EFFECTS OF THE SOY ISOFLAVONES ON THE GROWTH AND THE EXTERIOR DEVELOPMENT OF THE ISA BROWN PULLETS

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The soybean inclusion in the poultry feed continues to increase in recent years. Soybean contains isoflavones which are potential dietary supplement that may affect the growth and the productive performance. Isoflavones are diphenolic compounds in aglycone (unconjugated) and conjugated forms (**Kudou et al.,** 1991). The aglycone forms of isoflavones are daidzein, genistein and glycitein. The positive effect on the growth performance and carcass muscle was reported by **Cook et al.** (1998) in pigs, and the negative effect on the growth performance in broilers was reported by **Payne et al.** (2001a). Some studies have demonstrated that the long-term intake of daidzein and other isoflavones could interact with the animal reproduction and cause estrous disorders and regular ovary and genital development (**Kaladas,** 1989; **Nwannenna et al.,** 1995; **Odum et al.,** 2001; **Mitchell,** 2001). Other studies suggested its stimulatory effects on the growth performance in the broiler, the beef, the sheep and the pig (**Wang and Han,** 1994; **Han,** 1999; **Payne et al.,** 2001b). **Jiang et al.** (2007) reported that isoflavones affect and increase the growth, the meat quality and the antioxidative effect at male borilers treated with 0, 10, 20, 40 и 80 mg soybean isoflavones/kg feed during the 3 wks experimental period.

Therefore, the purpose of this experiment was to evaluate the effect of isoflavones on the growth and exterior development in chicken from hatching till 20 weeks old pullets of the ISA Brown poultry.

MATERIAL AND METHODS

The experiment was performed with ISA Brown chicken from hatching through 20 wks. The treated chicken were randomly assigned to 5 groups, 20 chicks per group. The chicks were housed in a standard poultry house and fed with basal diet and with isoflavones supplemented diets according to the experiment. Water was offered for ad libitum consumption throughout the experiment. The experiment lasted 20 wks. Chicken were randomly assigned to receive basal feed, and 300, 600, 1200 and 1800 mg supplemented isoflavones per kg feed. The experimental feed was enriched with concentrated product produced by the North China Pharmaceutical Corporation. The composition of the product consisted of: genistin, genistein, daiddzin, daidzein, glycitin and glycitein, and the total amount of isoflavones was 40.88 %.

The composition of the experimental feed is presented in Table 1.

The morphological changes of the chicken body were measured as body weight of the control and experimental groups using digital balance, and the body length, the breast circumference and the length of the legs were measured using the clot tape. The exterior was measured on the 13th, 16th and 20th week of age and the body weight was measured on the first day, 6th, 13th, 16th and 20th week.

The body indexes (in %) were calculated using the following formulas: - Long-leggedness (the ratio of leg length, cm and body length, cm x 100), Stockiness (the ratio of breast circumference, cm and body length, cm x 100) and Massiveness (the ratio of body weight, g and body length, cm x 100) (**Oblakova,** 2007).

The obtained data were tested for significance using the analysis of variance, the F-test according to **Snedecor and Cochran** (1989).

RESULTS AND DISCUSSION

Table 2 presents the body weight of the chicken after hatching to 20th week of age.

The body weight of the day old chicken was from 38.85 g to 40.00 g. On the 6th wks of age the average body weight was between 392.24 g (group III) and 438.04 g (Control group). The significant differences were found between the experimental groups and the control group (P<0.05). The biggest body weight of chicken at 13 wks of age was observed in the control group (1342 g). The average body weight of chicken aged 13 wks was from 1218 g (group III) to 1286 g (group IV). Statistical significant differences (P<0.01) in the body weight of 13 wks old chicken between all experimental groups and the control group were found.

At 16 wks of age the pullets from the experimental groups 3 and 4 are for 112 and 147 g smaller in comparison to the control group (P<0.01). This decreasing expressed in relative numbers are between 7.5 and 9.8% (groups IV and III). The body weight of the 20 wks old pullets has a similar trend in all experimental groups (P<0.05).

The obtained results for the exterior development and the indexes are presented in Table 3.

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

Ingredient, %	Period from hatch to 6 weeks	From 6 weeks to 12 weeks	From 12 weeks to 18 weeks	Before the first egg laid (18 to 22 weeks)
Maize	56.23	60.39	60.72	55.25
Soybean meal 44%	18.84	18.78	7.41	16.89
Sunflower meal 33%	15.34	6.50	14.68	15.00
Fish meal	5.00	2.57	–	–
Wheat bran	–	7.34	12.78	5.00
Soybean oil	0.35	–	–	0.70
Methionine 99%	0.07	0.02	0.03	0.07
L-lysine	0.10	0.07	0.08	0.06
Calcium carbonate	1.64	1.98	1.82	4.39
Mono calcium phosphate	1.42	1.32	1.38	1.45
$NaHCO_3$	–	–	0.10	0.16
Minezyl (Zeolites)	0.30	0.30	0.30	0.30
Salt	0.22	0.22	0.21	0.24
Mineral premix	0.50	0.50	0.50	0.50
Total	100.0	100.0	100.0	100.0
Chemical composition, calculated				
Dry matter, g/kg	89.24	89.04	88.95	89.42
Metabolic energy, Kcal/kg	2900	2800	2750	2750
Crude protein, g/kg	21.44	18.20	14.81	17.50
Crude fat, g/kg	3.14	2.86	2.89	3.13
Calcium, g/kg	1.05	1.10	1.00	2.00
Phosphorus (available), g/kg	0.78	0.74	0.81	0.78
Lysine, g/kg	1.20	1.00	0.65	0.85
DL Methonine, g/kg	0.53	0.39	0.33	0.41
Methionine + cystine., g/kg	0.83	0.67	0.57	0.68
Soybean meal isoflavones, mg/kg[1]				

[1] Isoflavones from soybean meal were calculated

Table 2. **Effect of isoflavones on the body weight of the chicken, g**

	Control Group Basal feed (BF)	Group I BF + 300 mg AI/kg	Group II BF + 600 mg AI/kg	Group III BF + 1200 mg AI/kg	Group IV BF + 1800 mg AI/kg
1st day	38.85	40.00	40.00	38.85	39.62
6th week	438.04[a]	424.90[b]	400.00[b]	392.24[b]	419.18[b]
13th week	1342[A]	1222[B]	1222[B]	1218[B]	1286[B]
16th week	1496[A]	1409[B]	1464[B]	1349[B]	1384[B]
20th week	1847[a]	1793[b]	1748[b]	1682[b]	1746[b]

AI- additional isoflavones Values are means ± *S.D*

A,B – Values in the same row with no common superscript differ significantly ($P<0.01$)

a,b – Values in the same row with no common superscript differ significantly ($P<0.05$)

Table 3. **Exterior development of the ISA Brown pullets**

	Age	Body lenght, cm	Breast circumference, cm	Length of the legs (femur + tibia +metatarsus), cm	Long-leggedness Index	Stockiness Index	Massiveness Index
Control Group Basal feed (BF)	13. wks	17.97	24.63	29.76	166	137	7.46
	16 wks	20.18	24.44	28.73	142	121	7.43
	20 wks	20.78	27.59	28.35	136	133	8.90
Group I BF + 300 mg AI/kg	13. wks	17.27	23.45	28.54	165	135	7.06
	16 wks	20.03	24.44	28.88	144	122	7.04
	20 wks	20.67	27.23	27.23	132	132	8.66
Group II BF + 600 mg AI/kg	13. wks	17.05	23.32	28.14	165	137	7.15
	16 wks	20.25	24.50	28.20	139	121	7.21
	20 wks	20.17	26.97	26.86	133	134	8.68
Group III BF + 1200 mg AI/kg	13. wks	17.00	23.37	27.60	162	137	7.18
	16 wks	20.24	23.79	28.07	139	117	6.67
	20 wks	19.95	26.65	26.89	135	134	8.42
Group IV BF + 1800 mg AI/kg	13. wks	17.67	23.55	28.55	162	133	7.30
	16 wks	20.40	24.45	28.12	138	120	6.76
	20 wks	19.81	26.47	27.25	137	134	8.83

AI- additional isoflavones

The body length is characteristic which indicates the evaluation of the development of the reproductive organs and the digestive system. There are no significant differences between the experimental groups in different periods during the investigation.

The values of the breast circumference and the length of the legs have a similar trend during the investigation.

The index of the Long-leggedness calculated on the base of the body length indicates that 13 wks old pullets have the highest value and reached 162 to 166%. The values of the index of Long-leggedness decreased on 138 to 144% in 16 wks old pullets, and on the 20 wks of age the index was similar and observed some increasing in the treated groups with a higher level of isoflavones.

The index called Stockiness, calculated on the basis of the breast circumference and the length of the body, indicates the highest level on the 13 wks of age and reached 133 to 137%, but the significant differences are not noticed as an result of the isoflavone treatment. The index decreased on 16 wks of age (117 to 121%), and significant differences are not noticed.

The Massiveness Index calculated on the basis of the body weight and the body length has a similar trend as other calculated indexes.

Several authors worldwide investigate the influence of isoflavones on the body weight of the chicken. **James et al.** (1994) and **Payne et al.** (2001b) reported that these phytoestrogens have effect on the increasing of the body weight of the broilers and the meat quality. In our experiment the body weight of the chicken fed with isoflavones supplemented feed during the period of growing and development was smaller in comparison with the control group, fed with basal diet.

There are some reported pieces of information (**Payne R.L. et al.,** 2001b; **Jiang Z.Y. et al.,** 2007) which indicate that phytohormones added in large amount in the feed of chicken caused changes in the body weight, appearence that have influence on some other exterior characteristics and the whole body conformation.

In our experiment the soya isoflavones supplemented in different concentration in the ISA Brown pullets diet caused depression of the body weight on the 6th week of age (P<0.05), the 13th week of age (P<0.01), on the 16th week of age (P<0.01) and on the 20th week of age (P<0.05) (Figure 1).

There is not enough relevant data on the influence of isoflavones on the body configuration of growing chicken from light egg strain varieties. From the data of our results it can be clearly seen that the length of the legs is longer in 13 wks old chicken and shorter in 20 wks old pullets. The average length in 13 wks of age is 28.52 cm and in 20 wks old pullets 27.32 cm. The same trend is observed with the long-leggedness index. The pullets (20 wks) have shorter

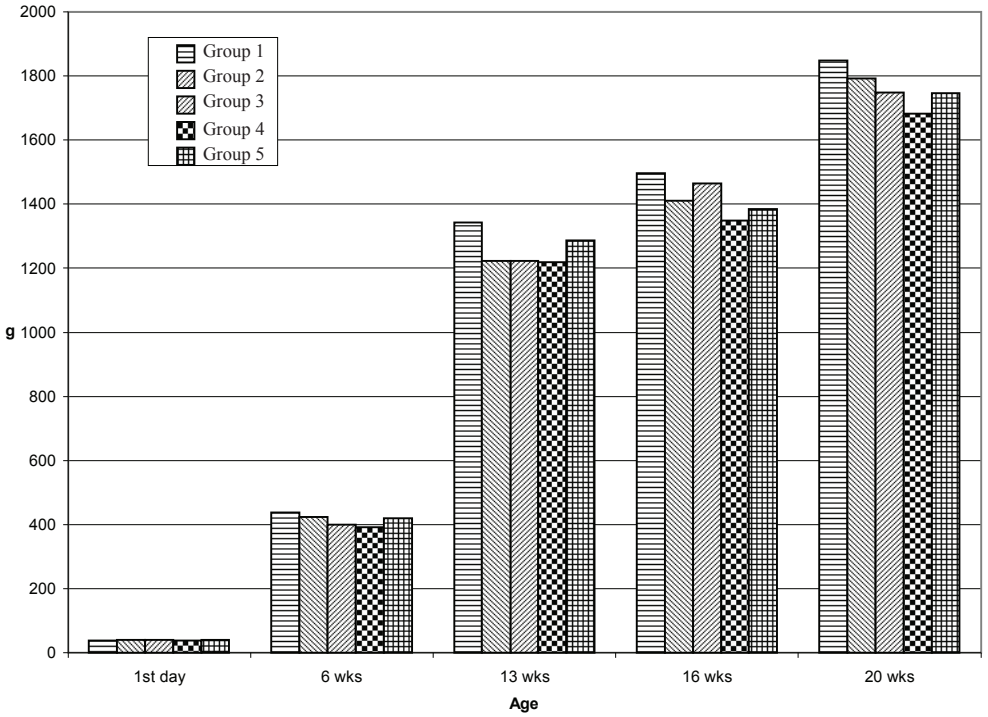

Figure 1. **Effect of supplemented isoflavones in the feed on the body weight of the chicken**

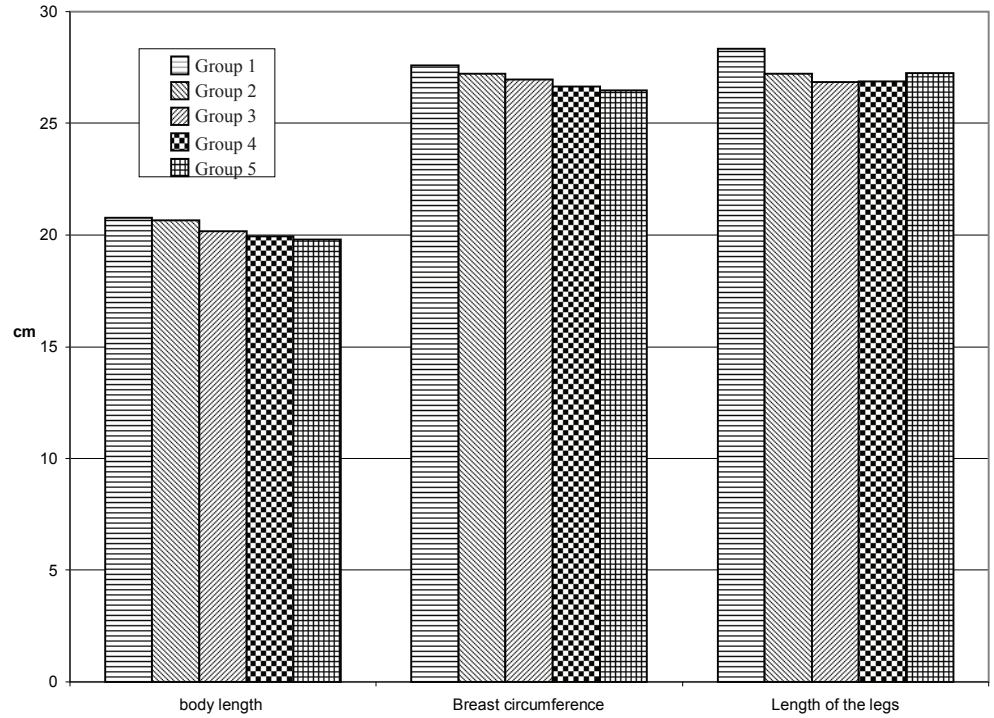

Figure 2. **Exterior measurements of the ISA Brown pullets at the 20th week of age**

legs and the opposite younger pullets (13 wks) have longer legs ($P<0.01$).

An opposite conclusion is found on the breast circumference which is longer in older pullets. The average in 13, 16 and 20 wks old pullets is 23.66, 24.32 and 26.98 cm, respectively. This trend is in a positive correlation with the age of pullets ($r=0.7$). The body length in 13 wks old pullets is in average 17.48 cm, but at 16th and 20th week the growth

is completed because the length is 20.4 cm (16th week) and 20.28 cm (20th week). The difference is significant between all experimental groups at 13th and 16th week of age, and between 13th and 20th week of age ($P<0.01$).

The skeletal exterior in the experimental groups depends on the age. The index of Long-leggedness has the highest value on the 13th week of age, but the index of the Stockiness has the smallest value on the 16th week of age.

The results of this investigation suggested that isoflavones supplemented diets did not influence the skeletal exterior indexes (Long-leggedness, Stockiness and Massiveness) of the ISA brown pullets.

Further experiments are required to investigate the influence of isoflavones on some other skeletal exterior characteristics of the ISA brown pullets.

CONCLUSIONS

From the obtained results of the investigation it can be concluded that soy isoflavones offered in different concentrations in the feed have influence on the body weight of the pulletes at all different ages during the experiment. The results of this investigation suggest that isoflavones supplemented in the diet did not influence the skeletal exterior indexes (Long-leggedness, Stockiness and Massiveness) of the ISA brown pullets.

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SUMMARY

The soy isoflavones are phytoestrogens with the same structure as the estrogen hormones, but with weaker activity. According to some authors, they influence the growth and the body weight of small chicken. Because of this we conducted a

study to establish the effect of isoflavones on the growth performances and the body weight of light strain chicken, from hatching to 20 weeks of age. The investigation has been made in a rearing farm. The feed in different periods was enriched with 40.88% isoflavone additive with amount of 300, 600, 1200 and 1800 mg /kg feed. From the obtained results of the investigation it can be concluded that soy isoflavones offered in different concentrations in the feed have influence on the body weight of the pulletes at all different ages during the experiment. The results of this investigation suggest that isoflavones supplemented in the diet did not influence the skeletal exterior indexes (Long-leggedness, Stockiness and Massiveness) of the ISA brown pullets.

Key words*: isoflavones, body weight, chicken, pullets*.

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