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The replacement of fishmeal by plant proteins in piglet production

L. Sardi, R. Paganelli, P. Parisini, M. Simioli, G. Martelli

Dipartimento Morfofisiologia Veterinaria e Produzioni Animali, Università di Bologna, Italy

Corresponding author: Luca Sardi. Dipartimento Morfofisiologia Veterinaria e Produzioni Animali. Via Tolara di Sopra 50, 40064 Ozzano Emilia, Italy. – Tel: +39 051 2097376 – Fax: +39 051 2097373 – Email: lsardi@vet.unibo.it

RIASSUNTO – La sostituzione della farina di pesce con fonti proteiche vegetali nella produzione del suinetto. 144 suinetti svezzati (età allo svezzamento giorni 28; peso vivo medio kg 7,58), sono stati omogeneamente assegnati a 4 gruppi sperimentali le cui diete prevedevano la sostituzione totale della farina di pesce con fonti proteiche vegetali rappresentate, rispettivamente, da farina di estrazione di girasole parzialmente decorticato, glutine di mais e concentrato proteico di patata. Le diete sono state bilanciate in termini di apporti in aminoacidi ed Energia Netta. Ad eccezione del gruppo alimentato con concentrato proteico di patata, che ha dimostrato un ritmo di accrescimento significativamente migliore, non si sono evidenziate differenze tra le tesi. Lo stato di salute è stato sempre soddisfacente, con una bassa mortalità (4%, circa) e un modesto “punteggio diarrea” (valore massimo punti 1,59). La presente esperienza indica come, nell'alimentazione del suinetto nel post-svezzamento, sia possibile sostituire la farina di pesce con fonti proteiche vegetali, purché vengano correttamente bilanciati gli apporti aminoacidi ed energetici delle diete.

Key words: piglet, vegetable proteins, growth, health.

INTRODUCTION – According to EC Commission Decision 9/2001 on BSE protection (OJEC, 2001), feedstuffs containing fishmeal can be produced only in establishments manufacturing animal feed which do not prepare feedstuffs for ruminant animals and which are authorised for this purpose by the competent authority. This fact, leading to a reduction of the productive capacity of small establishments, and the increasing aversion of consumers towards the use of animal protein in feedstuffs justify the studies about the possibility of excluding fishmeal from young animal formulations. The aim of the present work was to evaluate the effect of the total replacement of fishmeal by some vegetable protein sources in piglet diets.

MATERIAL AND METHODS – The experiment was conducted under the guidelines of current Italian legislation implementing Council Directive 91/630/EEC on pig protection. A total of 144 Landrace x Large White male piglets (average age at weaning of 28 days; average body weight of 7.58 kg) was used. Animals were homogeneously (on the basis of litter, age and body weight) allotted to four experimental groups, each containing six replications of six piglets, fed as follows: a group A (control) in which piglets received a common diet containing fishmeal and groups B, C and D in which fishmeal was replaced by partially dehulled sunflower meal (solvent extract), corn gluten meal and potato protein concentrate, respectively. Aminoacids and Net Energy supplies of the four diets were equalized by means of synthetic aminoacids and soybean oil addition. Feed was ad libitum offered as pellet. To meet piglets' requirements (INRA, 1989), two feed formulations for each group were used: from 8 to 15 kg body weight (first phase) and from 15 to 30 kg body weight (second phase). Percent composition and chemical analyses (performed according to AOAC, 1990) of the four experimental diets offered in the above mentioned phases are shown in Table 1. Piglets were kept in environmen-

tally controlled rooms. Water was ad libitum available. Piglets were individually monitored for: initial weight; weight on 21st day of trial (intermediate); final weight (50th day of trial); average daily weight gain (ADG); feed intake per replicate; feed conversion rate (FCR) per replicate; mortality (and causes); diarrhoea incidence and diarrhoea score with points awarded on a 1-to-4 scale (1 indicating normal consistency of faeces and 4 indicating severe diarrhoea; to perform this classification the number of piglets of each replication and faeces consistency were used, according to Sardi *et al.*, 2004). The experimental data obtained were submitted to analysis of variance with the diet as the main effect (SAS, 1999). To compare data from diarrhoea score a chi-square test was used.

Table 1. Percent composition and analyses of the diets.

Body weight		8-15 kg				15-30 kg			
Groups		A	B	C	D	A	B	C	D
Cereals	%	54.66	52.90	52.00	54.81	61.69	60.72	59.95	61.48
Wheat bran	"	6.00	-	6.00	6.00	6.00	-	6.00	6.00
Soyabean meal	"	16.00	22.00	18.50	15.00	18.00	19.50	17.30	17.50
Milk whey	"	11.00	11.00	11.00	11.00	5.00	5.00	5.00	5.00
Fishmeal	"	6.00	-	-	-	3.50	-	-	-
Sunflower meal	"	-	6.00	-	-	-	8.00	-	-
Corn gluten meal	"	-	-	5.00	-	-	-	5.00	-
Potato protein conc.	"	-	-	-	6.00	-	-	-	3.50
Soyabean oil	"	3.00	4.00	3.25	3.30	2.50	3.00	2.80	2.80
Limestone		1.51	1.29	1.40	1.40	1.40	1.20	1.35	1.30
Dicalcium phosphate		0.70	1.35	1.35	1.35	0.80	1.20	1.20	1.25
Premix	"	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
L-Lysine HCl	"	0.24	0.40	0.50	0.22	0.20	0.34	0.41	0.20
Methionine	"	0.11	0.14	0.09	0.11	0.07	0.07	0.03	0.06
Threonine	"	0.08	0.12	0.11	0.01	0.04	0.07	0.06	0.01
Moisture	%	10.18	10.11	10.22	10.30	10.81	10.80	10.97	10.83
Crude Protein	"	18.55	18.17	18.39	18.49	17.16	17.22	17.40	17.17
Lysine ⁽¹⁾	"	1.25	1.25	1.25	1.25	1.09	1.10	1.10	1.10
Methionine ⁽¹⁾	"	0.75	0.75	0.74	0.75	0.67	0.67	0.67	0.67
Threonine ⁽¹⁾	"	0.81	0.81	0.81	0.81	0.72	0.72	0.72	0.72
Digestible Energy ⁽¹⁾	kcal/kg	3335	3376	3363	3370	3321	3342	3352	3341
Net Energy ⁽¹⁾	"	2433	2425	2417	2426	2431	2417	2435	2427

⁽¹⁾ Calculated values according to INRA (1989).

RESULTS AND CONCLUSIONS – The growing parameters (ADG and FCR) and the health status of piglets are reported in Table 2. Piglets receiving potato protein (group D) showed a higher (P<0.01) final body weight, which corresponded to a significantly higher ADG in both phases with more marked differences during the first period (1-21 days of trial; P<0.01). No significant differences among groups were observed with regard to growing parameters of piglets either on fishmeal (group A) or sunflower meal (group B) and corn gluten meal (group C) diets.

Mortality rate was low (close to 4%) and equally distributed among groups, as well as diarrhoea score that never exceeded 1.6 points. Data indicating diarrhoea intensity confirms this positive trend as it was demonstrated by a low number of severe diarrhoea occurrences in all groups.

With respect to the inclusion in piglet diets of partially dehulled sunflower meal, our results agree with those reported by Cortamira *et al.* (2000) and Lipinski *et al.* (2002). The above described improvement of the growth rhythm of piglets receiving potato concentrate diet, that may be ascribed to the favourable native aminoacids profile of the ingredient, is only partially consistent with the results reported by Sève (1977) and Latorre *et al.* (2001) who found no differences in growing parameters between potato protein and fishmeal fed piglets.

From our data it is concluded that fishmeal used at 6% in piglet diets can be replaced by similar amounts of vegetable protein (i.e. partially dehulled sunflower meal, corn gluten meal and potato protein concentrate), provided that the diets are equalized in terms of Net Energy and aminoacids supplies and a high standard of hygiene is ensured.

Table 2. Growing parameters and health of piglets.

Groups		A	B	C	D	RMSE
Piglets	n.	36	36	36	36	-
Replications	n.	6	6	6	6	-
Initial body weight	kg	7.58	7.58	7.57	7.58	1.138
Body weight on 21 st d of trial	"	15.40 ^B	15.45 ^B	15.58 ^B	16.93 ^A	2.040
Final body weight (50 d)	"	30.19 ^B	30.07 ^B	30.11 ^B	32.83 ^A	4.077
ADG:						
- 1-21 d	g/d	372 ^B	375 ^B	382 ^B	445 ^A	78.737
- 21-50 d	"	510 ^b	504 ^b	501 ^b	548 ^a	78.986
- 1-50 d	"	452 ^B	450 ^B	451 ^B	505 ^A	75.662
FCR:						
- 1-21 d		1.62	1.57	1.58	1.54	0.121
- 21-50 d		1.84	1.79	1.84	1.80	0.151
- 1-50 d		1.75	1.70	1.73	1.69	0.138
Total diarrhoea occurrences	n.	54	52	69	45	-
Diarrhoea score	points	1.54	1.59	1.53	1.54	-
Diarrhoea intensity:						
- mild	%	31.5	28.9	21.7	37.8	-
- medium	"	62.9	67.3	68.2	57.8	-
- severe	"	5.6	3.8	10.1	4.4	-

Values on the same row with different superscripts are different (a, b P<0.05; A, B P<0.01).

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