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INFLUENCE OF POSTHATCH DEVELOPMENTAL CHANGES IN THE DIGESTIVE TRACT ON DIGESTIVE ENZYMES ACTIVITY AND BROILERS PERFORMANCE.

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ABSTRACT

. The developmental patterns of digestive tract growth and some digestive enzymes activity have been studied in two broiler strains at the first day post-hatching, 2, 4 and 6 weeks of age. The strains used were Hubbard (A) and Arbor acres (B), unsexed, day-old broiler chicks. Growth performance data and digestive tract length were recorded. The intestinal contents of proventriculus (P); duodenum (D); jejunum (J) and ileum (I) were collected, weighed and kept in equal quantities of buffer saline unitl used in the determination of amylase, lipase, trypsin and chymotrypsin activities during different growth periods. Some blood plasma enzymes, RBC's count, haemoglobin concentration and heterophil to lymphocytes ratio were also examined.

The results showed significant ($P \leq 0.05$) strain differences in body weight, weight gain, feed intake and feed conversion ratio. Starin A surpassed strain B in all growth performance parameters studied, which reflect their different genetic background. Moreover, strain A has better feed conversion (2.10) than strain B (2.18) during the whole experimental period.

Digestive tract length increased rapidly from post-hatching to the second week of age, with the most pronounced increases in duodenum, pancreas, jejunum and ileum. In generel, there were significant strain differences in the rate of growth of different intestinal segments during the whole experimental period. From the physiological point of view, these intestinal segments, (D, Panc, J,. and I) are considered as early mature parts due to their importance as sites of digestive enzymes secretion or nutrients digestion and absorption.

Results showed also that amylase activity was higher in all intestinal segments studied except in proventriculus contents due to its acidic environment. This enzyme increased post-hatching till the 4th week of age and then decreased. Lipase activity increased during the experimental period and reached its maximum level between 4 and 6 weeks of age. Moreover , lipase activity was higher ($P \leq 0.05$) in duodenum, and jejunum than in ileum and proventriculus. A significant ($P \leq 0.01$) strain differences in lipase activity were observed which reflect their different obesity (fatness). Trypsin and chymotrypsin activities were higher at 2 and 4 weeks of age and then significantly ($p \leq 0.05$) decreased in both strains, due to the higher rates of protein turnover from digestive tract to muscles building during the first period.

There were significant strain and age differences in all blood parameters studied except the activity of LDH in blood plasma. Howevr., plasma LDH activity increased with age and reached its maximum level at 6 week of age. Furthermore, alkaline phosphatase (AP) activity in blood plasma significantly ($P \leq 0.05$) decreased with age, although higher values were observed during the first growing period (up to 4 wk) , that coincident with the higher osteoblastic activity.

Finally, considerable variations in Hb concentration and RBC'S counts were also observed in both strains, and also in H/L ratio which indicates that strain A was more sensitive to different stressors than strain B.

It is concluded that the developmental growth pattern of the digestive tract in broiler chicks exceeds that of the whole body during early post-hatching period. Also,

the digestive enzymes that measured in the present study, reach their maximal activity at different periods, which makes the dietary addition of exogenous enzymes during the whole growth period is questionable and needs further study.
Keywords: broilers, digestive enzymes, growth performance, blood constituents).

INTRODUCTION

The gastrointestinal tract of the newly hatched chicks is in continuous process of development and maturation. Many studies indicate that the digestive system is a limiting factor in food intake, digestion and absorption and subsequently growth during the first period post hatching (Sell, *et al.*, 1991; Mahagna and Nir, 1996; Yamauchi and Tarachai , 2000). It should be pointed out that the digestive tract development, especially duodenum, jejunum and pancreas in the modern chicken strains takes place during 6 to 8 days posthatching (Noy and Sklan 1996).

Sturkie, (1986) showed that the pancreatic secretion of domestic fowl chicks contained proteolytic, amylolitic and lipolytic enzymes, but the activities of these enzymes were poorly developed until seven days after hatching. However, determination of the total enzyme activities close to hatching has indicated an increase in intestinal trypsin, amylase, and lipase, all of which were correlated with both intestinal length and body weight (Sklan and Noy, 2000, Sklan, 2001 and El-Wardany *et al.*, 2003).

Mahagna and Nir, (1996) showed that the intestinal contents of broiler type chicks exhibited lower activities of amylase, lipase , trypsin and chymotrypsin compared with egg-type chicks during the first four days post hatching. These findings suggest that the production of pancreatic enzymes is triggered by feed intake and that they are secreted at relatively constant amounts per feed intake as the chick grows (Tarvid, 1995 and Sklan, 2001).

The present study was conducted to evaluate digestive enzymes activity in two broiler chick strains differing in their genetic background and to obtain some information about growth performance and some blood constituents related to post-hatching transition from embryonic endogenous feeding to digestive system – dependent exogenous feeding.

MATERIALS AND METHODS

The present study was carried out at the Poultry Physiology Laboratory, Faculty of Agriculture, Ain Shams University during summer months.

A total number of 300 one – day old chicks from two broiler strains (A and B) were used in this study. Chicks of each strain were housed in battery cages under continuous lighting regimens. They were fed on a starter diet during the first three weeks post-hatching, thereafter, the finisher diet was fed till the end of the experimental period. Table (1) shows nutrients composition and calculated analysis of the experimental diets.

Table (1): Formulation and nutrients composition of the experimental diets

Ingredients %	Starter	Finisher
Yellow carn	64.97	69.70
Soybean meal (48%)	25.24	21.50
Concentrate (52%)*	9.41	8.35
Bone meal	0.30	0.36
DL-Methionine	0.08	0.09
Calculated composition %		
Crude protein	22.66	20.69
ME (K cal / kg)	3084	3128
Calcium	0.92	0.84
Available phosphorus	0.45	0.42
Lysine	1.23	1.10
Methionine	0.42	0.39
Methionine + Cystine	0.76	0.70

- Each kilogram supplies 2332 ME Kcal / Kg, 7.2% crude fat, 7.7% calcium and 3.1% available phosphorus

Experimental procedures:

On the first day post-hatching and at 2,4 and 6 weeks of age, ten birds from each strain were randomly chosen and necropsies.

Blood samples were collected at 2,4 and 6 weeks of age in heparinaized tubes, centrifuged (4000 rpm for 15 min) and then blood plasma were decanted and stored (- 20 C) until the determination of some blood constituents. Specific activities of lactic dehydrogenase (LDH) and alkaline phosphatase (AP) enzymes in blood plasma were determined using available commercial kits (Bio Merieux, 69280 Mary, l'Etoile, France). Hemoglobin concentration (mg%) in blood and RBc's counts were measured using both laboratory Haemometer and Haemocytometer, respectively. At the same time, blood smears were done to determine heterophils (H) and lymphocytes (L) count and the H/L ratio was recorded and used as physiological indicator of stress as reported by (Maxwell and Robertson 1998). Digestive tract segments and pancreas were removed and their lengths were recorded to the nearest centimeter.

Digestive enzymes activity:

Chicks were slaughtered in a horizontal position to reduce the antiperistalsis movement of the intestinal segments and regurgitation of the food. In order to minimize the possibility of mixing between the contents of the adjacent segments, the gut was clamped with artery forcepses at the end of oesophagus, proventriculus, jejunum, gizzard, duodenum and ileum, then the content of each intestinal segment was collected, weighed and kept in equal volumes of buffer saline solution. The contents were then individually centrifuged (6000 rpm for ten min.) and the supernatant fluids were decanted and used for the determination of some digestive enzymes activity. Amylase activity was determined using the method described by Pinchasov and Noy. (1994), lipase activity according to Sklan, *et al.*, (1975) and both trypsin and chymotrypsin according to sklan and Helevy (1985).

Statistical analysis:

Data concerning the results of growth performance, blood parameters and digestive enzymes activity were analyzed with SAS$^{(R)}$ software using ANOVA procedure (SAS, 1994). Means were separated and compared by using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Growth Performance:

Means (± S.E) for live body weight and body weight gain (BWG) of both strain A and B at different ages are shown in Table (2). It is clear that strain A has significantly higher body weight at 3 and 6 weeks of age. However, both strains were nearly similar in BWG during the period from 3-6 weeks of age. It appears that the growth pattern of both strains during the whole experimental period was not similar which may be due to the genetic background of each strain as previously reported by many authors (Zuprizal, *et al.*, 1993; Berrong and Washburn, 1998; Hammouda, *et al.*, 2001).

Table (2): Effect of strain and age on the growth performance of broiler chicks.

Variable	Age (week)	Strain A	Strain B
Body weight (g)	0	38.40 ± 1.31^a	39.61 ± 1.12^a
	3	750.94 ± 66.18^a	698.86 ± 74.80^b
	6	1712.48 ± 159.75^a	1668.34 ± 148.38^b
Body weight gain (g)	0-3	712.55 ± 62.61^a	659.28 ± 58.43^b
	3-6	962.21 ± 48.48^a	969.59 ± 84.17^a
	0-6	1674.25 ± 136.50^a	1628.69 ± 165.80^b
Feed intake (g)	0-3	958.70 ± 84.15^a	915.92 ± 72.63^b
	3-6	2559.26 ± 180.66^b	2632.33 ± 152.45^a
	0-6	3517.92 ± 208.50^a	3548.22 ± 180.64^a
Feed conversion	0-3	1.35 ± 0.01^b	1.39 ± 0.08^a
	3-6	2.66 ± 0.13^b	2.72 ± 0.16^a
	0-6	2.10 ± 0.12^b	2.18 ± 0.21^a

1. (0) week = one day old

2. a, b, Means with different superscripts within rows are significantly different ($P \leq 0.05$).

Results also show that broiler chicks of strain B consumed significantly less feed than those of strain A during the first period of growth (0-3 weeks of age). This reduction in feed consumption may be due to the differences in growth rate of both strains, as indicated by the higher (BWG) of strain a during this period. On the other hand, feed intake was significantly increased during the second growing period(3-6 weeks of age) in strain B, although their body weight was lower than strain A . In general, the difference between both strains in the cumulative feed intake during the whole experimental period (0-6 weeks of age) was not significant.

Results of feed conversion ratio (Table 2) showed that strain A has significantly better feed conversion ratio compared by strain B during the whole experiment.

2. Digestive tract length (cm) :

Digestive tract segments length (proventriculus, duodenum, pancreas, jejunum, ileum and caecum) are presented in Table (3) . It is clear from the results that both strains have nearly similar intestinal part lengths at the first day post- hatching except jejunum which was significantly longer in strain B. This holds also true for the whole digestive tract length at one day, 2 and 4 weeks of age .

Table (3): Effect of strain and age on the digestive tract length (cm)

Age (Week)	Variable	P[2]	D	Panc.	J	I	C	Total (Dt)[3]
0[1]	Strain A	1.20+ 0.34	6.10 ± 1.14	2.18 ± 0.32	13.67 ± 1.78^{b}	14.03 ± 2.64	4.03 ± 0.62	45.38 ± 3.62^{3}
	Strain B	1.22 ± 0.19	6.87 ± 1.43	2.78 ± 0.49	15.67+ 1.2^{a}	14.20 ± 2.28	4.30 ± 0.68	48.44 ± 2.81^{a}
	Strain effect	NS[4]	NS	NS	*	NS	NS	*
	% change Strain(A)	-	-	-	-	-	-	-
	% change Strain B	-	-	-	-	-	-	-
2	Strain A	2.76 ± 0.11	24.90 ± 1.62^{b}	11.66 ± 1.45^{b}	70.44 ± 8.77	51.30 ± 4.27	11.14± 0.38	170.22 ± 25.36^{b}
	Strain B	2.68 ± 0.41	28.64 ± 7.47^{a}	12.48 ± 0.50^{a}	72.06 ± 8.09	53.06± 8.80	10.42± 1.15	176.66± 18.55^{a}
	Strain effect	NS	*	*	*	*	NS	**
	% change Strain(A)	2.30	4.10	5.30	5.10	3.60	2.80	3.70
	% change Strain (B)	2.20	4 20	4.50	4.60	3.80	2.40	3.70
4	Strain A	3.70 ± 0.49^{b}	25.5 ± 2.08	13.63 ± 0.75	66.13 ± 4.09^{b}	66.75 ± 7.59^{b}	15.63 ± 1.49	192.48 ± 20.15^{b}
	Strain B	4.05 ± 0.33^{a}	25.75 ± 3.86	14.68 ± 1.27	73.00 ± 6.82^{a}	70.38 ± 3.35^{a}	16.20 ± 1.39	204.64 ± 16.73^{a}
	Strain effect	*	NS	*	**	**	NS	**
	% change Strain(A)	1.30	1.02	1.20	0.94	1.30	1.40	1.10
	% change Strain (B)	1.50	0.90	1.20	1.01	1.30	1.60	1.60
6	Strain A	4.75 ± 0.29	27.50 ± 3.11^{b}	12.93 ± 0.94	81.88 ± 10.96	87.0 ± 8.16	18.75 ± 2.70	237.26 ± 23.61
	Strain B	4.38 ± 0.048	29.25 ± 2.06^{a}	13.95 ± 0.67	82.63 ± 5 09	82.06 ± 6.81	19.55 ± 3.93	235.56 ± 20.12
	Strain effect	NS	*	*	NS	*	NS	NS
	% change Strain(A)	1.30	1.10	0.95	1.20	1.30	1.20	1.20
	% change Strain (B)	1.10	1.10	0..95	1.10	1.20	1.20	1.20
0-6	% change Strain(A)	3.96	4.51	5.92^{a}	5.98^{a}	6 21^{a}	4.66^{a}	5.23
	% change Strain (B)	3.59	4.24	5.02^{b}	5.26^{b}	5.77^{b}	4.55^{a}	4.87

1. 0 week = one day old
2. P= proventriculus, D= duodenum,, Panc.= Pancreas, J=Jejunum, I-ileum, C=ceca.
3. DT=Total digestive tract length includes oesophagus, crop and all segments except ceca
4. NS= not significant, * = P ≤ 0.05, ** P ≤ 0.01.

From the first day post-hatching till the second week of age a rapid growth rate of the whole digestive tract was observed for both strains. The most pronounced increases were detected for duodenum (4.1,4.2 fold), Pancreas (5.3,4.5 fold) jejunum (5.1;4.6 fold) and ileum (3.6, 3.8 fold), in strain A and B, respectively.

It is likely that this increase is a consequence of the pronounced increases in feed consumption which take place during this period. These results are in close agreement with those reported by Nitsan, *et al.*, (1991); Murakami, *et al.*, (1992) and Jin, *et al.*, (1998) who reported that the length and weight of the whole digestive tract or its individual segments are changed by increasing feed intake as the birds aged.

After this increase a slower phase of digestive tract segments growth was observed at 4 and 6 weeks of age. The percent of increases were lower in both strains from 2 to 4 and from 4 to 6 weeks of age. However, the present results (Table 3) indicate that from the first day post-hatching to sex week of age (0-6), the proventriculus increased by about 3.96 and 3.59 fold; duodenum by 4.51 and 4.24 fold, pancreas by 5.92 and 5.02 fold; Jejunum by 5.98 and 5.26 fold ; ileum by 6.21 and 5.77 fold, ceca by 4.66 and 4.55 fold, and the whole tract by 5.23 and 4.87 fold; in strain A and B, respectively.

From the physiological point of view, this means that duodenum, pancreas, jejunum and ileum segments are considered early mature segments which reflects their importance as sites of digestive enzymes secretion or nutrients absorption. These findings support the previous results of Uni, *et al*, (1996 and 1999), Jin, *et al.*, (1998) and El-Wardany, *et al.*, (2003) who reported different rates of growth in intestinal segments related to genetic background of chickens strains.

3. Digestive enzymes activity:

Table (4) shows the specific activities of amylase, lipase trypsin and chymotrypsin enzymes in the contents of some intestinal segments in both strain A and B at different ages. It is clear that amylase activity in the duodenum, jejunum, and ileum contents was higher than in proventriculus content in both strains of chickens. Moreover, the results show that amylase activity increased , in all segments studied, after hatching until the fourth week of age and then decreased. The effect of age on amylase activity was significant , while the differences between strain A and B were only significant at the first day post hatching and at 4 weeks of age.

Concerning the activity of lipase, results in Table (4) showed considerable increases after the first day post hatching up to 6 weeks of age in all intestinal segments and in both strains. In contrast to amylase, the activity of lipase enzyme reaches its maximum between 4 and 6 weeks of age. Also, lipase activity was significantly higher in duodenum and jejunum contents than proventriculus and ileum. This may reflect the role of lipase in fat digestion and absorption in the previous segments. Furthermore, it appears from the results that there were significant differences between both strains in lipase activity. This may explain the differences in the weight of abdominal and subcutaneous fat that observed at the end of the experimental period (data not included) .

Table (4) : Digestive Enzymes activity within some intestinal parts in two broiler strains at different ages.

Variable	Age (week)	Strain A				Strain B				Strain effect
		P[2]	D	J	I	P	D	J	I	
Amylase	0[3]	0.22 ± 0.01^{cd}	0.56 ± 0.02^{c}	0.58 ± 0.05^{c}	0.46 ± 0.04^{d}	0.19 ± 0.01^{c}	0.48 ± 0.03^{c}	0.54 ± 0.05^{c}	0.39 ± 0.03^{d}	*
	2	0.32 ± 0.03^{b}	0.89 ± 0.06^{b}	0.93 ± 0.08^{b}	0.85 ± 0.08^{c}	0.28 ± 0.02^{b}	0.92 ± 0.05^{b}	0.87 ± 0.06^{b}	0.85 ± 0.04^{c}	NS[5]
	4	0.42 ± 0.04^{a}	1.22 ± 0.11^{a}	1.12 ± 0.09^{a}	1.32 ± 0.14^{a}	0.38 ± 0.03^{a}	1.09 ± 0.07^{a}	1.26 ± 0.12^{a}	1.16 ± 0.10^{a}	**
	6	0.30 ± 0.01^{b}	0.70 ± 0.08^{c}	0.96 ± 0.08^{b}	1.01 ± 0.09^{b}	0.26 ± 0.02^{bc}	0.92 ± 0.06^{b}	0.88 ± 0.04^{b}	0.99 ± 0.05^{b}	NS
Lipase	0	0.81 ± 0.02^{d}	2.80 ± 0.31^{c}	3.60 ± 0.54^{b}	2.20 ± 0.43^{c}	0.66 ± 0.03^{c}	2.40 ± 0.34^{c}	2.20 ± 0.65^{c}	2.80 ± 0.72^{c}	*
	2	1.10 ± 0.06^{c}	5.90 ± 0.82^{b}	4.50 ± 1.10^{b}	4.60 ± 0.75^{b}	0.93 ± 0.08^{b}	4.90 ± 0.95^{b}	4.20 ± 0.44^{b}	3.63 ± 0.36^{b}	**
	4	2.80 ± 0.63^{b}	9.60 ± 2.10^{a}	8.80 ± 1.40^{a}	6.70 ± 1.60^{a}	2.10 ± 0.23^{a}	9.90 ± 1.30^{a}	9.20 ± 1.80^{a}	5.60 ± 0.77^{a}	**
	6	3.40 ± 0.86^{a}	10.60 ± 1.44^{a}	9.80 ± 1.60^{a}	7.50 ± 1.30^{a}	2.60 ± 0.46^{a}	10.20 ± 1.40^{a}	8.20 ± 0.92^{a}	6.30 ± 0.84^{a}	**
Trypsin	0	4.60 ± 0.63^{c}	5.80 ± 0.86^{d}	4.20 ± 0.65^{c}	4.00 ± 0.55^{c}	3.80 ± 0.52^{d}	4.50 ± 0.73^{d}	4.40 ± 0.65^{c}	4.10 ± 0.41^{c}	NS
	2	52.80 ± 8.30^{a}	43.40 ± 3.70^{a}	26.50 ± 3.10^{a}	22.40 ± 1.20^{a}	48.60 ± 5.80^{a}	44.50 ± 4.60^{a}	31.20 ± 4.20^{a}	28.70 ± 3.10^{a}	**
	4	39.60 ± 5.20^{b}	38.10 ± 4.20^{b}	24.20 ± 3.30^{a}	18.60 ± 1.40^{a}	41.50 ± 6.20^{b}	37.80 ± 4.60^{b}	29.60 ± 3.50^{a}	16.60 ± 1.80^{b}	*
	6	35.50 ± 3.40^{b}	30.20 ± 2.80^{c}	20.10 ± 1.70^{b}	13.30 ± 1.10^{b}	32.40 ± 2.20^{c}	27.20 ± 3.10^{c}	18.60 ± 1.40^{b}	12.90 ± 1.20^{b}	NS
Chymo-trypsin	0	3.10 ± 0.81^{d}	2.80 ± 0.35^{c}	2.60 ± 0.24^{c}	2.20 ± 0.30^{b}	2.40 ± 0.22^{c}	2.40 ± 0.31^{c}	2.20 ± 0.16^{b}	1.99 ± 0.04^{c}	*
	2	10.60 ± 1.80^{b}	12.30 ± 2.10^{a}	10.40 ± 1.10^{a}	8.60 ± 1.20^{a}	13.60 ± 2.30^{a}	13.20 ± 1.80^{a}	10.50 ± 1.80^{a}	10.40 ± 2.10^{a}	NS
	4	14.60 ± 2.80^{a}	13.90 ± 1.70^{a}	11.40 ± 1.20^{a}	8.80 ± 0.98^{a}	13.80 ± 1.50^{a}	12.80 ± 1.80^{a}	12.20 ± 2.30^{a}	8.60 ± 1.20^{b}	NS
	6	5.30 ± 0.32^{c}	5.00 ± 0.28^{b}	5.20 ± 0.41^{b}	3.80 ± 0.13^{b}	5.80 ± 0.64^{b}	4.80 ± 0.42^{b}	4.20 ± 0.44^{b}	3.60 ± 0.23^{c}	*

1. Data expressed as unites / gram of intestinal contents.
2. P = proventriculus, D= duodenum, J = jejunum, I = ileum
3. o week = one day old
4. 4- a,b… Means with different superscripipts within columns are significantly different ($P \leq 0.05$)
5. NS = not significant,* = $P \leq 0.05$, ** = $P \leq 0.01$

On the other hand, trypsin and chymotrypsin activities were dramatically increased at 2 and 4 weeks of age and then decreased significantly in both strains. The effect of strain was significant at this period of growth for trypsin activity but not for chymotrypsin.

It is likely that this increase in trypsin activity and also chymotrypsin (although insignificant) reflects the higher rates of protein turnover from digestive tract to build muscles during this period, and thus needs higher proteolytic enzymes activity.

From the previous results, it is clear that a limited synthesis of digestive enzymes was recorded at the first day post-hatching and then a gradual increase was observed around the 2 to 4 weeks of age. It appears also that chicks are hatched with some reserves of pancreatic enzymes produced during the late embryonic growth period.

The present results are consistent with those reported by Nitsan, *et al*, (1991) and Noy and Sklan. (1995, 1999) who suggest that adaptation of birds to exogenous feed was associated with increases in gastrointestinal tract length , weight and the specific activities of digestive enzymes.

It is also of great importance to notice that, the maximum enzymes activities were recorded around the second and the fourth weeks of age for all enzymes studied except for lipase which reaches its maximum activity at six week of age. This may be due to the higher energy content of diet during this finishing period or the tendency of birds to build up adipose tissues instead of muscular tissues.

In general, our results confirm those reported by Yamauchi and Tarachai (2000) and sklan (2001) . It is concluded that the broiler type chicks ate at a rate approaching gut capacity and it may be suggested that the genetic background of the strain has a profound effect not only on patterns of body weight growth but also on the digestive tract size and digestive enzymes activity.

4. Blood parameters:

Broiler chicks of strain A and B differ significantly in alkaline phosphatase (AP) activity , Hb, RBC's and H/L ratio however, lactic dehydrogenase (LDH) levels were not significant (Table 5).

The present results revealed that plasma (LDH) concentration increased with age . At sex weeks of age, plasma (LDH) level was higher than at 2 and 4 weeks of age. It is well known that (LDH) is a main cytoplasmic enzyme, that catalyse the reduction of pyruvate to lactic acid especially in cardiac muscles. Increases of its level are therefore unspecific and occur during stress and in some kidney, liver and heart diseases and as a results of haemolytic anemia and pulmonary infraction (Lin, *et al*., 2000). The specific activity of alkaline phosphatase (AP) was significantly decreased as the birds of both strains aged. However, strain A has slightly lower values than strain B. An interesting observation concerning (AP) activity was the higher values obtained during the first period of growth (0-4 weeks) in both strains which may be due to the higher osteoblastic activity associated with bone formation and remodeling. Our results are in close agreement with those reported by many investigators who stated that the formation of medullary bone of different avian species is closely related to higher (AP) activity (Sturkie, 1986; Qin and klandorf , 1993). Also , both enzymes were reported to be changed in birds exposed to heat stress condition. In this respect, Sritharet, et al., (2002) reported that (LDH) , but not (AP) increased in blood plasma of Japanese quails exposed to heat stress (40°C for 2 h) , and in broilers exposed to (35°C) for 48 hours (Lin, *et al.*, 2000).

Table (5): Effect of strain and age on some blood constituents of broiler chicks.

Age (week) / Parameter	Strain A			Strain B		
	2	4	6	2	4	6
LDH(U/L)	229.50 ± 16.80^a	266.40 ± 22.30^q	314.30 ± 31.60^a	265.40 ± 20.00^a	278.30 ± 18.20^a	386.60 ± 41.50^a
AP (U/L)	148.60 ± 12.80^b	164.40 ± 20.80^a	136.70 ± 16.60^b	188.40 ± 25.20^b	170.20 ± 20.00^a	144.20 ± 13.60^b
Hb (mg %)	9.30 ± 1.20^b	9.90 ± 1.60^b	10.8 ± 0.72^a	10.50 ± 2.10^a	9.60 ± 1.60^b	10.80 ± 1.80^a
RBC'S$\times 10^6$	3.18 ± 0.95^b	3.62 ± 0.89^b	3.96 ± 1.10^a	3.41 ± 1.62^b	3.62 ± 0.93^b	4.12 ± 0.62^a
H/L ratio	0.56 ± 0.03^b	0.62 ± 0.06^a	0.68 ± 0.08^a	0.38 ± 0.02^c	0.54 ± 0.06^b	0.50 ± 0.08^b

a,b.... Means with different superscripts within rows are significantly different ($P \leq 0.05$).

Moreover, there is evidence that (AP) activity decreased with age but (LDH) did not differ significantly (Depta and Koncicki, 2000) which in close agreement with our results.

The results of some haematological parameters are also presented in Table (5). Haemoglobin concentration (Hb) was significantly lower at 2 and 4 weeks compared to 6 week of age and at 4 weeks only in strain A and B, respectively. This may be related to the higher body weight of strain A compared with the other strain. This increase was also related to the RBC'S counts at similar ages. It is generally accepted that (Hb) concentration is related to the number of erythrocytes and the degree of saturation with oxygen and the iron level in blood. Also, both (Hb) and RBC's counts are accordingly influenced by the thyroid gland status and other physiological and nutritional factors. These findings were also reported by Sturkie, (1986); Samar Elnagar, *et al.*, (2001) and Ibrahim, (2005).

The results in Table (5) revealed that heterophils to lymphocytes ratio (H/L) was higher in strain A than strain B at different ages. It is suggested that H/L ratio can be used to detect the presence of physiological stress for most stressors (Gross and Siegel, 1993). The reference values for this ratio of about 0.20 , 0.50 and 0.80 are characteristics of low, optimal and high degrees of stress, respectively. In this concern, it appears that strain A was more sensitive to different stressors than strain B. It worsenoting that the present experiment was done during the summer season, and it seems that strain B was more resistant to various stressors than strain A which may reflect different genetic background of both strains. This is in close agreement with the reports of Maxwell and Robertson (1998) and Al-Murrani, *et al.*, (1997) who showed the H/L ratio was highly heritable criteria.

It is concluded that the rate of digestive tract development in broiler chicks during the early post-hatching period exceeds that of the whole body. However, it is difficult to draw conclusions about the digestion of young birds without understanding of factors affecting digestive enzymes activity.

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تأثير التغيرات تطور القناة الهضمية علي نشاط انزيمات الهضم والأداء الانتــاجي بعد الفقس في كتاكيت اللحم

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اجريت هذه التجربة بهدف دراسة تأثير التغيرات في نمو القناة الهضمية علي نشاط بعض انزيمــات الهضم والاداء الانتاجي في سلالتين من سلالات دجاج اللحم وذلك من عمر يوم بعد الفقس حتي ٦ أسابيع . حيث تم استخدام ٣٠٠ كتكوت غير مجنس من سلالتي الهبرد (سلالة أ) والأربرايكــرز (ســلالة ب) تــم توزيعهم عشوائيا في أقفاص التربية (١٥٠ كتكوت لكل سلالة) تحت نظام إضاءة مستمرة وقد تمت تغذيــة الطيور من عمر يوم حتي ٣ أسابيع علي عليقة بادئ تحتوي علــي ٢٢,٦% بــروتين خــام و ٣٠٨٤ ك / كالوري طاقة ممثلة ثم تمت التغذية علي عليقة ناهي تحتوي علي ٢٠,٦٩% بــروتين خــام و ٣١٢٨ ك / كالوري طاقة ممثلة حتي نهاية التجربة . وقد سجلت قياسات الأداء في أعمار (يوم ، ٣ ، ٦أسابيع) بينما تم قياس أطوال أجزاء القناة الهضمية وتم تقدير انزيمات الهضم وبعض قياسات الدم في أعمار (يوم ، ٢، ٤، ٦ أسابيع) . وقد أوضحت النتائج الأتي :

١- كان للسلالة تأثير معنوي علي معدلات الأداء في كتاكيت اللحم حيث سجلت السلالة أ قيم معنوية أعلــي في وزن الجسم ومعدل استهلاك غذائي أقل عند عمر ٣ ، ٦ أسابيع وكذلك افضل معدل تحويــل غــذائي خلال فترة التجربة مقارنة بالسلالة (ب).

٢-زادت أطوال الاثني عشر والبنكرياس والصائم واللفائفي معنويا في كل من السلالتين بزيادة العمر وكانت هذه الزيادة اكبر من عمر يوم حتي أسبوعان مقارنة بباقي الاعمار . كذلك اثرت السلالة تــأثيرا معنويــا علي التغير في أطوال البنكرياس والصائم واللفائفي وقد سجلت السلالة (أ) أعلي نسبة تغير في الاطــوال مقارنة بالسلالة (ب)

٣-زاد نشاط انزيم الاميليز معنويا في كل أجزاء القناة الهضمية من الفقس حتي ٤ أسابيع ثم انخفــض بعــد ذلك . كذلك زاد نشاط انزيم والليبيز معنويا وسجل اقصي مستوي له عند أعمار ٤ ، ٦ اســابيع . وكــان للسلالة تأثير عالي المعنوية علي انزيم الليبيز من عمر ٢ اسبوع وحتي نهاية التجربــة حيــث أعطــت السلالة (ا) فيما أقل من السلالة (ب) بينما زاد نشاط انزيمي التريبسين والكيموتربسين معنويا عند عمر ٢ أسبوع ثم أنخفض عند عمر ٦ أسابيع في كلا السلالتين .

٤- كان للعمر والسلالة تأثير معنوي علي كل قياسات الدم ما عدا نشاط انزيم اللاكتيك ديهيدروجينيز الــذي زاد (زيادة غير معنوية) بزيادة العمر في حين انخفض مستوي انزيم الالكالين فوسفاتيز معنويا في كــلا السلالتين عند عمر ٦ أسابيع وقد سجلت السلالة (أ) أعلي قيم معنوية لنسبة كرات الدم البيــضاء (H / L) في جميع الاعمار مقارنة بالسلالة (ب) مما يدل علي أنها أكثر حساسية لموامل الاجهاد المختلفة.

أتضح من النتائج ان تطور القناة الهضمية ونشاط انزيمات الهضم في كتاكيت اللحم تصل لأقصي نشاط لها في اعمار مختلفة خلال فترة النمو مما يجعل من إضافة بعض الانزيمات إلــي علائــق بــداري التسمين في حاجة إلى المزيد من الدراسة.