

Effect of Substitution of Vicia Sativa Raw and Treated Seeds as A substitute for Soybean Meal on Productive Performance of Broiler Chickens

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Abstract: The study was carried out using 405 chicks with a one-day-old, type Rose 308. The birds were randomly distributed to nine experimental treatments, with three replicates per treatment (15 birds/replicate). The birds were fed *ad libitum* during the 42-day trial period, 9 diets were used for study in the starter and 9 diets in the finisher period, as protein source used the Vetch 12.5% and 25% as an alternative to soybean meal, Vetch was treated by soaking in water or acetic acid (1% concentration) or by adding activated charcoal 50 gm / 100 kg diets. The results of the 21-day starter level showed a significant difference ($P \leq 0.05$) for live body weight, weight gain, consumed feed, and feed conversion ratio between control treatment and Vetch treatments 12.5% and 25% soaked water, acid and activated charcoal. While there were no significant differences in Mortality% in the period 21 days, in the finisher period (22-42 days), the results showed significant differences ($P \leq 0.05$) between control treatment, Vetch seed and Vetch seeds treatments for body weight, weight gain, consumed feed and feed conversion ratio, Also, there was no significant difference between treatments for mortality% in this period.

Keywords: Vetch; water soaked; acid soaked; activated charcoal; broilers.

I. Introduction:

Legumes are one of the main sources of plant protein concentrates in poultry nutrition, some is a good source of energy [1], as well as their high content of essential amino acids, except for their lack of the main amino acid, like soybean protein, which may rise to animal protein, but it does not match the nutritional value of crude protein in terms of quality, due to its content of nutritional inhibitors (Anti-Nutritional Factors), which it is compounds that cause negative effects on birds consuming these seeds, which negatively affect the nutritional value of legumes, limiting their use in the relation of many simple-stomach animals such as raw materials [2], including Vetch.

Vetch is legumes that build soil and increase fertility, all types of Vetch approved for planting are crops of the good nutritional value as well as being cheap, locally produced, and containing a high percentage of crude protein 29.83% and represented energy (2880 - 3100 kg price/kg feed [3-5]. Vetch seeds chemical analysis in Nineveh Research Department found that the Vetch seeds used in the study contain 26.25% crude protein and 2520 kilocalories/kg of energy, the most important inhibitors present in Vetch seeds that negatively affect the growth of the bird and the utilization of the food consumed is β -Cyanoalanin as this compound negatively affects the growth rate and leads to the occurrence of deaths in birds consuming the vetch as they contain cavanine nutritional inhibitors. Convicine, Vicine [5,6]. Several studies have been carried out aimed at identifying the nature of these compounds found in the Vetch seeds and the possibility of reducing their negative effects in birds consumed in terms of growth and to improve their nutritional value, many methods have been used, including soaking with water [6,7], and acid soaking [3], and cooking [8]. Genetic selection [9], and peeling Dehulling [10], as well as the use of forage supplements or some chemical compounds [11]. This study aims to find the effect of partial replacement of different levels of *Vicia sativa* (Common Vetch) seeds and to treat in a way that soaks with water or soaks with acetic acid, as well as the addition of activated charcoal to the treatment of raw Vetch on the productive performance of broilers.

II. Materials and Methods:

This study was carried out in the Poultry Research Unit Fields / Nineveh Research Department / Agricultural Research office/ Ministry of Agriculture for the period from 15/10/2013 to 11/11/2013 to study partial replacement at different levels of soybean with raw and treated Vetch seeds as a source of crude protein on the production performance of broiler diets. Ross308 birds were obtained at one-day-old in this study from al-Amin Commercial Company's hatchery in Nineveh province, 405 birds were used randomly distributed on nine experimental treatments, three repeaters per treatment, and the birds were fed *ad libitum* on the first period (represented energy 3000-kilo calories/kg and crude protein 22%) 1 - 21 days and a lifetime from the age of 22 days to the age of 42 days contained (metabolic capacity 3100 kg price/kg and crude protein 20%) The main nutrients of the diets were calculated according to (NRC, 1994) and as described in tables (1 and 2), taking into account the absence of the addition of chemical composition and the proportions of ingredients for the substances for treatments (4-9) because they are similar to the treatments (2 and 3) the difference only in the treatment of raw Vetch seeds.

1. Treatments: In this study, 9 different treatments were used, with 3 repeaters/ treatment each including 15 birds, which fed 42 days on the following treatments.

- 1- Control treatment (free of Vetch seeds).
- 2- 12.5% raw Vetch seeds treatment (12.5% RV).
- 3- 25% raw Vetch seeds treatment (25% RV)
- 4- 12.5% water-soaked vetch for 24 hours treatment (12.5% WSV).
- 5- 25% water-soaked vetch for 24 hours treatment (25% WSV).
- 6- 12.5% Vetch soaked with 1% acetic acid for 24 hours treatment (12.5% ASV).
- 7- 25% Vetch soaked with 1% acetic acid for 24 hours treatment (25% ASV).
- 8- 12.5% raw Vetch seeds treated by adding 50 g activated coal / 100 kg feed treatment (12.5% RVC).
- 9- 25% raw Vetch seeds treated with the addition of 50 g activated coal / 100 kg feed treatment (25% RVC).

2. Statistical analysis: Complete Randomized Design used to determine the significant effects of treatments on the traits studied, treatment averages were compared using the Duncan Multiple tests [12], using the Statistical Program (SAS).

3. Results and Discussion:

3.1. The effect of vetch seeds level and treatments type on the bird's growth in the starter period: (1-21 days):

Table (3) showed that the treatment 12.5% WSV (776) g/bird and 25% acid-soaked Vetch (778) g/bird have the same effect with control treatment (866) g/bird in body weight (BW) with no significant differences, while the control BW increased significantly ($P \leq 0.05$) over the rest of the treatments for this period, as noted in most of the results obtained that the BW decreases by increasing the vetch concentration, these results were consistent with [13], this may be due to RV contain many anti-nutritions such as tannin, which interferes with the metabolizim of protein in the bird body and thus has a negative effect on the birds growth at this period of life [14,15]. The increase in BW in vetch soaked water or acid may be explained to the soaking process is effective in removing or minimizing the negative effect of β -Cyanoalanin, which is present in the vetch seeds for the susceptibility of this compound to the water solubility, where the soaking process leads to the elimination of 80% of the proportion of this compound [7], as well as reduction of the effect of nutritional inhibitors [7], while the process of soaking raw vetch seeds with acetic acid was effective in removing or reducing the action of these inhibitors.

Similarly, the weight gain (WG), it has taken the same line as the treatment of control (826) g / bird did not differ significantly from 12.5% WSV (736) g / bird or 25% acid-soaked vetch (738) g / While it increased significantly ($P \leq 0.05$) on other treatments, mostly the WG decreased by increasing Vetch concentration in various treatments, these results agree with [2,16] in Quail. The decrease in WG in these treatments may be due to the decreasing the birds food intake. On the other hand, the addition of activated charcoal not had a positive effect on the birds growth compared to the birds in control or treatment of water or acid soaking, possibly due to a decrease in the feed consumed.

The statistical analysis results for feed consumption (FC) indicated a significant decrease ($P \leq 0.05$) only for Vetch 25% and activated coal treatment (1215.4) g/bird with control ,12.5% , 25% RV and 12.5% WSV (1320.8,1372.1, 1325.5 and 1311.5) g/bird respectively, clearly mathematic decrease in FC with increasing vetch concentration for all RV treatments. These results were in agreement with [2], in reducing the FC by increasing the concentration of the water-soaked protein source, the same researcher attributed the reason to the reluctance of birds to consume the high protein diet due to the increased concentration of its content of nutrition inhibitors, which leads to a delay in digestive functions.

Table 1. components and chemical composition of experimental diets (starter).

Ingredients	Control	Vetch seeds 12.5%	Vetch seeds 25%
yellow corn	30	30	30
Wheat	27	20	15
Soybean cake	29	22.5	16
Protein concentrate	8	8	8
Yeast	2	2	2
Vetch beans	-	12.5	25
Limestone	0.7	0.7	0.7
Table salt	0.3	0.3	0.3
Chemical analysis			
Crude protein	22.9	23.3	22
Representative energy / kg of feed	3000	3035	3026
Lysine	1.6	1.98	2.6
Methionine	0.45	0.71	0.76
Methionine + cystin	0.83	0.91	0.82
Calcium	0.87	0.89	0.88

Table 2. components and chemical composition of experimental diets (finisher).

Ingredients	Control	Vetch seeds 12.5%	Vetch seeds 25%
yellow corn	43	30	30
Wheat	19	27.5	19
Soybean cake	23	15	10
Protein concentrate	8	8	8
Yeast	2	2	2
Vicia beans	-	12.5	25
food oil	4	7	5
Limestone	0.7	0.7	0.7
Table salt	0.3	0.3	0.3
Chemical analysis			
Crude protein	20.17	20.13	20.13
Representative energy / kg of feed	3138.6	3112.2	3150
Lysine	109	1.79	2.43
Methionine	0.41	1.39	1.46
Methionine + cystin	0.77	1.09	1.19
Calcium	0.95	0.91	0.93

Table 3. Effect of partial replacement of raw and treated vetch on the performance of birds in starter period 1-21 days (Mean±SD).

Treatment	BW	WG	FC	FC R	Mortality%
Control	8.6±866	8.7±826	19.7±1320.8	0.12±1.6	-
	A	A	AB	A	
%12.5 RV	56.6±759.3	56.6±719.3	21.6±1372.1	0.08±1.9	1
	BC	BC	A	A	A
%25RV	21.45±739.3	21.4±699.3	11.7±1325.5	0.05±1.9	-
	BC	BC	AB	A	
%12.5WSV	33.1±776.33	9.4±736.3	24.6±1311.5	0.03±1.9	-
	AB	AB	AB C	A	
%25 WSV	33.1±703.67	29.9±684.6	33.2±1223.1	0.11±1.8	1.6
	BC	BC	CD	A	A
%12.5ASV	43.6±665.3	43.6±625.33	15.7±1225.5	0.03±1.9	1
	C	C	CD	A	A
%25 ASV	6.9±778	6.35±738.6	24.3±1251.5	0.03±1.8	1
	AB	AB	BC D	A	A
%12.5RVC	20.21±764.6	20.21±724.6	33.9±1244.1	0.08±1.8	1
	BC	BC	BCD	A	A
%25 RVC	35.1±757.32	33±684	49.6±1215.4	0.12±1.7	1
	BC	BC	D	A	A

Vertically different letter indicate that there are significant differences ($P \leq 0.05$) between treatment, according to the Duncan test.

From table (3) above it is clear that there is no significant difference between control and ASV and WSV, and RVC treatments in FCR. However, the control treatment was numerical lower than the other treatments, which means between (1.8-1.9) gm feed/g weight, while the closest FCR was for 25% RVC which reached to 1.7 g feed/g weight, the reason for this results perhaps caused by the related of growth and FC, where it was noted that there was a decrease in FC (Table 3) associated with the level of Vetch seeds in the attic and the type of treatment, which was reflected in the results of FCR. These results were agreed with [13], who found no significant effect on the different levels of raw vetch in the broiler compared to the control. It also agreed with [2], who found that FCR do not be improved by the high protein sources in broiler and with [16] in quail.

Table (3) showed that there were no significant differences between the treatments for mortality % , possibly due to the decrease in toxic compounds, particularly β -Cytanolanin, which amounted to 63 mg/kg of feed in this type of [7], which was positively reflected in the decrease in the rate of bird mortality at this age for all experimental treatment, these results were disagreed with [5,13].

3.2. The effect of vetch seeds level and treatments type on the bird's growth in the finisher period (22-42 days):

Table (4) showed that the best BW was when birds feeding control diets (2802.7) g/bird, which differed significantly from all experimental treatments, the lowest BW was when birds feeding on 25% RVC diets 2116.4 g/ bird , While there are

no significant differences between the rest diets, their means between 2266.7 - 2493.0 g / bird, As for the different vetch treatments, both treatments of RV gave the highest value, the treated vetch 12.5% treatments were better by BW than the 25% vetch treatments. These results agreed with [15,17,18]. Table 4 showed an improvement in birds WG which fed on WSV, ASV and RVC diets, no significant differences were recorded between birds fed on a control diet 1940 g / bird, compared to birds fed both diets of WSV which reached 1617.7 and 1542 g / bird, respectively, as the diets of ASV 1808 and 1565.3 g / bird, respectively. Whereas, the 25% RVC diet achieved the least increase in growth compared to the control diet, as the WG decreased at a significant ($P < 0.05$) when the birds fed this diet 1392.7 g / bird, the same with birds feeding on RV seeds at 25%. While there was no significant difference between the birds fed on RVC 12.5% 1618.7 g / bird, and the control, The improvement in WG of vetch seeds with high levels may be due to the fact that the age of birds had a positive effect in reducing the effect of these trophic inhibitors with a negative effect on performance [17,18]. The decrease in WG for birds fed on 25% RV diet and 25% RVC diet may be due to the RV containing some nutritional antagonists, including tannine, which reaches 0.85 g / kg , tannine interferes with The process of protein metabolism in the body, that will be negatively affect the growth of birds, [14,15], as well as the lack of sulfuric acids [3]. Some adsorbents or binders are used in some types of toxins treatment, it may have a negative effect on the growth and feed conversion or health status of birds due to the binding property with some important nutrients in the diet. Some adsorbents or bonding compounds are used in some toxins treatment, it is may have a negative effect on the growth, FCR and health status of birds due to the ability to binding with some important nutrients of diet, causing signs called specific deficiency symptoms. syndromes [19]. This is may be the most influential factor due to the addition of activated charcoal in the diets which contain high level of vetch, where it was noted that the process of soaking with water or acid leads to a decrease in the proportion of cyanoalnnine and a complete elimination of vicin and convention [3]. The decrease in WG in birds which fed on 25% RV and 25% RVC may have been to contain RV on some anti-nutritional substances, including tannins, which interfere with the process of protein representation in the body, which negatively affects the birds growth [14,15].

Table (4) shows that the feed consumed (FC) had a significant decrease ($P \leq 0.05$) with the presence of vetch seeds in the diets, whether raw or treated, in addition to the fact that the FC decreased with vetch percentage increasing more than 12.5%, these results agree with [2,14,18].

Table (4) showed there was no significant difference between the control diet 1.93 and the diet of RV with both concentrations 2.00 and 1.94 in FCR and WSV diet for both concentrations 2.1 and 2.0, respectively, as well as birds fed on ASV diets 1.80 and 2.0, respectively. Whereas the RVC 25% was higher than RVC 25%, with significantly difference (≤ 0.05 P) than the control diet. No significant difference between control diet and 12.5% RVC , It is also noticed that most of the treatments with a concentration of 12.5% vetch were more efficient FCR than the treatments with 25%, these results agreed with [18], and disagree with [17].

It is noticed that there is an improvement in the FC as well as the FCR for a 21 - 42 days period (Majeed, 2009 and Kolor , 2011) when feeding broiler on diets containing different percentages of raw vetch. producing in the Center for Agricultural Research in Arid and Semi-Arid regions (ICARDA), (2004) which is considered to have a low content of glutamyl and cyanoalnnine with high protein content. Table (4) it is evident that there are no significant differences between the treatments understudy for the percentage of mortality, the reason may be due to what the decrease in toxic compounds, especially the compound-Cyanoalanin, which was positively reflected in the decrease in the mortality rate of birds at this age [7], for all experimental transactions.

Table 4. Effect of partial replacement of Vetch seeds and treatment of the production performance of birds and the finishing stage (21-42 days) (average \pm standard error).

Treatment	body weight	weight gain	Feed Consumption	Feed Conversion Ratio	Mortality%
Control	32.2 \pm 2802.7	28.7 \pm 1940	49.6 \pm 3763.5	0.03 \pm 1.93	1
	A	A	A	B	A
%12.5RV	34.3 \pm 2483.3	31.6 \pm 1724	67.2 \pm 3553.1	0.05 \pm 2	1
	B	AB	B	AB	A
%25RV	42.2 \pm 2493	34.7 \pm 1753	59.5 \pm 3414.8	0.08 \pm 1.94	1
	B	BC	BC	B	A
%12.5WSV	38.4 \pm 2394	8.3 \pm 1617.7	24.9 \pm 3466.9	1.7 \pm 2.14	-
	BC	AB	BC	AB	
%25	45.2 \pm 2266.7	32.4 \pm 1542	5.6 \pm 3199	0.06 \pm 2	2.3
WSV	BC	AB	D	AB	A
%12.5ASV	42.4 \pm 2473.3	44.3 \pm 1808	140.4 \pm 3354.5	0.06 \pm 1.8	1
	B	A	BC D	B	A
%25	39.2 \pm 2443.3	40.2 \pm 1565.3	47.2 \pm 3171.4	0.03 \pm 2	1
ASV	BC	AB	C	AB	A
%12.5RVC	31.3 \pm 2383.3	\pm 1618.7	15.8 \pm 3505.2	0.04 \pm 2.1	1
	BC	33.8AB	BC	AB	A
%25	30.2 \pm 2116.4	29.7 \pm 1392.7	74.6 \pm 3326.9	0.08 \pm 2.3	1
RVC	C	B	CD	A	A

Vertically different characters indicate that there are significant differences ($P \leq 0.05$) between those averages, according to the Duncan test.

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