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# Effect of Processing on Nutritional Value of Common Vetch (*Vicia sativa*) Seed as a Feed Ingredient for Broiler Chicks

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**Abstract.** This study was carried out to evaluate the nutritional value of unprocessed or processed common vetch seeds (CVS) for use in broiler diet. A total of 420 broiler chicks (Ross 308) were used in a completely randomized design from 22-42 days of age. The experimental diets were included raw and processed CVS at three levels (100, 200 and 300 g/kg) and a corn-soybean diet as control. Inclusion of different levels of unprocessed CVS in the diet had no significant effect on feed intake when compared to control birds. The processing method significantly improved ($P<0.05$) feed intake in birds that fed with 100 g/kg CVS. Inclusion of raw CVS in broiler diet resulted in body weight gain reduction during the intervention diet period compared to control diet. In all dietary levels of CVS, processing method used in this study improved the body weight gain and these improvements were more pronounceable in higher levels of CVS. Feed conversion ratio during 21 to 42 days of age was similar ($P>0.05$) in birds fed with 100 g/kg raw or processed CVS and control birds. The results of present study showed that unprocessed CVS can be usedup to 100 g/kg in grower diet with no detrimental effect on bird's performance and processing method that used improved nutritional efficiency of raw CVS for broilers somewhat.

**Keywords:** Broiler, Performance, Vetch (*Vicia sativa*)

## 1. Introduction

Shortage in and the high costs of conventional feed ingredient like corn and soybean meal has increased interest in finding acceptable feed sources using native grain species for use in broiler diets. Common vetch seed (CVS) is an example of legume seed that has potential as a supplementary feed source. CVS has many valuable characteristics such as high yield, resistance to drought, well adapted semiarid regions [1,2], good energy and protein content[3,4,5], and the ability to grow in poor soils. However, raw CVS contains some anti-nutritional factors that limit its inclusion as major feed source in broiler diets. Feeding poultry on diets containing raw CVS has been found to produce some detrimental performance effects. Farran et al. [2] showed that the inclusion of 250 g/kg raw CVS in diet of laying hens decreased egg production and feed consumption. In studies with broiler chickens, it has been shown that broiler chickens could tolerate up to 100 g/kg raw CVS in diet [6,7], and higher level of raw CVS ( 200 and 300 g/kg) resulted in growth retardation in broiler chickens [7,8]. Inclusion of 500 g/kg raw CVS causes 100% mortality in broiler chicken [9].

The lower performance of broilers on diets containing raw CVS arises from the presence of some anti-nutritional factors in the seed including vicine, convicine and beta-cyanoalanine[5,10,11]. The adverse effects of these compounds may be reduced by using processing techniques such as soaking in water and/or cooking. Saki et al. [7] showed that cooking (60 Min at 100 °C) the raw CVS could not alleviate its detrimental effect on broiler performance. However, Ressler et al.[10] demonstrated that cooking with

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exchanging the water during cooking and washing the seeds or lengthy steeping in water at room temperature effectively removed the neurotoxins from raw CVS. Therefore, a more complex water soaking procedure than previously tried such as continues flow soaking in water in combination with cooking might be more effective.

Indeed, in the studies that CVS has been evaluated for use in broiler diets, the raw CVS has been used with birds from the first day of age, but that there is limited information about the feeding of CVS in grower or finisher of broiler production. It is possible that older birds might tolerate the raw CVS better than younger birds, as studies with laying hens showed that laying hens (older birds) could tolerate the higher levels of raw CVS in the diet. Therefore, the aims of the present study was to investigate the adequacy of heat treatment (cooking) in combination with continues soaking the seeds in water as a mean to improving tolerance of CVS as a feed ingredient in grower diet of broilers.

## 2. Materials and Methods

A total of 420 (210 males and 210 females) one day old broiler chicks (Ross 308) were distributed equally in 28 floor pens and fed a corn-soybean based diet during the first 21 days of age. On day 22, chickens weighted and they were allocated randomly to experimental diets based on having similar body weight in each pen. This represented the intervention phase of the trial lasting from 22-42 (grower diet) days of age. The experimental diets included raw and processed CVS at three levels (100, 200 and 300 g/kg) and a corn-soybean diet as control. The dry raw CVS used in this experiment was obtained from local common vetch fields. The seeds were cleaned and kept in room temperature until processing. The processing method of the seeds included soaking them in water (1:1, wt/vol) at room temperature for 10 h; washing with tap water, cooking (90 min at 95 ºC; 1:1, wt/vol), washing with tap water, cooking again ( 30 min at 95 ºC), washing again, and finally sun drying.

Feed and water were provided*ad libitum*. All diets were formulated to be isonitrogenous and isocaloric to meet or exceed broiler nutrient requirements according to NRC[12]. Crude protein, crude fiber, ether extract, calcium and phosphorus of CVS were determined by AOAC[13] methods, and for metabolizable energy and amino acid contents Rezayazdi and Seyfdavati[14] data were used. The chickens were weighed at the start of the feeding trial (day 22), and weekly during the experimental period. Total feed consumption per pen was recorded and feed conversion ratios were calculated on day 42 of the experiment. Mortality was also recorded daily for each treatment.

The data were analyzed as a completely randomized design by analysis of variance (ANOVA) using the general linear model (GLM) procedure of SAS[15]. Means were compared using Duncan's Multiple Range Test. Level of significance was set at $p<0.05$.

## 3. Results and Discussion

### 3.1. Feed Intake

The effect of processing on feed intake of broiler chickens fed with the three levels of CVS from 21 to 42 days of age is shown in Table 1. Inclusion of 100, 200, and 300 g/kg of unprocessed CVS in growth diet of broiler chickens had no significant effect on feed intake when compared to control birds. This indicates that the CVS toxins have no effect on seed palatability for broilers. The present complex processing method significantly improved ($P<0.05$) feed intake in birds that fed with 100 g/kg CVS, but in other inclusion levels, the improvement in feed intake was not significant. Similar to this finding, Saki et al [7] found no differences in feed intake when incorporated 100 or 200 g/kg raw CVS in broiler diets. However, in contrast to our finding, reduction in feed intake has been reported in egg-laying hens when 225 g/kg [2] or 220 g/kg [16] CVS has been included in the diet. The observed difference between present results, and those reported in egg laying hens could be due to the type of birds used in both studies.

### 3.2. Body Weight Gain

Inclusion of raw CVS in broiler diet resulted in body weight gain reduction during the intervention diet period compared to control diet (Table 1). Increasing the level of raw CVS from 100 to 200 or 300 g/kg resulted in more reduction ($P<0.05$), as the body weight gain was 5.5, 13 and 22.9 % lower than control in

chicks fed with 100, 200 and 300 g/kg raw CVS, respectively. In all dietary levels of CVS, processing method used in this study improved the body weight gain and these improvements were more pronounceable in higher levels of CVS (Table 2). The body weight gain of chicks fed with 100 g/kg processed CVS was similar to control birds (P>0.05). However, the body weight gain of broilers fed with 200 or 300 g/kg processed CVS were still lower (P<0.05) than control, but were comparable (P>0.05) to birds fed with 100 g/kg raw CVS. In agreement to these findings, Saki et al [7] showed that the inclusion of 200 and 300 g/kg of raw CVS in the diet decreased the body weight in broiler chickens, but feeding 100 g/kg had no detrimental effect on bird's body weight. Darre et al[6] also fed broiler chickens with 100 g/kg of raw CVS and reported no significant differences in body weight or weight gain. In contrast to our finding, Farran et al[4] showed that feeding 600 g/kg raw CVS was detrimental for broiler chickens and resulted in 100% mortality. Farran et al[5] in another study included 200, 400 and 600 g/kg of raw CVS in broiler starter diet and reported that birds fed with 200 g/kg did not show the toxicity symptoms, but inclusion of 400 and 600 g/kg raw CVS resulted in 40 and 97.5 % mortality, respectively. Detrimental effects of CVS on egg-laying hens were well-established with respect to growth reduction and lower egg production[2, 17]. Growth retardation by feeding the CVS to broiler chicken could be attributed to the toxin β-cyanoalanine (BCA) [9], which has been known for its toxic effect such as inhibition of trans-sulfuration[18]. CVS in general is deficient in sulfur amino acids (methionine and cystein), and inhibition of trans-sulfuration by BCA may intensify this deficiency. Inside BCA, other anti-nutritional factors present in raw CVS such as lectin[19] and trypsin inhibitor[20] which could have a detrimental effect on the nutrient utilization in birds. The lower digestibility of essential amino acids of raw CVS in comparison to soybean meal has been reported by Perez et al. [21] and Farran et al.[3].

In contrast to our finding, Padidar-Jahromi[8] showed that incorporation of 200 g/kg raw CVS in the growth diet of broiler chickens has no detrimental effect on bird's performance. The apparent difference between our results, and those reported by Padidar-Jahromi could be due to (1) difference between locally varieties of CVS used in both studies and difference in those anti-nutritional content and, (2) difference in bird sex used in both studies (broiler chickens from either sexes vs. male broilers).

In the present study, processing the CVS improved broilers growth performance somewhat, but it could not completely alleviate the detrimental effects of CVS. This indicates that this processing method could not remove all anti-nutritional factors from CVS.

## 3.3. Feed Conversion Ratio

Feed conversion ratio (FCR) during 21 to 42 days of age was similar (P>0.05) in birds fed with 100 g/kg raw or processed CVS and control birds (Table 2). However, inclusion of 200 or 300 g/kg raw or processed CVS increased (P<0.05) FCR when compared to control diet, as the FCR in birds fed with 300 g/kg raw CVS was 0.6 unit higher than control birds. The higher FCR in these groups could be due to those lower weight gains with no pronounceable changes in feed intake. In contrast to our findings, Pourhesaby et al. [22] and Padidar-Jahromi[8] reported no changes in FCR when broiler chickens fed with diets containing 200 g/kg raw CVS. This difference could be attributed to different vetch varieties used.

Table 1: Effect of processing on feed intake, weight gain and feed conversion of broiler chickens fed with different levels of common vetch seed from 21 to 42 days of age

| Treatments | Performance attributes at 21-42 days of age | | |
|---|---|---|---|
| | Feed intake (g) | Weight gain(g) | Feed conversion (g/g) |
| Control | $2877.5^{abc}$ | $1400.0^{a}$ | $2.05^{e}$ |
| 100RCV | $2866.0^{b}$ | $1324.0^{abc}$ | $2.12^{de}$ |
| 100PCV | $2926.2^{a}$ | $1357.5^{ab}$ | $2.16^{cde}$ |
| 200RCV | $2886.0^{ab}$ | $1217.1^{d}$ | $2.37^{b}$ |
| 200PCV | $2946.9^{a}$ | $1325.7^{abc}$ | $2.22^{cd}$ |
| 300RCV | $2842.3^{bc}$ | $1080.2^{e}$ | $2.64^{a}$ |
| 300PCV | $2877.3^{abc}$ | $1272.9^{cd}$ | $2.26^{bc}$ |
| SEM | 11.41 | 20.60 | 0.038 |

a–e values in rows with no common superscripts differ significantly ($P \leq 0.05$)

## 4. Conclusion and Application

Raw CVS can be usedup to 100 g/kg in grower diet with no detrimental effect on bird's performance. However, the dietary inclusions of 200 g/kg and above were detrimental for broiler chickens.

Processing method that used here improved nutritional efficiency of raw CVS for broilers somewhat, as the productive performance of birds fed with 200 g/kg processed CVS was similar to control birds, but it could not completely alleviate the detrimental effects of highest level (300 g/kg) of CVS on bird's productive performance.

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