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CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF A LIQUID MEAT MASH MADE FROM SLAUGHTER BY-PRODUCTS IN SWINE NUTRITION

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The chemical composition and nutritive value for swine of liquid meat mash from slaughter by-products were investigated. After the addition of water, the by-products were thermically treated under a pressure of 3.5 bars for 60 minutes and the product was preserved with phosphoric acid. The protein quality of the meat mash was investigated on an iso-protein and approximately iso-energetic base and was compared to fish meal in fattening swine from 27—53 kg livebody mass.

This meat mash contained about 25% dry matter with 23% crude protein and 56% fat. When half (B-treatment) or all (C-treatment) the dietary fish meal was supstituted with meat the average daily weight gain was reduced by 14 g (2.4%) (B), and 34 g (5.7%) (C) respectively compared to the control treatment. The differences between treatments were not statistically significant (P>0.05). The efficiancy of complete diet utilization was lower 4.7% crude protein (B-treatment) taht is, 9% crude protein (C-treatment) and by 14.5% metabolizable energy, that is by 28.1%.

Key words: liquid meat mash, slaughter by-products, swine nutrition, chemical composition, nutritive value.

INTRODUCTION

One of the possible ways of utilizing inedible by-products is by thermic processing into a liquid meat amsh. Liquid meat mash is a product obtained by cooking animal materials to the stage of a soup-like mash that can be directly used as a feed for swine. According to Marzcali (1988) liquid meat mash may be added to the level of 20% for piglets weighing 25—45 kg, and for fattening swine of 46—50 kg bodyweight. Soybean was not added but the amount of corn silage and liquid meat mash was increased. Đorđević et al. (1988) found that liquid meat mash used as a complete substitute for other protein feeds in swine feeding considerably reduced the production costs.

The value of liquid meat mash has not been investigated enough, so the aim of this work was to determine the chemical properties and nutritive value of liquid meat mash in swine feeding.

MATERIALS AND METHODS

By-products of the slaughter of fattened swine such as the intestines, stomach with its content and lungs (in the proportion 80:11:9) were used in the ivestigation. This material contained 64.35% water, 7.83% crude protein, 2.03% crude fibre, 20.57% crude fat, 2.69% mineral matters, 1.11% protein nitrogen, 0.14% non-protein nitrogen, 0.026% α-amino nitrogen and 0.12% ammonia.

After the addition of water, this material, was thermically treated in an autoclave under the pressure of 3.5 bars for 60 minutes. The liquid mash obtained was preserved with phosphoric acid after cooling to 80° C.

Chemical analyses were done by AOAC (1980) methods. Microbiological investigations were made using standard methods.

Piglets with an initial weight of 27 kg, were divided into three groups of 14 animals equalized for age, livebody mass, sex and provenience. Feed was given in troughs. The liquid meat mash was poured oevr the meal part of the diet and mixed in (B and C) imediately before feeding. Feed was given twice a day and water was accessible from automatic waterers. The trial lasted for 44 days.

The control diet contained 5% fish meal (A-treatment). Half of the fish meal, that is, 50% protein from fish meal (B-treatment) and all of the fish meal, that is, 100% of its proteins (C-treatment) were substituted on an iso-protein base with liquid meat mash proteins with simultaneous partial iso-energetic substitution of corn with liquid mash and compensation for less corn protein with sunflower meal protein. The ratios of the other protein ingredients (soybean meal, fodder meal, alfalfa meal) in the supplementary and complete feed mixtures were not changed. The ratios of supplement feed mixtures and liquid meat mash in treatments B and C were maintained by daily weighing the mixtures and liquid meat mash for each feeding and they were brought to the required ratios by weekly weight corrections.

Statistical analyses of average daily weight gain were done by the methods of Hadživuković (1973).

RESULTS AND DISCUSSION

The chemical and microbiological properties of the liquid meat mash used in trial feeding of swine are shown in Tables 1, 2 and 3.

On the base of the results given in Table 1 it can be seen that the liquid meat mash contained about 25% dry matter. Crude protein in the dry matter was 22.64% (88.23% in vitro digestibility) and fat content was 55.92%.

Table 1. Statistical analysis of the chemical composition of the liquid meat mashes used in the feeding trial

($\bar{x}$ 5)

Parameters	$\bar{x}$	$S\bar{x}$	S	V
Moisture, %	74.82	0.660	1.475	1.971
Crude protein, %	5.70	0.294	0.657	11.526
Crude fibre, %	1.78	0.092	0.205	11.517
Crude fat, %	14.08	0.632	1.414	10.043
Mineral matters, %	2.25	0.102	0.228	10.133
N-free extract, %	1.22	0.140	0.316	25.90
Protein digestibility, %	88.23	0.98	2.202	2.50
Nitrogen fractions, %	in sample		in dry matter	
Protein nitrogen, %	0.592		2.351	
Non-protein nitrogen, %	0.320		1.271	
α-amino nitrogen, mg %	53.00		238.95	
Ammonium nitrogen, %	0.034		0.135	

Table 2. Microflora of meat liquid mashes used in the feeding trials

Sample	Total number of saprophyte bacteria/1 g	Fungi mold/1 g	Pathogenic microorganisms/ 50 g
1	65.000	5.500	negative
2	100.000	1.000	,,
3	90.00	4.500	,,
4	100.000	500	,,
5	68.000	1.000	,,

The relative amounts of nitrogen fractions in liquid meat mash in relation to the contents in the startig material indicated that crude proteins were significantly hydrolized and that some amino acids were deaminated.

Liquid meat mash proteins contained 56% essential and semi-essential amino acids. In the total amount of all amino acids, lysine, methionine with cystine and tryptophane were represented at 5.66%, 2.15% and 0.63% respectively. The low content of cystine (0.99%) and tryptophan (0.63%) indicated that the crude proteins contained a considerable amount of collagenic proteins.

The results obtained for microbial contamination of liquid meat mash before use (Table 2) indicate that preserved meat mash was free from pathogenic microorganaisms and that contamination with saprophyte bacteria, fungi and molds was insignificant.

The basic production results are shown in Table 3 and statistical analysis of average daily weight gain in Table 4.

Table 3. Basic production results

Item[1])		Treatment A	Treatment B	Treatment C
Initial number of piglets per group		14	14	14
Initial livebody mass, kg		27.6	27.5	27.6
Average daily feed intake per head	kg	1.52	1.55	1.56
	index	100.0	102.0	102.6
Average daily weight gain per head	kg	0.592	0.578	0.558
	index	100.0	97.6	94.3
Average daily feed consumption per weight gain unit	kg	2.56	2.68	2.79
	index	100.0	104.7	109.0
Average final livebody mass per head, kg		53.4	52.9	52.1
Final number of animals in group		13	14	14

[1]) Diets with 12 5% moisture

Table 4. Statistical analysis of average daily weight gain (kg)

Treatment	n	$\bar{x}$	$S\bar{x}$	s	V	F 0.05 Exp.	F 0.05 Tab.
A	14	0.592	0.018	0.067	11.32		
B	14	0.578	0.019	0.070	12.11	0.91^{NS}	3.24
C	14	0.558	0.016	0.059	10.57		

From the statistical analysis of average daily weight gain (Table 4) it can be seen that there were small differences between treatments, but that weight gain variations withim all treatments were relatively high. On the base of these data it can be concluded that the weight gains in treatments B and C, were not statistically reduced compared to control treatment ($P>0.05$) when 2.5—5.0% fish meal was substituted with the liquid meat mash investigated. The rate of weight gain was slightly lower with increasing level of liquid meat mash in the above mentioned diets.

The efficiency of complete diet utilization was also slightly lower with increasing levels of liquid meat mash in the diet. The details are presented in Table 5. Crude protein consumption per kg of weight gain was higher by about 9% (B-treatment), or 16% (C-treatment) compared to control treatment A. However, comparing our results for crude protein

Table 5. Crude protein, total lysine and metabolizable energy consumption per weight gain unit (kg)

Item		Treatment		
		A	B	C
A. Crude protein (g)				
1. Mixtures-DS		371	357	337
2. Meat liquid mash		—	48	94
Total	g	371	405	431
	index	100.0	109.2	116.2
B. Total lysine (g)				
1. Mixtures-DS		16.64	15.74	14.76
2. Meat liquid mash		—	2.74	5.48
Total	g	16.64	18.48	20.24
	index	100.0	111.1	121.6
C. Metabolizable energy (MJ)				
1. Mixtures-DS		33.816	33.452	32.823
2. Meat liquid mash		—	5.277	10.556
Total	MJ	33.82	38.73	43.34
	index	100.0	114.5	128.1

consumption with the world recognized standards of the American National Research Council (NRC, 1978), the result obtained in treatment C was lower only by about 8%. Crude protein consumption for weight gain of fattening swine of 20—60 kg was between 472 and 527 g x kg^{-1} in the investigations carried out by Delić et al. (1981). Vukić et al. (1982) found that consumption was 461—478 g x kg^{-1} in swine of 22—67 kg. The results obtained are fairly good although the utilization of dietary proteins was considerably reduced when fish meal proteins were substituted with those from liquid meat mash.

The American standards mentioned (NRC, 1988) predict a lysine consumption of 19.43 g/kg of weight gain for the same weight category of swine. As consumption in treatment B was only slightly lower, and in treatment C it was somewhat higher, the result is satisfactory. It is more important to mention that conversion was reduced by more than 10% when half the fish meal proteins were substituted with liquid meat mash proteins. Moreover, when fish meal proteins were completely substituted, the conversion was reduced by over 20% compared to the control diet. The lower conversion of total lysine than crude protein points to the possibility that there was more inactivated lysine in liquid meat mash compared to fish meal.

The utilization of metabolizable energy in the diest containing liquid meat mash was lower in these investigations. In treatment B it was decreased by about 15%, and with diet C by 28% compared to the control diet A. NRC standards (1988) predict the average consumption of 35.8 MJ per kg of weight gain in fattening swine of 20—60 kg, but Delić et al. (1981) registered the consumption of about 49.2—50.4 MJ digestible energy per kg of weight gain. This is approximately 48—49 MJ of metabolizable energy according to formula for calculation (Henry and Perez, 1982).

Although the energy conversion of the control diet (treatment A) in our investigations was nearly identical to NRC (1988) recommendations, the conversion was significantly reduced when liquid meat mash was incorporated in the diet. It is possible that many factors affected the conversion. One of them is the markedly higher metabolizable energy content in the diets with liquid mash (4—8%), especially in treatmnt C. The diet in treatment A had approximaely the optimum energy-protein ratio, which according to NRC (1988) standards amounts 0.89 MJ for crude protein percentage or 20.58 MJ for total lysine percentage. These ratios were 0.94 and 21.12 MJ, for diet B and 0.97 and 22.34 MJ for diet C. This means that they had an energy surplus that can affect the efficiency of energy utilization. This was caused because of variable crude fat contents in liquid meat mash used in trial mixtures. The surplus of metabolizable energy in diets cotaining meat liquid mash can be reduced and equalized by partial defatting of liquid meat mash.

In addition, the degree of total lysin inactivation during thermic processing should be further investigated. Energy-protein or lysine ratio is, in fact, the ratio of energy and available lysine. If lysine from liquid meat mash was of lower availability then lysine from fish meal then the real energy-lysine ratio could be even greater and could impair energy utilization.

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HEMIJSKI SASTAV I HRANLJIVA VREDNOST MESNE KAŠE OD KLANIČNIH NUZPROIZVODA U ISHRANI SVINJA

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SADRŽAJ

Ispitivan je hemijski sastav i hranljiva vrednost mesne kaše od nuzproizvoda klanja svinja (creva, želudac sa sadržajem i pluća u odnosu 80:11:9). Sirovina je uz dodatak vode termički obrađena bez (odmašćivanja) pod pritiskom od 3,5 bara u vremenu od 60 minuta. Dobijena kaša je konzervirana dodatkom fosforne kiseline posle hlađenja do 80° C. Kvalitet proteina kaše ispitan je na izoproteinskoj i približno izoenergetskoj osnovi, u poređenju sa ribljim brašnom, na svinjama u tovu 27—53 kg žive mase.

Dobijena mesna kaša imala je oko 25% suve materije a u njoj 23% sirovih proteina, in vitro svarljivosti cca 88% i 56% masti. Sirovi proteini kaše sadrže oko 56% esencijalnih i poluesencijalnih aminokiselina. U ukupnoj količini svih aminokiselina lizin, metionin sa cistinom i triptofan učestvuju sa 5,66%, 2,15% i 0,63%. Zamena 2,5% (B-tretman) ili 5% (C-tretman) ribljeg brašna sa proteinima kaše, smanjilo je prosečan dnevni prirast grla za 14 g ili 2,4% (B), odnosno za 34 g ili 5,7% (C), u poređenju sa kontrolnim tretmanom. Razlike među tretmanima nisu bile statistički značajne ($P > 0,05$).

Efikanost iskorišćavanja ukupnog obroka B-tretmana bila je slabija za 4,7%, sirovih proteina za 9,2%, ukupnog lizina za 11,1% i metaboličke energije za 14,5%, dok je iskorišćavanje ukupnog obroka C-tretmana bilo slabije za 9,0%, sirovih proteina za 16,2%, ukpnog lizina za 21,6%, a metaboličke energije za 28,1%, u poređenju sa kontrolnim A-tretmanom. Utrošak obroka A-tretmana za kilogram prirasta iznosio e 2,56 kg, sirovih proteina 371 g, ukupnog lizina 16,6 g i 33,8 MJ metaboličke energije.