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EFFECT OF DIETARY EXTRUDED FULL-FAT SOYBEAN SEED ON BROILER PERFORMANCE

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ABSTRACT

Total of 180 day-old Anake-2000 broiler chicks were divided randomly into equal four treatments, to study the effect of dietary different levels (10, 20 and 30 %) of extruded full-fat soybean seed on growth performance, feed efficiency, carcass characteristics and some blood constituents.

Chicks fed diets contained extruded full-fat soybean seed had significantly higher weight gain values, although feed consumption was decreased when compared with the control group. As a result, feed conversion was improved for all chicks fed extruded full-fat soybean.

Dietary different levels of extruded full-fat soybean decreased blood cholesterol content. Also, liver content of cholesterol and total lipids were decreased.

On the other hand, the highest value for proportional carcass weight was observed with chicks fed 20 % extruded full-fat soybean. Moreover, the same treatment was economical than the other treatments.

Keywords: soybean fat, broiler, performance.

INTRODUCTION

It is important to acknowledge some of energy resources toward researching and publicizing their benefit to be recognized as a high quality and economical feed ingredient.

Whole soybean seed without the extraction of its voluble and high quality oil content, is referred to as full- fat soya. Full-fat soybean seems to be an interesting ingredient in broilers feed as an alternative for separately added animal fats or vegetable oils, which can not or hardly compete with feed grains as energy source.

Raw soybean seed cannot be used successfully in poultry feed or human food, because it contains many anti-nutritional factors. Therefore, it is very important to inactivate this anti-nutritional substances in soybean.

All studies coincide in the need of processing the beans in such way that all anti-nutritional factors are eliminated (Herkelman *et al*., 1989 and Zhang *et al*., 1991).

For all that, a new nutritional technology have emerged, and created for using full-fat soybean in poultry nutrition. The extrusion process is such a method to inactivate the anti-nutritional substances, so adding high quality oil to the diets could be available, (Wiseman, 1984; Stillborn *et al*., 1987 and Waldroup & Hazem, 1988).

Due to these interesting technological and nutritional aspects of full-fat soybean, this experiment aimed to investigate the effect of using different levels of extruded full-fat soybean seed as energy and protein sources on broiler performance.

MATERIALS AND METHODS

This experiment was conducted at the poultry experimental station, Department of Animal Production, Faculty of Agriculture, Al-Azhar University. The chemical analysis of this study was carried out at the laboratories belonging to Animal Production Research Institute, Agriculture Research Center, Dokki, Egypt.

A total number of 180 day-old Anak-2000 chicks were individually weighed, wing banded and randomly distributed into four equal treatments, each of 45 chicks. Each treatment was subdivided into three replicates of 15 chicks each with approximately similar initial body weight. Chicks of all experimental treatments were kept under similar hygienic and environmental conditions and vaccinated against common diseases.

Starter and finisher diets (Table 1 and 2) were supplemented with three levels (10, 20 and 30 %) of extruded full-fat soybean (obtained from Independent Poultry Advisory Group, I.P.A.G.) in addition to the fourth treatment which was free from extruded full-fat soybean (control diet). All rations was isonitrogenous and isoenergetic.

Floor brooders with gas heating were used for chicks with density of 10 chicks per square meter. Feed and water were offered to all chicks ad. Libitum. Individual live weight and feed consumption for each replicate were recorded at weekly intervals during the experimental period. The proximate analysis of the different samples (Table 1 and 2) were carried out according to the Official Methods of Analysis (A.O.A.C., 1980). The methods described by Caskey and Knapp (1944) and Borchers *et al*. (1948) were used to determine the activities of urease and trypsin inhibitor, respectively.

At the end of the experimental period, random samples of three birds from each treatment were slaughtered to determine the carcass characteristics. Shank and head were separated, the birds were then eviscerated and intestine, gizzard, lungs, spleen, liver, heart and reproductive organ were removed. The carcass and giblits (empty gizzard, liver and heart) were separately weighed.

Blood samples were collected at the same time of slaughtering and centrifuged to determine serum total lipid (Zollner and Kirsch, 1962) and cholesterol (Watson, 1960). This biochemical determinations of blood serum were performed colorimetrically by using commercial kits purchased from Alcan Company, Egypt. Moreover, the method of Floch *et al*. (1957) was used for the isolation and purification of tissue to estimate total lipid and cholesterol in the liver.

Mortality rate was calculated by subtracting the number of live birds at the end of the experiment from the initial total number of birds. Economic efficiency was expressed as feed cost / kg gain.

Analysis of variance was conducted on all data using the General Linear Models Procedure as SAS (SAS Institute, 1993). Significant differences between treatment means were determined using Duncan's multiple-range test (Duncan, 1955). Data estimated in percent form were subjected to arc-sin transformation before being analysed and re-transformed again to the original scale before presentation, (Bliss, 1937).

Table (1): Formula and chemical analysis of starter diets .

Treatments / Item	Levels of extruded full- fat soybean			
	0 % (control)	10 %	20 %	30 %
Yellow corn	49.5	50.3	51.4	46.7
Soybean meal (44%)	40.2	31.9	23.5	14.6
Extruded Full fat soybean	--	10.0	20.0	30.0
Soya oil	6.0	3.5	0.9	-
Limestone	1.4	1.4	1.3	1.3
Dicalcium phosphate.	1.9	1.9	1.9	1.9
Sodium chloride	0.25	0.25	0.25	0.25
Methionine	0.2	0.2	0.2	0.2
Choline chloride	0.05	0.05	0.05	0.05
Zinc bacitracine	0.1	0.1	0.1	0.1
Anticocsidia	0.1	0.1	0.1	0.1
Vit. & Min premix *	0.3	0.3	0.3	0.3
Wheat bran	-	-	-	4.5
Total	100	100	100	100
Chemical analysis % :				
Crude protein	22.0	22.04	22.02	22.07
Crude fiber	4.32	3.98	4.06	4.21
Ether extract	7.95	7.64	7.03	7.76
Ash	5.02	5.64	5.16	5.72
Calculated values:				
ME kcal/kg diet	3100	3100	3102	3104
Lysine %	1.29	1.29	1.29	1.29
Methionine %	0.54	0.54	0.54	0.54
Methionine+cystine%	0.92	0.92	0.92	0.91

Each 3 kg of vitamin and minerals mixture contain: Vit.A, 12000,000 IU; Vit D_3, 2000,000 IU; Vit.E, 10,000 mg; Vit. K3, 2000 mg; Vit. B_1, 1000 mg; Vit B_2, 5000 mg; Vit B_6, 1500 mg; Vit B_{12}, 10 mg; Pantothenic acid, 10,000 mg; Nicotenic acid, 30,000 mg; Folic acid, 1000 mg; Bioten, 50 mg; Choline, 50,000 mg; Copper, 10,000 mg; Iodine, 1000 mg; Iron, 30.000 mg; Manganese, 60,000 mg; Zinc, 55,000 mg; Selenium, 100 mg; and Cobalt, 100 mg .

Table (2): Formula and chemical analysis of finisher diets.

Treatments / Item	Levels of extruded full- fat soybean			
	0 % (control)	**10 %**	**20 %**	**30 %**
Yellow corn	58.5	59.6	60.5	55.2
Soybean meal	31.8	23.4	15.0	6.1
Extruded Full fat soybean	--	10.0	20.0	30.0
Soya oil	6.0	3.3	0.8	-
Limestone	1.3	1.3	1.3	1.3
Dicalcium phosphate	1.6	1.6	1.6	1.6
Sodium chloride	0.2	0.2	0.2	0.2
Methionine	0.1	0.1	0.1	0.1
Zinc bacitracine	0.1	0.1	0.1	0.1
Anticocsidia	0.1	0.1	0.1	0.1
Vit & Min premix *	0.3	0.3	0.3	0.3
Wheat bran	--	--	-	5.0
Total	100	100	100	100
Chemical analysis % :				
Crude protein	19.02	19.05	19.00	19.07
Crude fiber	3.89	3.92	4.01	4.06
Ether extract	8.42	7.86	7.29	8.13
Ash	5.31	5.36	5.88	5.92
Calculated values:				
ME kcal/kg diet	3212	3203	3200	3203
Lysine %	1.07	1.07	1.06	1.06
Methionine %	0.40	0.40	0.41	0.40
Methionine+cystine%	0.75	0.74	0.75	0.75

*** Each 3 kg of vitamin and minerals mixture contain: Vit.A, 12000,000 IU; Vit D_3, 2000,000 IU; Vit.E, 10,000 mg; Vit. K3, 2000 mg; Vit. B_1, 1000 mg; Vit B_2, 5000 mg; Vit B_6, 1500 mg; Vit B_{12}, 10 mg; Pantothenic acid, 10,000 mg; Nicotinic acid, 30,000 mg; Folic acid, 1000 mg; Bioten, 50 mg; Choline, 500,000 mg; Copper, 10,000 mg; Iodine, 1000 mg; Iron, 30.000 mg; Manganese, 60,000 mg; Zinc, 55,000 mg; Selenium, 100 mg; and Cobalt, 100 mg .**

RESULTS AND DISCUSSION

1.Proximate analysis of raw or extruded full-fat soybean seed and soybean meal:

Data presented in Table (3) showed the proximate analysis of full-fat soybean seed as raw material or extruded, and soybean meal.

Extrusion in a simple terms is a process in which the whole or ground soybean are forced through a barrel with variable screw configurations, and are pressed through a die at the end (Josef and Barbi, 1996).

Table (3): Proximate analysis of raw, extruded full-fat soybean seed and soybean meal, (on dry matter basis).

Item	Raw full-fat soybean seed	Extruded full-fat soybean seed	Soybean meal
Moisture %	9.70	8.11	9.00
Crude protein %	38.59	39.34	45.60
Ether extract %	23.77	21.37	1.21
Crude Fiber %	8.50	7.41	7.86
Ash %	6.74	5.63	6.59
Nitrogen free extract %	22.40	26.25	38.74
Trypsin units inhibited (TUI/mg.)	81.25	8.41	2.98
Urease activity Δ PH	1.61	0.10	0.04

The achieved results show that, the extruded full-fat soybean is a highly valuable source of crude protein and energy (ether extract content), since the circumstances during the extrusion process are such ideal to destroy most of the anti-nutritional factors which involved in raw soybean seed (trypsin inhibition and urease activity). Also, this process is very important, so it leads to destroy the cell wall which permits oil to draw out, consequently the extruded full-fat soybean is preferring by its natural and highly oil content. In addition, the anti-nutritional substances are sufficiently inactivated, yet their contents are nearly as those found in soybean meal.

It is clear that, the index of urease activity and trypsin inhibitor (Table 3) were reduced to 0.10 Δ PH and 8.41 TUI/mg with a loss of 93.79 % and 89.64 %, respectively, in their activities in extruded full-fat soybean relative to those originally found in raw soybean seeds. The decrease in the urease activity in extruded full-fat soybean was more pronounced than that in trypsin inhibitor. This result is in coincide with that of McNaughton and Reece, (1980) who indicated that, more heat was required to completely suppress the trypsin inhibitor content than urease.

The previous results enable to suggest that, variations which found in the proximate analysis between raw and extruded of full-fat soybean seed may be attributed to the change occurred in the water content of treated full-fat soybean as a result of heat treatment. This may have a pronounced reflection on the proportional content of different components.

Buitrago (1992) indicated that, extruded full-fat soybean contains from 37 to 38 % crude protein and between 3400 and 3800 kcal/kg metabolizable energy. So, Navarro *et al*. (1996) stated that, it is an excellent alternative to upgrade the protein energetic value of the diets.

2.Live body weight and weight gain:

All chicks were fed on a commercial starter diet during the first week of age to minimize the maternal effect. This may create suitable condition to appraise the effect of dietary treatments during the subsequent periods of growth. Chicks within all treatments have commenced with a nearly similar initial live body weight (about 150 g. at 7 days of age).

Concerning the results during the entire period elapsed (Table 4) between 1 and 6 wks. of age, revealed that, chicks which were fed diets contained extruded full-fat soybean seed had significantly (P<0.05) higher weight gain values than those fed the control diet..

Obviously, incorporation of extruded full-fat soybean seed at the levels of 10, 20 or 30 % gave nearly values of weight gain at the period 1-6 wks, being 1733.15, 1759.98 and 1779.77 g. / bird, respectively with no significant differences among them, and all were significantly (P> 0.05) better than the control group. The proportional increment for weight gain was 8.33, 10.01 and 11.24% for chicks fed 10, 20 and 30% extruded full-fat soybean seed, respectively compared to the control one (Table 4). These results indicated that, weight gain was obviously improved with elevating the level of extruded full-fat soybean seed in broiler diets from 0.0 up to 30 %.

Table (4): Effect of different experimental treatments on Anak broiler chicks performance.

Item	Levels of extruded full-fat soybean				Sig.
	0 % (control)	10 %	20 %	30 %	
Initial body weight (at 1 wk of age g)	152.93	152.93	150.47	152.47	Ns
Live weight :					
At 4 wks of age (g)	1053.70 ^{b}	1058.18 ^{b}	1093.86 ^{a}	1117.72^{a}	*
At 6 wks of age (g)	1752.85 ^{c}	1884.77^{b}	1910.45^{ab}	1932.72^{a}	*
Weight gain :					
(1-4) wks of age (g/chick)	900.77 ^{b}	906.56^{b}	943.39^{a}	964.77^{a}	*
(4-6) wks of age (g/chick)	699.15^{b}	826.59^{a}	816.59 ^{a}	815.00 ^{a}	*
(1-6) wks of age (g/chick)	1599.90 ^{b}	1733.15 ^{a}	1759.98 ^{a}	1779.77 ^{a}	*
Feed consumption :					
(1-4) wks of age (g/chick)	1590	1510	1540	1550	Ns
(4-6) wks of age (g/chick)	1810 ^{a}	1650 ^{b}	1740 ^{ab}	1720 ^{ab}	*
(1-6) wks of age (g/chick)	3400 ^{a}	3160 ^{b}	3280 ^{ab}	3270 ^{ab}	*
Feed conversion :					
(1-4) wks of age (g)	1.77^{a}	1.67^{b}	1.63^{b}	1.61^{b}	*
(4-6) wks of age (g)	2.61^{a}	2.00^{b}	2.13^{b}	2.11^{b}	*
(1-6) wks of age (g)	2.13^{a}	1.82^{b}	1.86^{b}	1.84^{b}	*
Mortality rate %	4.44	-	2.22	4.44	

Means of the same raw bearing different letters differed significantly (P<0.05).
NS= Not significant
*** = Significant (P<0.05).**

This improvement may be due to the elevated temperature which results directly through friction process (dry extrusion, Josef and Barbi, 1996), consequently shattered the fibers and preserving the high nutritional value of the soya protein, since the heating time is to few seconds (5 second), so amino acids are intact.

Rand *et al*. (1996) showed that, in extruded full-fat soybean seed not only the absence of anti-nutritional activity is of importance, also the digestibility consequently, absorbability and availability of the nutrients specially fatty acids. Moreover, Koci *et al*. (1996) indicated that, in extruded full-fat soybean seed the proportion of multiple unsaturated fatty acids increased and achieved with highly valuable sources of crude protein. In addition, Swick (1996) stated that, full-fat soybean contains high levels of linoleic acid, lysine, vitamin E and lecithin. In this respect, vitamin E is the most common natural anti-oxidant (Wahba, 1969), since the presence of vitamin E lead to upgrade the natural soya oil and may improved oil stability by inhibiting the rancidity of oil. Also. Also, lecithins are particularly important in fat metabolism by the liver, consequently the natural oil which is involved in full-fat soybean seed became more digestible and had an extra caloric effect, so full-fat soybean in being an excellent source of both protein and energy.

Generally, it was stated that, using extruded full-fat soybean need was more efficient than the control diet.

3. Average feed consumption and feed conversion:

During the experimental period (1-6 wks), it was clearly noted that, feed consumption was decreased for all groups fed extruded full-fat soybean seed than that fed the control by about 7.06, 3.53 and 3.82% for chicks fed 10, 20 and 30% extruded full-fat soybean), respectively (Table 4).

Analysis of variance showed a significant (P>0.05) variations between control chicks and those fed 10 % extruded full-fat soybean seed (Table 4). However, no significant differences were found among the three groups fed 10, 20 and 30 % extruded full-fat soybean seed in the diet, since chicks consumed nearly equal values of feed.

Concerning feed conversion (Table 4), during the overall experimental period, it was evident that, chicks which fed diets contained 10, 20 and 30 % extruded full-fat soybean seed gave nearly equal values with no significant differences among them (1.82, 1.86 and 1.84 kg diet for each kg gain, respectively). However, the fed conversion of the group fed the control diet was significantly (P > 0.05) the poorest one, (2.13 kg diet for each kg gain).

As a matter of fact, the influence of improving feed conversion for chicks fed diets containing 10, 20 or 30 % extruded full-fat soybean seed may be due to the elevated temperature during the extrusion process which lead to destroy oil cells membrane, consequently, oil has been released with abundantly of polyunsaturated fatty acids which have been determined essential for better growth, (Murray *et al*., 1991). Moreover, this improvement may be attributed to the interactions between oil (which involved in full-fat soybean) and other dietary components. This theory, supported by Summers,

(1984) and Lewis (1985). They indicated that, oil which involved in full-fat soybean cells can improve the absorbability of the other nutrients.

The proportional improvement of feed conversion for chicks fed diets containing the three different levels of extruded full-fat soybean seed (10, 20 and 30 %) were 14.55, 12.68 and 13.62 %, respectively during the overall experimental period (Table 4) when compared with the control diet.

Monari, (1990) indicated that, the use of full-fat soybean as an ingredient becomes attractive at feed mills where the addition of fat is not practical.

4. Carcass characteristics:

The results obtained for carcass characteristics are listed in Table (5). It was observed that, the inclusion of extruded full-fat soybean in broiler chicks diet resulted in higher values of relative carcass weight in comparison to that of the control group. The highest value in this respect was recorded for chicks fed 20 % extruded full-fat soybean (65.88 %) followed by those of 30 % (65.35 %) and 10 % (64.30 %) in a descending order. The improvement of relative carcass weight in the groups fed 20 and 30 % extruded full-fat soybean than the control group was significant (P<0.05).

Table (5): Effect of different experimental treatments on relative weights of carcass parameters.

Treatments	Pre-slaughter weight (g)	Relative weight						
		Car-cass %	Liver %	Gizzard %	Heart %	Giblets %	Abdominal fat-pad %	Panc-rease %
Control diet	1990	63.15[b]	2.42	1.58	0.66	4.65	1.41	0.22
10 % Extruded soybean	2110	64.30[ab]	2.26	1.70	0.53	4.49	1.39	0.19
20 % Extruded soybean	2030	65.88[a]	2.11	1.72	0.54	4.36	1.57	0.26
30 % Extruded soybean	2087	65.35[a]	2.03	1.84	0.54	4.41	1.43	0.25
Sig.		*	NS	NS	NS	NS	NS	NS

Means in the same column having different letters, differ significantly
NS = Not significant.
*** = Significant (P<0.05).**

The effect of extruded full-fat soybean inclusion in chicks diets on the other carcass parameters studied were not greatly obvious.

The present results revealed that, the values of proportional pancrease weights were insignificantly increased when chicks fed diets containing 20 or 30 % extruded full-fat soybean comparatively with those fed the control diets. This increase may be related to increasing pancreatic juice, and demonstrated the increment which occurred in abdominal fat-pad in the same treatments (Table 5).

In this concept, Murray *et al.* (1991) stated that, about 40 % of glucose is stored as fat. The same author's added that, insulin substance is a potent inhibitor of lipolysis in adipose tissue and thus has as indirect anabolic effect. Similarly, Farner (1943) collected pancreatic juice by cannulating a panceatic duct of chickens and demonstrated strong amylolytic action of the juice.

5. Total lipids and cholesterol in both liver and blood serum:

Results in Table 6 showed no significant differences among treatment due to applied diets. However, there was a slight decrease in liver content of cholesterol and total lipids with using different levels of extruded full-fat soybean seed.

Table (6): Cholesterol and total lipids in blood serum and liver as affected by feeding different treatments.

Item	Levels of extruded full-fat soybean				Sig.
	0 % (control)	10 %	20 %	30 %	
Liver cholesterol (g/L)	1.990	1.342	1.688	1.597	NS
Liver total lipids (g/L)	7.013	7.000	6.440	6.107	NS
Blood cholesterol (g/L)	3.732	3.118	3.423	3.470	NS
Blood total lipids (g/L)	3.575	3.535	3.490	3.557	NS

NS = Not significant

On the other hand, the dietary different levels of extruded full-fat soybean decreased blood cholesterol content compared with the control diet.

(Murray *et al*., 1991) indicated that, a high ratio of polyunsaturated fatty acids to saturated fatty acids (P:S ratio) in the diet is a major factor in lowering blood cholesterol concentration this could explain the depression occurred in blood cholesterol level in chicks fed progressive levels of extruded full-fat soybean seed up to 30 %, since full-fat soya oil contain a moderate level of natural unsaturated fatty acids (the ration of unsaturated to saturated fatty acids was 5.58 : 1 as calculated from NRC, 1994).

6. Economical efficiency of the experimental diets:

The economical efficiency expressed as feed cost / kg weight gain. In this study, the cost of feed/kg weight gain was decreased by increasing extruded full-fat soybean levels in broiler diets from 0 up to 30 %, (Table 7). The rate of decrease was greater in diet contained 20 % full-fat soybean.

Assuming the relative economical efficiency for the control diet as 100 %, so it was 81.87, 80.70 and 81.29 % for the other three experimental diets (10, 20 and 30 % extruded full-fat soybean), respectively.

On the other hand, the proportional improvement for the three previously mentioned diets were 18.13, 19.30 and 18.71 %, respectively. This indicates that, diets contained extruded full-fat soybean were more economical than the control diet.

From the economic point of view, extruded full-fat soybean can be used as a partial substitute for different amount of soybean meal and yellow corn as a protein and energy source up to 20 % in broiler diets.

Table (7): Average of costs and economical efficiency of experimental diets.

Treatment	Feed intake (kg)		Price of feed consumed (LE)		Total Feed cost (LE)	Total gain (kg)	Feed cost / kg gain (LE)	% feed cost / kg gain
	Starter	Finisher	Starter	Finisher				
Control diet	1.590	1.810	1.32	1.41	2.73	1.600	1.71	100
10 % Extruded full-fat soybean	1.510	1.650	1.21	1.22	2.43	1.733	1.40	81.87
20 % Extruded full-fat soybean	1.540	1.740	1.19	1.24	2.43	1.760	1.38	80.70
30 % Extruded full-fat soybean	1.550	1.720	1.21	1.26	2.47	1.780	1.39	81.29

REFERENCES

A.O.A.C. " Association of Official Agricultural Chemists" (1980). Official Methods of Analysis. 10th Ed. Washington, D.C.

Bliss, C.I. (1937). The arcsine percentage transformation table. Plant Production (Leningrad), 12:67.

Borchers, R.; C.W. Ackerson and F.E. Mussehl (1948). Trypsin inhibtor. VI. Effect of various heating periods on the growth promoting value of soybean oil meal for chicks. Poultry Sci., 27 : 601-604.

Buitrago, J.A. (1992). Soya integral an alimentation de aves. Asociacion Americana de soya. Cali, Colombia.

Caskey,C.D. Jr. and F.C. Knapp (1944). Methods for detecting inadequate heated soybean-oil meal. Ind. Eng. Chem. Anal. Ed., 16: 640-641.

Duncan, D.B. (1955). Multiple range and multiple "F" test. Biometerics, 11: 1-42.

Farner, D.S. (1943). Biliary amylase in the domestic fowl. Biol. Bull., 84 : 240.

Floch, J.; M. Less and G.H. Sloanestanley (1957). A simple method for the isolation and purification of total lipids from animal tissue. J. Biol. Chem., 226 (1): 497-509.

Herkelman, K.L.; G.L. Cromwell; T.S. Stahly and T.W. Pfeiffer (1989). Utilization of low trypsin inhibitor soybean by bigs and poultry. K.Y. Swine Res. Rep. Progress Rep., 321 : 33-36.

Josef, W. and P.E. Barbi (1996). Technology comparisons and results on processing and nutrition of fullfat soya. Second International Fullfat Soya Conference. August, 21-24, 1996, Budapest, Hungary.

Koci, S.; Z. Kociova; Z. Ceresnakova; O. Palanska and T. Matrai (1996). Effect of extruded full-fat soya on efficiency in layers and broilers. Second International Full-fat Soya Conference, August, 21-24, 1996, Budapest, Hungary.

Lewis, D. (1985). Interrelationships between nutrients in poultry diets. Proceedings of the conventry seminar, 1985. National Renders Association, PP. 17-24.

McNaughton, J.L. and F.N. Reece (1980). Effect of moisture content and cooking time on soybean meal, urease index, trypsin inhibitor and broiler growth. Poultry Sci., 59 : 2300 - 2306.

Monari, S. (1990). Fullfat soya Handbook. American Soybean Association, Brussels, Belgium.

Murray, R.K.; D.K. Granner; P.A. Mayes and V.W. Rodwell (1991). Herper's Biochemistry, Twenty-Second Edition, Appleton & Lange, Norwalk, Connecticut / Los Altos, California.

National Research Council, N.R.C. (1994). *Nutrient Requirement of Poultry*. Nation Academy Press, Washington, D.C. Ninth Revised Edition.

Navarro, H.; M. Forat; A. Casarin; C. Lopez and Miles (1996). The use of high levels of full-fat soybean in broiler rations, Second International Fullfat Soya Conference, August, 21-24, 1996, Budapest, Hungary.

Rand, N.T.; D. Cier and S. Viola (1996). Israeli experience with fullfat soybeans. Second International Fullfat Soya Conference, August, 21-24, 1996, Budapest, Hungary.

S.A.S. Istitute (1993). SAS. Applications Guide.1993 Edition. SAS Institute Inc., Cary. NC.

Stillborn, H.; L.I. Ndife; B.L. Bowyer; H.M. Hellwig and P.W. Woldroup (1987). The use of full-fat soybeans in chicken diets. Poultry Misset International. February, 1987, P. 20-23.

Summers, J.D. (1984). The extractoric value of fats in poultry "Fats in Animal Nutrition" Ed. By J. Wiseman, Butterworks, London, PP. 265 - 276.

Swick, R.A. (1996). Feeding full-fat soybean to layers in ASIA. Second International Fullfat Soya Conference, August, 21-24, 1996, Budapest, Hungary.

Wahba, N. (1969). Review of biochemistry, First Ed., Vol. 1, El-Naser Modern Bookshop, Cairo.

Watson, D. (1960). Determination of total cholesterol. Clin. Chem., Acta, 5: 637.

Wiseman, J. (1984). Full-fat soybeans in diets. Watt Publishing Feed International, February, 1984.

Woldroup, P.W. and K.R. Hazem (1988). An evaluation of roested, extruded and raw unextruded soybeans in the diet of laying hens. Nutrition Report,Int. 18 : 99 – 103.

Zollner, N. and Kirsch (1962). Determination of total lipids in serum.Ger. Exp. Med., 135 : 545.

Zhang, Y.; M. Parsons and T. Hymowitz (1991). Effect of soybeans varing in trypsin inhibitor content on performance of laying hens. Poultry Sci., 70 : 2210 – 2213.

أ ثـر اسـتخدام بـذور فـول الصـويا كامـل الـدهن المعامـل بـالبثق الجـاف علـى الأداء الإنتاجي لدجاج اللحم

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تم تقسيم 180 كتكوت تسمين من صنف أناك 2000 إلى أربعة مجاميع متساوية لدراسة تأثير التغذية بفول الصويا كامل الدهن المعامل بالبثق الجاف بمستويات 10، 20، 30 % على أداء النمو ، كفاءة التحويل الغذائى ، صفات الذبيحة وبعض مكونات الدم.

كانت أعلى قيم للوزن المكتسب للكتاكيت المغذاة على غذاء يحتوى على بذور فول الصويا كامل الدهن المعامل بالبثق الجاف بالرغم من تناقص إستهلاكها من العلف عندما قورنت بمجموعة المقارنه ، و كنتيجة لذلك تحسنت كفاءة التحويل الغذائى.

كما أدت التغذية بمستويات مختلفة من فول الصويا كامل الدهن المعامل بالبثق الجاف إلى تناقص محتوى الدم من الكوليسترول ، و أيضآ تناقص محتوى الكبد من الكوليسترول والدهون الكلية .

من ناحية آخرى أعطت الكتاكيت المغذاه على 20 % فول الصويا كامل الدهن المعامل بالبثق الجاف أعلى وزن للذبيحة. هذا بالأضافة إلى إن تلك المعاملة كانت أفضل المعاملات إقتصادياً.

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