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Presence of anti nutritional factors in chickling vetch (*Vicia sativa*) in the local variety of Himachal Pradesh

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Abstract

Vetch (*Vicia sativa*) comes as an intentional or unintentional adulterant in whole lentil or lentil *dhal*. Vetch is considered as a good source of protein, very good in taste but also contains some toxic constituents which may be deleterious to human health. The results indicated that use of vetch as a pure dhal or as an adulterant in day-to-day house holds use is not without risk. Out of the treatments, autoclaving was found to be effective against anti nutritional factors. During experiment, maximum adverse effects were observed as hoping gait, low feed intake, low gain in body weight, low protein intake and low digestibility coefficient etc. on one-day-old chicks.

Key words: Tannins, TIA, digestibility co-efficient, protein level, gait, feed intake.

Introduction

In Himachal Pradesh, utilization of pulses constitutes a primary source of proteins.

To meet the protein requirement of the ever growing predominantly vegetarian human population, efforts are in progress in the country to increase the pulse production and to make those pulses consumable, which may otherwise adversely, affects the human health. These pulses commonly called as ***dhals*** vary in their qualitative composition. Although the people invariably in every meal consume most pulses, but excessive consumption of some of the pulses has been reported to result in adverse effects on human health due to the presence of certain anti-nutritional factors. Now a day, these pulses are not consumed directly but come as adulterant either intentionally or unintentionally. Like khesari, vetch (rodi) is found as an unintentional adulterant, belonging to the leguminosae family. It is a hardy crop and found as a weed in wheat, groundnut and other fodder crops; requires very little irrigation and other inputs and is resistant to drought and floods. In the past, the seeds of vetch were consumed by the people as a *dhal,* but now its use is on decline and almost negligible. It also contains good amount of protein (23.5%) as stated by Hector *et al.* (1990), higher than the legumes commonly consumed, but like Khesari, the seeds of vetch were also reported to contain toxic constituents which are responsible for lathyrism in human beings. With this consideration in mind, the present investigation was undertaken to see the presence, detoxification of anti-nutritional factors and also assessing the effect of vetch (*V. sativa*) on the biological performance of chicks.

Material and Methods

Preparation of samples: The seeds of vetch were procured from local farmers, cleaned of dust, dirt or any other foreign material, dried and packed in polyethylene bags for further analysis. Before analysis vetch seeds were soaked overnight in water at room temperature making sure that all the seeds were completely covered with water. Dried vetch seeds were also autoclaved for 1 hour at 0.7-kg cm^2 pressure.

Chemical analysis: Soaked and autoclaved samples were dried, ground into powder form and were analyzed in triplicate for Total Phenolic Compounds/Tannins and Trypsin Inhibitor Activities using the standardized methods of Singh *et al.* (1981) and Roy and Rao (1971), respectively.

Animal experiment: In order to assess the toxic effects of vetch (*V. sativa*), a feeding trial on the seven days old male layer chicks (Anderson Thomson Strain), which were

Table 1. Chemical composition of feed given to the experimental chicks

S.No.	Treatments	Moisture (%)	Ash (%)	Ether extract (%)	Crude protein (%)	Crude fibre (%)
1.	Control	11.89	15.03	6.03	23.05	8.43
2.	Vicia (25%)	12.71	13.44	4.95	22.06	7.10
3.	Vicia (50%)	13.63	12.30	4.76	22.49	7.62
4.	CD (P=0.05)	1.78	0.87	0.31	0.74	0.64

brought from Embrocia Hatcheris (Pathankot) was conducted in the department of Animal Nutrition, College of Animal Husbandry and veterinary Sciences, CSK HPKV Palampur.

The control diets (BIS, 1992) was prepared from the vetch by using different protein levels (25% and 50%) and fed to the chicks. Random samples of fifteen chicks were transferred in each compartment according to their average initial body weight which was between 27.0±60 and fed regularly on control as well as on different levels of experimental diets. Each level of diet as well as control diet was given in the two compartments' birds randomly for duplicate study. Care was taken to feeds the chicks on homo-nitrogenous diets for thirty days.

The basic diet composition: Composition of starter diets (25% and 50% of vegetable proteins) to be replaced with test materials, like vetch (*V. sativa*).

Ingredients	T_0 control (CP%)	T_1 rodi (25%)	T_2 rodi (50%)
Premix*	30 kg (13%)	22.5 (9.8)	15.0 (6.5)
Vicia sativa (22.97)	-	12.5 (3.2)	25.0 (6.5)
Maize (9.0%)	32.8 (3.0)	29.2(2.6)	21.9 (2.0)
Wheat (13.1%)	30.0 (3.93)	28.7 (3.8)	31.0 (4.1)
Fish meal (48%)	5.0 (2.4)	5.0 (2.4)	5.0 (2.4)
DCP	2	2	2
Trace Minerals and Vitamins	0.156	0.156	0.156
Total	100.0 (22.3)	100.0(21.9)	100.0(21.5)

Composition of Premix*

	Crude Protein %	
GNC (Ground Nut Cake)	42.0 %	10 kg (4.2)
Sunflower cake	34.2 %	5 kg (1.7)
Soya flakes	47.5 %	15 kg (7.1)
Total		30 kg (13.0 %)

Composition of Trace Minerals and Vitamins*

Rovimix (Vit A B2 D3 K)	15g
B Care	40g
Ferrous oxide	2g
Manganese sulphate	25g
Ferrous sulphate	10g
Di-calcium phosphate	4g
Zinc sulphate	8g
Copper sulphate	2g
Zinc oxide	1g
Potassium oxide	250mg
Sodium thiosulphate	750mg

Results and Discussion

Total phenolic compounds/ tannin contents in the samples analyzed, ranged from 1.45 to 2.05g, observed minimum in autoclaved vetch seeds (1.45g/100g) followed by soaked and raw (1.73 and 2.05g/100g) vetch seeds as stated in Table 2. Statistically significant difference was observed between the treatments and this difference could be due to the water-soluble nature of these

antinutritional factors. The tannin contents present in vetch were observed to be higher from those recommended by Aletor *et al.* (1994). Maximum Trypsin Inhibitor activities were observed in untreated vetch samples (13.45mg/g), but after giving the soaking and autoclaving treatments, less activity were observed i.e.11.29 and 6.71mg/g of sample respectively, and this could be due to the water soluble nature of these protease inhibitor activities. The mean value of TIA in *V. sativa* Linn was reported as 5.21 TIA per mg (Leterme, 1988), which was less than local variety of vetch.

Table 2. Anti-nutritional factors in Vetch (*V. sativa*)

Treatments	Tannins (g/100g)	TIA* (mg/g)
Vetch		
Raw	2.05	13.45
Soaked	1.73	11.29
Autoclaved	1.45	6.71
CD (P=0.05))	0.04	0.90

TIA* Trypsin Inhibitor Activity

Biological Studies

The changes in physical activities of chicks were indicated in the Table 3 and results showed that there was apparently some deleterious effects on the chicks fed on 25% and 50%vetch. The group fed on 25% level of vetch protein, a good growth with no symptom of dysentery/ diarrhoea and a normal gait was observed. Whereas the feather were found to be slightly ruffled with less feed intake, but in case of the birds fed on 50% level of vetch protein, stunted growth with no symptom of dysentery/ diarrhea were observed whereas the feather were found to be ruffled. A few birds showed paralysis of legs (unable to bear weight on legs), hopping gait, incordination, etc. in contrast to the control birds. The reasons assigned for this kind of behavior may be due to the neurotoxin and other antinutritional factors present in the vetch as reported by Ganapathy *et. al.*(1963).

The chicks fed on control diet gained maximum weight (225.67±5.18g) where as the chicks fed on 25% and 50% vetch diets showed gain of 154.34±5.18 and 118.81±0.52g, respectively (Table 4). Neurotoxins, trypsin inhibitors, phenolic compounds etc. may be responsible for the growth retardation in the chicks fed on different levels of vetch. It was also clear from the study that by increasing the concentration of protein in the experimental chick's diet there was reduction in the gain in body weight as compared to the chicks fed on control diet.

FER represents the weight gain of an animal per weight of feed consumed under specific conditions (Table 4). Determination of FER in experimental subjects fed on two levels (25% and 50%) of vetch, revealed that the FER values were the lowest for group fed on control diets and this difference could be due to the poor digestibility of the increased vetch concentration in the diet.

Table 3. Effects of experimental diets on physical activities of chicks

Treatment	Growth	Dysentery/ Diarrhoea	Feather	Feed intake	Gait
Control	Excellent	No	Normal	Normal	Normal
Vetch (25%)	Good	No	Slightly ruffled	Slightly affected	Normal
Vetch (50%)	Stunted	No	Ruffled	Affected	Hopping

Table 4. Biological performance of experimental chicks

Parameters	Raw	25 % protein level	50 % protein level	CD (P=0.05)
Average initial body weight (g)	27.19±0.22	27.19 ±0.00	27.19± 0.22	
Average gain in body weight (g)	225.67± 5.18	154.34± 5.18	118.81 ±0.52	8.61
Feed utilization (g)	515.90± 17.27	427.77±6.76	393.00±7.29	33.97
Feed efficiency ratio (FER)	0.44	0.36	0.30	0.014
Protein intake	114.01	93.26	84.69	-
Protein efficiency ratio (PER)	1.98	1.66	1.40	-
Mean digestibility coefficient	79.71	74.43	62.65	4.92

Protein intake for control diet was observed maximum (114.01g) followed by 93.26g and 84.69g in case of 25%and 50% vetch respectively. As is clear from the Table4 that chicks consumed less protein level in case of 50% vetch because of the poor digestibility owing to the presence of neurotoxins and other antinutritional factors.

Protein efficiency ratio is the weight gain of an animal per gram of protein consumed under certain specific conditions. The determination of PER in the chicks was 1.66 and 1.40 in case of 25% and 50% vetch diets respectively, however control fed birds showed maximum value (1.98). Broiler chickens when fed on 37% raw vetch seeds decreased the PER because of the presence of antinutritional factors (Latif *et. al.*, 1976).

Regarding the digestibility co-efficient which refer to the disappearance of the consumed protein or part of food in the digestive tract. The coefficient of digestibility then is the percentage of the substance, which is sufficiently digested; to be absorbed from the alimentary canal i.e. which is consumed and not excreted in the faeces. Mean digestibility co-efficient for chicks fed on control diet was found to be 79.71 followed by 71.87 and 68.56 for chicks fed on 25% and 50% vetch diets. All the values were significantly different when compared with birds fed on control diet.

The study concluded that Trypsin Inhibitor activities were observed to be maximum in raw seeds of vetch, but lower TIA and tannin contents were observed after autoclaving. It was observed that reduction in antinutritional factors resulted more from heat treatment than soaking. The biological studies involving different levels (25 and 50%) of the vetch, chicks revealed stunted growth, ruffled feathers, and abnormal gait, feed efficiency ratio (FER), gain in body weight, protein efficiency ratio (PER), digestibility co-efficient, protein utilization were observed lower statistically when fed on diets blended with 25% and 50% vetch in comparison to the chicks fed on control diet.

It has therefore been concluded from the study that local variety of vetch can be consumed in very limited quantity once in a while without much effect on human health, but regular and excessive consumption may lead to certain health hazards/serious health problem.

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