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EFFECT OF DIFFERENT MOLTING PROGRAMS ON PRODUCTIVE AND SOME PHYSIOLOGICAL PARAMETERS IN NORFA AND FAYOUMI HENS

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SUMMARY

Norfa and Fayoumi hens were induced to molt by feeding on a basal diet supplemented with 20,000 p.p.m. ZnO for 8 d (Z), 0.3% $Al_2(SO_4)_3$ for 17 d (AL), 10,000 p.p.m. ZnO + 0.15% $AL_2(SO_4)_3$ for 12 d (ZAL), 20,000 p.p.m. ZnO for 4 d followed by 0.3% $AL_2(SO_4)_3$ for 8 d (Z-AL) and 0.3% $AL_2(SO_4)_3$ for 8 d followed by 20,000 p.p.m. ZnO for 4 d (AL-Z). Control hens did not receive any supplementation (C). Egg production, feed intake, liver, ovary and oviduct weights, mortality%, back skin temperature (BT), rectal temperature (RT) and respiration rate (RR) were recorded.

During molting, egg production was reduced but did not cease in the dietary treatments except (ZAL). In the same time egg production was reduced by all treatments in Fayoumi and by (ZAL) in Norfa compared with the control hens. All the experimental groups returned to its pre-molting egg production levels at postmolting except those treated with (AL-Z), where the level remarkably increased compared to that during molting, but it still lower than that in pre molting.

Daily feed intake during molting was significantly ($P \leq 0.01$) decreased for (Z) and (ZAL) treated hens. Al-Treated hens were not affected in this respect, (Z-AL) and (AL-Z) groups showed intermediate values during molting.

Mortality percent in the control group was comparatively greater than that in treated groups.

The liver weight of hens fed (AL) and (ZAL) was significantly less than that of the other treated and control groups. An opposite trend was noticed for the liver weight of hens fed (Z-AL). Using (ZAL) caused more reduction in weight of the ovary and oviduct as compared to the other groups. However, the ovarian weight of hens fed (AL) was comparatively heavier than that of the other groups. Oviduct weight was significantly reduced in the treated groups.

Bick skin temperature (BT) did not significantly differ among experimental groups and between both breeds as well as during and post molting. The opposite was true for rectal temperature (RT) ($P \leq 0.01$). There were significant differences among treatments and between either during or post molting in respiration rate ($P \leq 0.01$).

Keywords: Laying hens, molting agents, physiological parameters

INTRODUCTION

In domestic chickens, which are bred for high egg production and under ordinary circumstances, egg production decreases and molting takes place at the end of the laying cycle. Molting cycle requires about 4 months for a hen to drop her feathers and grow new set.

It is possible, however, to speed up the process through induced molting. Such a process is a procedure used in poultry industry to recycle laying hens to give another season of egg production. Force molting has further advantages, likewise, it improves profits, increases subsequent egg production and quality during the post-molt period and delays the high costs of starting a new flock. During the last two decades, the application of force molting has been tremendously increased. Egg producers need to select the most economical program for their operations.

Various nutritional systems have been used to induce molting in Single Com%wWhite Leghorn laying hens, e.g. using high levels of dietary zinc as zinc oxide Shippee et al., 1979 Berry and Brake, 1985 and Hattaba et al., 1990) and high levels of dietary aluminum as aluminum sulfate (Hussein et al., 1989 b).

Physiological changes in liver and reproductive system have been characterized during molt induced (Berry and Brake, 1985; Johnson and Brake, 1992; Breeding et al., 1992; and Soliman, 1993).

The present study was conducted; I- to compare different molting programs in Norfa and Fayoumi hens. II- to study the effect of molting methods on some physiological parameters.

MATERIALS AND METHODS

The present study was conducted at the Poultry Farm, Faculty of Agriculture, Menofiya University, Shibin El-Kom. A hundred and fifty of each of Fayoumi and Norfa (a cross bred of Fayoumi X Baladi X two lines of Norwagian Leghorn selected for egg number and egg weight) hens were randamly selected, at 50 weeks of age. Six groups of 25 hens for each breed were individually kept in wire cages in good ventillated pens and photoperiod was 16 L: 8 D/day during the experimental period. The experimental groups were fed on a basal diet supplemented with one of the force molting-agents as indicated in Table (1).

Egg production was recorded at weekly intervals as precentage (egg number in week/number of hens x 7) x 100 pre-molting (2 weeks) during molting (4 weeks) and postmolting (4 weeks). Five birds were selected at random from each experimental group after end of the treatments period for each group and slaughtered to determine absolute and relative weight of liver with gall bladder, ovary with ova and oviduct in proportional to live body weight. The average daily feed intake was determined during molting and postmolting periods. Similarly, back skin (BT) and rectal (RT) temperatures were determined (11.00 a.m.) using thermocaple as well as respiration rate (RR).

All percentage data were converted to angles using arcsin transformation prior to statistical analysis. Results were subjected to statistical analysis according to the method of analysis of variance described by (Snedecor and Cochran, 1967).

Duncan's new multiple range test was also used to compare each two means of the different traits studied (Steel and Torries, 1960).

Table 1. The composition of basal diet

Ingrediens	%
Ground yellow corn	47.0
Wheat bran	23.7
Soybean meal	15.0
Animal protein source	8.0
Bone meal	0.4
Ground limestone	4.0
Oyster shell	0.4
Salt (Sodium chloride)	0.5
Vitamine mixture	0.5
Mineral mixture	0.5
Crude protein(%) calculate	18.7
Energy ME/Kg Kcal calculated	248.5

The dietary treatments

	Milting forcers		Treatments period
	Zinc oxide(PPM)	Aluminum sulfate(%)	(days)
(Z)	20000	--	8
(AL)	--	0.30	17
(ZAL)	10000	0.15	12
(Z-AL)	20000	--	4
	--	0.30	8
(AL-Z)	--	0.30	8
	20000	--	4
(C)	--	--	--

Number of hens in each treatment was 25 Norfa+25 Fayoumi.

RESULTS AND DISCUSSION

Egg production:

Data in Table (2) show that, during the molting period, the average of percentage of egg production in Norfa hens was greater than that in Fayoumi for all treatments except in those treated with (ZAL) as well as the control birds, which were quite similar in both breeds. The breed difference was significant ($P \leq 0.05$). Birds received (ZAL) yielded lower egg production than

Table 2. Percentage of egg production for Norfa (N) and Fayoumi (F) hens premolting, during molting and postmolting

Treatment	Breed	Pre-molt/ week 1	2	Av.	During molting/ week 1	2	3	4	Av.	Depression% during molting period	Postmolting/ week 5	6	7	8	Av.	Overall av.
(Z)	N	42	49	46	32	4	32	44	28	39	33	47	62	43	46	
	F	45	25	35	15	9	22	26	18	49	38	53	40	36	42	
	Av.	44	37	41	24	7	27	35	23	44	36	50	51	40	44	36a
(AL)	N	20	37	29	29	38	47	50	41	--	34	40	32	41	37	
	F	31	30	31	1	7	23	47	20	35	38	55	38	40	43	
	Av.	26	34	30	15	23	30	49	30	--	36	48	35	41	40	33a
ZAL	N	22	33	28	13	13	--	21	12	57	41	35	18	42	34	
	F	50	46	48	30	7	2	8	12	75	29	32	36	46	36	
	Av.	36	40	38	22	10	1	15	12	68	35	34	27	44	35	28b
Z-Al	N	24	30	27	13	13	37	39	26	3.7	37	37	28	38	35	
	F	43	35	39	22	7	10	29	17	56	25	24	26	29	26	
	Av.	34	33	34	18	10	24	34	22	35	31	31	27	34	31	29b
(AL-Z)	N	54	47	51	27	31	16	34	27	47	32	34	29	34	32	
	F	31	30	31	23	22	4	20	17	45	29	31	26	34	30	
	Av.	43	39	41	25	27	10	27	22	46	31	33	28	34	31	31ab
(C)	N	37	22	30	12	38	33	35	30	--	31	37	27	44	35	
	F	19	29	24	24	31	29	40	31	--	29	36	28	42	34	
	Av.	28	26	27	18	35	31	38	31	--	30	37	28	43	35	31ab
Overall	N	35							27					37		
	F	35							19					35		
Average	Av.	35a							23b					36a		

other treatments. On the other hand, the control and (AL)-treated birds yielded higher egg production than other treatments and both were quite similar. Intermediate and quite similar values of egg production were recorded for (Z), (Z-AL) and (AL-Z) treated groups. The differences between treatments were significant ($P \leq 0.05$). It also clearly appears that the egg production was at minimum if not stopped at the 2 nd week in (Z) and (Z-AL) treated group, 3 rd week in (ZAL) and (AL-Z)-treated groups and the 1st week in (AL)-treated Table (2).

In other words, the percentage of egg production was substantially depressed during the molting period, and the greatest depressive effect was noticed in the (ZAL) treated group. The (AL)-treated and control groups were exceptional, where such depressive effect did not appear.

In the post-molting period, the percentage of egg production apparently increased, so that it attained its pre-molting level in all the experimental groups, except that in the (AL-Z) treatment, where it remained lower. The differencesabetween pre-molting and postmolting were not significant, however, both significantly ($P \leq 0.01$) differed from that during molting. Breed effect in contrast to treatment effect was not prominent.

Shippee et al. (1979), Mohamed (1990), Breeding et al. (1992) and Soliman (1993) found that hens stopped egg production after zinc oxide treatment during the second and third weeks, which agreed with the present findings. On the other hand, the results of Hussein et al. (1989a) were in disagreement with the present findings for the Norfa hens but it was in agreement with that of Fayoumi. They reported that the egg production of SCWL hens fed on (0.3% AL) almost ceased at day 15 from the start of that treatment. In other publication, Hussein et al. (1989b) reported a siginficant but negative effect of (0.3% AL) on egg production.

The results indicate of the present study that the Norfa hens fed on zinc oxide returned to their normal egg production after 3 weeks of ceasing their egg production. These results agree with that of McCormick and Cunningham (1984 a) who stated that Leghorn hens fed on 20,000 ppm zinc oxide returned to their normal production after 3 weeks from the beginning of the treatment. Fayoumi hens fed on diet containing zinc oxide showed a remarkable increase in egg production during the postmolting period (42%) compared with that produced during pre-molting period (35%) and hens returned to their production at the 5th weeks post-molting. Mohamed (1990) found that ISA Brown and Fayoumi hens fed on 20,000 p.p.m. zinc oxide returned to their normal production at the 7th and 8th weeks postmolting, which agree well with the results of the present study.

Feed Intake :

Table (3) indicates that the average of daily feed intake during the period of molting substantially decreased in (Z) and (ZAL) treated hens to be about 50% of that consumed by the control hens in such a period as well as that of all the experimental groups during postmolting. Hens treated with (Z-AL) or (AL-Z) gave intermediate values of daily feed intake during molting. All the treated groups consumed comparable amounts of ration during postmolting, which reached the normal level consumed by the control hens. This finding may suggest the depressive effect of ZnO as compared to $Al_2(SO_4)_3$ in this respect, which may be resulted from differences in their palatability by the birds this assumption could be evidently supported by the results in Table (3) concerning the average daily feed intake when it was measured after the application of ZnO and $Al_2(SO_4)_3$ in (Z-AL) and (AL-Z) treated groups. The values obtained were lower after ZnO application regardless of the sequence of application. The breed difference in this concept was significant ($P \leq 0.01$).. Moreover, (AL) treated group showed a comparable level of average daily feed intake during molting to that consumed by the control in that period and the other experimental groups in post molting. The differences between treatments were highly significant ($P \leq 0.01$) as well as between during molting and postmoltings.

Data available in the literature agree with the present finding (Bessei and Lantzsch, 1981; McCormick and Cunningham, 1984 b; Mohamed 1990; and Soliman, 1993) who reported that feeding hens on high levels of ZnO resulted in a decrease in their feed intake. However, Hussein et al. (1988) found that the treatment with $AL_2(SO_4)_3$ in diet of Japanese Quail decreased their feed intake during molting. This may be due to species differences.

Table 3. Average of daily feed intake (g/hen/day) by Norfa (N) and Fayoumi (F) hens during molting and post-molting periods

Treatment	Breed	During-molting* (for 4 wks)	Postmolt* (for 4 wks)	Overall mean
(Z)	N	42.4	77	59.7
	F	36.9	73.5	55.2
	Av.	39.7	75.3	57.5d
(AL)	N	85.9	89.8	87.8
	F	77.8	77.5	77.6
	Av.	81.9	83.7	82.7a
(Z-Al)	N	47.4	81.0	64.1
	F	41.8	81.0	61.1
	Av.	44.6	80.6	62.6 cd
(Z-Al)	N	67.8	74.8	71.3
	F	53.6	79.8	66.7
	Av.	60.7	77.3	69.0bc
(AL-Z)	N	69.3	92.3	80.8
	F	59.6	63.5	61.6
	Av.	64.5	77.9	71.2 bc
(C)	N	70.0	88.0	78.8
	F	63.4	75.0	68.9
	Av.	66.5	81.3	73.9 ab

g/hen/day

Mortility:

Data in Table (4) show that the mortality was comparatively greater in the control group as compared to that in the treated groups. This may suggest that the procedures applied for force molting did not adversely affected the viability of the birds under consideration. No consistent differences were noticed in mortality percent in the control group, neither during and post molting, nor between Norfa and Fayoumi hens.

Among the treated groups, the least mortality percent was obtained in the zinc oxide-treated group (4.2%), meanwhile, it was ranged in the other treated groups (8.3 to 12.5%, Table 5). No regular trend was observed between the Norfa and Fayoumi hens among the treated group.

Lee (1982) reported a similar tendency, where the mortality rate in control Leghorn hens was significantly higher than that in the treated groups. Mohamed (1990) found an opposite trend.

Table 4. Number and percentage of mortality of Norfa and Fayoumi hens during and postmolting periods

Treament	No.of birds	Breed	During molting No.	%	Post molting No.	%	Total No.	%
	24	N	1	4.2	0	0.0	1	4.2
(Z)	24	F	0	0.0	1	4.2	1	4.2
	48	Av.	1	2.1	1	2.1	2	4.2
	24	N	1	4.2	2	8.3	3	12.5
(AL)	24	F	1	4.2	1	4.2	2	8.4
	48	Av.	2	4.2	3	6.2	5	10.4
	24	N	1	4.2	3	12.5	4	16.7
(ZAL)	24	F	0	0.0	2	8.3	2	8.3
	48	Av.	1	2.1	5	10.4	6	12.5
	24	N	0	0.0	2	8.3	2	8.3
(Z-AL)	24	F	0	0.0	3	12.5	3	12.5
	48	Av.	0	0.0	5	10.4	5	10.4
	24	N	0	0.0	3	12.5	3	12.5
(AL-Z)	24	F	0	0.0	1	4.2	1	4.2
	48	Av.	0	0.0	4	8.3	4	8.3
	24	N	3	12.5	3	12.5	6	25.0
(C)	24	F	3	12.5	2	8.3	5	20.8
	48	Av.	6	12.5	2	10.4	11	22.9
	144	N	6	4.2	13	9.0	19	13.2
Overall	144	F	4	2.8	10	6.9	14	9.7
average	288	Av.	10	3.5	23	8.0	33	11.5

Liver weight:

The liver weight of Fayoumi and Norfa hens fed (AL) and (ZAL) were significantly less than that of the other treated and control groups. An opposite trend was noticed for the liver weight of hens fed on (Z-AL) which were ($P \leq 0.01$) heavier than that of the other experimental groups (Table 5). Berry and Brake (1985) reported that liver weight of fasted hens were significantly less than those of hens fed diet contained high Zn, low Na as induced molting agents as well as the control diet for 4, 8 and 12 days. However, Soliman (1993) reported that there were no significant differences between fasting and high Zn fed commercial flocks of hubbard broiler breeder. The decrease in liver weight of aluminum sulfate and the mixture of ZnO & Al2(SO4)3 groups were due not only to removal of liver energy stores (glycogen and Lipid) but presumably also to the loss of estrogen dependent egg component synthesis. The liver is the site of yolk phospholipoprotein synthesis, which is dependent on ovarian steroids (estrogens) (Sturkie, 1976).

Table 5. Effect of feeding different dietary treatments on liver, ovary and oviduct weights of Norfa (N) and Fayoumi (F) laying hens (±S.E)

Treament	Breed	Liver	Ovary	Oviduct
		wt (g)	wt (g)	wt (g)
(Z)	N	40.3±0.16	19.6±0.56	25.3±0.31
	F	43.6±0.24	17.8±0.52	20.4±0.62
	X	42.0±0.21a	18.7±0.52cb	22.8±0.45c
(AL)	N	25.8±0.11	31.6±0.12	38.0±0.11
	F	33.8±0.14	37.6±0.12	31.4±0.10
	X	29.8±0.13bc	34.6±0.12a	34.7±0.11b
(ZAL)	N	27.4±0.36	4.0±0.30	9.5±0.53
	F	30.3±0.14	7.5±0.77	11.6±0.48
	X	28.9±0.25c	5.7±0.54d	10.5±0.51d
(Z-AL)	N	52.4±0.23	22.2±0.56	25.2±0.55
	F	42.8±0.14	27.2±0.60	20.4±0.50
	X	47.6±0.19a	24.7±0.58b	22.8±0.53c
(Al-Z)	N	39.8±0.37	12.2±0.84	21.4±0.31
	F	45.4±0.31	8.4±0.65	11.2±0.50
	X	42.6±0.34a	10.3±0.75cd	16.3±0.41cd
(C)	N	30.9±0.22	20.1±0.40	61.5±0.42
	F	46.2±0.34	17.9±0.67	31.6±0.79
	X	38.6±0.28ab	19.0±0.54cb	46.6±0.61a

Ovary and Oviduct weights:

Table (5) presents ovary and oviduct weights of Norfa and Fayoumi hens fed on diffeent dietary treatments.

Using mixtures of aluminum sulfate and zinc oxide as force molting caused significant decrease in weight of the ovary and oviduct as compared to the other groups. On the other hand, the ovarian weight of hens fed aluminum sulfate was significantly ($P \leq 0.05$) heavier than that of the other groups. The oviduct weights of control hens, however, were significantly ($P \leq 0.01$) heavier than those of the treated groups. McCormick and Cunningham (1984b), Berry and Brake (1985), Breeding et al. (1992) and Soliman (1993) concluded that feeding high zinc as a means of inducing a forced rest affects a marked and rapid reduction in ovary and oviduct weights. The effectivenss of zinc to induce the cessation of lay is due, at least in part, to a direct inhibitory action on ovarian granulosa cell function both in differentiating and in preovulatory follicles (Johnson and Brake, 1992).

Back skin (BT) and rectal (RT) temperatures and respiration rate (RR):

Table (6) clearly indicates that there were no significant differences in back skin temperature among the treated groups and between either both breeds or during and post molting. An opposite trend was noticed in rectal temperature among treatments groups, breeds and periods where the differences were significant (P 0.01).

In the mean time, respiration rate (RR) was ($P \leq 0.01$) comparatively higher in the treated groups than that of the control. During molting, the respiration rate (RR) in both breeds significantly differed from those recorded at post molting ($P \leq 0.01$). However, no breed differences in (RR) were obtained in this concept.

Zinc oxide and aluminum mixture could be recommended for molt inducing in Norfa and Fayoumi chickens.

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Table 6. The back skin, rectal temperatures and respiratory rate (BT, RT and RR) for Norfa (N) and Fayoumi (F) hens during and postmolting (X±S.E.)

Treatment	Breed	BT During molting	BT Post molting	BT overall average	RT During molting	RT Post molting	RT overall average	RR During molting	RR Post molting	RR overall average
(Z)	N	35.8±0.38	36.1±0.35	36.0	40.7±0.16	40.5±0.12	40.6	44.7±4.1	39.0±3.4	41.9
	F	34.5±0.55	35.5±0.22	35.0	40.1±0.80	40.9±0.08	40.5	40.0±3.5	35.6±3.0	46.8
	Av.	35.2	35.8	35.5	40.4	40.7	40.5c	42.4	46.3	44.3ab
(AL)	N	35.8±0.46	35.2±0.35	35.5	40.6±0.13	40.9±0.08	40.8	40.1±3.0	49.8±5.6	45.0
	F	34.8±0.88	34.7±0.87	34.7	40.5±0.13	41.0±0.01	40.8	46.7±3.8	53.3±4.2	50.0
	Av.	35.3	35.0	35.1	40.6	41.0	40.8a	43.4	51.6	47.5a
ZAL	N	35.5±0.60	35.8±0.31	35.6	40.8±0.17	41.0±0.12	40.9	41.3±3.6	52.2±3.5	46.7
	F	35.6±0.78	35.4±0.18	35.5	40.3±0.12	40.5±0.32	40.4	36.9±2.8	51.5±2.5	44.2
	Av.	35.6	35.6	35.6	40.6	40.8	40.6bc	39.1	51.9	45.5ab
Z-Al	N	35.7±0.77	35.7±0.22	35.6	40.6±0.18	40.8±0.13	40.7	39.8±2.3	46.3±3.0	43.0
	F	35.9±0.53	36.1±0.28	36.0	40.8±0.11	40.8±0.13	40.8	34.5±2.3	41.6±3.3	38.0
	Av.	35.8	35.9	35.8	40.7	40.8	40.7ab	37.2	44.0	40.5bc
(AL-Z)	N	35.8±0.77	35.7±0.25	35.7	40.6±0.14	41.0±0.01	40.8	42.4±2.5	54.5±4.2	48.5
	F	35.8±0.76	35.0±0.24	35.4	40.5±0.14	40.7±0.18	40.6ab	34.3±3.5	47.7±3.4	41.0
	Av.	35.8	35.4	35.6	40.6	40.9	40.7	38.4	51.1	44.7ab
(C)	N	35.4±0.78	35.5±0.34	35.5	40.9±0.14	40.4±0.25	40.7	36.5±2.2	39.0±3.0	37.8
	F	35.5±0.85	35.0±0.26	35.3	40.6±0.14	40.9±0.08	40.8	33.6±3.7	41.4±3.2	37.5
	Av.	35.5	35.3	35.4	40.8	40.7	40.7ab	35.1	40.2	37.6c

Average air temperature during expermintal period was 27.2°C.

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تأثير القلش الاجبارى على الأداء وبعض المقاييس الفسيولوجية للدجاج البياض

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قسمت ١٥٠ دجاجة من كل من النورفا والفيومى الى ٦ مجاميع مقارنة (كل مجموعة ٢٥ دجاجة). غذيت مجاميع التجربة على العليقة العادية المضاف إليها ٢٠,٠٠٠ جزء فى المليون أكسيد زنك لمدة ٨ أيام، ٠,٣٪ كبريتات الومنيوم لمدة ١٧ يوم ، ١٠,٠٠٠ جزء فى المليون أكسيد زنك + ٠,١٥٪ كبريتات ألومنيوم لمدة ١٢ يوم و ٢٠,٠٠٠ جزء فى المليون أكسيد زنك لمدة ٤ أيام تبعها ٠,٣٪ كبريتات الومنيوم لمدة ٨ أيام تبعها ٢٠,٠٠٠ جزء فى المليون أكسيد زنك لمدة ٤ أيام ومجموعة الكنترول. وسجلت نتائج انتاج البيض والغذاء المأكول وأوزان الكبد والمبيض وقناة المبيض ونسبة النفوق ودرجة حرارة الظهر والمجمع ومعدل التنفس وكانت النتائج المتحصل عليها كالآتى :

١- انتاج البيض فى مجاميع النورفا المعاملة بأكسيد الزنك وكبريتات الألومنيوم ثم اكسيد الزنك والكنترول كانت أعلى من مجاميع الفيومى المتناظرة. والعكس صحيح للمجاميع أكسيد الزنك + كبريتات الومنيوم واكسيد الزنك ثم كبريتات الومنيوم وكبريتات الألومنيوم وذلك قبل القلش.

٢- أثناء القلش كان إنتاج البيض للنورفا أعلى من الفيومى ماعدا مجموعة أكسيد الزنك + كبريتات الألومنيوم والتى كانت متساوية فى كلا النوعين.

٣- انخفض انتاج البيض فى الفيومى أثناء القلش فىكل المجاميع المعاملة بالمقارنة بفترة ماقبل القلش أو بالكنترول أثناء فترة القلش .

كل المجاميع التجريبية عادت فى فترة مابعد القلش لمستوى انتاجها من البيض قبل القلش ماعدا مجموعة كبريتات الألومنيوم ثم أكسيد الزنك والتى كانت أعلى من فترة أثناء القلش ولكنها ظلت أقل من فترة قبل القلش.

٥- الغذاء المأكول اليومى أثناء فترة القلش لمجموعتى أكسيد الزنك وأكسيد الزنك + كبريتات الألومنيوم انخفض بمعدل ٥٠٪ عن المستهلك بواسطة الكنترول وأثناء القلش وبعد القلش .

٦- الدجاج المعامل بكبريتات الألومنيوم لم يتأثر في هذا المضمار والمجموعتين أكسيد الزنك ثم كبريتات الألومنيوم وكبريتات الألومنيوم ثم أكسيد الزنك كانت تتوسط القيم أثناء فترة القلش .

٧- نسبة النفوق لمجموعة الكنترول كانت أعلى من المجموعات المعاملة.

٨- وزن الكبد للدجاج المغذى على كبريتات ألومنيوم وأكسيد الزنك + كبريتات الألومنيوم كان أخف معنويا عن مجاميع المعاملات الأخرى والكنترول والعكس صحيح لمجموعة الدجاج المغذى على اكسيد الزنك ثم على كبريتات الزنك .

٩- أدى استعمال مخلوط أكسيد الزنك مع كبريتات الألومنيوم الى انخفاض في وزن المبيض وقناة المبيض أكثر من المجاميع الأخرى بينما كان وزن المبيض أثقل معنويا للدجاج المغذى على كبريتات الألومنيوم وكان وزن قناة المبيض أثقل معنويا لدجاج الكنترول عن المجاميع الأخرى .

١٠- لم يكن هناك اختلاف معنوى في درجة حرارة الظهر بين المجاميع التجريبية أو بين النوعين وكذا بين فترتى أثناء القلش وبعد القلش والعكس صحيح لدرجة حرارة المجمع. اختلف معدل التنفس اختلاف معنويا بين المعاملات التجريبية وبين فترتى أثناء القلش وبعد القلش .