IAFM Fish Meal Flyer

international association of fish meal manufacturers

Hoval House. Mutton Lane. Potters Bar, Hertfordshire, EN6 3AR Telex: 94013381 (IAFM G) Tel: (Potters Bar) 0707 42343
Fax: 0707 45489

For General Release No. 11 - APRIL 1986

A COMPARISON OF SOYABEAN MEAL AND FISH MEAL AS THE MAIN DIETARY PROTEIN SOURCES FOR THE EARLY WEANED PIG

SUMMARY

A growth trial was undertaken with pigs weaned at three weeks of age which had previously been dosed with a small quantity of protein (10g) in the form of soyabean meal or fish meal. This was intended to prime the intestinal immune system and increase the severity of any subsequent allergenic response after weaning when the piglets received a semi-synthetic diet in which most of the protein it contained came from soyabean meal or fish meal according to previous treatment allocation.

Growth rate (265g v 165g per day) and feed required per unit increase in liveweight (1.14 v 1.72) were significantly better for the fish meal treatment ($P<0.001$ in both cases).

None of the piglets had diarrhoea. However, those receiving the soyabean meal diet produced faeces with a significantly higher moisture content (64.3 v 52.9; $P<0.001$).

Introduction

Early weaned pigs (weaned before four weeks of age) are particularly sensitive to the form of protein offered in their diet. The intestinal immune system at this early age cannot distinguish between dietary proteins not originating from the dam and those in harmful bacteria, e.g. E coli. As a result there is a short term hyper-sensitivity to dietary protein (allergenicity). A severe allergic response to a dietary protein can cause inflammation and impaired functioning of the intestinal wall. The balance of water movement is affected resulting in diarrhoea. Absorption of nutrients is impaired, resulting in depressed growth or weight loss. Proliferation of harmful bacteria e.g. E coli in the intestine may follow, and can result in death.

Piglets consuming small amounts of creep feed prior to weaning (less than 600g) may have their intestinal immune system 'primed'. As a result the allergenic response to dietary proteins after early weaning is likely to be increased.

The extent of an allergenic response to dietary protein is

affected by the type of protein. Work of Professor Bourne and his colleagues at the University of Bristol (1,2) and Dr. Leslie Hepple at the Animal and Food Research Institute, Shinfield, Reading (3) has indicated that the allergenic response of early weaned pigs to fish meal is lower than that to soyabean meal, with the result that piglets respond better to diets containing fish meal.

To test this, a growth trial was undertaken at the Norwegian Herring Oil and Meal Industry Research Institute in Norway with pigs weaned at three weeks of age fed semi-purified diets containing either fish meal or soyabean meal as the main source of protein. Piglets were dosed prior to weaning with a small amount of the test protein which they subsequently received after weaning to 'prime' their intestinal immune system.

Experimental Method

Norwegian Landrace piglets from two litters on two commercial farms were allocated to two groups matching litter and sire in each group of seven or eight male piglets. Whilst still with the dam, on days 11 and 12 after birth, each piglet was dosed daily with 7g of micronised fish meal in 35ml water or 11g of micronised soyabean meal in 55ml of water (equal to a total of 10g protein) according to their subsequent treatment group allocation - fish meal or soyabean meal. Both the proteins were of commercial production. Creep feed was not fed. This protein dose was intended to 'prime' the intestinal immune system, and was based on the procedure followed by the Bristol workers (1, 2).

At 21 days of age piglets were weaned abruptly and taken to the experimental station where they were housed in individual cages for an experimental period of 17 days and fed ad lib, four times daily. They had free access to water. Faeces were sampled each morning. Piglets were weighed prior to caging and at weekly intervals.

Composition of the experimental diets (semi-purified) is given in table 1. They contained 25% crude protein from either fish meal or soyabean meal.

Results and Discussion

Piglets appeared completely healthy throughout the suckling period, the 17-day post weaning experimental period, and subsequently until they reached 25kg liveweight when they were sold. They consumed slightly less soyabean diet in the experimental period (table 2).

The piglets fed the fish meal diet gained signficantly more weight in the experimental period (265g v 165g per day; $P<0.001$) and used significantly less feed per unit liveweight gain (1.14 v 1.72; $P<0.001$) compared with those fed the soyabean meal diet (see table 3). Growth achieved was slightly higher than that commonly achieved by piglets of similar ages fed fish meal and soyabean meal as the main protein sources.

It was also higher than that of piglets weaned at four weeks of age receiving to six weeks of age a diet with 12% fish meal versus soyabean meal (142g v 78g per day) in a trial at the University of Copenhagen (4).

Throughout the experimental period and subsequently (to 25kg liveweight when the pigs were sold) consistency of faeces appeared normal. From day 7 to day 17 of the

experimental period faeces were collected and dry-matter determined. None of the faeces had a moisture content above 80% (see table 4) which was indicative of the absence of post-weaning diarrhoea (2), confirming visual inspection. However the moisture content of the faeces of piglets fed the diet with soyabean meal was constantly and signficantly ($P<0.001$) higher than that of those fed the diet with fish meal (64.3% v 52.9%).

The improved growth of these early weaned piglets fed diets in which protein was provided in the form of fish meal rather than soyabean meal confirms the finding of other trials (4). The superior amino acid profile of fish meal and higher availability of its amino acids in relation to the young pig's requirements have been suggested as reasons for the improved growth when fish meal replaces soyabean meal.

The absence of diarrhoea in the soyabean treatment piglets contrasts with results from the Bristol University group (2). Post weaning diarrhoea in piglets is believed to be affected by several factors including immunological status, diet and challenge from infection which in turn will be affected by hygiene standards. The high hygiene standards of the research unit and the fact that the piglets were on elevated screen floors which prevented direct contact with faeces may have reduced this challenge.

Though this experiment did not show clear differences in allergic responses between the proteins tested, as measured by incidence of diarrhoea, there may be differences which in less hygenic environments where challenge from intestinal infections is greater, may affect diarrhoea incidence.

References

1. Newby, T.J., Miller, B.G., Stokes, C.R., Hampson, D., Bourne, F.J., 1984. In 'Recent Advances in Animal Nutrition'. Edt. Haresign, W. and Cole, D.J.A., Butterworths, London.

2. Miller, B.G., Newby, T.J., Stokes, C.R., and Bourne, F.J., 1984. Influence of diet on post weaning malabsorption and diarrhoea in the pig. Res. Vet. Sci. 36 187-1-193.

3. L. Hepple 1985 - Personal communication.

4. Gulbrandsen, K.E., 1984. Fish meal in diets for young pigs. IAFMM Technical Bulletin No. 17.

Acknowledgement

This experimental work was undertaken by the Norwegian Herring Oil and Meal Industry Research Institute, Bergen, Norway on behalf of the IAFMM. We are grateful to Dr. Johannes Opstvedt, Mr. Tor Hjertnes and their colleagues at the Institute for undertaking the work and producing the report on which this Flyer is based.

TABLES FOR FLYER NO 11 (APRIL 1986) 'A COMPARISON OF SOYABEAN MEAL AND FISH MEAL AS THE MAIN DIETARY PROTEIN SOURCES FOR THE EARLY WEANED PIG'

Table 1. Composition of experimental diets.

	Diet 1	Diet 2
Fish meal[1], %	-	34,48
Soybean meal[2], %	55,06	-
Lactose[3], %	20,00	20,00
Maize starch[4], %	10,00	10,00
Glucose[5], %	6,14	18,43
Maize oil[6], %	3,48	2,00
Oat hulls[7], %	2,00	13,91
Vitamin and mineral pre mixture[8], %	0,46	0,46
Dicalcium phosphate, %	2,21	0,44
Calcium carbonate, %	0,64	0,27
Ethoxyquin, %	0,02	0,02
Calculated content:		
Protein, %	25,0	25,0
Digestible energy (DE), kcal/kg	3521	3480
Fat (Soxhlet), %	4,1	4,1
Ca, %	0,9	0,9
P, %	0,7	0,7
Crude fibre, %	4,7	4,7

1) Contained 72.5% of protein and 6.2% of fat (Soxhlet). Assumed to contain 4223 kcal DE/kg.
2) Contained 45.2% of protein, 1.2% of fat (Soxhlet). Assumed to contain 3350 kcal DE/kg.
3) Assumed to contain 3900 kcal DE/kg.
4) Assumed to contain 3500 kcal DE/kg.
5) Assumed to contain 3900 kcal DE/kg
6) Assumed to contain 8820 kcal DE/kg
7) Contained 33.8 % crude fiber, assumed to be indigestible.
8) Provide per kg of feed: Vitamin A, 2.200 I.U., vitamin D, 320 I.U., vitamin E, 50 mg, vitamin K, 0,2 mg, thiamin, 1,3 mg biotin, 0,2 mg, riboflavin, 3,0 mg, niacin, 22,0 mg, phantothenic acid, 13,0 mg, pyridoxine, 13,0 mg, choline, 1,100 mg, vitamin B_{12}, 0,022 mg, folic acid, 1,25 mg, copper, 6,0 mg, manganese, 20,0 mg, zink, 50,0 mg, selenium, 0,1 mg, iodine, 0,22 mg, cobolt, 0,12 mg.

Table 2. Average daily feed consumption (g).

	Diet 1 Mean (Sd[1])	Diet 2 Mean (Sd)
Day 1	124,3 (11,3)	133,8 (14,1)
2	145,7 (19,0)	150,0 (15,1)
3	172,9 (9,5)	172,5 (10,4)
4	222,9 (21,4)	225,0 (20,7)
5	227,1 (16,0)	226,3 (15,1)
6	244,3 (27,0)	251,3 (22,3)
7	270,0 (24,5)	277,5 (26,6)
8	295,7 (20,7)	300,0 (32,1)
9	308,6 (28,5)	322,5 (41,7)
10	330,0 (34,6)	352,5 (41,7)
11	358,6 (36,3)	381,0 (40,5)
12	360,0 (34,6)	382,5 (41,7)
13	355,7 (40,4)	380,0 (39,6)
14	365,7 (43,1)	360,0 (26,7)
15	381,4 (48,1)	411,3 (43,6)
16	384,3 (42,8)	431,3 (44,2)
17	395,7 (33,6)	450,0 (45,4)

1) Sd = Standard deviation.

Table 3. Average live weights, live weight gains, feed consumption and feed conversion.

	Diet 1	Diet 2	SEM[1)]
Live weight at start, g	6780	7690	761,9
Live weight at end, g	9743	12461	802,2
Live weight gain, g/d	165	265	14,9
Feed consumption, g/piglet/d	283	301	22.7
Feed conversion, g feed/ g live weight gain	1,72	1,14	0,063

1) SEM = Standard error of treatment mean.

Table 4. DM (dry matter) content of feces from individual piglets from day 9 to day 17.

Diet nr. 1: Soybean meal.

	Piglet no.								
	1	2	3	4	5	6	7	Average	SE
Days									
9	29,8	30,3	33,8	27,4	29,4	28,6	31,6	30,1	2,1
10	43,0	32,1	35,8	37,4	25,1	43,8	28,2	35,1	7,1
11	29,7	34,3	37,1	32,5	25,6	28,8	39,3	32,5	4,8
13	36,1	36,9	31,2	33,5	39,1	30,5	35,4	34,7	3,1
16	38,7	30,1	34,9	61,6	23,8	48,6	42,3	39,9	12,5
17	29,2	30,0	37,1	63,7	57,8	30,8	44,0	41,8	14,0
Overall mean								35,7	9,0

Diet no. 2: Fish meal

	Piglet nr.									
	1	2	3	4	5	6	7	8	Average	SE
Day										
9	43,9	43,6	44,2	42,8	43,1	-	47,3	46,7	44,5	1,8
10	42,9	53,9	37,5	38,2	42,7	57,2	53,0	51,2	47,1	7,6
11	36,6	61,2	37,3	39,5	54,0	38,5	45,4	53,5	45,8	9,4
13	47,8	50,8	53,9	42,7	46,3	-	53,4	-	49,2	4,4
16	56,1	46,7	42,0	41,4	47,3	41,7	50,4	46,5	46,5	5,0
17	56,9	50,2	44,2	47,1	48,4	42,7	53,6	53,5	49,6	5,9
Overall mean									47,1	4,4