

THE EFFECT OF SUBSTITUTION OF FISH MEAL WITH HIGH PROTEIN PLANT FEED IN NUTRITION OF SOWS AND PIGLETS **

**B. Živković^{1*}, W. Migdal², V. Veselinović³, Č. Radović¹,
O. Kosovac¹, M. Fabjan¹**

¹Institute for Animal Husbandry, Belgrade-Zemun;

²Akademia Rolnicza, Kraków, Poland;

³Bankom, Novi Beograd

*Corresponding author: vlada87@net.yu

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Abstract: The effects of use of high protein plant feed - Ekofish meal in nutrition of sows in lactation, sucking piglets and weaned piglets were investigated in this paper. Considering our previous positive experiences in use of similar feed in nutrition of weaned piglets and fatteners, objective of this paper was to evaluate the effects of use of high protein feed based on plant proteins in diets for lactating sows, suckling and weaned piglets.

Investigated feed was produced according to specific technology in production facilities of the firm Bankom in Serbia.

Investigations were carried out on the Experimental pig farm of the Institute for Animal Husbandry, Belgrade-Zemun in Serbia.

Obtained results showed that in isonitrogen mixtures the introduction of studied feed as substitute for fish meal had positive effects: by 6,18% lower losses of body mass of sows during lactation, by 1,6 shorter service period, with almost identical gain (difference of 2 g) in suckling piglets, increased consumption of pre-starter by 1,1 kg/litter in piglets during creep feeding, and similar but by 4,73% lower cost of gain with similar feed conversion in weaned piglets.

In general, obtained results have shown that use of high protein plant feed can be recommended in nutrition of sows, suckling and weaned piglets.

Key words: high protein plant feed, sows, piglets

Introduction and Literature Review

Based on the decision of the Commission of the European Union 9/2001,

mixtures containing fish meal can be produced only in livestock feed production facilities where feed for ruminants are not produced and which are specialized for this purpose with permit/licence granted by authorized expert institutions (*Sardi et al.*, 2005). This fact leads to increased protests of consumers against use of animal proteins in livestock feeds which justifies further research of the possibility to exclude fish meal from diets used in pig nutrition.

Based on our earlier positive experiences in use of feed called Vitaprotein 50 imported from Belgium (*Hoorick van*, 2003) in nutrition of weaned piglets (*Živković et al.*, 2007) and fatteners (*Živković et al.*, 2006; *Živković et al.*, 2007), which was of similar nutritive characteristics like the plant feed - Ekofish meal u in nutrition of weaned piglets (*Adamović et al.*, 2006), sows, piglets and fatteners (*Živković et al.*, 2007), objective of this paper was to evaluate the effects of use of high protein feed based on plant proteins in diets for lactating sows, suckling and weaned piglets.

Investigated feed was produced according to specific technology in production facilities of the company Bankom in Serbia.

Material and methods

Investigations were carried out on Experimental pig farm of the Institute for Animal Husbandry, Belgrade-Zemun. Trial included total of 22 sows in two nutrition treatments. Distribution criteria were origin of the animal, farrowing parity and boars used for their insemination.

Ten day prior to farrowing all pregnant heads were transferred to farrowing facility. Sows of the first group – control, and of the second – trial groups were fed diets for suckler sows, investigated feed (table 2) was included in experimental mixture, and control mixture was based on fish meal (table 3). In all compared mixtures the level of crude proteins was equal, with remark that during lactation only sows were fed individually, and other categories had group feeding, in all categories nutrition was ad libitum.

Subsequent to farrowing, from the age of 8 days, suckling piglets were fed additional mixtures where again control mixture was based on fish meal and trial mixture based on investigated feed. After weaning, groups consisting of part of suckling piglets were formed, paying strict attention to the nutrition of piglets in trial groups, i.e. that they continue to receive diets with high protein plant feed, and control piglets diets with fish meal (table 3).

For evaluation of obtained results following parameters were used: body mass of sows prior to farrowing and at weaning, losses of body mass of sows

during lactation, feed consumption of sows during lactation, number of live born piglets per farrowing, number of equalized piglets per litter, number of weaned piglets, average body mass of piglets at birth and weaning, average daily gain of piglets during lactation and rearing, and economical justification for introduction of investigated feed expressed as cost of 1 kg of gain.

Table 1. The scheme of the experiment

Group	1 control	2 experimental
Lactating sows		
Fish meal in the diet	+	-
Plant high protein feedstuff in the diet	-	+
Suckling piglets – creep feeding		
Fish meal in the diet	+	-
Plant highprotein feedstuff in the diet	-	+
/Feed/head/day, kg	Ad libitum	Ad libitum
Weaned piglets		
Fish meal in the diet	+	-
Plant highprotein feedstuff in the diet	-	+
Feed/head/day, kg	Ad libitum	Ad libitum

Table 2. Nutritive value of the compared feedstuffs used in the experiment

	Fish meal	Plant highprotein feedstuff
ME,MJ/kg	12,55	13,80
Moisture, %	8,0	8,0
Crude protein, %	65,0	60,0
Ether extract, %	5,0	5,0
Crude fiber, %	3,0	3,0
Ash, %	4,0	4,0
Calcium, %	0,90	0,90
Phosphorus total, %	0,54	0,54
Sodium, %	0,16	0,16
Some essential amino acids, g/16 gN :		
Lysine	7,81	7,83
Methionine + cystine	3,71	4,02
Tryptophane	1,00	1,08
Threonine	4,20	3,98

Table 3. The scheme of the nutrition of the experiment

	Sows		Piglets		
	Gestation	Lactation	Creep feeding	Weaning period	
Crude protein, %	13,5	18	22	20	18
Ekofish meal, % in diet	-	2,0	5,0	4,5	4,0

The feedstuffs used in the diets: corn, wheat middlings, soybean oil meal, sunflower oil meal, fish meal, plant highprotein feedstuff – ecofish meal, milk replacer for piglets – ekolak, full fat soybean, limestone, monocalcium phosphate, salt, vitamin-mineral premixture, L-lysine HCl

Obtained results were processed statistically by variance analysis and differences between averages using t-test.

Results and Discussion

a) Lactation period

In the trial, the possibility for introduction of high protein plant feed–Ekofish meal as substitution of fish meal in nutrition of sows in lactation, suckling and weaned piglets was investigated.

Obtained results (table 4) have shown that sows of the first group – control, fed diets with fish meal, lost during lactation period 16,82% of their own body mass. Group of sows fed diets containing investigated feed lost by 6,18% less of their own body mass compared to animals in control group. After weaning, it took in average 9,0 days for sows in control group to recover before next insemination, whereas in trial group average service period was only 7,4 days, which is shorter by average 1,6 feeding days (table 4).

In regard to feed consumption during lactation (table 4), nutrition of sows with control mixture resulted in average daily consumption of feed of 3,84 kg. Introduction of plant high protein feed into mixture during lactation caused significant ($P < 0,05$) decrease of consumption, in average by 0,18 kg or 4,69% compared to control group.

No significant difference in number of live born and still born piglets was established. Control group of piglets fed diets containing fish meal realized by 0,7 more weaned piglets per litter compared to trial group of pigs. No significant difference in rate of growth of piglets during suckling period.

was established regardless of the composition of investigated mixtures. Use of investigated feed in mixture for piglets during lactation induced increased consumption of pre-starter by 1,1 kg or 12,66% per litter in relation to control group of piglets (table 4).

Table. 4. Performance of the sows and suckling piglets in the experiment

Group	1 control	2 experimental
Lactating sows		
<i>Fish meal in the diet</i>	+	-
<i>Plant highprotein feedstuff in the diet</i>	-	+
Body mass of sows before farrowing, kg	234,2	228,8
Body mass of sows at the end of lactation, kg	194,8	192,7
The losses of body mass of sows, %		
*before farrowing/ at weaning	16,82	15,78
Compared to the control group, %	-	+ 6,18
Average daily feed consumption, kg	3,84^{a**}	3,66^a
Service period, days	9,0	7,4
Suckling piglets – creep feeding		
Duration of the lactation period, days	28,1	28,4
Number of liveborn piglets/litter	11,70	10,44
Number of egalized liveborn piglets/litter***	11,10	11,55
Number of stillborn piglets/litter	0,50	0,30
Number of weaned piglets/litter	9,70	9,00
Average body mass of piglets at farrowing, kg	1,417	1,473
Average body mass of piglets at weaning, kg	7,29	7,27
Average daily gain of piglets, g	210	208
Compared to the control group, %	-	- 0,95
Consumption of prestarter/litter, kg	8,53	9,61
Compared to the control group, %	-	+ 12,66

*) 1st control group weighed 9.9 days, and 2nd experimental group on 10.3 days before farrowing.

**) The same letters in the row over the average values mark statistical difference on the level $P < 0.05$.

***) After the colostrum consumed, the number of suckling piglets was unified.

b) Weaning period

In the weaning period, during 51 feeding days, piglets of control group

fed diets with fish meal, realized average daily gain of 309 g (table 5). Introduction of investigated Ekofish into isoprotein mixtures had no significant effect on growth piglets. No significant difference in consumption and conversion of feed between investigated groups was established.

In table 6 are given indicators of economical justification for introduction of Ekofish meal into mixtures for piglets in weaning. Its use in mixtures reduces the cost of feed by 4,46% so for the same feed conversion cost of gain of piglets fed diets containing Ekofish is more favourable by 4,73% compared to control group of animals, which confirms the justification for use of this feed from the nutritive and economical standpoint of view in nutrition of this pig category.

Table 5. Performance of weaned piglets in the experiment

Group	1 control	2 experimental
<i>Weaned piglets</i>		
<i>Fish meal in the diet</i>	+	-
<i>Plant highprotein feedstuff in the diet</i>	-	+
Body mass of piglets at the beginning of experiment, kg	8,21	8,21
Body mass of piglets at the end of experiment, kg	23,99	23,90
Duration of experiment, days	51	51
Average daily gain of piglets, g	309	307
Compared to the control group, %	-	- 0,65
Average daily feed consumption, kg	0,682	0,674
Compared to the control group, %	-	- 1,17
Feed conversion ratio, kg	2,20	2,19
Compared to the control group, %	-	+ 0,45

Table 6. Economic analysis of the use of plant highprotein feedstuff in the nutrition of weaned piglets in the experiment

Group	1 control	2 experimental
<i>Weaned piglets</i>		
<i>Fish meal in the diet</i>	+	-
<i>Plant highprotein feedstuff in the diet</i>	-	+
The price of the diets, %	100,00	95,54
Feed conversion ratio, %	100,00	99,54
The price of the weaned piglets, %	100,00	95,27
Compared to the control group, %	-	+ 4,73

Main ingredients of the investigated high protein plant feed are soy bean protein isolates, soy bean protein concentrates, full fat soy bean and soy bean meal (*Adamović et al.*, 2006).

In case of soy bean products, hydrolyzed soy bean protein is excellent source of nutritious substances for piglets (*Ferrini et al.*, 2004). Piglets fed products containing soy bean protein can progress equally as piglets fed diets containing fish meal (*Davis et al.*, 2000; *Min et al.*, 2003; *Sardi et al.*, 2005). Soy bean protein isolates can be good alternative (*Ebert et al.*, 2004) and due to arginine even superior to whey protein (*Ebert et al.*, 2005), although inferior to casein (*Junghans et al.*, 2004), i.e. they can replace up to 50% of skimmed milk protein powder (*Junqueira et al.*, 2004) in piglet nutrition. Piglets fed soy bean isolates in mixture have better utilization of feed and less incidence of diarrhea (*Jones et al.*, 1990; *Kiers et al.*, 2003) and by measuring of digestibility in ileum their superiority over diets based on concentrated soy bean protein was established (*Barriero et al.*, 2006).

Compared to soy bean meal, isolates have demonstrated their superiority (*Jones et al.*, 1990) due to better lysine digestibility (*Sohn et al.*, 1994) and better development of intestinal villus and crypt in small intestine (*Li et al.*, 1990; *Li et al.*, 1991) which in general influences better piglet production (*Lenahan et al.*, 2003). In nutrition of weaned piglets, investigated Ekofish resulted in great stimulative effect and its use can be recommended (*Kovčín et al.*, 2006).

It is certain that the effect of introduction of plant protein sources depend on percentage of their inclusion into mixtures, processing method and age of pigs. Improved efficiency of use of plant proteins can be attributed to the adaptability of the digestive system in pigs (*Kidder and Manners*, 1980).

Conclusion

The effects of the investigated plant protein feed Ekofish meal are investigated as substitute for fish meal in nutrition of sows, suckling and weaned piglets. Obtained results demonstrated that introduction of investigated feed in diets did have following effects:

- Lower losses of body mass of sows in lactation by 6,2% and shorter service period by 1,6 days compared to nutrition based on fish meal,
- Fewer weaned piglets by 0,7 piglets/litter compared to treatment with fish meal in diet,
- Almost identical gain in suckling and weaned piglets,

- Increased consumption of mixture used for additional feeding of suckling piglets by 1,1 kg/litter compared to indicator realized in group fed diets with fish meal,
- There was no difference in production of weaned piglets regardless of the use of fish meal or Ekofish meal in diets,
- Analysis of the cost of gain of weaned piglets showed that use of Ekofish meal reduces the cost of gain by 4,73% compared to the group fed diet with fish meal.

In general, obtained results have shown that the use of Ekofish meal can be recommended in nutrition of sows, suckling and weaned piglets.

EFEKTI ZAMENE RIBLJEG BRAŠNA BILJNIM VISOKOPROTEINSKIM HRANIVOM U ISHRANI KRMAČA I PRASADI

*B. Živković, W. Migdal, V. Veselinović, Č. Radović, O. Kosovac,
M. Fabjan*

Rezime

Ispitivani su efekti korišćenja visokoproteinskog hraniva biljnog porekla – Ekofish meal u ishrani krmača u laktaciji, prasadi na sisi i u odgoju. Imajući u vidu naša ranija pozitivna iskustva o korišćenju sličnog hraniva u ishrani odbijene prasadi i svinja u tovu, cilj ovoga rada je bio da se ocene efekti korišćenja visokoproteinskog hraniva zasnovanog na biljnim izvorima proteina u obrocima krmača u laktaciji, prasadi na sisi, i u odgoju.

Ispitivano hranivo je proizvedeno po određenoj tehnologiji u pogonima kompanije Bankom u Srbiji.

Istraživanja su izvedena na eksperimentalnoj farmi svinja Instituta za stočarstvo, Beograd-Zemun u Srbiji.

Dobijeni rezultati su pokazali da je u izonitrogenim smešama uvođenje ispitivanog hraniva umesto ribljeg brašna imalo pozitivne efekte izražene za 6,18% manjim gubicima telesne mase krmača tokom laktacije, za 1,6 dana kraćim servis periodom, skoro istim prirastom (razlika 2 grama) kod prasadi na sisi, povećanom potrošnjom predstartera za 1,1 kg/leglo kod prasadi

tokom prihranjivanja, sličnim ali za 4,73% jeftinijim prirastom uz sličnu konverziju hrane kod prasadi u odgoju.

U celini dobijeni rezultati su pokazali da se preporučuje korišćenje biljnog visokoproteinskog hraniva u ishrani krmača, prasadi na sisi i u odgoju.

Zahvalnost

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