed to compare among different groups or different weeks of experiment. Statistical analysis was performed using SPSS student version 16.00, June 2000.

III. Results and Discussion

The effect of dietary treatments on growth performance of Molar ducks are shown in table (3). Data revealed significant difference in growth performance throughout the experiment due to dietary treatments.The results showed significant increase in body weight , body weight gain and improvement in FCR in the group fed mixed diet of OP and DRC with 6% supplemented with enzyme(T7) compared to control , this mean that the low level of both diets(6%) is better than high level of each individually(12%), however BWG was superior for birds fed 12% OP with or without enzymes comparing with CON and other groups. this can be explained by lower feed intake in the groups fed on high level of rumen content which reflected on body weight gain , the reduced intake of birds on 12%DRC could be attributed to depressed appetite resulting from un pleasant smell of the diet. Donkoh et al. [20], Dongmo et al. [21] and Odunsi [22] had earlier reported that the inclusion of rumen content impart obnoxious odour to the final diet and make it less palatable to birds causing a depression in consumption. However the improved weight gain and feed efficiency in low level of DRC and olive pulp could be attributed to higher protein component (microbial protein), long change fatty acids and partially digested feed protein [23]. This result is in agreement with the reports of Onu et al. [24] and Elfaki et al. [25] ,who reported significant effects of rumen content on poultry but did not conform with the reports of Dairo et al.[6] in rabbits . The improved performance could also probably be due to adequate dietary crude fiber level. Crude fiber activates the intestine and more occurrence of peristaltic movement, more enzyme production resulting in efficient digestion of nutrients [26]-[27]. Birds fed the dried rumen content and olive pulp supplemented with enzymes revealed high body weight gain because the enzymes reduced digesta viscosity, enhanced digestion and absorption of nutrients especially fat and protein, improve apparent metabolizable Energy value of the diets, increased feed intake and reduced beak impaction and vent plugging decreased size of gastrointestinal tract [28]-[29]-[30]. On other hand using OP in high percentage 12% with or without enzyme resulted in improvement in BWG and FCR comparing to CON . Taklimi, et al. [31] reported that OP at 15%. and 20% increased crude fiber concentration and resulted in higher FI, either to meet energy requirements or because OP was more palatable. This result is in consistence of those reported by other workers when broilers were fed high fiber diets, such as tomato dried pulp, date pits, dried citrus pulp and olive pulp [32]-[11]-[33]. Moreover Fadi et al. [34] recorded that Feed intake and feed /gain were observed to be significantly higher in the Muscovey ducks fed 35% palm kernel cake compared to the control.

Some carcass characteristics of molar ducks fed dietary treatments are shown in table (4). Dressed weight was increased insignificantly in groups of birds fed on DRC 12% with enzyme and OP 12% without enzyme. However increment in dressed weight in T5, T6, T7 was significant .The highest value recorded in birds fed mixed diet of DRC 6% and OP 6% supplemented with enzymes (T7) is in agreement with Inci et al. [35] who reported significant effect for DRC on carcass weight of quail. But Abo-Omar [10] observed no significant effect in carcass weight due to OP inclusion in broiler diet . Onu et al. [24] and Abo-Omar [10] didn't find any impact for DRC and OP inclusion in diet on dressing percentage, liver and heart relative weight respectively which is in consistence with our results. Increasing gizzard weight in all diets containing high fiber content represent greater work of digestion and metabolism by this organ. Considering the high fiber content of the feed ,the gizzard as the grinding machine in the birds digestive system had to build up more muscles to be apt to perform its function since generally it is not adapted to high fiber diets. Svihus [36] and Elfaki et al. [25] also found that there was a rapid and conspicuous enlargement in size of gizzard when structural components such as hulls, wood shaving, large cereal particles or dried rumen content were included in the diet.

Table (5) represent the effect of experimental diets on some blood and serum parameters of ducks. Absence of the significant effect for the treatment diets on hemoglobin and decreasing PCV , though within normal range, show the preparedness of the birds for defenses against diseases and transportation of the nutrients. In fact Frderick [37] showed that higher levels of hematological characteristics of livestock suggest their physiological disposition to the plane of nutrition. This corroborates with the findings of Alikwe et al.[38] who concluded that the haematological variables of their study suggest that the test diets didn't participate much sever effect on the health status of the experimental chicks. No significant differences were determined on serum total protein, albumin, globulin and GOT. However all dietary treatments revealed insignificant decrease in GOT compared to control group. this results indicating no adverse effect of DRC and OP on serum parameters and normal function of liver as reported by Emenalon et al.[39]and Attia et al.[40] that an excess of this parameters in the blood may cause over functioning or damage of the liver and muscles. Although insignificant decrease in GPT in all groups compared to control but it is within normal range. This results are in agreement with that of Collette et al.[41].

IV. Conclusion

In conclusion, based on the results of the present study, DRC and OP can be included in duck diets up to 12% with enzyme supplementation or in a mixture of both of them up to 6% after 4 weeks of age, which not only has no deleterious effect on birds health status but also improve growth performance and carcass characteristics. In addition, the new ideas like recycling some wastes as olive pulp or rumen contents are very helpful for environment and for production of unconventional rations.

International Journal of Agriculture Innovations and Research
Volume 4, Issue 3, ISSN (Online) 2319-1473

Table 1: Chemical composition of Sun Dried Rumen Contents (DRC) and olive pulp(OP)

Ingredient	DM%	EE%	Ash%	CF%	CP%	NFE%	Ca%	P%	MEKcal/kg
DRC	91.3	7.81	9.25	28.28	18.53	35.97	0.70	0.69	2190
OP	87	12	7.50	24	10.2	23.3	0.6	0.1	2470

DM= dry matter, EE=ether extract, CF= crude fiber, CP= crude protein, NFE= nitrogen free extract, Ca= calcium, P= phosphorus. ME= metabolizeable energy, ME was calculated according to Lodhi *et al*. (1970).

Table 2: Ingredients and proximate composition of experimental diets

Ingredient (%)	**Treatments**							
	CON	T1	T2	T3	T4	T5	T6	T7
Yellow corn	57.73	57.76	45.73	45.76	45.73	45.76	45 .73	45.76
Wheat bran	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Soya bean meal (44%)	21.5	21.5	20	20	20	20	20	20
Corn gluten	4	4	4	4	5.5	5.5	4.5	4.5
Rumen content	-	-	12	12	-	-	6	6
Olive pulp	-	-	-	-	12	12	6	6
[1]Di calcium phosphate	1.9	1.8	1.9	1.8	1.9	1.8	1.9	1.8
Lime stone	1.65	1.5	1.65	1.5	1.65	1.5	1.65	1.5
Vegetable oil	3	3	4.5	4.5	3	3	4	4
[2]Lysine	0.55	0.50	0.55	0.50	0.55	0.50	0.55	0.50
[3]Methionine	0.47	0.45	0.47	0.45	0.47	0.45	0.47	0.45
Salt	0.35	0.34	0.35	0.34	0.35	0.34	0.35	0.34
[4]Premix	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Anti-oxidant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Enzyme (Zado)	-	0.3	-	0.3	-	0.3	-	0.3
Total	100	100	100	100	100	100	100	100
Calculated composition								
Crude protein	18.17	18.17	18.71	18.71	18.64	18.64	18.52	18.52
Ether extract	2.7	2.7	3.18	3.18	3.72	3.72	3.44	3.44
Crude fiber	3.75	3.75	6.7	6.7	6.2	6.2	6.5	6.5
Calcium	1.1	1.04	1.18	1.11	1.17	1.10	1.17	1.11
Phosphrus	0.48	0.46	0.54	0.52	0.47	0.46	0.51	0.49
Methionine	0.77	0.73	0.72	0.70	0.74	0.72	0.73	0.70
Lysine	1.2	1.2	1.15	1.12	1.16	1.13	1.15	1.12
ME(kcal/kg)	2936.7	2936.76	2896	2896.06	2853.4	2853.46	2887.4	2887.46

[1]Dicalcium phosphate, 18% granular phosphate and 23 % calcium. [2]L-Lysine HCL 99% (Feed Grade) L-Lysine: 78.0% Min (Indonesia). [3]DL-Methionine, Met AMINO® (DL-2-amino-4-(methyl-thio)-butane acid, DL-methionine, α-amino-Y-methyl-oily acid) by Feed Grade 99% (EU). [4]Each 3 kilograms contain: vitamin A 12000000 IU, vitamin D3 3000000 IU, vitamin E 40000 mg, vitamin K3 3000 mg, vitamin B1 2000 mg, vitamin B2 6000 mg, vitamin B6 5000 mg, vitamin B12 20 mg, niacin 45000 mg, biotin 75 mg, folic acid 2000 mg, pantothenic acid 12000 mg, manganese 100000 mg, zinc 600000 mg, iron 30000 mg, copper 10000 mg, iodine 1000 mg, selenium 200 mg and cobalt 100 mg.

(CON) basal diet, (T1) basal diet with 0.3 % Zado, (T2) 12% DRC diet, (T3) 12% DRC diet with 0.3% Zado, (T4)12% OP diet, (T5) 12% OP diet with 0.3% Zado, (T6) 6% DRC + 6% OP diet, and (T7) 6% DRC + 6% OP diet with Zado.

International Journal of Agriculture Innovations and Research
Volume 4, Issue 3, ISSN (Online) 2319-1473

Table 3: Body weight (BW), body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) values of Molar ducks in response to diet and age

Exp. Period (week)	Treatments							
	CON	T1	T2	T3	T4	T5	T6	T7
0 week	1416±35.12^{a}	1406±54.25^{a}	1412±62.61^{a}	1410±71.41^{a}	1400±52.11^{a}	1411±72.51^{a}	1408±53.91^{a}	1415±36.24^{a}
1week								
BW,g	1810±61.99^{a}	1803±72.95^{a}	1811±52.24^{a}	1792±91.10 ^{a}	1790±79.10^{a}	1786±74.47^{a}	1796±61.90^{a}	1797±73.40^{a}
BWG,g	394±11.2^{a}	397±21.4^{a}	399±15.8^{a}	382±17.4^{a}	390±19.5^{a}	375±23.7^{a}	388±13.8^{a}	382±12.3^{a}
FI	1024±95.2^{a}	1111.6±100.3^{a}	965.58±84.00^{ab}	878.6±54.2^{ab}	1131±67.4^{a}	1031.25±101^{a}	942.84±35.7^{ab}	901.52±98.4^{ab}
FCR	2.6 ±0.44^{a}	2.8±0.23 ^{a}	2.42±0.43 ^{a}	2.32±0.23 ^{a}	2.9±0.25 ^{a}	2.75±0.34 ^{a}	2.43^{a}±0.21 ^{a}	2.36±0.22 ^{a}
2week								
BW,g	2194±115.01c	2353±93.182^{ab}	2203±90.28^{c}	2230±102.59^{c}	2347±126.55^{ab}	2325±86.26^{ab}	2319±160.59^{ab}	2405±167.53^{a}
BWG.g	384±15.7^{c}	550±44.3^{ab}	392±54.7^{c}	438±33.8^{c}	557±35.7^{ab}	539±45.9^{ab}	523±64.1^{ab}	608±65.5^{a}
FI	1651.2±103^{ab}	2508±112.23^{a}	1528.8±97.45^{c}	1620.6±104^{ab}	2395.1±126.4^{a}	2215.29±144.2a^{b}	2034.47±112.4a^{b}	2079.36±100.3^{ab}
FCR	4.3±0.55 ^{b}	4.56±0.43 ^{b}	3.9±0.54 ^{ab}	3.7±0.45 ^{a}	4.3±0.56 ^{b}	4.11±0.33 ^{b}	3.89±0.34 ^{a}	3.42±0.66 ^{a}
3week								
BW,g	2607±258.17^{ab}	2754±294.83^{b}	2580±272.61c	2586±314.28c	2898±162.40^{ab}	2777±214.58^{ab}	2906±398.2^{ab}	3160±234.30^{a}
BWG,g	413±32.1^{ab}	401±22.7^{b}	377±12.3^{c}	356±24.4^{c}	551±33.5^{ab}	452±22.2^{ab}	587±22.4^{ab}	755±33.5^{a}
FI	2010.36±142^{a}	1719.34±99^{ab}	1090.03±22.2^{c}	987.98±123.2^{c}	870.26±56.4^{d}	740.61±34.7^{d}	931.52±45.7^{c}	1588.38±87.9^{b}
FCR	4.86±0.22 ^{c}	4.28±0.32 ^{c}	2.89±0.12 ^{b}	2.77±0.23 ^{ab}	1.5±0.32 ^{a}	1.63±0.22 ^{a}	1.58±0.23 ^{a}	2.1±0.12 ^{ab}
4week								
BW,g	3101±208.51^{ab}	3323±280.44^{ab}	3122±411.98^{b}	3175±502.1^{ab}	3349±211.60^{ab}	3385±280.44^{ab}	3483±246.80^{ab}	3672±211.60
BWG,g	494±44.1^{b}	594±23.8^{a}	542±23.6^{ab}	589±42.9^{ab}	451±12.9^{b}	608±35.2^{a}	577±77.8^{ab}	512±25.9^{b}
FI	1995.4±101^{ab}	2100.1±121^{a}	1899.98±123^{b}	1887.67±98.8^{b}	2020±114^{a}	2007±112^{ab}	1995.89±132^{ab}	2100.78±122^{a}
FCR	4.03±0.33 ^{b}	3.53±0.24 ^{ab}	3.50±0.45 ^{ab}	3.20±0.76^{a}	4.47±0.17 ^{b}	3.30±0.31 ^{a}	3.45±0.53 ^{ab}	4.10±0.42 ^{b}
5 week								
BW,g	3429±247.06^{b}	3527±386.10^{ab}	3461±281.55^{b}	3530±226.16^{ab}	3736±210.70^{ab}	3708±337.21^{ab}	3780±268.9^{ab}	3997±228.91^{a}
BWG,g	328±55.2^{ab}	204±32.9^{b}	339±44.2^{ab}	355±55.2^{ab}	387±54.9^{a}	323±33.3^{ab}	297±23.9^{ab}	325±53.2^{ab}
FI	1210±45.6^{a}	811.92±33.6^{b}	888±22.7^{b}	976.25±43.9^{ab}	1315.8±54.5^{a}	1172.49±34.8^{a}	926.64±65.8^{ab}	1007.5±76.3^{ab}
FCR	4.1±0.22 ^{c}	3.98±0.14 ^{c}	2.6±0.25 ^{a}	2.75±0.12 ^{a}	3.4±0.16 ^{b}	3.63±0.33 ^{b}	3.12±0.15 ^{b}	3.1±0.12 ^{ab}
0-5week								
BWG,g	2013±120.2^{b}	2121±115.4^{b}	2049±170.5^{b}	2110±143.5^{b}	2336±156.7^{ab}	2297± 202.4^{ab}	2372±176.8^{ab}	2582±200.5^{a}
FI	7890.96±134^{a}	8250.69±144^{a}	6372.39±123^{c}	6351.1±122.4^{c}	7732.16±167^{a}	7166.64±124.9^{b}	6831.36±134^{b}	7668.54±132^{ab}
FCR	3.92±0.25 ^{c}	3.89±0.32 ^{c}	3.11±0.32 ^{b}	3.01±0.24 ^{b}	3.31±0.15 ^{b}	3.12±0.11 ^{b}	2.88±0.13 ^{a}	2.97±0.22 ^{a}

^{abc}Values in the same row with a different superscript differ significantly at $P < 0.05$.
(CON) basal diet, (T1) basal diet with 0.3 % Zado, (T2) 12% DRC diet, (T3) 12% DRC diet with 0.3% Zado, (T4)12% OP diet, (T5) 12% OP diet with 0.3% Zado, (T6) 6% DRC + 6% OP diet, and (T7) 6% DRC + 6% OP diet with Zado.

Table 4: Effects of experimental diets on some carcass traits of Molar ducks at 9 weeks age

Parameter	Treatment							
	CON	T1	T2	T3	T4	T5	T6	T7
Live weight (g)	3399±408.95^{b}	3423±234.0^{ab}	3463±108.63^{ab}	3500±271.34^{ab}	3696±341.68^{ab}	3700±245.17^{ab}	3800±298.19^{ab}	3990±85.87^{a}
Dressing weight (g)	2675±64.54^{b}	2626±53.67^{b}	2666±111^{b}	2754±76.98^{ab}	2875±50.34^{ab}	2950±98.87^{a}	2964±132^{a}	3116±135^{a}
Dressing%	78.6±0.61^{a}	76.7±0.45^{a}	77±1.02^{a}	78.7±1.87^{a}	77.8±1.18^{a}	79.7±0.96^{a}	78±0.83^{a}	78.1±1.03^{a}
Liver%	1.79±0.09^{a}	1.81±0.02^{a}	1.84±0.02^{a}	1.83±0.04^{a}	1.78±0.02^{a}	1.82±0.05^{a}	1.81±.01^{a}	1.83±0.1^{a}
Gizzard	2.40±0.05^{b}	2.36±0.1^{b}	2.42±0.09^{b}	2.74±0.12^{a}	2.76±0.08^{a}	2.8±0.07^{a}	2.98±0.02^{a}	2.77±0.12^{a}
Heart	0.89±0.2^{a}	0.92±0..03^{a}	0.88± 0.01 ^{a}	0.92±0.01^{a}	0.95± 0.02 ^{a}	0.94±0.01^{a}	0.88±0.01^{a}	0.91±0.02^{a}

^{abc}Values in the same row with a different superscript differ significantly at $P < 0.05$.
(CON) basal diet, (T1) basal diet with 0.3 % Zado, (T2) 12% DRC diet, (T3) 12% DRC diet with 0.3% Zado, (T4)12% OP diet, (T5) 12% OP diet with 0.3% Zado, (T6) 6% DRC + 6% OP diet, and (T7) 6% DRC + 6% OP diet with Zado.

Table 5: Effects of experimental diets on some blood and serum parameters of ducks at 9 weeks of age

Parameters	Treatments							
	CON	T1	T2	T3	T4	T5	T6	T7
HB(g/dl)	13.53±0.14^{a}	13.37±0.54^{a}	13.23±0.08^{a}	13.90±.0.13^{a}	13.33±0.43^{a}	13.67±0.50^{a}	13.43±0.42^{a}	13.13±0.42^{a}
PCV%	36.00±1.73^{a}	35.33±0.58^{ab}	34.67±0.58 ^{ab}	34.33±0.58^{ab}	35.33±0.58^{ab}	34.67±0.58^{ab}	33.67±0.58^{ab}	34.00±1.00^{b}
Total protein(g/dl)	5.14 ±0.14^{a}	5.13±0.54^{a}	5.04±0.08^{a}	5.09±.0.13^{a}	5.11±0.43^{a}	5.03±0.50^{a}	5.09±0.42^{a}	5.20±0.42^{a}
Albumin(g/dl)	2.6 ±0.02^{a}	2.59±0.08^{a}	2.43±0.06^{a}	2.39±0.02^{a}	2.61±0.08^{a}	2.48±0.02^{a}	2.55±0.06^{a}	2.61±0.04^{a}
Globulin(g/dl)	2.54± 0.06^{a}	2.54±0.03^{a}	2.61±0.10^{a}	2.7±0.09^{a}	2.5±0.06^{a}	2.55±0.08^{a}	2.54±0.09^{a}	2.59±0.10^{a}
GOT(U/100mL)	86.67±3.79 ^{a}	86.33±3.79 ^{a}	90.67±6.35 ^{a}	87.00±2.10 ^{a}	88.67±3.79 ^{a}	86.67±0.58 ^{a}	90.67±60.35 ^{a}	88.67±3.79 ^{a}
GPT(U/100mL)	73.67±2.89^{a}	72.00±5.00^{ab}	72.00±0.00^{ab}	69.00±13.11^{ab}	63.67±2.89^{ab}	65.33±2.89^{ab}	63.33±2.89^{ab}	62.00±0.00^{ab}

^{abc}Values in the same row with a different superscript differ significantly at $P < 0.05$.
(CON) basal diet, (T1) basal diet with 0.3 % Zado, (T2) 12% DRC diet, (T3) 12% DRC diet with 0.3% Zado, (T4)12% OP diet, (T5) 12% OP diet with 0.3% Zado, (T6) 6% DRC + 6% OP diet, and (T7) 6% DRC + 6% OP diet with Zado.

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