

EFFECTS OF HEATING WITH SOAKING OF RAW SOYBEANS ON IMPROVING ITS NUTRITIONAL VALUE AND PRODUCTIVE PERFORMANCE OF ROSS 308 BROILER

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ABSTRACT

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This study was conducted at the Poultry Farm, Department of Animal production, Faculty of Agricultural Sciences, University of Sulaimani Bakrajo. The experiment started from 5/2/2010 to 10/4/2010. A total of 225 one-day old broiler Ross 308 chicks were used. The chicks weighed and distributed randomly into 5 treatments groups each with 3 replicates of 15 chicks per replicate. Treatments were as follows: control: soybean meal basal diet, the first treatment T1: 20% raw full fat soybean (FFSB) in the diet for the stages starter, grower, and finisher. The second treatment T2: 40% of FFSB in the diet for the stages starter, grower, and finisher. The third treatment T3: 20% FFSB treated by soaking for 6 hours with heating on temperature of 120-130°C for 20 minutes for the stages starter, grower, and finisher. The fourth Treatment of T4: 40% FFSB treated by soaking for 6 hours with heating on Temperature 120-130°C for 20 minutes starter and grower phases and 30% treated FFSB soaked and heated for the finisher stage. Results indicated that treatment soybeans significantly caused variation in body weight and weight gain. Birds in the third and fourth treated groups showed highest live body weight ($P < 0.05$) and had better feed conversion ratio ($p < 0.05$) at 38 and 42 days. Highest production index ($p < 0.05$) was observed in birds fed soaked and heated FFSB. Control group was superior ($p < 0.05$) for dressing percentage. It was concluded that feeding different replacement levels of treated FFSB by soaking and heating resulted using in better productive performance in broilers at all marketing ages.

Key words: FFSB, treatment, nutritional value, productive performance, broiler.

INTRODUCTION

Soybean products are the most important sources of protein and energy in livestock feeds for many animals. Soybeans have a good amino acids profile with a high content of lysine, tryptophan, isoleucine, valine, and threonine (Larrier and Leclercq, 1994) in addition, soybeans contain 180–220 g/kg of good quality oil mainly with a high proportion of linoleic acid (Waldroup, 1982).

FFSB considered a rich feed ingredient in protein and energy when compared with soybean meal. Sara (2002) reported that digestible energy of FFSB was 4660 kcal/kg, in comparison with 3561 kcal/kg for Soybean meal, while the fiber percent were 5.5 and 6.2%, respectively. FFSB contains a set of inhibitors (Anti-Nutritional Factor, ANF). The negative effect of inhibitors in simple stomach animals is a damage of wall stomach and immune reactions, as well as poor digestion of nutrients (Huisman, 1989). Trypsin inhibitor considered one of the most important ANF found in the FFSB because of its effect on enzymes

secreted by the pancreas (Stahly *et al.*, 1991). This inhibitor affected without doubt in birds performance through decrease effectiveness of trypsin and kimotrypsin via decrease digestion of protein (Al-mjamai, 2002).

Trypsin inhibitor divided into two type: KuntizTrpsin inhibitor and Bowman Birk (Masic *et al.*, 1990, Duragic *et al.*, 2008, Kirkpinar and Basmacioglu, 2006). Phytic acid also found in oilseeds, legumes and grains. Which is a source for phosphorus and naturally confounded, and it is necessary for seeds fetus growth (Gibson and Ullah, 1988).

The aim of this study was to investigate the effect of heating and soaking soybean on performance of broiler chicks.

MATERIALS and METHODS

The experiment started from 5/2/2010 to 15/6/2010, to study the effect of partial replacement of soybean meal by Full Fat Soya Bean on the performance of

broiler chicks. A total of 225 one-day old broiler Ross308 chicks treated as one group during the first week. During this period chicks were fed a uniform starter diet contains 21.8% protein and 3049 kcal metabolizable energy /kg. At the beginning of the second week all chicks were weighed (176-182g) and distributed randomly into 5 experimental groups each with 3 replicates, each replicate contains 15 birds reared on floor cages. The control group fed a ration without FFSB (Table 1) the first treatment T1: 20% raw full fat soybean (FFSB) in the diet for the stages starter, grower, and finisher the feeding showed in the (Table 2). The second treatment T2: 40% of FFSB in the diet for the stages starter, grower, and finisher (Table 2). The third treatment T3: 20% FFSB treated by soaking for 6 hours with heating on temperature of 120-130°C for 20 minutes for the stages starter, grower, and finisher (Table 3). The fourth Treatment of T4: 40% FFSB treated by soaking for 6 hours with heating on Temperature 120-130°C for 20 minutes starter and grower phases

and 30% treated FFSB soaked and heated for the finisher stage (Table 3). An individual chick was weighed with weighting sensitive scale 1kg±0.01 at one day-old. As well as the birds weighed weekly for each replicate started from the first week till marketing ages (38, 42 or 45 days). Weight gains for each replicate were calculated.

Weekly feeds consumed for each replicate were calculated according to this Equation: Average feed consumption = amount of feed consumption by birds during period (gm/bird/ experimental period) / (number of live birds during same period × experimental period in days) × total dead birds age (al-hadme, 1994). Accordingly feed conversion ratio was calculated for each replicate.

Statistical analysis were done according to CRD to study the effect of treatments using XL stat, version 7.5 (2004) Comparison of means were done using (Duncan, 1955).

Table 1: Physical and calculated chemical composition of control diet.

Feed Component	Starter % (7-21 Days)	Grower % (22-28 Days)	Finisher % (29,38,42-45)
Wheat	56.38	56.30	62.85
*Protein concentrate	5.00	5.00	5.00
**Sun flower seed oil	4.17	6.62	6.68
Soybean meal %44	32.50	30.42	23.99
CaCO ₃	1.17	1.20	1.17
NaCl	0.00	0.004	0.003
Lysine	0.07	0.00	0.00
Methionine	0.17	0.15	0.10
Di-Ca-P	0.54	0.31	0.21
	100.0	100.0	100.0
calculated Chemical composition			
ME(kcal/kg)	3010	3175	3225
Crud Protein %	23.00	22.00	20.00
Total P %	0.50	0.45	0.42
Methionine %	0.65	0.63	0.55
Met. + Cys. %	0.92	0.88	0.78
Lysine %	1.38	1.27	1.11
Crude Fiber %	3.98	3.83	3.56
Crude Fat%	5.53	7.95	8.09
Lenolenic Acid %	2.74	4.11	4.15

* Protein concentrate (Provimi –Jordan) components.44%protein, 2100 Kcal/Kg ME, (5%Fat,2%Fiber, Calcium 6.5%, phosphor 6%, Lysine3.85%,Methionine3.75%,Met. + Cys4%, Sodium 2.3%).

** Enriched With vitamin A,D.

Table 2: Physical and calculated chemical composition of experiment of diets in treatments T1 and T2.

Feed Component	T1			T2		
	Starter% (7-21 Days)	Grower% (22-28Days)	Finisher% (29,38,42-45)	Starter% (7-21 Days)	Grower% (22-28Days)	Finisher% (29,38,42-45)
Wheat	50.16	51.63	59.36	54.10	54.00	60.54
Protein Concentrate*	5.00	5.00	5.00	5.00	5.00	5.00
Sun Flower Seed Oil**	0.00	1.77	3.00	1.73	4.15	4.21
Soybean Meal %44	2.63	0.05	1.24	17.33	15.25	8.83
FFSB	40.00	40.00	30.00	20.00	20.00	20.00
CaCO ₃	0.97	0.99	1.02	1.10	1.10	1.07
NaCl	0.33	0.00	0.00	0.00	0.00	0.00
Lysine	0.10	0.01	0.00	0.09	0.00	0.00
Methionine	0.06	0.04	0.02	0.11	0.10	0.04
cholin chloride	0.11	0.11	0.10	0.04	0.04	0.06
Di-Ca-P	0.64	0.40	0.26	0.50	0.36	0.25
	100.0	100.0	100.00	100.0	100.0	100.0
Calculated Chemical Composition						
ME(kcal/kg)	3030.47	3175	3225	3010	3175	3225
Crud Protein %	23.00	22.00	20.00	23.00	22.00	20.00
Total P %	0.50	0.45	0.42	0.50	0.45	0.42
%Methionine	0.57	0.54	0.48	0.61	0.58	0.50
Met. + Cys. %	0.92	0.88	0.78	0.92	0.88	0.78
Lysine %	1.38	1.25	1.10	1.38	1.25	1.10
Crude Fiber %	3.94	3.80	3.60	3.98	3.82	3.55
Crude Fat %	7.26	9.04	8.91	6.07	8.48	8.64
Lenolenic Acid %	3.54	4.53	4.46	2.94	4.31	4.36

protein concentrate (Provimi –Jordan) components.were 44%protein 2100 Kcal/Kg ME, (5%Fat, 2%Fiber, Calcium 6.5%, phosphor 6%, Lysine3.85%,Methionine3.75%,Met. + Cys4%, Sodium 2.3%).

** Enriched With vitaminA,D.

Table 3: Physical and calculated chemical composition of experiment of diets in treatments T3 and T.

Feed Component	T3			T4		
	Starter% (7-21 Days)	Grower% (22-28Days)	Finisher% (29,38,42-45)	Starter% (7-21 Days)	Grower% (22-28Days)	Finisher% (29,38,42-45)
Wheat	54.37	54.30	60.83	50.76	51.43	59.70
Protein Concentrate*	5.00	5.00	5.00	5.00	5.00	5.00
Sun Flower Seed Oil **	1.71	4.16	4.23	0.00	1.88	3.01
Soybean Meal %44	17.00	14.92	8.50	1.99	0.00	0.76
FFSB	20.00	20.00	20.00	40.00	40.00	30.00
CaCO ₃	1.07	1.10	1.07	0.96	1.00	1.02
NaCl	0.00	0.00	0.00	0.33	0.00	0.00
Lysine	0.09	0.00	0.00	0.10	0.01	0.00
Methionine	0.13	0.11	0.06	0.10	0.07	0.04
cholin chloride	0.04	0.05	0.06	0.11	0.11	0.10
Di-Ca-P	0.59	0.36	0.25	0.65	0.40	0.27
	100.0	100.0	100.0	100.0	100.0	100.0
ME(kcal/kg)	3010	3175	3225	3033	3175	3225
Crud Protein %	23.00	22.00	20.00	23.00	22.00	20.00
Total P %	0.51	0.45	0.42	0.50	0.45	0.42
Methionine %	0.62	0.59	0.52	0.57	0.56	0.50
Met. + Cys. %	0.92	0.88	0.78	0.92	0.88	0.78
Lysine %	1.38	1.25	1.10	1.38	1.25	1.10
Crude Fiber %	3.95	3.81	3.54	4.01	3.80	3.53
Crude Fat %	5.85	8.27	8.42	7.28	8.75	8.59
Lenolenic Acid %	2.82	4.18	4.23	3.53	4.36	4.27

Protein concentrate (Provimi –Jordan) components. 44%protein 2100 Kcal/Kg ME, (5%Fat, 2%Fiber, Calcium 6.5%, phosphor 6%, Lysine3.85%,Methionine3.75%,Met. + Cys4%, Sodium 2.3%).

** Enriched With vitaminA, D.

RESULTS

Table (4) showed the effect of FFSB treated by soaking and heating on final weight gain of chicks at 38, 42 and 45 days of age. Linear decrease ($p < 0.05$) in body weight of birds fed FFSB with each increase in FFSB level in the diet was noticed. It is obvious when first and Second birds groups were compare versus control group at all ages. Effect of using treated FFSB on the total weight gain of chicks showed in table (5). Birds fed in the fourth treated group showed superiority ($p < 0.05$) in the weight gain (1908.76 and 2434.40 kg) compared to other treatments, during 1-38 and 1-45 days old. It was noticed that birds in the third treated group were superior in final weight gain (2257.48) compared to control and second treated during 1-42 days old.

Table (6) illustrates the effect of using treated FFSB on feed consumption of chicks up to market weights. Feed conversion ratio was the highest for birds of fourth group (1.79) (Table 7).

The results in Table (8) showed that the effected of using raw and treated FFSB on the percentage of livability of the birds. The average mortality resulted in all groups were similar and within normal range. The statistical analysis resulted in a non-significant effect among treatment groups on the percentage of livability of the birds at all ages. Minimum production index was found in birds second treated (Table 9).

Table (10) showed the live-weight at slaughter while Table (11) presented carcass weights with edible entrails. The statistical analysis referred a significant differences in percentages of dressing with edible entrails (Table 12). Birds in the second treated group had highest dressing percentage (89.72%) ($p < 0.05$) by 38 days old and this may due to highest body weight before slaughter. On the other hand, birds in the first treated group gave highest percentage (80.59%) in dressing with edible entrails, while the birds in the second treated group had the lowest percentage (58.51%) at 42 days of age.

Table (13) illustrated the breast percentage, where significant ($p < 0.05$) between control versus soaking and heat treatments at 38 days old. Furthermore, soaking and heating FFSB significantly ($p < 0.05$) had better breast % compared both control and raw FFSB groups at age 45 days.

Table (14) showed effect of treatment of FFSB on percentage of thigh weights at 38, 42 and 45 days. It was noticed significant differences found for percentage of thigh at 42 and 45 days old between treated FFSB compared to control group. Moreover, inclusion rate of FFSB affected thigh weights. The minimum percentage for the thigh was recorded for birds in the second treated group (21.74%) while the highest percentage for the thigh was recorded for birds in the third treated group (28.86%).

Table 4: Effect of feeding raw and treated FFSB of final body weights (g) of broilers (mean \pm standard deviation).

Age Treatment	38 day			42 day			45 day		
control	1794.19	\pm 99.75	c*	2290.21	\pm 181.04	ab	2312.50	\pm 176.80	bc
T1	1574.70	\pm 82.48	d	1814.58	\pm 94.65	dc	2075.00	\pm 229.80	c
T2	1431.11	\pm 63.36	d	1564.80	\pm 75.40	d	1868.80	\pm 61.87	C
T3	1930.24	\pm 7.21	bc	2440.48	\pm 112.12	a	2206.30	\pm 97.23	Bc
T4	2100.24	\pm 106.91	a	2402.08	\pm 94.65	ab	2625.00	\pm 17.68	A

Table 5: Effect of feeding raw and treated FFSB of final weight gain (g) (mean \pm standard deviation).

Age Treatment	1-38 day			day1-42			1-45day		
control	1612.64	\pm 103.15	c	2108.66	\pm 184.60	b	2128.80	\pm 176.20	bc
T1	1399.26	\pm 82.82	d	1639.14	\pm 94.15	c	1899.50	\pm 234.80	c
T2	1271.58	\pm 66.78	d	1405.20	\pm 61.80	d	1704.10	\pm 47.20	C
T3	1747.22	\pm 8.13	bc	2257.45	\pm 114.78	a	2021.80	\pm 95.25	B
T4	1908.76	\pm 108.40	a	2210.59	\pm 90.59	ab	2434.40	\pm 23.19	A

* Different letters meant that there is a significant differences ($P < 0.05$)

Table 6: Effect of feeding raw and treated FFBS of feed consumption (g/ chick) of broiler during the different experimented point (mean \pm standard deviation).

Age Treatment	38 day			42 day			45 day		
Control	3845.90	\pm 167.10	a	5855.10	\pm 451.10	a	6041.66	\pm 413.94	a
T1	3366.70	\pm 33.00	b	5142.00	\pm 284.80	cd	5447.13	\pm 437.16	a
T2	2997.30	\pm 6.40	c	4662.10	\pm 97.40	d	4958.29	\pm 781.33	a
T3	3534.80	\pm 127.10	b	5724.50	\pm 211.00	ab	5823.34	\pm 722.39	a
T4	3391.10	\pm 179.40	b	5299.70	\pm 428.10	bc	5476.51	\pm 719.46	a

* Different letters meant that there is a significant differences (P<0.05)

Table 7: The Impact of the use of raw and soy beans treatment on final feed conversion ratio (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
control	2.39	\pm 0.15	a	2.78	\pm 0.06	Bc	2.84	\pm 0.04	A
T1	2.41	\pm 0.13	a	3.14	\pm 0.14	Ab	2.88	\pm 0.13	A
T2	2.36	\pm 0.13	a	3.32	\pm 0.17	A	2.92	\pm 0.54	A
T3	2.02	\pm 0.08	b	2.54	\pm 0.21	Cd	2.88	\pm 0.22	A
T4	1.78	\pm 0.12	c	2.40	\pm 0.15	D	2.25	\pm 0.32	A

* Different letters meant that there is a significant differences (P<0.05)

Table 8: The Impact of the use of raw and soy beans treatment on percentage of the final livability (mean \pm standard deviation).

Age Treatment	38 day			42 day			45 day		
Control	91.11	\pm 3.85	ab	91.11	\pm 3.85	ab	91.11	\pm 3.85	ab
T1	100.00	\pm 0.00	a	100.00	\pm 0	a	100.00	\pm 0.00	a
T2	95.83	\pm 3.61	ab	95.83	\pm 3.61	ab	95.83	\pm 3.61	ab
T3	91.11	\pm 15.40	ab	91.11	\pm 15.4	ab	91.11	\pm 15.40	ab
T4	86.67	\pm 6.67	b	86.67	\pm 6.67	b	86.67	\pm 6.67	B

* Different letters meant that there is a significant differences (P<0.05)

Table 9: The Impact of the use of raw and soy beans treatment on directory final production index (mean \pm standard deviation).

Age Treatment	38 day			42 day			45 day		
Control	180.50	\pm 16.50	de	167.00	\pm 9.80	abc	169.01	\pm 15.33	ab
T1	172.50	\pm 18.10	e	137.90	\pm 11.60	cd	160.90	\pm 24.77	ab
T2	153.70	\pm 20.70	e	107.60	\pm 7.80	d	136.20	\pm 29.60	B
T3	230.10	\pm 47.30	cd	212.50	\pm 58.70	ab	148.51	\pm 37.10	Ab
T4	271.10	\pm 44.50	bc	207.40	\pm 22.80	a	228.76	\pm 58.15	ab

* Different letters meant that there is a significant differences (P<0.05)

Table 10: The Impact of the use of raw and soy beans treatment on live weight at slaughter (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
control	2104.17	\pm 195.93	b	1916.67	\pm 309.62	bc	2112.50	\pm 370.09	b
T1	1737.50	\pm 347.80	c	1731.08	\pm 207.03	c	1875.00	\pm 239.05	cd
T2	1450.00	\pm 206.71	d	1925.42	\pm 299.23	bc	1668.75	\pm 289.01	D
T3	2362.50	\pm 266.39	a	2031.83	\pm 330.50	ab	2006.25	\pm 184.08	Cd
T4	2345.83	\pm 263.25	a	2200.00	\pm 265.55	a	2425.00	\pm 179.28	A

* Different letters meant that there is a significant differences (P<0.05)

Table 11: The Impact of the use of raw and soy beans treatment on carcass weights with edible viscera (g) (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
control	1528.72	\pm 158.69	a	1372.25	\pm 262.84	bc	1530.28	\pm 305.71	cd
T1	1328.89	\pm 188.48	bc	1397.00	\pm 228.65	abc	1400.35	\pm 266.90	cde
T2	1286.91	\pm 236.76	c	1113.83	\pm 153.21	D	1192.12	\pm 212.58	E
T3	1648.01	\pm 188.55	a	1491.00	\pm 272.53	ab	1383.95	\pm 230.24	Cde
T4	1693.85	\pm 225.82	a	1571.00	\pm 288.97	a	1793.20	\pm 154.02	Ab

* Different letters meant that there is a significant differences (P<0.05)

Table 12: The Impact of the use of raw and soy beans treatment on percentage of dressing percentages with the edible viscera (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
Control	72.60	\pm 1.49	Bc	71.87	\pm 9.45	b	72.20	\pm 4.07	a
T1	78.28	\pm 13.61	B	80.59	\pm 8.01	a	71.53	\pm 7.69	a
T2	89.72	\pm 14.96	A	58.51	\pm 8.25	c	71.44	\pm 3.28	a
T3	69.78	\pm 2.52	Bc	73.15	\pm 2.35	b	69.51	\pm 13.98	a
T4	72.60	\pm 9.22	Bc	71.47	\pm 10.73	b	73.90	\pm 1.89	a

* Different letters meant that there is a significant differences (P<0.05)

Table 13: The Impact of the use of raw and soy beans treatment on percentage of breast (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
Control	31.52	\pm 3.12	b	31.96	\pm 1.81	ab	31.70	\pm 2.06	a
T1	27.84	\pm 5.56	b	30.14	\pm 3.66	b	29.41	\pm 1.99	ab
T2	21.12	\pm 6.92	c	30.34	\pm 2.05	b	28.50	\pm 2.15	B
T3	33.01	\pm 6.11	a	32.37	\pm 2.62	a	30.31	\pm 1.96	Ab
T4	31.10	\pm 6.29	b	31.61	\pm 2.96	ab	31.64	\pm 2.84	A

* Different letters meant that there is a significant differences (P<0.05)

Table 14: The Impact of the use of raw and soy beans treatment on percentage of thigh (mean \pm standard deviation).

Age Treatment	38 day			day42			45day		
Control	26.84	\pm 1.22	a	27.29	\pm 1.35	ab	27.39	\pm 0.88	a
T1	25.78	\pm 5.00	ab	26.65	\pm 2.96	b	27.31	\pm 0.86	a
T2	21.74	\pm 6.83	b	28.50	\pm 1.34	ab	28.56	\pm 1.63	A
T3	26.25	\pm 1.66	A	28.86	\pm 3.54	a	27.67	\pm 1.07	A
T4	26.27	\pm 1.15	A	27.80	\pm 1.73	ab	26.80	\pm 0.82	A

* Different letters meant that there is a significant differences (P<0.05)

DISCUSSION

The results of this experiment agreed with result of Simeanu, (2008), who found the efficiency of soaking treatment and heating reduced the activity level of enzymes urease and trypsin inhibitor. Agunbiade, (2000) concluded that Significant improvement in live body weight and weight gain for the first two periods was observed in broilers fed diets containing 10% raw full fat soybean(RFFSB). The highest body weights and gains were obtained with the diets that contained the roasted, full-fat soybeans and the lowest values for the birds given the SBM-containing diet. Neither type of basal diet nor dietary full-fat soybean level influenced ($P > 0.05$) final body weights (36 d), weight gains or feed intakes and feed conversions during the finisher period(22–36 d) (Hamilton and McNivan, 2000). The result of body weight and weight gain was in agreement with the finding of Etusim *et al.* (2008) this may be due to better utilization and efficiency heated and soaking of FFSB which may led to get rid of some toxic materials or anti nutritional factors. This also agreed with Amaefula *et al.* (2005). Popescu and Criste (2003) noticed a marginal differences when using FFSB during 1-42 days old, and this also agreed with the study of Rathgeber *et al.* (2005).

It was noticed that total feed consumption for the control group was higher than other treatment groups at 38 and 42 days old. This is an evidence that raw FFSB as well as treated FFSB contain varying proportions of anti-nutritional factor which decrease feed consumption due to urease enzyme activity. Similar result was found by Popescu and Criste (2003). Consuming feed has positive relation with body weight as it is known (North, 1984). FFSB treatments and it is inclusion rate up to 38-42 days old had a significant effect on feed consumption compared to soybean meal.

This may be due to rid of anti-nutritional factors which are responsible of decrease growth as a result of untreated raw Soybean (Saxena *et al.*, 1963 and Lepkovsky *et al.*, 1965).

Autoclave heating of FFSB at 102° c for 30 minutes led to increase the growth and feed conversion ratio by 31% compared to raw Soybean. Such differences were reduce with advanced age and disappear by 6 weeks old. Autoclave heating of FFSB at 102° c for 30 minutes led to increase the growth and feed conversion ratio by 31% compared raw Soybean. Such differences were reduce with advanced age and disappear by 6 weeks old. This may an evidence that FFSB in all treatment had no negative effects on livability of the birds, this agreed with Etusim *et al.* (2008).

A high percentage of the share breasts in the group that consumed the heat treated soybeans can be explained by a sufficient quantity of proteins that chickens adopted during the growth, what is not the case for the group where the heat treated soybeans were used. Where is due to the presence of anti-nutritive factors in the first place of the proteases ‘ proteins adoption was difficult or impossible (Beukovic *et al.*, 2012). Considering the drumsticks, which have a larger share in the group on raw soybeans than in the group that has been on heat treated soybeans, the explanation lies in the fact that in terms of relative weight ratio (compared to conventional treatment), noting that the mass after conventional treatment of chickens was half less in the group that consumed a meal without heat treatment (Beukovic *et al.*, 2012).

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تأثير استخدام معاملة الحرارة مع النقع على تحسين القيمة الغذائية لحبوب فول الصويا الخام وعلى الأداء الإنتاجي لفروج اللحم سلالة Ross 308

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أجريت هذه الدراسة في حقل الدواجن التابع لمديرية الحقول الزراعية/كلية العلوم الزراعية/جامعة السليمانية في منطقة بكرجو، بدأت التجربة في ٢٥/٢/٢٠١٠ وانتهت في ١٠/٤/٢٠١٠، استخدم في التجربة (٢٢٥) أفراخ فروج اللحم من سلالة Ross 308 بعمر يوم واحد. وزنت الأفراخ ووزعت بشكل عشوائي على ٥ معاملات في التجربة بواقع ٣ مكررات لكل معاملة و١٥ فرخة لكل مكرر. كانت المعاملات كالتالي: معاملة السيطرة : (كسبة فول الصويا). المعاملة الأولى T1: حبوب فول الصويا الخام في العليقة بنسبة ٢٠% للمراحل البادئ والنامي والناهي. المعاملة الثانية T2: حبوب فول الصويا الخام في العليقة بنسبة ٤٠% للمراحل البادئ والنامي والناهي. المعاملة الثالثة T3: حبوب فول الصويا المعاملة بالنقع لمدة ٦ ساعات مع الحرارة على درجة حرارة ١٢٠-١٣٠م لمدة ٢٠ دقيقة بنسبة ٢٠% في العليقة للمراحل البادئ والنامي والناهي. المعاملة الرابعة T4: حبوب فول الصويا المعاملة بالنقع لمدة ٦ ساعات مع الحرارة على درجة حرارة ١٢٠-١٣٠م لمدة ٢٠ دقيقة بنسبة ٤٠% في العليقة لمرحلتى البادئ والنامي و ٣٠% لمرحلة الناهي. تباين تأثير معاملات حبوب فول الصويا في وزن الجسم والزيادة الوزنية، حيث أعطت المعاملات T3 و T4 اعلى أوزان الجسم الحي (P<0.05)، وأفضل معامل التحويل لغذائي بفرق معنوي (P<0.05) كان في المعاملات T3 و T4 في عمرين ٣٨ و ٤٢ يوماً تفوقت معاملة السيطرة على بقية المعاملات بالنسبة لصفة نسبة التصافي. تم التوصل إلى الاستنتاج بان معاملة حبوب فول الصويا الخام بالنقع والحرارة واستخدام نسب الإحلال المختلفة أدى إلى تحسن ملحوظ في الكفاءة الإنتاجية لدجاج اللحم في جميع أعمار التسويق تحت الدراسة.