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ORIGINAL ARTICLE

Effects of Replacement of Soybean Meal with Extruded Full-fat Soybean on Performance and Lipid Serum in Broiler

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ABSTRACT
An experiment, effects of replacing soybean meal with different levels of the extruded full-fat Iranian soybean (EFIS) on performance and lipid serum of broilers was evaluated. 300 one day male chicks (Ross 308) were selected and divided into five experimental groups with four replicates in a completely randomized design and were fed experimental diets for 42 days. The basic diet of the control groups and included 5, 10, 15 and 20% of the extruded full-fat Iranian soybean. During the first ten days of the feeding (starter period) all groups received the basic diet, but in during the period of (11-28d) and also (29-42) all groups received the experimental diets. The performance traits of broiler including weight gain, feed intake and feed conversion rate (FCR) and serum lipids were evaluated. The results show that the level of feed intake and FCR (P<0.05) in broilers fed with different levels of the EFIS was decrease. The serum cholesterol and HDL (P<0.01) and triglyceride levels (P<0.05) were increased with different levels of the extruded full-fat Iranian soybean. As a result, utilization of the EFIS at the 20% level led to increase on performance in broilers.
Keywords: Extruded soybean, soybean meal, performance, biochemical serum, broiler

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INTRODUCTION

Balancing diets with different levels of energy and protein, which are recommended by NRC [1] or stipulated in manuals for raising broilers, has always been a difficult issue for poultry diet specialists. This is due to the fact that accession to feed with high energy content is very limited. Hence the concentration of nutrients is reduced or diluted in starter diets. This leads to prolonged period of rearing and increased feed conversion coefficient. A group of feed material which contains high protein and energy is oil seeds. Unfortunately, existence of unfavorable contents such as anti-trypsin in raw soybean acts as an unproductive in utilization of them as poultry feed. Several different methods are used to process raw soybean seeds such as roasting, micronization, expanding, pelleting, dry and wet extrusion, and but each one of these methods have different effect on nutritional value of soybean. One of the processing methods is thermal extrusion in high temperature for short duration of time. In this process, temperature is raised between 150ºC and 160ºC for a period of 15 to 20 seconds. The result of this process is extruded full fat soybean. Fortunately, the technology of extruding oil seeds has been adopted in Iran and the product is supplied as the extruded soybean (seed). It is currently used as the domestic animal feed. Due to its high energy content, extruded soybean has the potential to cause changes in the carcass composition of poultry due to its high energy content. Subuh *et al* [2] reported 3% improvement in carcass performance of broilers fed with 10% soybean seed in diet. Attention to the fact that beside removal of anti-nutritional material during processing, extruded soybean seeds contain high energy and high protein; it is possible that they can be used as poultry feed. By its utilization, as poultry feed, there is no need to add oil to the diet. So, the complexity of adding oil and possibility of non-uniform distribution of oil is eliminated. The purpose of undertaking this experimental study is evaluating effects of replacing soybean meal with extruded soybean on performance and bio-chemical characteristics of serum of broilers.

MATERIAL AND METHODS

Three hundred one day old male broiler chickens were selected in a completely randomized design with five treatment and four replicates. There were fifteen broiler chickens in each replicate. The experimental groups included 0, 5, 10, 15 and 20% extruded full-fat Iranian soybean (EFIS). The broiler chickens were fed starter diet from day one until day ten and experiment starter was from 11d. The amount of soybean meal was reduced and amount of EFIS were increased in diets for different groups. At the end of the period three broilers were selected from each replicate and blood samples were collected. Data were analyzed through GLM procedure of the SAS (9.2) [3] software.

RESULTS AND DISCUSSION

Results of the study relating to effects of experimental diets on Performance in broiler chickens were in (Table 1, 2, and 3).

Feed intake

Results show that amount of feed intake of broiler chickens in grower, finisher periods, and the whole period in experimental groups with different levels of the extruded full-fat Iranian soybean (EFIS) were decrease than control group, but this difference was not significant. The findings of the present study is in conformity with the findings of the previous research works (4, 5), but, at the same time they are not in conformity with the findings of the researchers who witnessed increased intake of EFIS (6). This could be a reason for lack of effect of extrusion process on improving dietary intake of broilers, or increased energy intake of broilers with the EFIS leading to physiological fullness and lowered feed intake.

Weight gain

The weight gain in chicken during grower period and also the whole period in the experimental groups fed different levels of full fat soybean seeds were increased than control group, which was not significant. But, what must be considered is the fact that weight gain of broilers due to fed with the extruded full-fat Iranian soybean at the finisher period was increased than control diet ($p<0.05$). The results of the present research study is in conformity with the results of research studies (7 , 8) from viewpoints body weight gain and increased level of EFIS. Whereas, these findings are not in conformity with results of some other research works (4) from based on the fact that of lack of effectiveness of extrusion on broiler body weight gain.

Table 1: Effect of different levels of extruded soybean on feed intake of broiler

Treatment	Feed intake (g)		
	11-28 d	29-42 d	11-42 d
Control	1849.2	2383.0	4230.8
5% EFIS	1828.5	2355.8	4184.8
10% EFIS	1836.0	2394.5	4230.5
15% EFIS	1823.5	2287.3	4110.5
20% EFIS	1802.5	2285.0	4087.5
P value	0.771	0.254	0.908
SEM	12.86	15.07	135.26

a,b: Values in the same row not sharing a common superscript differ significantly ($P< 0.05$)
EFIS: Extruded full-fat Iranian soybean

Table 2: Effect of different levels of extruded full fat Iranian soybean on weight gain of broiler chicks

Treatment	Weight gain (g)		
	11-28 d	29-42 d	11-42 d
Control	963.7	911.5	1875.3
5% EFIS	999.7	943.7	1943.5
10% EFIS	1024.2	1059.0	2083.3
15% EFIS	994.0	1091.7	2085.8
20% EFIS	964.2	1088.0	2052.3
P value	0.676	0.077	0.190
SEM	33.46	25.62	71.03

a,b: Values in the same row not sharing a common superscript differ significantly ($P< 0.05$)
EFIS: Extruded full-fat Iranian soybean

Feed Conversion Ratio (FCR)

The results relating to effects of experimental diets on feed conversion ratio (FCR) of broilers in grower, finisher and the whole period are summarized in Table 3. The FCR for broilers feeding on higher level of EFIS during grower period and also during the whole period were significantly higher than the control group ($p<0.05$). This finding is in line with the results of the research works done on broilers fed on EFIS which found out that the FCR decreased significantly [8]. Furthermore, FCR in experimental groups which received regular level of the full fat Iranian soybean seed were significantly compared to the control group. But it as not significant among the groups fed with different levels of the EFIS. The reason for such discrepancy could be due to the apparent increase in indigestibility of protein, starch, and non-starch polysaccharides in ileum. These results are in line with the results obtained in previous research works, which reflect positive effect of extruded feed on increased FCR and as a result, performance of poultry [4 , 6].

Results showed, it can also be claimed that the 20% EFIS is suitable due to lowered feed intake and increased FCR. So, it is suggested that future research studies with over 20% EFIS diet are undertaken to see if better result can be achieved.

Table 3: Effect of different levels of extruded full fat Iranian soybean on FCR in broiler chicks

Treatment	FCR		
	11-28 d	29-42 d	11-42 d
Control	1.92	2.66^{a}	2.26^{a}
5% EFIS	1.83	2.33^{ab}	2.15^{ab}
10% EFIS	1.8	2.26^{b}	2.03^{b}
15% EFIS	1.84	2.09^{b}	1.97^{b}
20% EFIS	1.88	2.12^{b}	2.00^{b}
P value	0.383	0.03	0.019
SEM	0.022	0.057	0.059

a,b: Values in the same row not sharing a common superscript differ significantly ($P< 0.05$)
EFIS: Extruded full-fat Iranian soybean

Table 4: Effect of different levels of extruded full fat Iranian soybean on serum lipid of broiler (mg/dl)

	Extruded soybean in diet (%)						
Traits	control	5	10	15	20	P value	SEM
Cholesterol	138.25^{ab}	134.50^{ab}	149.50^{a}	120.00^{b}	126.00^{b}	0.0012	6.039
Triglyceride	64.00^{a}	53.25^{ab}	47.25^{b}	38.75^{b}	43.00^{b}	0.019	4.844
HDL	33.50^{a}	34.50^{a}	27.50^{a}	25.00^{b}	25.50^{b}	0.0058	1.89
LDL	90.10^{b}	82.85^{bc}	71.25^{c}	112.55^{a}	89.40^{bc}	0.0024	5.745

a,b: Values in the same row not sharing a common superscript differ significantly ($P< 0.05$)
EFIS: Extruded full-fat Iranian soybean

Serum Lipids

Data showed that utilization of the extruded full-fat Iranian soybean had significant effect in serum lipids of the broiler chicks. The serum cholesterol was a function of sinusoidal curve of the extruded soybean in a way that with increased level of soybean of up to 10%, the cholesterol serum increased ($p<0.01$) and then decreased. Plant-derived protein especially extruded full-fat soybean has been shown to decrease cholesterol.

The effect of extruded soybean on triglyceride was positive and significant. Hermier and Dillon [9] reported that serum lipoprotein concentrations could be changed by dietary fat in broilers. Anderson et al [10] reported that EFIS was effective in lowering the levels of serum triglycerides and cholesterol in humans and animals.

The lower effect was observed at 15% level of extruded soybean in diet ($p<0.05$). The HDL level decreased as the level of extruded soybean increased, but this decrease was significant at levels above 15% ($p<0.01$). Serum HDL carries about 75% of total cholesterol in chicks [11], it is more likely that this lipoprotein may be more influence by the type of dietary fat.

CONCLUSION

The effect of extruded full-fat Iranian soybean in broiler diets did not influence on performance of chickens during the whole period. Inclusion dietary different levels of from 5 to 20% on diet, decreased feed intake and weight gain increased of broiler. Therefore utilization of the EFIS at the 20% level led to increase in performance of broilers.

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