

EFFECT OF ADDITION OF COLLAGEN TO BEEF PATTIES
AND PORK SAUSAGE ON THE AMINO ACID COMPOSITION.

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Story in Brief

Comminuted wet collagen from cattle hide was used to replace lean meat in a ground beef patty formulation at 0, 10 and 20 percent level and at 0, 5, 10 and 20 percent level in a pork sausage formulation (both in the lean and fat portions separately). The products were analyzed for amino acid composition by HPLC. The products with collagen at all replacement levels showed a slight decrease in the essential amino acids but still had approximately 80% of the total essential amino acids. Therefore it may be concluded that collagen from cattle hide can be used to replace a portion of the lean meat or fat meat in ground beef patties and pork sausage up to 20% level still providing much of the nutritive value.

Introduction

Beef hide is a major by-product of the meat packing industry and its use (in addition to making leather) as a protein supplement in traditional foods improves the economy of animal agriculture. Proteins from varied sources like vegetable (soy protein, soy concentrate; cottonseed protein), milk (non-fat dry milk, whey proteins), single cell proteins, etc. are being utilized as additives or replacements in many meat products. Collagen, a versatile protein, is available from cattle hide. But, its use in food is not yet approved, except as a sausage casing, partially because it is deficient in certain essential amino acids. Collagen is also available in connective tissue trimmings from meats used for making restructured meats and also from mechanically deboned meats. Therefore, its use as a food is a challenge to the food scientist.

Earlier we reported on the use of fibrous wet collagen from cattle hide in bologna formulations by replacing lean meat up to 20% level. The present research is to find out whether this wet fibrous collagen when, used to replace a part of the lean meat in beef patties and lean and fat in pork sausage, would greatly affect the amino acid composition (nutritive value) of such products.

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Experimental

Comminuted wet collagen obtained from the Eastern Regional Research Station, Philadelphia, was used to replace lean and fat in the beef patty and pork sausage formulations as desired.

USDA good grade beef round and beef fat was obtained from a local packing company. The lean and fat were separated manually from the round. The lean meat, fat meat and beef fat separately was passed through a meat grinder with 1/2 in. plate once. The fat content in each batch was determined by a modified Babcock procedure and a beef patty meat formulation was computed to contain approximately 25% fat. The lean meat in the formulation was replaced with wet fibrous collagen at 0, 10 and 20% maintaining the 25% fat level. All the ingredients were mixed using a Hobart mixer. After mixing, the meat was passed through a 1/8 in plate of a meat grinder for uniform distribution. Patties weighing approximately 4 oz were formed using a Hollymatic 200 patty molding machine.

Fresh pork shoulders were obtained from a local meat packer. The lean and fat were each manually separated and separately ground once through a 1/2 in. plate of a meat grinder. Approximate fat content of pork lean and pork fat meat was determined, and a meat formulation was made to have 70% pork lean and 30% pork fat. Comminuted wet fibrous collagen was used to replace lean meat and fat meat separately at 0, 5, 10 and 20% levels. Seasonings and spices were mixed at the rate of 28 oz salt, 1 oz sage, 2 oz ground red pepper and 4 oz ground black pepper for 100 lbs sausage meat. The mixture was passed through a 1/4 in plate of a meat grinder once. Approximately 300 g of the sausage dough was stuffed into Supralon casings with a hand driven mechanical stuffer. All the meats were handled and stored at a cooler temperature of 35-40 F.

Amino acid analysis was done by high performance liquid chromatography after hydrolyzing the samples with methane sulfonic acid and dansylating with dansyl chloride. All measurements were in duplicate.

Results and discussion

Among the essential amino acids of ground beef patties (Table 1) there was a slight increase in the arginine and isoleucine as the collagen levels increased while the rest of the essential amino acids showed a general decrease. This is expected as the hide

Table 1. Amino Acid Composition (mean and standard deviation) of Ground Beef Patties at Different Levels of Collagen Replacement and of Collagen.

A.A.	0 %	10%	20%	COLLAGEN
ASP	11.11(.04)	6.78(.09)	6.90(.04)	4.32(.10)
GLU	14.85(.05)	9.22(.13)	9.50(.14)	6.51(.10)
HPR	0.96(.03)	1.20(0)	1.59(.02)	4.65(.08)
SER	3.57(.04)	2.29(.05)	2.44(.01)	2.25(.03)
THR	2.71(.04)	1.90(.04)	1.86(.06)	0.66(.12)
GLY	4.48(.06)	4.08(.11)	5.08(.04)	14.31(.37)
ALA	6.15(.04)	4.25(.16)	4.56(0)	5.58(.12)
PRO	2.26(.11)	2.41(.01)	2.81(.01)	5.70(.15)
ARG	3.95(.53)	4.25(.31)	4.56(0)	4.74(.08)
VAL	2.44(.06)	1.49(.01)	1.49(.01)	0.75(.03)
MET	1.49(.05)	0.91(.01)	0.88(.01)	0.36(.01)
ILE	1.05(.02)	1.12(.07)	1.30(.25)	0.51(.03)
LEU	3.78(.17)	3.50(.40)	3.66(.13)	1.95(.02)
TRY	ND	ND	ND	ND
PHE	4.88(.03)	4.67(.94)	4.61(.40)	2.88(.15)
CYS	0.39(.02)	0.24(.02)	0.20(.01)	ND
LYS	6.57(.10)	4.07(.09)	4.08(0)	2.31(.02)
HIS	3.29(.05)	2.00(.03)	2.03(.01)	0.57(.11)
TYR	2.48(.07)	1.60(.25)	1.42(.01)	0.51(.12)

ND= Not detected.

collagen has lower levels of essential amino acids (Table 1). However, of the total percentage of essential amino acids, the products with 10% and 20% collagen had approximately 80% of the original amino acids compared to the products without collagen.

Amino acid composition of pork sausage (Table 2) showed similar trends. There was a slight increase in isoleucine content only at all the replacement levels. When compared to no collagen product, the 5, 10 and 20% lean meat replaced products had approximately 94, 95, and 86 percent of the essential amino acid content respectively and the fat replacement levels of 5, 10 and 20% had 90, 85 and 78% respectively. Tryptophan, an essential amino acid, failed detection since it probably got destroyed during hydrolysis.

These results indicate that replacement of lean meat by hide collagen in ground beef patties and pork sausage where lean meat and fat was replaced separately up to 20% still provided much of the nutritive value.

Table 2. Amino Acid Composition (Mean Percentage) of Pork Sausage at Different Levels of Collagen Replacement.

A.A.	Fat Meat Replacement			Lean Meat Replacement			
	5	10	20	0	5	10	20
ASP	6.92	6.82	6.66	6.39	8.70	7.50	5.90
GLU	9.10	8.74	8.60	8.33	8.04	9.96	7.84
HPR	0.56	0.58	1.06	0.51	0.56	0.68	1.26
SER	1.88	1.76	1.76	1.83	1.92	2.18	1.76
THR	1.50	1.48	1.14	1.48	1.46	1.14	1.10
GLY	2.92	2.96	4.06	2.96	3.08	3.82	5.10
ALA	3.12	3.06	3.26	3.04	3.14	3.58	3.20
PRO	1.92	1.92	2.39	1.88	1.96	2.22	2.60
ARG	3.28	3.16	2.66	3.15	2.82	3.08	2.62
VAL	0.84	0.78	0.06	1.62	1.42	1.60	1.30
MET	0.88	0.82	0.78	0.91	0.92	0.90	0.72
ILE	1.04	0.98	0.96	0.88	1.02	1.24	0.98
LEU	3.96	3.74	3.60	4.53	4.52	4.36	4.16
TRY	ND	ND	ND	ND	ND	ND	ND
PHE	2.84	2.77	2.68	3.75	3.02	3.28	2.66
CYS	0.08	0.09	0.10	0.12	0.08	0.10	0.10
LYS	3.96	3.68	3.48	4.12	4.10	3.90	3.92
HIS	1.58	1.48	1.36	1.69	1.62	1.61	1.56
TYR	1.80	1.82	1.80	1.87	1.86	1.84	1.60

ND = not detected.