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Study on the Nutritional Value of Raw, Dehulled, Autoclaved, Cooked and Enzyme Supplemented to Raw Yellow Peas on Performance of Broiler Chicks

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Abstract: Yellow pea is a widely available grain legume for poultry diets that contains some anti nutritional factors that has negative effect in animals. For selection the more effective methods to improving the nutritional value of yellow pea various treatment methods were tested. In a completely randomized design, three hundred , 7-d old male broiler chicks (Arbor Acres) were distributed in six treatments with five replicate of ten birds each. Broiler chicks were fed diets containing cooked, dehulled, autoclaved and whole raw peas for a period of six weeks. In 1-3wk period daily feed intake (FI) and body weight gain (BWG) were higher ($p<0.01$) for birds fed dehulled and those fed autoclaved peas. In 3-6wk and whole period cooking and autoclaving improved ($p<0.01$) BWG and feed conversion rate (FCR). The autoclaved and cooked peas based diets had better FCR and higher BWG ($p<0.01$). Liver was bigger for birds fed enzyme added and treated peas ($p<0.01$). The relative abdominal fat was higher in processed treatments The results showed that in compared to raw peas cooked ,autoclaved dehulled had positive effect on the feeding value of yellow peas for broilers.

Key words: Peas, processing, enzyme addition, broilers, performance

Introduction

Peas have been available in many countries as a feeding source for poultry .The use of peas in the diets of growing chickens has been documented (Brenes *et al*., 1993a,b, Davidson, 1980). A major restriction on the use of peas in poultry diets is that they may contain Anti Nutritional Factors (ANF) that depress poultry performance (Savage, 1988). Feeding raw legumes to chickens generally results in lower growth rate and reduced feed efficiency compared with feeding processed legumes however each legume produces a different response (Wiryawan and Dingle, 1998). Igbasan and Guenter (1997) reported that untreated peas decreased egg production, feed conversion and egg mass output. A number of techniques are available for eliminating or inactivating ANF thus improving the nutritional value of poultry feeds. Van der Poel (1990), reported that ANF present in feed ingredients can be reduced by heat treatment. Castanan and Marquard (1989) examined the effects of enzyme supplementation on the utilization of legume seed and observed no major improvements in chick performance. Positive production responses from the addition of supplementary enzyme to poultry diets containing legume seeds have been reported (Brense *et al*., 1993; Igbasan and Guenter, 1996). Moderate heat treatment, especially with high moisture not only enhance palatability and acceptance but also improve protein quality (Silano *et al*., 1981). Conan and Carre (1989) as cited by Huyghebaert *et al*. (1979) demonstrated that pea meals processed by heat treatments usually display a better energy value and higher digestibility of protein. Another factor that may effect the nutritional value of pea seed is its content of hulls, which consists mainly of cellulose, hemicelluloses and lignin (Husinie, 1993). The aim of this study was to determine the extent to which cocking, autoclaving, decupling or enzyme supplementing would improve the utilization of yellow peas by broilers.

Materials and Methods

The peas used in this experiment was grown in the province of West Azerbaijan (Iran) and obtained from the local market. Decupling was carried out by a traditional pea splitter. The process involved after the soaking of seeds for a period of 12 hour. The soaked peas cracked by handy pea splitter followed by removal of the hulls from the cotyledon (dehulled peas) by hand after drying cotyledons were further purified by air classification. The dehulled peas were estimated to be more than 98% pure. A standard laboratory sterilizer used to autoclave, Peas were autoclaved for 20 minute at 121°C at a depth of 2 cm. Cooking was carried out in boiling water for 20 minutes after soaking 12 hours, then cold and dried in sun.

The crud enzyme used in this study was *Vitas aim x* (Inclusion rate was 0.05% as suggested by the manufacturer Vita feeds Tehran, Iran) Enzyme premix contained N2 Panoramas activity provided by Vita international Ltd Vita A/S Tehran Iran). The enzyme activities per gram of crude product as determined by manufacturer was 3000EPU .

Table 1: Composition of experimental diets (Percent)

Ingredients	Grower		Finisher	
	Control	Peas	Control	Peas
Corn	50.57	41.47	74.12	64.95
Peas	-	20	-	20
Soybean Meal	22.3	12.98	22.0	8.00
Wheat	20	20	-	-
Fish Meal	3	2.62	-	-
Meat meal	-	-	1.32	4.6
Dicalsium Phosphate	1.78	0.82	0.71	0.52
Oyster Shell	1.63	1.13	1.11	0.99
Vitamine[1]	0.3	0.3	0.3	0.3
Mineral[2]	0.3	0.3	0.3	0.3
Salt	0.1	0.1	0.1	0.1
DL. Met.	0.02	0.07	-	0.02
L. Lys	-	0.22	-	0.17
Enzyme[3]	-	0.05	-	0.05
Total	100	100	100	100
Calculated analysis				
Energy, Mcal/kg	2900	2900	300	300
Protein %	18.13	18.13	16.88	16.88
Ca %	1.23	0.90	0.75	0.75
Available P%	0.54	0.46	0.33	0.33
Lys	0.94	0.91	0.8	0.8
Met	0.34	0.34	0.3	0.3

[1]Amount Supplied Kg^{-1} diet: Vitamin A, 900 IU; vitamin D_3, 2000 IU; Vitamin E, 18IU; vitamin K, 2mg; Vitamin in B1, 1.8 mg; riboflavin, 6.6 mg; Vitamin B12, 15µg; tiamin, 1.8mg; Cholin chloride 500 mg; biotine, 100µg; Pyridoxin, 3mg; [2]Amount Supplied Kg^{-1} diet: Mn, 100 mg; Fe, 50mg; Cu, 10mg; Se, 0.2mg; Zn, 40 mg; [3]Amount and type of enzyme added is given in Materials and Methods.

Six is energetic and is nitrogenous grower and finisher diets were formulated (NRC, 1998) (Table 1). The inclusion level of peas were 20% and correction was made for the amounts of hulls in the diet that contained dehulled peas. Perrier to diet formulation approximate analysis of whole raw and dehulled peas were determined according to AOAC, 1984). Diets were formulated to contain 2900 and 300 kcal ME/kg on the assumption that the ME value of peas were 2600 Kcal /kg (Husinie, 1993).

A total of three hundred 7-d old male broiler chicks (Arbor Acres) were randomly distributed among ten treatments using ten birds per pen and five pen replicate per treatment. The mean pens weight ranges was ± 3.2 g.($p>0.o1$).All chicks were fed commercial chick starter mash form diet (21% protein) during 7-d pre experimental period. The chicks were housed in floor deep litter pens. The chick performance was measured in terms of feed consumption, weight gain and feed-to-gain ratio and the results were reported on a pen basis. All diets were given in mash form, and the experimental birds had free access to water and feed throughout the experiment.

Experiment was set up as completely randomized designs and pen basis data were subjected to analysis of variance using the procedure described by the SAS institute (1996). Treatment differences obtained upon statistical analyses were compared using Duncan's multiple range test (Duncan, 1955)

Results and Discussion

The composition of raw and dehulled yellow pea grain respectively were : crude protein 24.5%,crude fat 3.9%,crude fiber 6.05%, ash 2.75% and moisture 9.0% and crude protein 25.5%, crude fiber 3.28% , fat 3.49%, ash 2.85% and moister 8.5%.The whole raw peas compared with dehulled peas had less protein but richer in fiber. Husinie (1993) reported that the hull fraction in legume seeds consisted mainly of cellulose, hemicelluloses, and lignin. Removal of the hull from the seed greatly reduced its content of fiber and proportionately increased the concentration of other nutrients including protein, fat and digestible carbohydrates. The protein value in raw pea is higher than those reported in the literature (Brenes *et al.*, 1993a,b).

The main effects of dietary treatments on performance of experimental birds are shown in Table 1. There was a significant effect ($p<0.01$) of processing on average feed intake during 1-3 wk. In this period average feed intake was higher for treatment fed dehulled peas and lowest for treatment fed cocked peas compared to those fed raw peas or control diets. In the second (3-6wks) and all over (1-6 wks) periods neither physical processing nor enzyme treatments did not affect ($p>0.01$) feed intake however, numerically dehulled treatment consumed the highest and cocked treatment the lowest feed. These results are in contrast to Igbasan and Guenter (1997) those who reported that decupling of peas has no significant affect on daily feed intake in layer. The enzyme addition in different and whole period did not tend to reduce feed intake this results are not in agreement with the results of Brenes *et al.* (1993a,b) those who reported enzyme mixing tended to reduce feed intake.

The average body weight gain for chicks fed processed peas compared to those fed raw peas or control diets during 1-3wks period significantly improved($p<0.01$). The autoclaved and dehulled treatments showed the highest, the cocked and enzyme treated followed those. In 3-6 wks period processing did not improved average body weight gain compared to raw peas and control diets, but processing numerically improved body weight gain ($p>0.01$), autoclaved peas treatment showed the highest body weight gain followed by dehulled treatment. Enzyme addition to raw pea based improved body weight gain compared with raw peas based diet this results are in agreement with the finds of Brenes *et al.* (1993a,b) those who reported enzyme mixing to raw peas base diets tended to reduce body weight gain.

In feed conversion rate during 1-3wks period there were no significant effect between treatments. However

Table 2: Performance of broilers fed Processed and enzyme-supplemented Peas

Period WK	Parameters	Processing					
		1	2	3	4	5	6
1-3	Feed intake, g	1107^{bc}	1126^{ab}	1068^{c}	1111^{b}	1104^{bc}	1159^{a}
	Feed conversion	2.33	2.15	2.20	1.94	2.33	2.21
	Weight gain, g	476.6^{b}	524.2^{a}	484.6^{ab}	477.2^{b}	476.8^{b}	523.4^{a}
3-6	Feed intake, g	4101	4203	4075	4199	4166	4266
	Feed conversion	2.83^{a}	2.72^{ab}	2.68^{b}	2.74^{ab}	2.85^{a}	2.77^{ab}
	Weight gain, g	1448	1551	1524	1536	1462	1539
1-6	Feed intake, g	5207^{a}	5329^{a}	5143^{a}	5310^{a}	5270^{a}	5425^{a}
	Feed conversion	2.74^{a}	2.57^{b}	2.56^{b}	2.64^{ab}	2.72^{a}	2.62^{ab}
	Weight gain, g	1904^{b}	2075^{a}	2009^{ab}	2013^{ab}	1939^{ab}	2062

^{ab}Means in the same row with different letters are significantly different (P<0.01)

* 1=Control 2=Autoclaved peas 3=Cocked peas 4=Enzyme Supplemented raw peas 5=Raw peas 6 = Dehulled peas

enzyme treatment numerically improved feed conversion compared with raw peas and control diets followed by cocked and dehulled pea's diets. In 3-6 wks and all over experimental periods (1-6wks) the autoclaved and cocked based diets significantly improved ($p<0.01$) feed conversion rate compared to raw peas based and control diets. The cocked peas based diet showed the best feed conversion rate followed by cocked based diet and treatment with raw peas showed the worst. This result is in agreement with Owusu-Asiedu *et al.* (2002) those who reported that heat processing improved pea feed efficiency in piglets. Van der Poel (1990) and Gibes and Guenter (1997) reported that heat processing improve nutrient digestibility, reduce anti-nutrient factors and by altering the nature of protein in peas improve protein and amino acids digestibility. Improved nutrient digestibility and feed conversion rate in autoclaved and cocked peas based diets resulted higher body weight gain compared to raw peas based diet. In dehulled peas based diet compared to raw peas based diet reducing fiber and anti-nutrient by decupling tended improved feed conversion rate and higher body weight gain. Enzyme addition numerically improved feed conversion rate compared to raw peas based diet.

The results of this study and reported by other researchers (Brenes *et al.,* 1993a,b; Igbasan and Guenter, 1997) indicate that decupling reduced the fiber and anti-nutrient factors content of peas and increased the concentration of other nutrients including protein and improved broiler chicks performance.

The cocked and autoclaved treatments used in this study reduced ANF activity in the peas, thus lead to improved nutrient digestibility and metabolize able energy value of peas compared to raw peas similar results have been reported (Conan and Carre, 1989; Teiter *et al.*, 1991).

In conclusion autoclaving, cocking and dehulling of yellow peas improve feed conversion rate, increase body weight gain in broiler but autoclaving gives better results and addition of enzyme to 20% whole raw peas containing diet had no beneficial effect.

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