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EFFECT OF ONION AND /OR GARLIC AS FEED ADDITIVES ON BLOOD,TISSUE CONSTITUENTS AND GROWTH PERFORMANCE IN MUSCOVEY DUCKS

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SUMMARY

A total of one hundred and forty Muscovy ducks (one day old) were used for 12 weeks to study the effect of adding freshly onion and /or garlic to ration on blood , tissue constituents and also on growth performance parameters . Addition of onion and/or garlic lead to a significant increase in the level of serum total protein and albumin between groups while there is a significant decrease in serum cholesterol, total lipids , triglycerides , glucose and low density lipoprotein (LDL) while there is a non significant changes in level of serum high density lipoprotein(HDL). Also there is a reduction in tissue cholesterol (breast and thigh muscles) between groups. At the same time, it was observed that addition of fresh garlic plus onion in different ratios improved growth performance (body weight gain , feed consumption and feed conversion).

INTRODUCTION

In recent years, numerous studies have illustrated that medicinal plants can be used instead of chemical compounds as natural additives in animal and poultry diets to improve the quantity and quality of their products (Soliman et al. , 1999) .

Onion and garlic were used by Egyptian farmers since long time ago in poultry diets because they believed that both onion and garlic have protective effect against diseases and have valuable nutrient such as vitamins , minerals , essential amino acids and essential fatty acids (Kamanna and Chandraskhara , 1980).

Onion (Allium Cepa L.) is widely cultivated in Egypt and used as flavouring agents and popular remedy . Recently , it is suggested to use onion in poultry diets due to its insulin like activity which stimulate growth (El-Nawawi, 1991) .Moreover

onion has beneficial effect on lowering the level of cholesterol in blood plasma and serum in domestic fowl , it has valuable nutrients such as vitamins , minerals and essential amino and fatty acids. The active principals of onion are organic sulphides , catechol ,protocatechunic acid , essential oils as allyl propyl disulphide and glycollic acid , it contains the highest amount of ammonia , it acts as diuretic , expectorant and reduce cholesterol , arrest dysentry ,influenza , gout , anaemia , jaundice and malaria fever (Osman et al. ,1997) .

Garlic (Allium sativum) is widely distributed and used in all parts of the world as a spice and herbal remedy for the prevention and treatment of a variety of diseases ranging from infections to heart diseases (Konjufca et al.,1995) . Garlic is characterized by remarkable sulfur containing compounds which give garlic its distinctive smell. These sulfur containing compounds are responsible for the bioactions of garlic . The Egyptian garlic contains organo-sulfur compounds which are in the form of non protein amino acids called Allium which is considered as precursors of volatile flavour compound . In general when the fresh tissues of Allium sativum are damaged (crushed and minced) , the flavour precusors (alliin) react under the influence of alliinase enzyme , converting into allicin which possess the characteristic odour of crushed garlic , allicin is unstable , highly reactive compound once released inter reacted and decomposed producing a wide range of volatile compounds which gave the distinctive smell of garlic (Zaghloul , 2001) .The use of garlic or its constituents as hypolipidemic or hypocholesterolemic agents has been widely investigated not only to reduce blood cholesterol but also to suppress the level of total lipid and triacylglycerol (TAG) in serum of different experimental animals. Garlic has antibacterial , antifungal , antitoxic , antiparasitic and antioxidants properties (Challier et al.,1998 and Kavindra et al. 2000) . Also garlic because of its thyroid like activity has been suggested to stimulate growth (El- Nawawi , 1991).

Therefore the present study was carried out to study the effect of using fresh minced onion and garlic as feed additives on some chemical parameters on serum, tissues and growth performance of Muscovy ducks .

MATERIALS AND METHODS

140 (one day old) Muscovy ducks were fed for 2 weeks on a starter ration as one group according to Steven and John (1997) for ducks then divided randomly in 7 groups as follows:

Phase	Time/ Weeks	Group 1 (control)	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Starter	0-2	No. additives	No. additives	No. additives	No. additives	No. additives	No. additives	No. additives
Starter	2-6	No. additives	10 kg onion/ ton	20 kg onion/ ton	10 kg garlic/ ton	20 kg garlic/ ton	10 kg onion + 10 kg garlic/ ton	20 kg onion + 20 kg garlic/ ton
Finisher	6-12	No. additives	10 kg onion/ ton	20 kg onion/ ton	10 kg garlic/ ton	20 kg garlic/ ton	10 kg onion + 10 kg garlic/ ton	20 kg onion + 20 kg garlic/ ton

-Onion and garlic bulbs were peeled off and minced by using an electric mincer and mixed with the ration in certain ratios(1% onion , 2% onion , 1% garlic , 2% garlic , 1% onion + 1% garlic , 2% onion + 2% garlic) .

- Chemical composition of onion and garlic presented in table (1) according to Flores (1951).

Table (1): Chemical composition of onion and garlic

Ingredients	Moisture %	Crude protein %	Crude Fiber %	Ether extract %	Ash %	Calcium %	Phosphorus %
Onion	87.46	1.63	1.30	0.37	0.74	0.05	0.03
Garlic	78.79	3.14	1.36	0.95	0.78	0.05	0.06

- Control ration were analysed according to A.O.A.C. (1980) at every mixing during the experiment to compare between the calculated and actual values in table (2).

- Live body weight , individual blood samples from wing vein (10 samples from each group) and tissue samples (breast and thigh ,3 samples from each group) were taken biweekly from 4 weeks till 12 weeks.

Table (2): Ingredient and chemical composition of experimental rations.

Ingredients	Starter Phase	Finisher Phase
- Yellow corn	56.36	64.00
- Soyabean meal 44%	38.76	28.14
- Vegetable oil	1.00	3.50
- Di-calcium phosphate (18.5%)	1.33	1.34
- Lime stone	1.00	0.97
- Sodium chloride	0.4	0.40
- DL-Methionine	0.13	0.07
- Vit,mineral premix*	0.30	0.30
- Wheat brane	0.72	1.28
Calculated analysis:		
- CP%	22	18
- ME (K cal/kg)	2850	3100
- Calcium %	0.80	0.76
- AV.P.%	0.40	0.38
- Sodium %	0.18	0.18
- Methionin + Cystein %	0.48	0.39
- Lysin %	0.83	0.67
	1.19	0.92

* Starter (Roch): vitamin A 11 MIU, vitamin D3 2.4 MID, vitamin E 15.000 mg, vitamin K3 1.000 mg, vitamin B1 4.500 mg, vitamin B2 6.500 , niacin 35.000 mg , pantothenic acid 15.000 mg ,vitamin B6 6.000 mg , vitamin B12 (15 mg), folic acid 1.500 mg , biotin 450 mg , choline chloride 1.500.000 mg , selenium 275 mg , copper 10.000 mg , iron 58.000 mg , manganese 60.000 mg , iodine 1.000 mg , cobalt 100 mg .

*Finisher (Roch): vitamin A 12 MIU, vitamin D3 2.2 MID ,vitamin E 10.000 mg , vitamin K3 2.000 mg , vitamin B1 1.000 mg , vitamin B2 5.000 , niacin 30.000 mg , pantothenic acid 10.000 mg ,vitamin B6 1.500 mg , vitamin B12 10 mg , folic acid 1.000 mg , biotin 50 mg , choline chloride 500.000 mg , selenium 100 mg , copper 10.000 mg , iron 30.000 mg , manganese 60.000 mg , iodine 1.000 mg , cobalt 100 mg .

Chemical analysis of serum and tissue samples

1- Determination of serum cholesterol :

Serum cholesterol was determined by using commercial kit obtained from Stanbio laboratory , Inc., based on the method outlined by Allian et al. (1974).

2- Determination of serum total protein :

Serum total protein was determined by using commercial kit obtained from Stanbio laboratory , Inc., based on the method outlined by Doumas (1975).

3- Determination of serum albumin :

Serum albumin was determined by using kit obtained from Bio- Merieux- France based on the method outlined by Doumas et al.(1971).

4- Determination of serum total lipids:

Serum total lipids was determined by using commercial kit purchased from Cal ñ test Diagnostics, Inc.,based on the method outlined by Frings et al.(1970).

5- Determination of serum high density lipoprotein (HDL):

Serum high density lipoprotein was determined by high density lipoprotein (HDL) kit of Human Gesellschaft Fur Biochemical and Diagnostic according to the method recommended by Gordon and Amer (1977).

6- Determination of serum low density lipoprotein (LDL):

Serum LDL was determined by kit according to the method of Fruchart (1982).

7- Determination of serum glucose :

Serum glucose was determined by using kit according to the method recommended by Dubowski (1962).

8- Determination of serum triglycerides :

Serum triglycerides was detected by using kit according to the method recommended by Wahlejeled (1974).

9- Determination of cholesterol in tissue samples :

The extraction and purification of lipids from tissue samples (breast and thigh muscles) was done according to the method recommended by Folch et al. (1957) , then the cholesterol was determined in lipid extract of meat according to the method of Chourcham et al . (1959).

-Growth performance parameters

1- Live Body Weight (LBW)

Live body weight of ducks were individually recorded every two weeks during experimental period to the nearest gram in each treatment from 4th to the 12th week of age Then the average live body weight of each group was calculated. (Table 6).

2- Body Weight Gain (BWG)

The average live weight gain was calculated by subtracting the average initial live weight of a certain period from the average final live body weight at the same period (Table 6).

3- Feed Consumption

Daily feed intake per chick was calculated every 2 weeks interval for each group . The following equation was applied :

Average feed intake / chick / 2 weeks =

$$\frac{\text{The amount of feed consumed in gram / 2 weeks}}{\text{Number of chicks consuming feed}}$$

4- Feed Conversion (FC)

Feed conversion was recorded as the amount of feed consumed per unit of body weight gain

Feed conversion =

$$\frac{\text{Average of feed consumed in gram / 2 weeks}}{\text{Average body weight gain in gram / 2 weeks}}$$

Statistical analysis

The obtained data were statistically analysed by two ways analysis of variance according to the method recommended by Petrie and Watson (1999).

RESULTS AND DISCUSSION

Our received data were analyzed by two ways analysis of variance , groups (7 groups) and time (4,6,8,10 and 12 weeks). Our design is to compare between different treatments (groups). Obtained data (Table 3) revealed that addition of different levels of onion and /or garlic to the ration of Muscovy ducks lead to an increase in serum total protein and serum albumin in all groups in comparison with the control one this results were coinceded with Abdo et al.(1983) in Hubbard chickens ; Shash-Kanth et al. (1986) in albino rats and chickens and El- Deep (1994) in layers . That increase in protein and albumin concentrations may attributed mainly to the anabolic effect of onion by using the amino acid content of digested eaten protein.

Serum cholesterol (Table 3), show a significant decrease in all groups which received onion and / or garlic with different levels when compared with the control one. Jain (1976) suggested that , garlic increased secretion of cholesterol and its products in feces plus it deminished endogenous synthesis of cholesterol .These obtained data agreed with those obtained by Bordia et al. (1975) and Sharma et al. (1975) in rabbits ; Sainani et al. (1980) ; Qureshi et al.(1983) in white leghorn pullets ; Abdo et al.(1983) ; El Nahla (1983) ; El-Habbak et al.(1989) in quails ; El- Nawawi (1991); Taha et al. (1994); Ayoub (1996); Galal et al (1997); Osman et al .(1997) and Abdo (1998) in broilers; Mandour et al. (1999) and Zaghloul (2001) in chickens. It is clear that in case of time (4,6,8,10 and 12 weeks) there is a decrease in total protein , albumin and cholesterol .

Data outlined in table (4) showed the mean values of total lipids , high density lipoprotein (HDL) and low density lipoprotein (LDL) in serum of Muscovy ducks given different levels from onion and/or garlic in ration . From the illustrated data in table (4) it was found that levels of total lipids

and LDL in serum of Muscovey ducks were decreased between age/weeks and between all groups than the control one .While in HDL there is a non significant changes in case of age/weeks (4,6,8,10 and 12) or in all different groups which received onion and/or garlic in different levels in comparison with the control one . These results were nearly similar to those recorded by Augusti and Mathew (1974) ; Qureshi et al.(1983)in white leghorn pullets ; Nitiyanant et al. (1987); Taha et al .(1994) in experimental animals ; Alim El-Dein (1999) in Izobrown hens and Fayoumi ones ; Mandour et al. (1999) in male albino rats and Zaghloul (2001) in chickens . The lipid reducing action of onion and garlic could be attributed to their contents of organic disulphides which are good acceptors of hydrogen and their biological actions may be due to their reaction with thiol (O-SH) group substances and partly to that with reduced pyridine nucleotides (NADPH). As such reactions could inactivate thiol group enzyme and also oxidize NADPH , and all of these are necessary for lipid synthesis in liver . Thus the lipid lowering effects of onion and garlic depends upon their contents of organic disulphides and their ability to inhibit (SH) group (Admue et al.1982).

Data illustrated in table (5) showed the mean values of glucose , triglycerides in serum and cholesterol in tissues (breast and thigh muscles) of Muscovey ducks given different levels of onion and/or garlic. From the obtained data there is a significant decrease in the level of serum glucose and triglycerides and in tissue cholesterol in all groups when compared with control one. The obtained findings agreed with those recorded by Lau et al . (1987); Nitiyanant et al . (1987); Konjufca et al. (1995); Konjufca et al .(1997); Osman et al. (1997) and in Mandour et al (1999) . Saied (1974) recorded that onion had a hypoglycemic effect due to the presence of insulin like activity in onion .Jain and Vyas (1974) indicated that the hypoglycemic activity of onion is due to the better utilization of glucose by the cells in the absence of insulin secretion by the pancrease. On the other side , there is a significant decrease in case of age / weeks in serum glucose and serum cholesterol in all groups but in tissue cholesterol there is a decrease at 10 and 12 age/week in each group

Table (6) and table (7) revealed an improvement in body weight, body weight gain and a lower feed consumption at group 6 and group7 which received 10 kg onion + 10 kg garlic / ton and 20 kg onion + 20 kg garlic / ton respectively which reflected in feed conversion ratio which give low ration (more efficient). The obtained data agreed with those reported by El-Nahla (1983) ; El-Nawawy (1991);Horton et al.(1991) ; Konjufca et al.(1995) ; Parasad and Pandy (1995) ; Galal et al.(1997) ; Osman et al., (1997) ; abdo (1998) and Soliman et al., (1999).

Table (3): Mean values of total protein , albumin and cholesterol in serum of Muscovy ducks given different levels from fresh onion and garlic in ration

Groups / Serum Analysis	Age weeks	Control	10kg onion/ ton	20kg onion/ ton	10kg garlic/ ton	20kg garlic/ ton	10kg onion + 10kg garlic/ ton	20kg onion + 20kg garlic/ ton
Serum Total Protein (g/dl)	4	5.380 ±0.112	6.700* ±0.115	6.50* ±0.017	6.583* ±0.083	6.550* ±0.076	6.417* ±0.148	6.357* ±0.149
	6	5.480 ±0.130	6.517*° ±0.101	6.417*° ±0.230	6.350*° ±0.076	6.333*° ±0.083	6.083*° ±0.083	6.050*° ±0.104
	8	5.443 ±0.178	6.350*° ±0.236	6.267*° ±0.233	6.167*° ±0.166	6.083*° ±0.083	5.867*° ±0.072	5.783*° ±0.016
	10	5.783 ±0.016	6.180*° ±0.204	5.650° ±0.076	5.900*° ±0.175	5.767° ±0.044	6.033*° ±0.066	6.017*° ±0.060
	12	5.417 ±0.136	6.000*° ±0.144	5.420° ±0.013	5.783*° ±0.166	5.650*° ±0.860	5.583*° ±0.066	5.450*° ±0.104
Serum Albumin (g/dl)	4	3.583 ±0.044	3.867* ±0.017	3.850* ±0.023	3.917* ±0.017	3.867* ±0.033	3.883* ±0.016	3.850* ±0.028
	6	3.500 ±0.057	3.833*° ±0.017	3.783*° ±0.016	3.851*° ±0.028	3.833*° ±0.017	3.817*° ±0.016	3.767*° ±0.016
	8	3.700 ±0.076	3.817*° ±0.017	3.767*° ±0.016	3.814*° ±0.016	3.767*° ±0.017	3.783*° ±0.017	3.783*° ±0.017
	10	3.583 ±0.072	3.733*° ±0.016	3.717*° ±0.017	3.783*° ±0.017	3.733*° ±0.016	3.733*° ±0.019	3.600*° ±0.028
	12	3.567 ±0.033	3.683*° ±0.016	3.667*° ±0.016	3.683*° ±0.016	3.650*° ±0.028	3.600*° ±0.290	3.633*° ±0.044
Serum Cholesterol (mg/dl)	4	125.000 ±12.516	116.910* ±8.543	115.330* ±9.887	115.160* ±9.166	113.560* ±13.217	112.080* ±11.460	111.250* 9.984
	6	124.660 ±11.453	118.08*° ±7.586	116.25*° ±6.144	117.91*° ±11.543	116.08*° ±10.083	118.58*° ±7.543	113.75*° ±8.626
	8	124.000 ±11.527	117.16*° ±9.543	116.83*° ±6.589	117.16*° ±7.672	115.41*° ±5.083	113.66*° ±5.589	110.25*° ±6.144
	10	125.670 ±10.33	117.08*° ±5.083	113.58*° ±3.543	113.75*° ±5.626	111.25*° ±6.877	110.25*° ±6.144	106.92*° ±5.543
	12	124.000 ±11.00	118.50*° ±5.50	113.58*° ±4.416	11.25*° ±5.144	110.91*° ±4.556	106.40*° ±6.743	102.58*° ±4.743

Time L.S.D. at 0.05
- T. Protein: 0.070
- Albumin : 0.015
-Cholesterol : 0.150
° Sig. between time (age)

Group L.S.D. at 0.05
0.033
0.012
1.500
* Sig. between groups

Table (4): Mean values of total lipids, high density lipoprotein (HDL) and Low density lipoprotein (LDL) in serum of Muscovy ducks given different levels from fresh onion and garlic in ration.

Groups / Serum Analysis	Age weeks	Control	10kg onion/ ton	20kg onion/ ton	10kg garlic/ ton	20kg garlic/ ton	10kg onion + 10kg garlic/ ton	20kg onion + 20kg garlic/ ton
Serum Total Lipids (mg/dl)	4	372.08 ±17.220	363.66* ±15.830	361.91* ±33.360	367.16* ±15.430	363.50* ±24.280	364.73* ±22.550	360.06* ±14.970
	6	370.08 ±27.083	358.91*° ±18.39	357.58*° ±27.92	362.08*° ±17.090	358.25*° ±22.220	360.06*° ±14.970	353.31*° ±13.290
	8	368.41 ±43.300	354.25*° ±19.840	352.56*° ±26.720	355.50*° ±27.420	352.08*° ±17.090	353.83*° ±15.430	348.83*° ±16.720
	10	367.16 ±14.24	349.75*° ±1.842	346.75*° ±3.375	351.08*° ±34.890	346.25*° ±21.790	349.42*° ±20.63	344.22*° ±17.63
	12	370.40 ±29.800	343.81*° ±15.60	342.98*° ±26.422	345.33*° ±28.880	341.60*° ±23.970	344.50*° ±21.840	340.75*° ±26.10
Serum High Density Lipo-Protein (HDL) (mg/dl)	4	58.300 ±1.493	56.167 ±1.166	56.833 ±2.166	57.000 ±3.288	57.166 ±4.45	56.333 ±1.166	56.500 ±1.500
	6	57.733 ±1.233	57.066 ±2.066	57.666 ±4.313	57.168 ±4.244	57.334 ±5.044	56.500 ±4.500	56.833 ±3:166
	8	59.433 ±4.617	57.166 ±4.166	57.833 ±1.600	57.233 ±3.504	57.400 ±3.305	57.288 ±4.441	57.466 ±3.371
	10	57.833 ±4.166	57.632 ±2.296	58.300 ±5.492	57.500 ±4.200	57.633 ±3.296	57.333 ±3.504	57.500 ±3.288
	12	57.500 ±5.500	58.000 ±5.288	58.800 ±2.361	57.900 ±3.115	58.066 ±4.296	57.733 ±5.145	57.666 ±4.441
SerumLow Density Lipo-protein (LDL) (mg/dl)	4	66.100 ±6.985	60.333* ±5.928	61.000* ±4.763	60.500* ±5.100	60.800* ±4.802	59.166* ±5.881	56.333* ±4.589
	6	65.333 ±5.166	58.006*° ±5.808	59.233* ±5.932	60.066* ±4.976	59.333* ±6.927	57.233* ±5.933	55.566* ±5.924
	8	67.566 ±7.233	57.900*° ±4.208	56.900*° ±5.665	58.900*° ±6.737	57.233*° ±5.721	54.466*° ±4.536	54.400* ±5.917
	10	68.000 ±8.443	58.466*° ±5.504	56.466*° ±6.260	56.000*° ±5.763	54.733*° ±4.622	52.366*° ±4.811	51.300*° ±4,800
	12	67.833 ±7.027	57.400*° ±5.159	55.666*° ±5.166	51.733*° ±4.622	51.533*° ±4.841	49.400*° ±4.953	46.933*° ±4.648

Time L.S.D. at 0.05
- T. Protein: 3.300
- Albumin : 2.252
-Cholesterol : 0.206
° Sig. between time (age)

Group L.S.D. at 0.05
3.850
2.850
1.836
* Sig. between groups

Table (5): Mean values of glucose, triglycerides in serum and cholesterol in tissues of Muscovy ducks given different levels from fresh onion and garlic in ration.

Groups / Serum Analysis	Age weeks	Control	10kg onion/ ton	20kg onion/ ton	10kg garlict on	20kg garlict on	10kg onion + 10kg garlic/ ton	20kg onion + 10kg garlic/ ton
Serum Glucose (mg%)	4	166.270 ±15.894	135.316* ±12.973	100.083* ±8.083	132.08* ±10.710	98.583* ±8.543	102.083* ±8.709	97.000* ±7.500
	6	165.500 ±9.732	130.417* ±11.887	98.333* ±8.667	120.41*° ±12.959	95.416* ±6.220	95.416*° ±8.220	94.426* ±8.161
	8	166.270 ±11.894	125.23*° ±11.887	92.083*° ±10.083	116.96*° ±11.409	90.500*° ±8.144	93.666*° ±11.709	92.000* ±10.500
	10	165.000 ±15.154	122.75*° ±13.683	87.583*° ±7.309	115.41*° ±12.815	91.983*° ±8.610	91.750*° ±7.626	90.350*° ±8.076
	12	166.830 ±14.013	113.410*° ±3.424	81.250*° ±4.144	106.83*° ±7.428	86.916*° ±6.543	90.583*° ±10.083	88.666*° ±7.589
Serum Triglycerides (mg/dl)	4	158.000 ±15.577	147.416* ±14.781	146.00* ±11.00	147.083* ±11.044	146.150* ±12.050	145.416* ±10.103	143.750* ±8.803
	6	157.333 ±12.201	142.000* ±11.626	139.66*° ±13.222	141.75*° ±9.803	139.67*° ±9.333	139.42*° ±9.712	136.08*° ±11.548
	8	156.333 ±12.882	138.83*° ±12.445	132.41*° ±12.446	138.58*° ±11.543	132.41*° ±10.445	135.17*° ±11.734	133.68*° ±12.922
	10	157.333 ±12.201	132.66*° ±12.445	127.41*° ±11.445	130.08*° ±11.300	127.41*° ±11.447	130.50*° ±12.040	128:33*° ±11.444
	12	158.250 ±15.520	127.16*° ±12.691	122.00*° ±11.756	123.58*° ±12.543	122.00*° ±10.756	126.08*° ±9.961	122.50*° ±11.604
Tissue Cholesterol (mg/ 100gm)	4	±15.077 ±11.204	139.580* ±11.119	138.900* ±10.199	138.190* ±11.237	135.230* ±12.324	135.931* ±12.245	132.342* ±11.286
	6	142.143 ±10.055	139.210* ±11.105	138.460* ±12.252	137.750* ±11.218	134.480* ±12.188	135.170* ±11.316	131.691* ±11.386
	8	141.578 ±11.229	139.040* ±12.277	138.070* ±10.227	137.630* ±12.138	134.500* ±11.129	134.572* ±12.215	130.62*° ±10.426
	10	141.907 ±10.244	138.96*° ±10.221	138.01*° ±12.214	137.12*° ±10.202	133.81*° ±11.128	133.16*° ±10.300	128.53*° ±9.366
	12	143.018 ±10.190	138.24*° ±12.359	137.34*° ±12.230	136.95*° ±11.203	133.69*° ±12.174	129.26*° ±11.403	128.39*° ±11.571

Time L.S.D. at 0.05
- S. glucose: 5.655
- Triglycerides : 5.452
- Tissue Cholesterol : 0.75

° Sig. between time (age)

Group L.S.D. at 0.05
5.075
2.122
1.230

* Sig. between groups

Table (6): Averages of live body weight and body weight gain of Muscovy ducks as affected by diets containing different levels of onion and garlic at different age intervals.

Groups	Age weeks	Control	10kg onion/ ton	20kg onion/ ton	10kg garlic/ ton	20kg garlic/ ton	10kg onion + 10kg garlic/ ton	20kg onion + 20kg garlic/ ton
Initial Weight	2	995 ±10.255	990 ±10.333	1005 ±11.121	1000 ±10.255	1050 ±11.200	1045 ±12.234	1055 ±11.123
Live Body Weight (LBW) (gm)	4	1190 ±10.399	1210 ±12.111	1300 ±10.235	1300 ±12.255	1350 ±11.522	1450 ±12.424	1490 ±12.299
	6	1650 ±10.255	1790 ±12.357	1690 ±14.244	1650 ±13.222	1700 ±14.435	1720 ±15.452	1790 ±15.224
	8	1850 ±15.244	2350 ±17.542	2575 ±20.222	2000 ±18.888	2040 ±18.254	2650 ±20.333	2680 ±21.200
	10	2250 ±20.252	2900 ±24.101	3200 ±27.520	2520 ±22.254	2800 ±24.512	3310 ±27.288	3350 ±30.145
	12	2880 ±25.550	3400 ±29.500	3475 ±30.542	3200 ±27.546	3350 ±30.355	3670 ±32.254	3700 ±33.325
Body Weight Gain (BWG) (gm)	4-6	460	580	390	350	350	270	300
	6-8	200	560	885	350	340	930	890
	8-10	400	550	625	520	760	660	670
	10-12	630	500	275	680	550	360	350
	4-12	1690	2190	2175	1900	2000	2220	2210

Table (7): The Collective results of duckling performance fed the experimental diets.

Groups	Control	10kg onion/ ton	20kg onion/ ton	10kg garlic/ ton	20kg garlic/ ton	10kg onion + 10kg garlic/ ton	20kg onion + 20kg garlic/ ton
Body weight (g) at 4 weeks	1190	1210	1300	1300	1350	1450	1490
Final body weight (g) at 12 weeks	2880	3400	3475	3200	3350	3670	3700
Weight gain (4-12 weeks)	1690	2190	2175	1900	2000	2220	2210
Total feed consumed (g) (4-12 weeks)	10750	10800	10850	10600	10670	10600	10650
Average feed conversion (4-12 weeks).	6.36	4.931	4.988	5.578	5.335	4.775	4.819

From the obtained results, it could be concluded that addition of 10 kg onion + 10 kg garlic/ton and 20 kg onion +20 kg garlic / ton give a most better result in growth performance, biochemical parameters and an economical benefit of used ration in Muscovey ducks.

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