EFFECTS OF FİRST TRANSİTİON TİME TO FEED AND HERBAL POWDERS ON İNTESTİNAL MORPHOLOGY AND GROWTH PARAMETERS İN BROİLER CHİCKENS

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The development of digestive tract during the first week of life is important in broiler chicks to achieve the high genetic potential of growth during their short life period. The first transition time to feed at post-hatching generally delays because of long holding time in hatcher and transportation. These two long periods might have negative effect on growth performance due to delay intestinal development at the beginning of the life. It is known that the residual yolk can contribute for one day or two days to meet nutrient requirements of broiler chiks only for survival but not for fast growth. The yolk sac provides immediate posthatch energy and protein (**Noy and Sklan,** 2002). If energy and protein are not supplied by feed, chicks use yolk sac for energy and protein to ensure intestinal growth. The use of yolk sac nutrients for nutritional purposes may deprive the antibody production at posthatching.

Results of studies have indicated that one day delay of the first transition time to feed and water may result reduction in early growth of the gastrointestinal truct (GIT), liver and pancreas (**Dibner et al.,** 1998). **Sklan et al.** (2000) determined a linear decrease 0.14 to 0.17 g per h in body weight of newly hatched chicks when they were in hatcher. The most dramatic changes in small intestine occur within the first 24 h posthatch. The number of crypts per villus reaching plateau after 72 h posthatching. Thus, the early transition to feed is also important for early intestinal growth (**Geyra et al.,** 2001a). Because, on the day of hatching jejunal crypts were small and there is single crypt per villus. However, during the 108 h posthatch crypts develop rapidly branching and increasing in size, cell numbers and cell size (**Uni et al.,** 2000). Although the intestinal development is rapid from 2 d after hatching, the rates of development were different in duodenum, jejunum and ileum. For example, villus volume in the duodenum reaches a plateau after 7 d. However, it continues to increase in the jejunum and ileum (**Uni et al.,** 1999). The role of development of the GIT is always faster than body weight (**Jin et al.,** 1998). The weight of pancreas and small intestine increase ten fold by day 8 while that of the whole body increase during this period by 2.5 fold (**Nitsan et al.,** 1991). Villus height and width increase 25 to 100% in all segments of the small intestine from 4 to 10 d of age. However, dietary nutrients may be poorly utilized during the first 7 to 10 d posthatching. Because digestive enzyme contrubution increases throught the first 14 d of age (**Wilson,** 1991). The late transition time to feed has been shown to retard maturation of systems that begin developing in the hatching only after the addition of nutrients. The most evident changes in GIT are in intestinal length, villus height and density. Duodenum length and the weight of duodenum, jejunum and ileum increase by feding 2 h posthatching (**Maiorka et al.,** 2006). The development in small intestine is maximum between 4th and 8th day (**Uni et al.,** 1999).

Wheat and other cereal grains contain soluble nonstarch polysaccharide (**Sarıca et al.,** 2005). Water soluble nonstarch polysaccharides such as pentosans in wheat are held responsible for the reduction in nutrient digestibility. Researchers have showed that the water-soluble arabynoxylanes of wheat cause an increase in viscosity of digesta in small intestine (**Knudsen,** 2001) and reduce passage rate of time and stimulate the proliferation of microflora and microbial function (**Preston et al.,** 2001). The negative effects of nonstarch polysaccharide can be prevented by adding enzymes to diets (**Santos Jr. et al.,** 2004).

After banning the use of antimicrobial growth promoters (AGPs), there has been an increase in the use of the new kinds feed additives originated from plants. Feed additives in the form of powder and extracted essential oil from herbs considered to be antimicrobial (**Çabuk et al.,** 2006) and stimulatory activity in digestive system (**Ramakrishna et al.,** 2003). Thyme

(*Thymus vulgaris* L.) is a herbaceous perennial plant belonging to the *Lamiaceae* family (**Ghasemi et al.,** 2010). Thymol and carvacrol are the main effective phenolic substances in thyme. Carvacrol is an antimicrobial effective isomer of thymol. Thyme could be considered as an alternative natural growth promoter for poultry instead of AGPs. Garlic, a member of *Allium* family (*Liliceae*) has been used traditionaly for ages. Garlic has shown antibiotic, antimicrobial, immunmodulatory effects. The major active ingredients of garlic are alicin, a joene, s-allyl cysteine (**Fadlalla et al.,** 2010). Authors have conducted experiments to determine the effect of thyme or thyme oil (**Hernandez et al.,** 2004; **Demir et al.,** 2005; **Sarıca et al.,** 2005; **Demir et al.,** 2008; **Ocak et al.,** 2008; **El-Ghousein and Al-Beitawi,** 2009; **Ghasemi et al.,** 2010; **Amerah et al.,** 2011; **Cross et al.,** 2011) and garlic (**Demir et al.,** 2005; **Sarıca et al.,** 2005; **Onibi et al.,** 2009; **Al-Kassie**, 2010; **Fadlalla et al.,** 2010) on growth performance and intestinal microflora.

Researchers have conducted many studies on herbal feed additives as alternative to antimicrobial growth promoters to manage to replace some herbal products to banned AGPs. However, there is not so many experiments conducted to determine the effect of herbal products on intestinal parameters of broiler chicks together with early or late transition time to feed at posthatching. In recent years, posthatching nutrition and herbal feed addidives as alternative to AGPs have attracted interest in broiler nutrition. It might be important to determine the interaction between first transition time to feed and using herbal products in diets with exagenous enzymes when regarded intestinal development, intestinal villus height and crypt depth. The aim of this study was to investigate effects of early or late transition time to feed after hatching and supplemented diets with enzyme, thyme powder, garlic powder and their combinations on growth performance, intestinal development, villus height, crypt depth and inner organ weights in broiler chickens.

MATERIAL AND METHODS

One hundred and fifty, day-old feather-sexed male broiler chicks (Ross) were purchased from a local hatchery at 4 h posthatching. They were weighed individually (mean body weight 42±0.7g) on arrival, transferred to individual wire cages and randomly assigned to one of five treatments. Each treatment group consisted of 30 individual replicates with one bird per cage. This study was conducted according to the guidelines of the University Animal Care and Use Committee. The temperature of the experimental room was 32 ^{o}C for the 1st week and then gradually decreased to 21 ^{o}C for the 4th week and kept on this temperature until 42 d of age. A continuous artificial lighting program was provided throughout the entire experimental period. Water supplied *ad libitum* following the experimental method.

The basal diet was formulated to meet the nutrient requirements of broiler chickens reported by NRC (1994). The experimental diets were fed *ad libitum* with starter, grower and finisher diets. The composition of basal diet is presented in Table 1. Additives such as AGPs or coccidiostats were omitted from the diets during the experimental period.

The treatment groups in this experiment were designed as:

T1 (Positive control): No supplemented basal diet was given 4 h posthatch,

T2 (Negative control): No supplemented basal diet was given 36 h posthatch,

T3 (Enzyme): Supplemented basal diet with enzyme was given 36 h posthatch,

T4 (Herbal): Supplemented basal diet with thyme powder and garlic powder was given 36 h

posthatch,

T5 (Enzyme+herbal): Supplemented basal diet with enzyme, thyme powder and garlic powder was given 36 h posthatch.

The enzyme was Yemzim®B (bio-vet, Bursa, Turkey) containing xylanase and cellulase added to diet 1 g per kg diet. The thyme powder and garlic powder were Nor-Spice®Thyme Powder and Nor-Spice®Garlic Powder (NOR-FEED ApS Hvidovre, Denmark), respectively added to diet 1 g per kg diet.

Broiler chicks of T1 had free access to water and to no supplemented diet 4 h posthatch without waiting after placement. Others were maintained without access to feed and water for 36 h. They were waited for receiving feed and water for 32 h after placement so they were exposed totally 36 h starvation after hatching. Body weight and feed intake were individually measured at weekly intervals. Birds were weighed individually and feed consumption for each bird was recorded weekly. Weight gain and feed conversion (feed:gain) were then calculated.

Five birds were randomly selected from each treatment group and killed at 7, 14, 21 and 42 d of ages to determine the effects of treatments on villus height

Table 1. **Composition of the basal diet**

	Starter (d 0-14)	Grower (d 14-35)	Finisher (d 35-42)
Ingredients, %			
Wheat	45.25	41.75	9.00
Fullfat soybean	22.80	21.00	19.90
Soybean meal	18.60	15.00	10.60
Maize	9.00	17.00	16.00
Soybean oil	0.76	1.95	1.270
Dicalcium phosphate	1.74	1.43	1.418
Limestone	1.135	1.13	1.035
Salt	0.15	0.20	0.233
DL- Methionine	0.211	0.186	0.195
Vitamin premix*	0.25	0.25	0.25
Mineral premix**	0.10	0.10	0.10
Calculated contents, %			
Metabolisable energy, MJ/kg	12.97	13.39	13.60
Crude protein	23.01	21.01	18.47
Methionine	0.55	0.50	0.49
Methionine+cysteine	0.91	0.83	0.75
Lysine	1.17	1.05	0.90
Calcium	1.01	0.90	0.85
Available phosphorus	0.45	0.40	0.35

*Vitamin premix/kg diet: Vitamin A-12.000IU; vitamin D_3-1500 IU; vitamin E- 50 mg; vitamin K_3-5 mg; vitamin B_1-3 mg; Vitamin B_2- 6 mg; vitamin B_6-5 mg; vitamin B_{12}-0.03mg; niacin-25 mg; Ca-D-panthothenate-12 mg; folic acid-1 mg; D-biotin-0.05mg;apo-carotenoic acid ester-2.5 mg; choline chloride-400 mg.
**Mineral premix/kg: Mn-80 mg; Fe-60mg; Zn-60 mg; Zn-60mg; Cu-5mg; Co-0.20mg; Se-0.15mg.

Table 2. **Effects of the treatments on growth performance, feed intake and feed conversion of broiler chickens**

Parameters	T1	T2	Treatments T3	T4	T5	s.e.m.	*P*
Body weight, g							
d 7	106.6^{a*}	98.8b^{c}	100.4^{ab}	92.4^{c}	98.6^{bc}	1.16	<0.003
d 14	264.0^{a}	257.0^{ab}	272.7^{a}	240.2^{b}	266.5^{a}	3.63	<0.048
d 21	526.0	529.3	561.6	504.3	543.3	8.71	NS
d 42	1958.5	1943.0	1967.0	1907.0	1924.0	32.36	NS
Feed intake, g							
d 0-7	106.0^{a}	86.0^{b}	85.0^{b}	79.4^{b}	86.8^{b}	1.62	<0.000
d 0-14	320.2^{a}	302.7^{ab}	296.2^{ab}	279.0^{b}	313.5^{a}	4.42	<0.030
d 0-21	809.3	823.6	790.6	752.3	797.0	10.98	NS
d 0-42	3571.0	3560.5	3491.5	3415.5	3476.5	51.36	NS
Feed conversion, g:g							
d 0-7	1.724	1.594	1.505	1.659	1.577	0.033	NS
d 0-14	1.477	1.436	1.315	1.414	1.413	0.229	NS
d 0-21	1.699	1.715	1.546	1.632	1.689	0.183	NS
d 0-42	1.877	1.881	1.819	1.833	1.848	0.013	NS

s.e.m.: standard error of means; P: probability; NS:not significant; a,b,c: values on the same line not sharing a common supercript are significantly different at $P<0.05$.

Table 3. **Effects of the treatments on villus height in small intestine segments, µm**

Parameters	T1	T2	Treatments T3	T4	T5	s.e.m.	*P*
Duodenum							
d 7	770.0^{c}*	844.0^{bc}	898.0^{b}	1080.0^{a}	948.0^{b}	26.81	<0.000
d 14	1644.0^{a}	1432.0^{bc}	1600.0^{ab}	1396.0^{c}	1555.0^{abc}	30.28	<0.023
d 21	838.0^{c}	1680.0^{b}	1650.0^{b}	660.0^{d}	2045.0^{a}	109.12	<0.000
d 42	1455.0^{c}	1660.0^{b}	698.0^{d}	1700.0^{b}	1960.0^{a}	89.42	<0.000
Jejunum							
d 7	788.0^{a}	574.0^{b}	624.0^{b}	640.0^{b}	624.0^{b}	17.98	<0.000
d 14	810.0^{c}	726.0^{d}	1028.0^{a}	914.0^{b}	708.0^{d}	25.96	<0.000
d 21	922.0^{b}	836.0^{b}	916.0^{b}	834.0^{b}	1200.0^{a}	34.43	<0.000
d 42	1396.0^{b}	1476.0^{ab}	1565.0^{a}	1575.0^{a}	1380.0^{b}	24.65	<0.012
Ileum							
d 7	310.0^{c}	760.0^{b}	556.0^{c}	436.0^{d}	900.0^{a}	43.75	<0.000
d 14	550.0^{bc}	652.0^{a}	536.0^{c}	586.0^{b}	566.0^{bc}	10.34	<0.000
d 21	652.0^{c}	696.0^{c}	884.0^{b}	642.0^{c}	1310.0^{a}	52.60	<0.000
d 42	635.0^{c}	418.0^{d}	1086.0^{b}	1245.0^{a}	1225.0^{a}	69.25	<0.000

s.e.m.=standard error of means, P= probability, NS=not significant, a,b,c,d= values on the same line not sharing a common supercript are significantly different at *P*<0.05.

Table 4. **Effects of the treatments on crypt deth in small intestine segments, µm**

Parameters	T1	T2	Treatments T3	T4	T5	s.e.m.	*P*
Duodenum							
d 7	145.0^{b}*	104.0^{c}	184.0^{a}	106.0^{c}	112.0	7.0	<0.000
d 14	144.0^{ab}	102.0^{b}	115.0^{b}	136.0^{ab}	175.0^{a}	7.70	<0.018
d 21	160.0^{a}	118.0^{b}	135.0^{ab}	120.0^{b}	125.0^{b}	4.68	<0.014
d 42	190.0^{ab}	172.0^{b}	72.0^{c}	220.0^{a}	220.0^{a}	12.36	<0.000
Jejunum							
d 7	102.0	110.0	106.0	122.0	114.0	2.88	NS
d 14	132.0^{b}	118.0^{b}	188.0^{a}	148.0^{b}	118.0^{b}	6.90	<0.001
d 21	162.0^{ab}	166.0^{ab}	114.0^{b}	168.0^{a}	205.0^{a}	9.06	<0.020
d 42	194.0	186.0	155.0	185.0	165.0	5.92	NS
Ileum							
d 7	94.0^{b}	152.0^{a}	106.0^{b}	96.0^{b}	142.0^{a}	6.40	<0.001
d 14	116.0^{c}	142.0^{b}	84.0^{d}	130.0^{bc}	166.0^{a}	6.12	<0.000
d 21	132.0^{c}	136.0^{bc}	132.0^{c}	158.0^{b}	175.0^{a}	4.83	<0.003
d 42	155.0^{bc}	84.0^{d}	144.0^{c}	175.0^{ab}	195.0^{a}	4.43	<0.000

s.e.m.=standard error of means, P= probability, NS=not significant, a,b,c,d= values on the same line not sharing a common supercript are significantly different at *P*<0.05.

and crypt depth in small intestine segments. The duodenum, jejunum and ileum segments of small intestine were removed by using the procedure described by **Uni et al.** (1999). The segments were then prepared to determine the villus height and crypt depth according to the method of **Lee** (1968). Morphometric measurements in the intestine segments were measured using light microscobe. The morphometric parameters were villus height (from the tip of the villi to the villus crypt junction) and crypt depth (defined as the depth of the investigation between adjacent villi). The weight and length of intestines, the relative weight of heart, liver, pancreas and spleen, and abdominal fat were also measured on the killed broiler chickens at 21 and 42 d of age.

Data obtained from the exmeriment were subjected to analysis of variance (ANOVA) procedures for com-

Table 5. **Effects of transition time to feed at posthatching and herbal feed additives on small intestine length, relative weight (g/100 g body weight) of small intestine, inner organs and abdominal fat**

Parameters	T1	T2	Treatments T3	T4	T5	s.e.m.	*P*
Intestine length, cm							
d 21	125.2	132.8	133.4	125.4	128.6	2.07	NS
d 42	192.6	182.4	180.4	181.0	180.4	2.25	NS
Intestine weight							
d 21	6.578	6.428	6.243	7.161	6.599	0.16	NS
d 42	5.306	4.788	4.600	4.400	4.897	0.15	NS
Liver							
d 21	2.617	2.741	2.740	2.634	2.730	0.04	NS
d 42	1.877	2.051	1.834	1.783	1.971	0.03	NS
Pancreas							
d 21	0.658	0.596	0.613	0.581	0.670	0.154	NS
d 42	0.369	0.348	0.349	0.358	0.361	0.010	NS
Heart							
d 21	0.775	0.755	0.716	0.759	0.736	0.015	NS
d 42	0.503	0.518	0.531	0.568	0.527	0.013	NS
Spleen							
d 21	0.066^{c*}	0.081^{bc}	0.071^{bc}	0.101^{a}	0.118^{a}	0.005	<0.011
d 42	0.108	0.097	0.109	0.106	0.122	0.098	NS
Abdominal fat							
d 21	1.163^{ab}	1.174^{ab}	1.475^{a}	0.821^{b}	0.955^{b}	0.067	<0.015
d 42	1.706	1.977	1.676	1.393	1.435	0.093	NS

s.e.m.=standard error of means, P= probability, NS=not significant, a,b,c= values on the same line not sharing a common supercript are significantly different at $P<0.05$.

pletely randomized design by using SPSSWIN 6.1.3 (SPSSWIN, 1994). The differences between means were tested by using The Multiple Range Test of Duncan (**Duncan,** 1955).

RESULTS AND DISCUSSION

Growth, feed intake and feed conversion

Results of the initiation time to feed after hatching and the feed additives on body weight, feed intake and feed conversion of broiler chickens are shown in Table 2. There were significant ($P<0.05$) differences in body weight and feed intake between treatment groups at 7 and 14 d of age. Broiler chickens from T1 had higher ($P<0.05$) body weight at first week than those exposed 36 h starvation after hatching with exception of T3 group. The detrimental effect of late transition time to feed on body weight continued in T4 group during the second week of the experiment. Briefly, transition to feed at 36 h posthatching significantly depressed body weight in chicks during first week. At 14 d of age, broiler chicks of T4 group had significantly lower body weight than T1, T3 and T5 groups. However, the differences in body weight disappeared after 14 d of age so final body weights in groups were similar at 42 d of age.

The late transition time to feed significantly ($P<0.05$) decreased feed intake in broiler chicks of T2, T3, T4 and T5 groups compared to T1 during the first week. Broiler chickens in T4 group consumed less ($P<0.05$) feed than T1 and T5 groups between 0 and 14 d of age. After 14 d of age, no differences were observed in feed intake. However, no differences in feed conversion was determined ($P>0.05$) in broiler chicks exposed to starvation for 4 or 36 h after hatching during the 42 d experimental period. Broiler chickens of T1 and T2 groups had similar ($P>0.05$) body weight, feed intake and feed conversion at 42 d of age.

Villus height in duodenum

Villus heights in small intestine is shown in Table 3. Villuses in duodenum at 7 d of age for T4 broiler chickens were significantly ($P<0.05$) higher than the others. The villuses ($P<0.05$) were longer in T1 group compared to T4, T5 and T3 groups at 7 d of age. At 14 d of age, the villus height was more ($P<0.05$) in T1 birds compared to T2 and T4 birds. However, T2, T3 and T5 groups

had similar villus heights. It was observed some dramatically changes in villus height at 21 d of age. The villuses in duedonum of T5 birds were significantly heigher than other groups at 21 d of age. Birds from T2 and T3 had similar villus height at 21 d of age. The villuses were heigher in T5 birds than the others at 42 d of age. T2 and T4 birds had similar villus height at 42 d od age. The shortest villuses were determined in T3 birds. The villus height in T1 was lower than T5, T4 and T2 groups at 42 d of age. As a result, supplemented diets with the enzyme and the two herbal powders significantly increased villus height when compared to other treatment groups at 42 d of age. The late transition time to feed had no negative effect on villus height with exception of T3 group in duedonum at 42 d of age

Villus height in jejunum

The villuses of T1 birds in jejunum were higher (P<0.05) than other groups at 7 d of age. Late transition time to feed significantly depressed villus height in the jejunum of broiler chicks at first week of life. Birds of T3 group had highest (P<0.05) villus height at 14 d of age. At 21 d of age, villus heights were longer in group T5 that started to have their diet at 36 h posthatching than the others. At 42 d of age, the villus height in T3 and T4 groups were significantly (P<0.05) higher than T1 and T5 groups. No detrimental effect of late transition time to feed like 7 d of age was observed in treatment groups when compared to T1 birds at 42 d of age.

Villus height in ileum

The villus height in ileum was significantly longer (P<0.05) in T5 birds than other groups at 7 d of age. In contrast, it was significantly longer in T2 birds compared to others at 14 d of age. At 21 d of age, the highest (P<0.05) villus height was determined in T5 group followed T3. Broiler chickens in T1, T3 and T4 groups had similar villus height. The supplemented diets with enzyme, herbal powders or both of them improved villus height in ileum at 42 d of age compared to no supplemented T1 and T2 groups. The shortest villus was observed in group T2 compared to T1. It is clear that the addition of enzyme, herbal powders or combination of enzyme and herbal powders increased villus height in jejunum at 42 d of age despite of late transition time to feed.

Crypt depth in duodenum

Crypt depth in small intestine segments is shown in Table 4. The crypt depth in duedonum was higher (P<0.05) in T3 birds than other groups at 7 d of age. T2, T4 and T5 groups had similar but lower (P<0.05) crypt depth than T1 group. The enzyme addition to diet caused an increase in crypt depth in duedonum at 7 d of age. The highest (P<0.05) crypt depth was observed in T5 birds compared to T2 and T3 birds at 14 d of age. At 21 d of age, T1 birds had the highest crypt depth. However, crypt depth in T4 and T5 groups were the same but higher than T2 and T3 groups at 42 d of age.

Crypt depth in jejunum

Crypt depth in jejunum was not differed by the treatments at 7 and 42 d of age. The highest (P<0.05) crypt depth was observed in T3 group at 14 d of age compared to the others. The highest crypt depth was measured in T5 broiler chickens at 21 d of age. The late transition time and feed additives had no effect on crypt depth in jejunum at 42 d of age.

Crypt depth in ileum

The crypt depth in ileum of T2 and T5 birds at 7 d of age was significantly higher than T1, T3 and T4 birds. At 14, 21 and 42 d of age, the highest crypt depth were determined in broiler chickens of T5. Birds received supplemented diets with enzyme and two herbal powders had more crypt depth despite of late transition time to feed at 42 d of age. Crypt depth in group T2 was shorter compared to T1 group.

Small intestine length and the relative weight of small intestine, inner organs and abdominal fat

The length and the relative weights of small intestine at 21 and 42 d of age were not significantly affected by the treatments (Table 5). The relative weight of liver, pancreas, heart, spleen and abdominal fat were not differed by the treatments at 42 d of age. However, herbal powders in the diets of T4 and T5 groups increased (P<0.05) the relative weight of spleen at 21 d of age. The herbal powders also tended to decrease (P>0.05) in the relative weight of abdominal weight at 21 d of age compared to T1 and T2 groups. Morover, addition of enzyme to diets of broiler chickens received their diet after 36 h starvation had the highest (P<0.05) abdominal fat.

The effects of time of initiation to feed after hatching and influence of dietary enzyme, thyme and garlic powders or their combination on productivity, intestinal parameters and inner organ weights were determined in this study.

There were a decrease in body weight and feed intake in broilers initiated to feed at 36 h posthatching received no supplemented or supplemented diets with enzyme, two herbal powders or enzyme and two herbal powders without affecting feed conversion ratio during the first and second weeks of life. The effect of the late initiation to feed on body weight, feed intake

and feed conversion ratio was not appeared after 14 d of age. Our findings of growth performance of broiler chickens are in agreement with the results of **Halevy et al.** (2000) and **Gonzales et al.** (2003) who conducted experiments to determine the effects of fasting time and found a decrease in body weight and productivity especially during the first week. In contrast, **Castel et al.** (2000) reported no effect of holding time for 24 h after hatching in the hatcher on body weight and feed conversion of broiler chicks. These findings are also different from the findings of **Dibner et al.** (1998) which showed that initiation of feeding within 24 h posthatching enhanced growth and feed intake, while increasing initiation of feeding above 24 h posthatching retarded growth and reduced feed intake following initiation of feeding within 36 h posthatching is to use of nutrients for maintenance requirements and growth, specially for intestinal growth (**Noy and Sklan,** 1999). This preferential growth occurs regardless of initiation of feeding after hatching. If the nutrients are not supplied by feed, newly hatched chicks use the nutrients of the yolk sac for intestinal growth (**Maiorka et al.,** 2006).

In the present study, neither enzyme addition nor the addition of thyme and garlic powders to diet couldn't improve body weight and feed intake during the first week of life in starved chiks for 36 h after hatching. However, researchers who conducted experiments by using thyme powder (**El-Ghousein and Al-Beitawi,** 2009; **Onibi et al.,** 2009) and garlic powder (**Fadlalla et al.,** 2010) indicated an improvement in body weight gain and feed conversion of broiler chickens received these herbal powders in their diets. In contrast, some researchers have also reported that thyme powder (**Ocak et al.,** 2008) and garlic powder (**Demir et al.,** 2005) had no positive affect on body weight, feed intake and feed conversion in broiler chickens. Body weight and feed intake of broiler chickens after 14 d of age were not significantly affected by the treatments. These parameters were the same after 14 d of age. Feed conversion was also not affected by the same treatments during 42 days experimental period. It can be concluded that the 36 d fasting time after hatching had no negative affect on body weight, feed intake and feed conversion when they received no supplemented or supplemented diets with enzyme, thyme and garlic powders or with the combination of them. Fasted chicks for 36 h after hatching could compensate lower body weight and feed intake after 14 d of age with or without inclusion of enzyme, thyme and garlic powder or enzyme, thyme and garlic powders to diets. Lack of available published results have been obtained from experiments similar to our study is a limitation factor to compare the results in detail.

The villuses in duedonum at 7 d of age were higher in treatment groups compared to positive control group. The highest villuses were measured in broilers fed diets supplemented with thyme and garlic powders or enzyme, thyme and garlic powders at 42 d of age. Briefly, inclusion of thyme and garlic powders to diet increased villus height despite of 36 h fasting period after hatching. However, the villuses in jejunum of broilers fasted 36 h after hatching were shorter than those fed after 4 h posthatching. Broilers exposed to 36 h fasting after hatching fed diets supplemented with the enzyme or thyme and garlic powders had higher villuses in jejunum at 42 d of age. At 7 d of age, the higher villuses in ileum were suprisingly determined in broiler chicks exposed to 36 h fasting after hatching fed supplemented diets with enzyme, thyme and garlic powders. At 42 d of age, the highest villuses in ileum of broiler chickens exposed to 36 h fasting after hatching were also measured in broilers fed supplemented diets with thyme and garlic powders or enzyme, thyme and garlic powders. These two groups had also the deepest crypt in duedonum and ileum at 42 d of age.

Intestinal morphology results in this study are in line with the findings of **Gonzales et al.** (2003) who found posthatching fasting had lower biometrical values for villus height and crypt depth than chiks fed immediately after placement. **Geyra et al.** (2001b) indicated that the small intestines of hatching chicks undergo rapid developmental changes in the immediate post-hatch period. The transition from endogenous nutrient supply from yolk usually begins 48 h or more after hatching, owing to logistical considerations of production. The effects of fasting were specific to both time of fasting and the intestinal segment examined. They found a decreased development in the duedonum and jejunum, but was less apparent in the ileum. They showed that fasting between 0 and 48 h decreased crypt size in the duedonum and jejunum, the number of crypts per villus, villus proliferation, villus area and the rate of enterocyte migration. Jejunum appeared to be the most sensistive of the intestinal segments. **Uni et al.** (2000) also reported that jejunal crypt on the day of hatching were small and a single crypt per villus was observed. However, during the 108 h posthatch crypts developed rapidly branching and increasing in size, cell number and cell size. **Batal and Parsons** (2002) determined an increase 25 to 100% in villus height with in all seg-

ments of the small intestine between 4 and 10 d of age. There were great individual variability in villus height and crypt depth in broiler chickens. The individual variabilities were also observed at the beginning of the experiment on examined chicks to determine initial villus height and crypt depth. However, crypt depth in jejunum was not changed by the treatments at 7 and 42 d of age. In our knowledge, there are not any published researches on the effect of herbal powders on villus height and crypt depth in broiler chickens exposed to a fasting time after hatching.

The effects of fasting and inclusion of enzyme, thyme and garlic powder to broiler diets had no significant affect on length and weight of small intestine and the relative weight of liver, pancreas and heart. The relative weights of spleen in birds received thyme and garlic powders or enzyme, thyme and garlic powders were higher than the other treatment groups at 21 d of age, but they were the same at 42 d of age. Results of this study are consistent with those reported by **Hernandez et al.** (2004), **Çabuk et al.** (2006) and **Ocak et al.** (2008) who found no significant effects of treatments on these parameters. The reason for the increased spleen at 21 d of age by adding thyme and garlic powders is unknown. However, these herbal powders could have a specific affect on spleen growth. There was a decrease in the realative weight of abdominal fat at 21 d of age but not at 42 d of age by feeding thyme and garlic powders or enzyme, thyme and garlic powders. **Onibi et al.** (2009) reported a decrease in abdominal fat by feeding garlic powder in broiler chickens.

In conclusion, 36 h fasting time after hatching had no affect on productivity after 14 d of age. Broiler chickens could compensate growth retardation when their diets supplemented with enzyme, thyme powder and garlic powder if birds expose to starvation period after hatching. The fasting time and the additives had no regular effect on villus heights and crypt depths. However, intensive researches are needed to explain interactions between fasting and herbal feed additives and the effects of them on intestinal morphology, development, intestinal microorganisms and enzyme secretions.

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EFFECTS OF FİRST TRANSİTİON TİME TO FEED AND HERBAL POWDERS ON İNTESTİNAL MORPHOLOGY AND GROWTH PARAMETERS İN BROİLER CHİCKENS

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SUMMARY

This study was conducted to determine the effects of early or late transition time to feed after hatching and supplemented diets with enzyme, thyme powder and garlic powder or with their combination on growth performance and intestinal morphology in broiler chickens. One hundred and fifty, day-old male broiler chicks were purchased 4 h posthatching, transferred to cages and randomly assigned to one of five treatments. The treatment groups were no supplemented diet was given 4 h posthatch, no supplemented diet was given 36 h pothatch, supplemented diet with enzyme was given 36 h posthatch, supplemented diet with thyme powder and garlic powder was given 36 h posthatch and supplemented diet with enzyme, thyme powder and garlic powder was given 36 h posthatch, respectively. There were no differences (P>0.05) between treatment groups for 42 d body weight, feed intake and feed conversion. However, late transition time to feed decreased (P<0.05) body weight and feed intake at first week of the experiment. The villus height in duodenum of birds were given supplemented diet with enzyme and two herbal powders was given 36 h posthatch were higher (P<0.05) than the other groups. The villus height in jejunum of birds fed with enzyme supplemented diet was given 36 h posthatch and the birds fed the diet supplemented with the two herbal powders was given 36 h posthatch were higher (P<0.05) than birds were given supplemented diet with enzyme and the two herbal powders was 36 h posthatch and birds received no supplemented basal diet was given 4 h posthatch. The highest villus height in ileum was measured in birds fed the two herbal powders supplemented diet was given 36 h posthatch and birds were fed diet supplemented with enzyme and the two herbal powders was given 36 h posthatch. The crypt depth in duodenum of birds fed supplemented diet with the two herbal powders was given 36 h posthatch and birds were given supplemented diet with enzyme and the two herbal powders was given 36 h posthatch were higher (P<0.05) than other groups. However, the highest (P<0.05) crypt depth in ileum was determined in birds were given supplemented diet with enzyme and the two herbal powders was given 36 h posthatch. Results of this study show that late transition time to feed depressed the body weight at first week but broiler chickens compensated it at 42 d of age. Birds were fed supplemented diets with thyme powder and garlic powder had higher villus height and crypt depth in duodenum and ileum.

Key words: *broiler chickens; initiation to feed; garlic, thyme; villus height; crypt depth*