Global Journal of Scientific Researches
Available online at gjsr.blue-ap.org
©2014 GJSR Journal. Vol. 2(4), pp. 105-110, 30 April, 2014
E-ISSN: 2311-732X

Effect of genotypes, storage periods and feed additives in broiler breeder diets on embryonic and hatching indicators and chicks blood parameters

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Received: 25 March, 2014 *Accepted: 10 April, 2014* *Published: 30 April, 2014*

ABSTRACT

The current study was conducted in the college of agriculture – University of Anbar – Iraq, for the period from 1-3-2011 to 5-4-2011, (810) eggs were used from two broiler breeders: Arbor acres and Ross (308) of 42 weeks of age. The study aimed to know the effect of genotype of broiler breeders and storage periods (1, 5, 9 days), in addition to explore the effect of the feed additives of ginger and/or celery seeds (by 0.25 and/or 0.50 each) in broiler breeders diets on certain embryonic biomarkers: number of somites pairs at the age of 3 days (SB) and the weight of the embryo at the age of 7 and 14 days (Ewt7 ; Ewt14) weight of the hatched chicks (Htw), the percent of hatching (Hat) and certain biochemical traits of hatched chicks (PCV, WBC, Glucose, Protein and Cholesterol). Results showed significant differences between the two genotypes in hatched chicks' indicators might be the reason in varying the performance of the resultant broiler birds, the study also showed better results in storage treatments of 1 to 5 days than 9 days in most studied characteristics. In addition, it has been observed important improvement in the characteristics of embryos and hatched chicks in feed additive treatments of ginger and celery seeds comparison with control. We can pretend that this study contribute to get chicks with good and health specification, and of high production value.

Keywords: Broiler breeders, genotype, storage periods, feed additives, ginger, celery seeds.

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INTRODUCTION

The healthy chicks are considered the final and the important product in the hatchery industry, since it is the main way to increase production, improving the quantity and the number of the hatched chicks would be achieved in concentrating on number of factors that influence this result, and the importance of the embryonic stages which are considered the main foundation of the healthy chicks and the pro-embryonic growth (Al-Murrani, 1978), where the genetics play an important role in this stage (Muramatsu, 1990, Eitan, and Soller, 2002). Eggs storing on the other hand is considered a routine treatment and must be adopted, which affect the embryonic evolution which eventually affect the quality and the hatching percentage (Petek, 1990). In addition to that maternal diet is considered the determinative factor to improve the embryonic stage through supplying all the requirements of all nutrients in the egg (Wilson, 1997), or through improving the antioxidant system during embryonic growth and the pro-embryonic stages (Surai,1999), which is provided by many additives, where many important elements are transferred from hen to the embryos via the yolk, like vitamin E and the Selenium and others (Surai, 2000), as well as many phenolic compounds featured in the crushed ginger and celery seeds (MohammedSaeid, 2012), their concentration can be increased by adding them to maternally diets to improve the embryonic tissues and reduce its sensitivity to lipid oxidation (Osman, 2010). Speak, (1998) confirmed that chicken embryo's tissues are sensitive to effective oxygen due to the high content of unsaturated long chain fatty acids, which reduced the hatching percentage because of the increased percentage of destructible embryos. Due to the lack of studies concentrating on the role of feed additives, the period of storing or the variation in genotype to the modern broiler breeder

chicks, indicating the vital growth of embryos and the hatching chicks, this study has been conducted to point out these important factors.

Materials and Methods:

This study was carried out in the college of agriculture– Univ. of Anbar– Iraq, from 1/3/2011 to 4/5/2011. (810) eggs of two flocks Arbor Acers and Ross (308) of 42 weeks of age were bought from the state foundation for agricultural researches and used for this study. They were fed in nine different ways: The first was standard diet without additives (energy: 2870 K calories with 16.12% protein), the second and third were standard diet with 2.5 and 5 Kg/ton of ginger crush respectively, the fourth and the fifth were diet with 2.5 and 5 Kg/ton of crushed celery seeds, the sixth, seventh eighth and ninth diets with 2.5 and 2.5 Kg/ton; 2.5 and 5 Kg/ton; 5 and 2.5 Kg/ton; 5 and 5 Kg/ton of both ginger and celery seeds respectively. Hatching eggs were collected and numbered and then stored in cold store (11 degree Celsius) for three storage phases (1, 5 and 9 days), then were put in a private hatchery in Heet - Anbar/ Iraq (Alfurat Hatchery). The following characteristics were measured: number of somite pairs at 3days; weight of the embryo at 7 and 14 days. Eggs were divided such as: three eggs in each group (two groups at three periods of storing and nine feeding treatments = 54 groups), while the rest of the eggs were assigned to the percentage of hatching and chicks weights at hatching time. Blood samples were collected from hatching chicks at the hatching time through Jugular veins with EDTA, then the plasma were separated then stored, and the following test were conducted: PCV, WBC, Glucose, total protein, cholesterol. Statistical analysis were conducted according to CRD and a comparison between the means were made using Duncan test (1955) with statistical program (SAS, 2001).

RESULTS AND DISCUSSION

Table (1) shows that the weight of the embryos at the age of 7 days was 0.88g for both of genotypes, while at the age of 14 days, the weight was 17.16 and 17.30g for Arbor acres and Ross genotypes respectively, without any significant differences. Significant differences can be notices between the genotypes in chicks weight (table 1), Arbor acres flock exceeded the Ross 308, but the hatching ratio was decreased, and with the blood biochemical characteristics, it was notable that the Arbor acres exceeded the Ross with the concentration of glucose and the protein in the blood serum.

The average of embryos weight at the age of 14 days was heavier than what (Muramtsu, 1990) had expected which is (12) g, this could be because of the genetic progress resulted by a selection of the growth rate in hybrid, which reflects the variation in the growth speed of embryos. Regarding the superiority of Arbor acres in body weight of hatched chicks was due to the benefit that this type of hybrid had taken from the nutritional compounds deposited in the egg, which the hens have convert them from the diet to the egg (Suk and Park. 2001; Aydin and Cook. 2004), eventually increase in the efficiency of benefit by the embryos, which reflected positively on blood characteristics, such as the protein and glucose, which reflect the efficiency of the bio-metabolism (Aydin and Cook 2004), which reflect again on the weight at hatching time showing their activities and vitality. This would agree with Liu, (2003) in proving that effective nutrition to the hen would reflect on its embryos, and then increase in weight at hatching (Kingora, 2011), differences in chicks weight from different breeds can be explained as the percentage of the components of the egg, mainly the yolk (Hynkova, 2004; Suk and Park. 2001), or to the difference in cholesterol concentration in the yolk which is the most important source of feed in embryogenesis (Yilmaz Dikmen and Saha, 2007), those results agreed with what Eitan and seller, (2002) mentioned, which is the selection of high body weight of different hybrid is the reason in increasing muscle mass in the developing embryos causing an increase in heat and then increase in mortality and decrease in the percentage of heavy chick weight hatching.

The hatching ratio was close to that of Al-Murrani, (2002), and we agree with Rosihski and Bednarczyd (2002) and Eitan and Soller (2002) that there are significant differences in the embryogenesis, as well as differences in hatching ratio and the weight at hatching time (Adeleke, 2012). genotypes has heavier chick weight at the time of hatching are lesser hatching ratio, so the selection programs work on increasing body weight in these genotypes followed by an increase in the proportion of embryonic mortality and then reducing the hatchability, and this might be due to the differences among these genotypes in protein synthesis and eventually affecting the embryo weights (Muramatsu, 1990), which is reflected negatively of hatchability, where significant hatching ratio declined in the flock of Arbor acres (80.85%) comparing with Ross (87.87%), where the high body weight at hatching time may lead to reduce the hatching ratio (Hyankova, 2004; and Yu, 1998).

Table 1. Effects of genotype on certain embryonic development indicators, hatchability, and biochemical characteristics of hatched chicks

Breed*		SB	Ewt7 (gm)	Ewt14 (gm)	Hwt. (gm)	Hat(%)	PCV	WBC	Glu	Pro	Cho
Arbor Acres	µ	39.13	0.88	17.16	a 44.02	b 80.85	31.46	24555	a 136.67	a 3.34	437.25
	Std.	0.93	0.02	0.56	0.41	0.37	0.89	23.79	3.32	0.36	11.37
Ross	µ	38.79	0.88	17.30	b 43.25	a 87.87	30.67	24991	b 131.10	b 3.23	438.89
	Std.	1.07	0.19	0.51	0.44	0.26	3.77	47.58	5.47	0.28	13.96
Total	µ	38.44	0.89	17.22	43.65	84.35	30.95	24810	133.88	3.29	438.07
	Std.	2.38	1.16	2.38	0.39	1.23	1.55	52.53	7.51	0.44	11.64

* [a—c] Mean values within a column with no common superscript differ significantly (P ≤0.05).

*SB=somites pairs, Ewt= embryonic waight, Hwt=Hatch waight, PCV=Pocked cell volume, WBC=white blood cells, Glu=glucose, Pro=protein and Cho=cholesterol

Table (2) shows significant differences in most of characteristics under study, where embryonic development indicators showed significant differences in the number of somites pairs favorable of the second treatment (5 day storing), which exceeded the first treatment, also regarding the weight of the embryo at the age of 14 days, the second treatment exceeded the third, and the weight in the first treatment exceeded that in the third (9 day storing) and was not different from the second (5 day storing). Regarding the hatching ratio, the second treatment exceeded the third, and the blood biochemical characteristics showed that the first treatment has exceeded all of the rest treated (except for the white blood cells).

It can be seen from table (2) that five day storing has significantly increased number of embryonic indicators: somites pairs at the age of three days which significantly exceeded the other treatments, and the weight of the embryo at the age of 14 days, this result can be explained through the effect of the storing period on the metabolic activities of the embryo, and therefore on the rate of growth and the formation of the different tissues, which reflect on the increase in the weight of the embryos and thus the hatching chicks (Reis, 1997).

Regarding the weight of chicks during hatching, this result agrees with what (Fasenko, 2002; Reis, 1997) came up with, and that is the hatching chicks at production day is heavier than the those hatched from eggs stored for many days, as the weight decreases gradually and significant with the storage periods (Ruiz and Lunam. 2002), and this might be due to that long period storing affect the albumin PH (Dawes. 1975) causing the loss of the quality of albumin, since the fluidity of albumin works on decreasing the gas penetration and lower loss of carbon dioxide and thus an increase in embryonic mortality and lower rate of hatching with longer storing periods (Lapao, 1999). Besides the low hatching rate and increase in embryonic mortality with longer storing periods can be due to the incapability of embryos to keep a suitable amount of glycogen in the muscles and the heart (Fasenko. 2007) or the increase in the number of dead cells (Reijrink, 2010) and therefore an increase in embryonic deformation and incapability of hatching (Decuypere and Bruggeman, 2007).

The reaction of this is clear on the biological blood indicators, which indicated the health of the hatched chicks from the control group in most of the characteristics. The results of this study does not agrees with what Petek, (2006) came up with, which he mentioned that there is no effect of the storing periods on hatching rate when he compared the effect of storing period of 14 storing groups (from 1 to 14 days), he interpreted the reason to the differences of the species and genotype.

Table 2. Effects of storage periods on certain embryonic development indicators, hatchability, and biochemical characteristics of hatched chicks

Storage		*SB*	*Ewt7*)*gm*(	*Ewt14*)*gm*(	*Hwt.*)*gm*(	*Hat* (%)	*PCV*	*WBC*	*Glu*	*Pro*	*Cho*
1	*µ*	*c* 36.37	0.890	*ab 17.27*	*a 44.25*	*ab 85.07*	*a 33.01*	*b 24871*	*a 140.72*	*a 3.35*	*a 461.27*
	Std.	1.795	0.090	1.610	0.160	0.210	0.860	11.860	13.560	0.560	12.560
5	*µ*	*a* 40.66	0.890	*a 17.50*	*b 43.63*	*a 87.61*	*c 28.67*	*a 26780*	*a 139.76*	*a 3.38*	*b 439.17*
	Std.	0.996	0.030	0.520	0.360	0.510	1.230	23.990	8.560	0.560	19.560
9	*µ*	*b* 38.36	0.880	*b 16.78*	*c 42.96*	*b 80.59*	*b 30.06*	*c 23602*	*b 122.02*	*b 3.15*	*c 410.68*
	Std.	1.072	0.050	0.720	0.380	0.370	0.790	16.790	4.600	0.600	15.600
Total	*µ*	38.440	0.890	17.220	43.650	84.350	30.950	24810	133.880	3.290	438.070
	Std.	2.380	1.160	2.380	0.390	1.230	1.550	52.530	7.510	0.440	11.640

* [a—c] Mean values within a column with no common superscript differ significantly (P ≤0.05).

*SB=somites pairs, Ewt= embryonic waight, Hwt=Hatch waight, PCV=Pocked cell volume, WBC=white blood cells, Glu=glucose, Pro=protein and Cho=cholesterol

Table (3) shows significant differences in many indicators and characteristics under this study between feeding treatments on different ratios of the food additives, it is noticed significant superiority for most treatment characteristics under study compared with control treatment, best treatments in somites pairs at the age of 3 days were the third, sixth, eighth and ninth treatments which were 40.71, 39.63, 39.72, and 35.94 respectively. While the fourth and control treatment recorded the lowest

rates with an average of 34.94 and 35.94 g respectively. Also the weight of the embryo at the age of 7 days for the fifth, sixth and ninth treatments significantly exceeded the rest of the treatments and they were 0.93, 0.95 and 0.93 g respectively, the fourth treatment came lowest at 0.80 g and treatments: second, third, sixth and ninth came at highest rate of the embryos weight at the age of 14 days which were 18.6., 17.97, 17.93 and 17.23 g respectively. While the first (control) treatment was at the lowest at a rate of 16.05 g.

Second, third, seventh and ninth treatments exceeded the rest treatments regarding the weight of the chicks at hatching and recorded the following readings 43.86, 45.0, 44, 04 and 43.99 g respectively. Control treatment recorded the lowest significant at rate of 41.80 g, whereas the rate of hatching, the results showed that the third, fifth and the ninth treatments exceeded the rest of the treatments, and the first fourth and seventh treatments came in the lowest and were 78.7, 78.78 and 77.83 % respectively.

Table 3. Effects of feed additives on certain embryonic development indicators, hatchability, and biochemical characteristics of hatched chicks

Treatments		SB	Ewt7 (gm)	Ewt14 (gm)	Hwt (gm)	Hat (%)	PCV	WBC	Glu	Pro	Cho
t1	µ	d 34.94	ab 0.90	c 16.05	c 41.80	c 78.70	b 29.01	abcd 24971	137.35	b 3.23	cd 425.0
	Std.	1.67	0.13	1.51	0.92	0.43	1.48	21.48	11.92	0.34	22.94
t2	µ	b 38.66	ab 0.89	a 18.60	a 43.86	b 84.78	ab 31.14	abc 24614	131.87	ab 3.38	ab 464.2
	Std.	2.42	0.23	1.22	0.97	0.83	2.49	18.59	4.74	0.91	15.94
t3	µ	a 40.71	bc 0.85	a 17.97	a 45.00	a 88.70	c 26.02	a 27352	129.78	b 3.25	a 475.3
	Std.	2.71	0.13	2.09	0.37	0.66	11.90	23.48	0.64	0.64	16.94
t4	µ	cd 35.94	c 0.80	bc 16.99	ab 43.73	c 78.78	a 32.73	d 22636	133.79	b 3.13	cd 420.3
	Std.	2.41	0.01	2.12	0.23	0.43	1.38	31.28	1.01	1.73	11.21
t5	µ	b 38.54	a 0.93	bc 16.75	b 42.89	a 88.70	a 32.10	ab 26104	127.39	ab 3.38	cd 422.3
	Std.	1.91	0.13	1.23	2.91	0.67	2.11	42.48	7.94	0.88	21.91
t6	µ	ab 39.63	a 0.95	a 17.93	ab 43.73	ab 85.00	b 28.96	abc 25620	135.33	a 3.52	d 404.3
	Std.	1.22	0.09	3.99	0.02	0.41	1.77	18.43	21.92	0.82	21.92
t7	µ	bc 36.37	bc 0.85	bc 16.93	a 44.04	c 77.83	ab 30.67	cd 23133	137.50	b 3.26	abc 442.8
	Std.	2.90	0.12	2.09	1.92	0.88	1.54	34.23	17.12	2.31	19.22
t8	µ	ab 39.72	bc 0.85	bc 16.62	ab 43.60	ab 85.00	a 32.03	bcd 23906	133.02	b 3.22	bcd 435.5
	Std.	2.14	0.10	5.92	3.91	0.61	1.35	25.41	9.92	0.89	12.23
t9	µ	ab 40.61	a 0.93	ab 17.23	a 43.99	a 92.61	a 31.57	ab 26131	138.74	b 3.20	abc 450.8
	Std.	1.01	0.01	4.01	0.48	1.33	1.22	23.54	16.24	0.18	31.54
Tot	µ	38.44	0.89	17.22	43.65	84.35	30.95	24811	133.88	3.29	438.07
al	Std.	1.38	1.16	2.38	0.39	1.23	1.55	52.53	7.51	0.44	11.64

* $^{a-c}$ Mean values within a column with no common superscript differ significantly ($P \leq 0.05$).

*SB=somites pairs, Ewt= embryonic waight, Hwt=Hatch waight, PCV=Pocked cell volume, WBC=white blood cells, Glu=glucose, Pro=protein and Cho=cholesterol

The blood indicators showed noticeable contrast between the treatments where the PCV of the fourth, fifth eighth and ninth treatments, while the third treatment recorded the lowest rate of 26.02, whereas regarding the WBC the third treatment recorded the highest rate, while the fourth recorded the lowest rate, the sixth treatment exceeded the rest of the treatments regarding the overall plasma protein of a value of 3.52 (g/100 ml), whereas regarding the cholesterol the results showed that the second and the third treatments exceeded at a rate of 464.2 and 475.3 (mg/ 100ml) while the first, fourth fifth and the sixth recorded the lowest rate.

The superiority of the food additives treatments of the broider breeders, especially the embryonic indicators, when compared with the control treatment could be due to the benefit from those additives in supplying and transferring food ingredients and components to the egg, where the success of the hen in supplying the perfect habitat (inside the egg) such as the nutrients to the embryos, can be the main factor in boosting the embryonic evolution in the right direction, and this agrees with Aydin and Cook.(2004) and Kingora (2011) where the quality of nutrients of the diet directly affect the combination of the fatty acids of the embryos and hence reduce of embryonic mortality and increase the vitality of the embryos and the hatching rate, where Surai (2000) and Osama, (2010) mentioned that Selenium and vitamin E have an important role in concentrating the Glutathione in the liver and eventually improving the antioxidant system during embryonic evolution. Rocha, (2010) assured that adding materials has an antioxidant function in the diet of the broider breeders has improved the oxidation resistance of the chicks.

The higher vital indicators of the embryos reflected positively on the weight and the hatching rate of the chicks, the results of this study agreed regarding the improvements of the hatching rate of the treatments with food additives with (MohammadSaeid. 2012), who mentioned that a lot of active materials exists in the crushed ginger and celery seeds has improved the hatching rate, since the ginger contains components like flavonoids, limoin and vitamins E and C (Shalaby and Zorba. 2010), as well as a great amount of feed elements, minerals and vitamins that are considered important in the growth of the embryos (Lu, 2003). The suitable nutrition habitat works on reaching the hatching stage with high vitality enabling the chicks to continue their activities (Wilson. 1997), which was clearly reflected on the vital indicators of the blood physiology of the hatching chicks regarding the exceeding in the blood characteristic to the treatments with feed additives, which is agreed upon by Latour, (2000)

that the feed additives to the broider breeders diet have improved the total protein and cholesterol level and other indicators in the hatched chicks plasma. The differences between the genotypes in most of the vital indicators of the embryos and the hatched chicks might be the reason in varying the performance of the broider breeders, so we might need to conduct more studies to figure out the relation between the embryo's characteristics and the production performance.

It can be concluded that we should look carefully at the progeny's physiology due to the effect of the active materials that transferred from dams to the eggs, it is clear that there are differences between important characteristics of embryos and chicks under the study because of different genotypes or storage periods, as well as the role of feed additives to the ginger crush and celery seeds which worked of improving characteristics of the produced chicks. We think that the new foundation to understand the fact that good chicks can be obtained through concentrating on the role of all of the factors acting on the embryos and the chicks which facilitate accomplishing the perfect balance to the health, and eventually can submit the current results as an important solutions to the problems that face the produced chicks in the hatching industryr.

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