

Enzyme Activity in Pancreata of Hens Fed Raw Soybean Meal

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INTRODUCTION

Numerous studies have been reported on the response of the laying hen to feeding raw soybean meal. (4,5,13,14,16).

Saxena et al. (14) showed that with 0.5% added methionine to a soybean meal diet only slight pancreatic hypertrophy was observed. This is contrast with other workers (3,10,11,16) who observed an enlargement in the pancreata of hens fed the unheated soybean meal. Although some work has been done on some enzymes of the enlarged pancreas, in the case of the chick, (1,9,12) no such studies were conducted with the hen. The objective of the experiment to be reported herein is to examine some enzyme levels in pancreata of hens fed autoclaved or raw soybean meal.

MATERIALS AND METHODS

Sixteen S.C. white leghorn hens were used in this study. They were divided into two groups and fed diets identical to that of Saxena et al. (15) containing raw and autoclaved soybean meal as a source of protein, plus 2.5% limestone, for 4 weeks, after which the hens were fasted for 16 hours. Four hens of each treatment were sacrificed after the fast and the other four were resumed on their respective diet for six hours then sacrificed. After body weight and pancreata size were measured, amylase, trypsin and chymotrypsin activities were determined in the pancreata.

Amylase activity was determined by the 3,5 dinitrosalicylate method of Bernfeld (2). Trypsin and chymotrypsin activities were estimated according to Hummel (7) using TAME, (tosyl-arginine-methyl-ester) and BTEE (benzoyl-tyrosyl-ethyl-ester) as specific substrates for trypsin and chymotrypsin respectively. Definitions of units of enzyme activity and procedure of activation of trypsinogen and chymotrypsinogen in the homogenates of the pancreata were as described by Salman et al. (12). Protein was determined in the homogenates by measuring the absorbancy at 280 nm and 260 nm to correct for nucleic acids as described by Layne (8).

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RESULTS AND DISCUSSION

Enlargement of the pancreas of the hens fed raw soybean meal was evident, where values of 4.75 gm and 3.40 gm were found for the raw and autoclaved soybean meal (Table 1). This enlargement was not as pronounced as that observed in the chick (15), despite the high level of protein from the raw soybean meal.

Table 1 Pancreatic enlargement in hens fed autoclaved or raw soybean meal.

Soybean meal	Pancreas size	
	<i>Wt. in gm</i>	<i>Wt. in gm/100 gm body wt.</i>
Raw	4.75a	0.240a
Autoclaved	3.40b	0.165b

The specific activity of amylase and chymotrypsin were depleted at a faster rate when the autoclaved soybean meal was fed. However, this was not the case with trypsin specific activity. Chymotrypsin and trypsin specific activities were higher in pancreata of fasted hens previously fed unheated soybean meal. Amylase specific activity in the fasted birds was not much different where either diet was previously fed (Table 2).

Table 2 Enzyme specific activity in pancreata from hens fed raw or autoclaved soybean meal.

Soybean meal	Amylase		Trypsin		Chymotrypsin	
	fasted ¹	fed ²	fasted ¹	fed ²	fasted ¹	fed ²
Raw	7.2	6.4	29.8	23.4	417.2	259.2
Autoclaved	6.8	3.8	21.6	20.0	364.6	177.4

The total pancreatic activity of amylase, trypsin and chymotrypsin was always higher in the enlarged pancreata, in fasted hens, and hens fed 6 hours after the fast. This increased activity may be related to an increased number of acinar cells in the pancreas as was shown for the chick's pancreas by Salman et al. (13). They have indicated that the increase in size was a result of hyperplasia. The amount of enzyme discharged by the pancreas was higher in amylase when autoclaved soybean meal was fed. This was true for trypsin and chymotrypsin when unheated soybean meal was fed for 6 hours (Table 3).

Table 3 Total enzyme activity in pancreata from hens fed raw and autoclaved soybean meal.

Soybean meal	Amylase 10 ³		Trypsin 10 ⁴		Chymotrypsin 10 ⁴	
	fasted ¹	fed ²	fasted ¹	fed ²	fasted ¹	fed ²
Raw	16.8	14.6	8.3	6.1	119	69.1
Autoclaved	8.7	5.3	4.2	3.6	72.3	33.2

¹ Hens fasted for 16 hours after being on feed for 4 weeks.

² Hens fed their respective diets after 16 hours of fast.

Trypsin specific activity was less than the activity observed with young chicks (12). This may be due to a decreased sensitivity or increased resistance of the adult bird to inhibitors in soybean meal. The levels of amylase and chymotrypsin specific activity were comparable to those found in the chick. The response for pancreatic secretion was slower in the hen as a result of feeding as compared with the chick (12).

SUMMARY

Pancreata of hens fed raw soybean meal developed enlargement with amylase and chymotrypsin activity comparable to that of chicks as observed by Salman et al. (12). However, trypsin activity was lower than that found in chicks indicating a possible partial resistance of the adult bird to soybean inhibitors.

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