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THE POSSIBILITY FOR FISH MEAL SUBSTITUTION IN PIGLET FEEDING

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The possibility substitution of fish meal with a high protein meal for feeding weaned piglets was investigated. The high protein meal was produced by combining blood, meat and hidrolized feather meal. The fish meal was substituteTR?5Tn basis.

The high protein meal was added to the starter mash for piglets (treatment A) substituting for two-thirds (treatment B) or the complete amount (4%) of fish meal (treatment C). This reduced the average daily weight gain by 6.83% (treatment B) and 7.38% (treatment C) respectively compared to the control diet (treatment A).

Feed conversion per unit of weight gain was 6.33% higher (treatment B) and 8.02 % higher (treatment C) than in piglets fed the control mash (treatment A). The carcass quality of the piglets fed the rations containing high protein meal instead of two-thirds of the fish meal was comparable to the carcass quality of the piglets on control treatment A.

Key words: high protein meal, substitution, weaned piglets, feeding.

INTRODUCTION

The shortage of high quality animal proteins is a problem in aminal production, especially in swine production. Imported fish meal is the most distinctive representative in this group raw materials, because domestic sources are very scarce, although there are considerable, potential possibilities for the utilization of slaughter by-products. However, these by-products can be used instead of imported fish meal only if the quality of the final products is adequate (suitable technology). Several products with different characteristics should be made of the slaughter by-products. Part of the fish meal or other sources of animal proteins can be replaced by special high quality feeds produced by combining different slaughter by-products.

Thus, blood proteins are not paritcularly palatable (Morison, 1955) and they are deficient in isoleucine (Ristić and Kormanjoš, 1988). The content of sulphur-containing amino acids is rather low (Sabljak-Uglješić and Prilika, 1979; Radovanović et al., 1987; Ristić et al., 1988). but the content of lysine is very

high. Well composed diets with ingredients rich in isoleucine and methionine produced very good results (Valadez, 1965; Ristić et al., 1985).

Hydrolized feather meal, although deficient in lysine, histidine and tryptophan (Vessels and Saunders, 1971; Baker et al., 1981; Ristić et al.,1988; Ristić and Kormanjoš, 1988) is complementary with blood meal since hydrolized feather meal contains high levels of isoleucine and sulphur-containing amino acids.

High quality meat meal is deficient in tryptophan (Ristić, 1981; Ristić et al., 1984) and the content od lysine, isoleucine and thereonine is marginally deficient (Atkinson and Carpenter, 1970; Stockland et al., 1971; Skurry, 1974; Meade, 1975) but by including blood meal and hydrolized feather meal into the diets, this deficiency can be overcome. Meat meal is an excellent source of energy, phosphorus an calcium (Meade, 1976; Jung, 1974) and it complements very well the deficit of these components in blood and hydrolized feather meal.

The production of special animal feeds and their combination allows the formulation of a protein feed with a better amino acid composition and a higher biological value than the components used to make it.

The aim of this work was to investigate the posibility for substitution of fish meal with the composed high protein meal in piglet nutrition.

MATERIALS AND METHODS

A high protein meal was composed of blood, meat and hydrolized feather meal on the basis of their digestibility, protein and amino acid value in a suitablee weght ratio (75.0:3.3:15.7%). The chemical composition of the high protein meal was as follows: 9.80% moisture, 78.88% crude protein, 5.48% crude fat, 0.26% crude fibre, 4.97% mineral matter and 0.68% N-free extract. This meal contained 5.79% lysine, 2.14% methionine +cystine and 1.17% tryptophan.

The fish meal used contained 7.26% moisture, 63.82% crude protein, 11.20% crude fat, 14.74% mineral matter and 2.98% N-free extract.

The chemical characteristics were determined by AOAC methods (1980).

Weaned crossbred piglets large Yorkshire x Swedish Landrace x Belgian Landrace) of average initial weight 8 kg were used in the experiment. Three groups of 8 piglets each were formed for each treatment and equalized according to sex, weight, age and breed. The piglets were kept in standard pens on the floor. Feed was given in the form of meal mashes from self-feeders and water was available ad libitum. The trial lasted for 32 days. The piglets were weighed individually, before formation of the groups and at the end of the experiment. Statistical analysis was performed by the methods of Hadživuković (1969).

Two-thirds and all the fish meal was substituted with the high protein meal on an iso-protein basis in treatmens B and C respectively and compared to the control treatment A. The basic composition of the experimental diets is presented in Table 1 and their chemical composition in Table 2.

Nine experimental animals from treatments A, B and C were taken in order to examine the effects of fish meal substitution with the new high protein

meal on the carcass quality. The following characteristics were examined: livebody mass before slaughtering, the mass of chilled carcasses, dressing percentagets, length of the carcasses and backfat thickness.

Table 1. Composition of the experimental mashes

Components, g.100g^{-1}	Treatment[1)]		
	A	B	C
Corn	68.60	68.90	68.90
Fish meal	4.00	1.30	—
High protein meal	—	2.20	3.30
Soybean meal	14.90	14.90	14.90
Sunflower meal (40%)	5.00	5.00	5.00
Sugar	3.00	3.00	3.00
Dicalcium phosphate	1.00	1.30	1.50
Limestone	1.00	0.90	0.90
Lincospectin	0.10	0.10	0.10
Tilan-20	0.40	0.40	0.40
Premix[2)]	2.00	2.00	2.00

[1)] A — Control mash
B — Two-thirds of fish meal was substituted
C — Fish meal was not included in this mash
[2)] Premix also provided 0.08% synthetic lysine and 0.07% DL-methionine in complete mashes.

Table 2. Chemical composition of the experimental mashes

Item, g.100g^{-1}	Treatment		
	A	B	C
Moisture	11.97	12.23	12.49
Crude protein	18.16	17.85	17.95
Crude fat	3.90	3.86	3.62
Mineral matters	4.47	4.17	4.41
N-free extract	58.93	58.82	58.91
Oats feed units	121.60	121.30	121.40
Digestible energy, MJ.kg^{-1}	14.11	14.08	14.09
Lysine	0.91	0.86	0.83
Methionine + cystine	0.66	0.57	0.56
Tryptophan	0.19	0.19	0.20
Histidine	0.45	0.43	0.43
Isoleucine	0.74	0.71	0.70
Leucine	1.58	1.60	1.62

RESULTS AND DISCUSSION

The effects of treatment on various production parameters of the piglets are presented in Table 3 and their statistical analysis in Table 4.

Table 3. The effects of the treatments on various production parameters

Production parameters		Treatment		
		A	B	C
Number of animals in the experiment		24	24	24
Number of groups in the experiment		3	3	3
Average initial body weight, kg		7.87	7.92	7.96
Average daily feed consumpion per head	g	865	857	864
	index	100.0	99.19	99.88
Average daily weight gain	g	366	341	339
	index	100.0	93.17	92.62
Average feed conversion per unit of weight gain	kg	2.37	2.52	2.56
	index	100.0	106.33	108.02
Number of animals at the end of the experiment		24	24	24
Final body weight, kg		19.59	18.85	18.82

Table 4. Statistical analysis of productions parameters

Treatment	n	$\bar{x}$	$S\bar{x}$	s	C	F-test (0.05)	
						Exp.	Tab.
I Average daily feed comsuption per head, g							
A	3	864	12.41	21.50	2.49	0.66^{NS}	5.14
B	3	857	5.67	9.82	1.15		
C	3	864	8.08	14.00	1.62		
II Average daily weight gain, g							
A	3	366	5.21	9.02	2.47	1.97^{NS}	5.14
B	3	341	9.35	16.20	4.75		
C	3	339	11.84	25.70	7.57		
III Average feed conversion per unit of weight gain, kg							
A	3	2.37	0.07	0.12	4.86	1.97^{NS}	5.14
B	3	2.52	0.09	0.15	5.84		
C	3	2.56	0.12	0.20	11.79		

The average daily weight of piglets on treatment B was lower by 25 g or 6.83% compared to piglets on treatment A while piglets on treatment C had a 7.38% lower daily weight gain (27 g) compared to treatment A. The differences were not statistically significant ($p<0.05$).

The average feed conversion per unit of weight gain was 0.15 kg or 6.3% (higher) in treatment B, and 0.19 kg or 8.02% higher in treatment C compared

to control treatment A. The differences in feed conversion per unit of weight gain between the treatments were not statistically significant either ($p<0.05$).

In general, substitution of the fish meal in starter mash for piglets with high protein meal on an iso-protein basis produced very good results. Thus, the small differences observed were not statistically significant.

The poorer performance obtained with experimental mashes B and C most probably were the consequence of the lower lysine concentration in these mashes compared to control mash A (Table 2).

Thus, the level of lysine was reduced in diet B by 5.49% and in diet C by compared to control diet A, which intensified the negative effect on performance of lysine as the limiting amino acid.

The lower lysine concentration was the consequence of the amout of hydrolized feather meal in the high protein meal investigated (15.70%). Compared to fish meal proteins, keratins contain considerably lower lysine concentrations (Baker et al., 1981; Beilorai et al., 1982; Papadopulos et al., 1986; Ristić et al., 1988).

Simular investigations have been performed by other workers who also obtained positive results (Atkison and Carpenter, 1970; Stockland et al., 1971 Skurray, 1974; Meade, 1976; Isakov et al., 1982). They found that meat meal supplemented with lysine can be used as a substitute for fish meal proteins in swine feeding. In the experiment carried out by Isakov et al. (1992), 4% of fish meal and 15% of soybean was substituted by 4% meat meal and 15% high protein sunflower meal with addition of 1.7% lysine concentrate in the first fattening period (20-60 kg) (lysine concentration in the concentrate amounted to 15-22%). In the second fattening period (60-100 kg), 20% of the meal was replaced, in the same way, by 2% meat meal and 1.2% lysine concentrate. The results obtained for the whole experimental period showed that daily feed intake, on the average, was equal in both groups. Fattening swine fed meat meal, sunflower meal and lysine concentrate had a 2% higher daily weight gain with equally good feed conversion.

At the slaughtering line it was found that swine fed "improved" meat meal had a 1% lower dressing percentage but the meat percentage in warm carcasses was nearly the same as in swine fed mashes with fish meal.

A favorable effect of combined protein feeds (meat meal and single-cell protein meal) as substitutes for fish meal was found by Ristić et al., (1984) in swine fattening. Swine fed improved meat meal with single-cell proteins had only a slightly lower weight gain compared to those fed fish meal. The weight gain difference in the first fattening phase was 0.6% and in the second phase it was 1.6%. However, the control group given fish meal had a lower feed conversion in both fattening phases compared to the experimental group. In the first phase it was lower by 7.5% and in the second one by 5.5%.

The carcass characteristics of the piglets are presented in Table 5.

When the results for carcass characteristics of the piglets from treatment B and those from control treatment A were compared it was found that the average mass of piglets from treatment B before slaughter was lower by 0.61

kg or 2.99% compared to the mass of piglets from the control treatment. The mass of chilled caracasses of piglets from treatment B was lower by 0.41 kg or 2.73% compared to the mass of piglets from treatment A. The dressing percentage (calculated from the mass of chilled carcasses) of piglets from treatment B was higher by only 0.17% compared to treatment A. The length of the carcasses, determined as the distance between os pubis-atlas, was nearly the same in both groups, while the backfat thickness with skin determined over M. longinssimus dorsi was lower in the piglets from treatment B by only 0.34 mm.

Table 5. The carcass characteristics of piglets obtained after treatments A, B and C

Characteristics investigated		A	B	C	Significance of the difference
Livebody mass before slaughter (kg)	$\bar{x}$	20.39	19.78	18.85	n. s.
	S	1.769	2.548	2943	
	C	8.676	12.882	13.228	
Mass of chilled carcasses (kg)	$\bar{x}$	15.03	14.62	13.59	n. s.
	S	1.483	2.024	2.102	
	C	9.866	13.844	15.470	
Dressing percentage (%)[x)]	$\bar{x}$	73.67	73.84	71.93	n. s.
	S	1.989	1.117	2.501	
	C	2.700	1.594	3.477	
Length of the carcass (cm)	$\bar{x}$	62.37	62.34	61.08	n. s.
	S	3.789	2.957	2.990	
	C	6.075	4.745	4.896	
Backfat thickness (mm)	$\bar{x}$	9.17	8.83	8.17	n. s.
	S	1.722	1.602	1.472	
	C	18.784	18.145	18.017	

On the basis of the results obtained it can be concluded that the differences in carcass characteristics investigated between treatment A and B were very small. These findings suggest that the carcass quality of piglets fed on diets containing two-thirds protein meal instead of fish meal was comparable to the carcass quality of piglets from control treatment A.

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MOGUĆNOST ZAMENE RIBLJEG BRAŠNA U ISHRANI PRASADI

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SADRŽAJ

Izvršeno je ispitivanje mogućnosti zamene ribljeg brašna u ishrani zalučene prasadi prosečne početne težine cca 8 kg. Svaki tretman je ispitan istovremeno na 3 grupe po 8 grla, međusobno ujednačenih po polu, težini, starosti i rasi. Prasad je držana u klasičnim boksovima na podu. Zamena ribljeg brašna je izvršena na izo-proteinskoj osnovi. U kontrolnoj smeši (A-tretman) zamenjena je trećina (B-tretman) ili celokupna količina ribljeg brašna u smeši (C-tretman) sa visokoproteinskim brašnom proizvedenim komponovanjem krvnog, mesnog i brašna od hidrolizovanog perja.

Prosečna dnevna konzumacija smeša bila je približno ista u sva tri tretmana.

Prosečni dnevni prirast prasadi hranjene sa smešom B-tretmana bio je manji za 6.83% u poređenju sa prasadi A-tretmana, dok su prasad na smeši C-tretmana imala dnevni prirast prosečno manji za 7.38% od prasadi iz kontrolne grupe.

Kvalitet trupa prasadi hranjenih obrocima u kojima je 2/3 sadržaja ribljeg brašna zamenjeno visokoproteinskim hranivom odgovara kvalitetu trupa prasadi kontrolnog A-tretmana.