No. 21 JUNE 1995

ifoma FISH MEAL FLYER

BROILERS GROW BETTER WITH FISH MEAL IN DIET - TRIAL AT LINCOLNSHIRE COLLEGE OF AGRICULTURE

by

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SUMMARY

Diets containing three commercial sources of Chilean fish meal were compared against diets without fish meal fed to broilers in a trial at Lincolnshire Agricultural College, UK. Comparing growth of birds fed diets with and without fish meal, there was a significant growth improvement of 3.9%, averaging the fish meal diets, weight gains being 2134 v 2053g ($P<0.01$) to 42 days of age. Feed conversion was similar (1.963 v 1.974). Comparing the fish meal treatments, there were no differences in growth. This response to fish meal feeding with fast growing broilers is greater than that seen from a literature survey 20 years ago when broilers grew more slowly (see Technical Bulletin number 3).

Treatment responses to the fish meals are discussed in relation to their composition, including fatty acid analysis and biogenic amine content.

A review of many trials conducted worldwide showed that growth of broilers which received fish meal was improved - the overall improvement was around 2% (Pike, 1975). Most of this trial work was done over 20 years ago. Since then there have been few published reports of broiler feeding trials to assess fish meal.

During this time there have been major improvements in genetics and husbandry. For example, a Ross broiler reached around 1.2kg at 42 days of age in 1972 whereas in 1991 the improved Ross birds reached around 2.2kg at this age. Carcass meat yields have also improved (Ross, 1995; Dudley-Cash, 1995).

With the improved growth, especially in lean meat production, protein requirements have become more exacting. Formulators now typically formulate to higher amino acid concentrations - will this increase the nutritional contribution of a concentrated high quality protein source such as fish meal?

The make-up of diets fed to broilers over the past 20 years has changed. A wider range of proteins is now used, with less dependence on soyabean meal. Rapeseed meal, pulses and maize gluten products are widely used in Europe, for example. These protein rich vegetable feeds have amino acid contents which are less well suited than soyabean meal to meet the bird's requirements for essential amino acids for optimum growth.

Fish meal has been shown to complement the soyabean meal replacers - rapeseed meal and maize gluten meal in broiler diets (Opstvedt *et al*, 1991), and is expected to complement pulses also.

The adverse effects of a disease challenge may be lessened by introducing long chain polyunsaturated omega-3 fatty acids (LCPUFA ω3's) into the broiler's diet. There is evidence that fish oil as a source of LCPUFA ω3's can provide health benefits (Korver *et al*, 1994; Korver and Klasing 1995 a and b). Vaccinating poultry provides a mild disease challenge. Feed intake may be lowered following vaccination. There is evidence that the presence of LCPUFA ω3's may reduce the feed intake depression.

Fish meal supplies a protein source which has an amino acid profile more suitable to meet the amino acid requirements of broilers in a peptide form. Provided it is antioxidant treated, it also provides LCPUFA ω3's. What is the effect of fish meal in the diet of to-day's fast growing intensively reared broiler? A trial was carried out at Lincolnshire College of Agriculture, UK to answer this question in practical, but properly controlled, conditions.

Trial Design and Methods Used

The trial compared broiler diets based on wheat, soyabean meal and peas with and without fish meal. The fish meal replaced soyabean meal, and diets were balanced for energy, methionine and lysine. Details of the diets are given in Appendix Tables 1 to 4. Three sources of commercial Chilean fish meal (different ports of importation) were compared.

A total of 2,700 birds (sexed Ross broiler chicks) were accommodated in 45 pens each holding 60 birds. There were nine replicate pens of birds (three female, three male, three as hatched) per treatment with the exception of a control treatment (no fish meal) to which 18 replicate pens were allocated.

Three phases of feeding were used – starter (0 to 10 days), grower (10 to 28 days) and finisher (28 days to finish). Birds were fed *ad lib* to 42 days when they were slaughtered. From each treatment 30 carcasses (15 males and 15 females) were selected at random to determine meat yield and carcass analysis.

Birds were vaccinated against Infectious Bronchitis (IB) at the hatchery. They received a further IB vaccination (H120) via the drinking water at 17 days of age; at 17 and 24 days of age Gumboro vaccination was given. Over the period from 17 to 28 days of age pen feed intake was measured daily.

RESULTS OF THE TRIAL

Growth and Feed Intake and Conversion

The growth, feed conversion and feed intake of the broilers are shown in Table 1. Feed intake was higher in the fish meal fed birds. Birds receiving the fish meal diets grew significantly faster than those receiving the diet without fish meal. The weight gains were 2134 v 2053g for the fish meal (average) and control treatments respectively. The difference of 3.9% was significant ($P< 0.01$). Feed conversion was numerically better for fish meal fed birds (1.963 v 1.974), but the difference was small and not statistically significant. Female birds generally consumed less feed and grew more slowly than males, though both males and females responded to fish meal by increasing feed intake and growth rate. Though there were differences in the improvement of growth with the fish meals from different sources, these differences were small.

Analysis of the fish meals revealed marked differences in their content of biogenic amines – see Appendix Table 5. This indicates that there was a difference in the freshness of the fish used to prepare the fish meals. Despite this, there was no effect on growth rate relating to amine content, suggesting that up to 3000 ppm amine content (histamine, cadaverine, putrescine plus tyramine) growth rate is not affected.

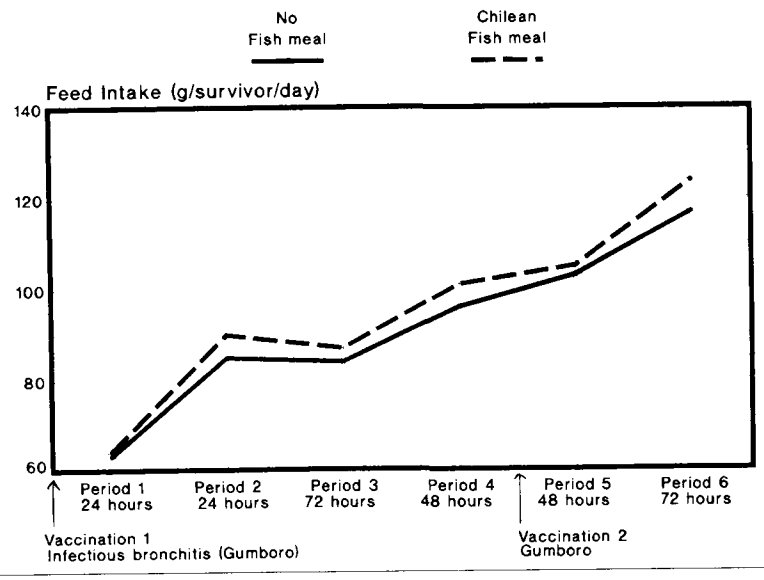
TABLE 1

Performance of Broilers [1] Fed Diets With and Without South American Fish Meal – Effect of Fish Meal Source – Trial at Lincs College of Agric.

Perform-ance	Control	Fish Meal Chile	SED	Fish Meal Source			SED[3]	SED[4]
				Port of Selby	Port of Colchester	Port of Hull		
Feed/bird (g)	3880	4001	52.4	4035	3992	3975	64.2	74.2
Wt gain (g)	2053	2134	28.6	2129	2160	2112	35.0	40.4
fcr[2]	1.974	1.963	0.019	1.971	1.928	1.989	0.023	0.027
Mortality %	4.20	4.31	1.92	3.81	3.84	5.28	2.35	2.72

[1]As hatched.
[2]Feed conversion ratio – feed ÷ wt gain.
[3]For comparison of a fish meal treatment with control.
[4]For comparison of one fish meal treatment with another.

FIGURE 1: FEED INTAKE FOLLOWING VACCINATION



Feed Intake after Vaccination

Following the first vaccination there was an indication that feed intake did not increase daily from around 17 to 20 days of age; thereafter it appeared to increase as before. Nevertheless, feed intake was higher with the fish meal diet - over the 12 days it was measured it averaged 100.5 v 96.4g per day per bird for fish meal v no fish meal treatments, though the difference was not significant (see Figure 1).

Meat Yield

Results of carcass dissection are shown in Table 2. Because the 30 carcasses per treatment for dissection were taken at random, their weights do not accurately reflect treatment weights. There was an indication that breast meat yield was higher (301g v 294g) and waste less (397g v 412g) for fish meal fed birds. The slightly higher carcass weight of the birds that did not receive fish meal may reflect their higher weight at slaughter. When breast meat yield was adjusted to equal liveweight the increase with fish meal diets became more marked (303g v 291g), a 4% increase which was significant ($P<0.05$).

TABLE 2

Effect of Fish Meal on Meat Yield of Broilers – Trial at Lincs College of Agric.

Carcass data	Control	Fish Meal Chile	SED
Breast meat (g)	293.5	301.1	9.7
Thigh meat (g)	284.4	284.2	7.8
Carcass fat[1] (g)	39.0	41.1	3.1
Carcass wt (g)	361.2	356.4	9.4
Waste[2] (g)	411.7	396.9	10.9
Evisc wt[3] (g)	1468	1481	13.1
Breast meat[4] (g)	291.4	303.2	7.4

[1]Main fat pads plus some gizzard fat
[2]Viscera, head, feet, neck, some skin and feathers
[3]Weight (slaughtered) less waste
[4]Corrected for liveweight by covariance analysis

CONCLUSION

The significant improvement in growth with fish meal shows it gives important benefits with to-day's fast growing broilers. Indeed, the improvement in growth was double the average improvement seen in trials done some 20 years earlier. Some of the improvement may have resulted from an overall increase in feed intake since there was no improvement in feed conversion ratio. This in turn may have arisen in part because the birds when challenged with vaccination responded less adversely than those not receiving fish meal and LCPUFA ω3's. These ω3's may have suppressed the acute phase response to immunological challenge, both the administered vaccinations and to natural subclinical disease and dust challenge.

Fish meals with up to 3000 ppm of biogenic amines (histamine, cadaverine, putrescine plus tyramine) can give good growth rates in broilers.

The breast meat yield of broilers, an important factor affecting carcass value for birds being processed, appears to have increased as a result of fish meal feeding.

ACKNOWLEDGEMENTS

The UK Sea Fish Industry Authority is gratefully acknowledged for its financial contribution towards the cost of this work.

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APPENDIX TABLE 1

LINCOLNSHIRE BROILER TRIAL
COMPOSITION OF DIETS

	STARTER				GROWER				FINISHER			
INGREDIENTS	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3
WHEAT	59.9	68.2	68.1	66.5	58.3	63.7	63.6	62.5	62.7	65.9	65.8	65.3
SOYA DEHULLED	25.0	12.4	12.5	13.7	24.0	15.6	15.7	16.5	20.0	15.8	15.9	16.2
PEAS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MEAT & BONE	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$NAHCO_3$	0	0.3	0.3	0.3	0.2	0.3	0.30	0.3	0.2	0.3	0.3	0.3
FISH MEAL	0	7.5	7.5	7.5	0	5.0	5.00	5.0	0	2.5	2.5	2.5
FAT	4.4	2.0	2.1	2.5	7.0	5.8	5.80	6.1	7.0	5.8	5.9	6.1
LYSINE	0.29	0.25	0.25	0.25	0.18	0.15	0.15	0.15	0.05	0.05	0.05	0.05
METHIONINE	0.28	0.22	0.22	0.22	0.25	0.20	0.20	0.20	0.24	0.20	0.20	0.20
DICAL	1.5	0.8	0.7	0.7	1.5	0.9	0.80	0.8	1.3	0.9	0.9	0.9
LIMESTONE	0.7	0.4	0.4	0.4	0.5	0.5	0.50	0.5	0.5	0.5	0.5	0.5
SALT	0.3	0.1	0.1	0.1	0.2	0.1	0.06	0.1	0.2	0.2	0.2	0.2
SUPPLEMENT [1]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Chilean 1 – Selby; Chilean 2 – Colchester; Chilean 3 – Hull

[1] See Appendix Table 4 for details

APPENDIX TABLE 2

LINCOLNSHIRE BROILER TRIAL
COMPOSITION OF DIETS

	S T A R T E R (0 to 10 days of age)				G R O W E R (10 to 28 days of age)				F I N I S H E R (28 days of age to finish)			
NUTRIENTS	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3	CONTROL	CHILEAN 1	CHILEAN 2	CHILEAN 3
PROTEIN	21.35	21.29	21.28	21.31	20.58	20.50	20.52	20.53	19.01	19.04	19.05	19.02
OIL	5.76	4.21	4.21	4.59	8.48	7.74	7.67	8.00	8.49	7.53	7.55	7.76
ME (MJ/KG)	12.60	12.61	12.62	12.61	13.15	13.26	13.25	13.26	13.30	13.25	13.25	13.27
LYSINE	1.34	1.34	1.34	1.34	1.22	1.22	1.22	1.22	1.01	1.02	1.02	1.02
METHIONINE	0.57	0.59	0.58	0.59	0.53	0.53	0.52	0.53	0.50	0.49	0.48	0.49
METH. & CYST.	0.90	0.90	0.90	0.91	0.85	0.84	0.84	0.85	0.80	0.78	0.78	0.79
CALCIUM	0.97	0.96	0.93	0.95	0.91	0.92	0.91	0.92	0.85	0.84	0.84	0.84
AV. PHOS.	0.55	0.58	0.56	0.57	0.55	0.53	0.52	0.52	0.50	0.48	0.48	0.48
SODIUM	0.16	0.21	0.21	0.22	0.17	0.19	0.19	0.20	0.16	0.20	0.20	0.21
CHLORIDE	0.25	0.23	0.23	0.24	0.20	0.19	0.19	0.20	0.19	0.20	0.20	0.21
POTASSIUM	0.86	0.68	0.68	0.70	0.83	0.71	0.71	0.72	0.76	0.71	0.71	0.71
TRYPTOPHAN	0.24	0.22	0.22	0.23	0.23	0.22	0.22	0.22	0.21	0.21	0.21	0.21
ISOLEUCINE	0.92	0.90	0.89	0.90	0.89	0.87	0.87	0.88	0.82	0.81	0.81	0.81
THREONINE	0.74	0.74	0.74	0.75	0.72	0.72	0.72	0.72	0.65	0.66	0.66	0.66
ACID-BASE	21.53	21.48	21.51	21.99	22.77	21.97	22.02	22.32	21.09	21.59	21.63	21.73

APPENDIX TABLE 3

RESULTS OF LABORATORY ANALYSIS FOR ALL DIETS

TREATMENT	STARTER		GROWER		FINISHER	
	PROTEIN	OIL	PROTEIN	OIL	PROTEIN	OIL
Control 1	20.68 (21.35)	5.41 (5.76)	19.70 (20.58)	8.52 (8.48)	18.26 (19.01)	8.14 (8.49)
Chile 1	20.78 (21.29)	4.26 (4.21)	19.35 (20.50)	8.08 (7.74)	19.35 (19.04)	7.82 (7.53)
Chile 2	20.96 (21.28)	4.33 (4.21)	19.82 (20.52)	8.17 (7.67)	18.99 (19.05)	7.73 (7.55)
Chile 3	21.08 (21.31)	3.84 (4.59)	19.76 (20.53)	8.23 (8.00)	19.18 (19.02)	7.80 (7.76)

Figures in brackets are the calculated values.
All values are percentages.

APPENDIX TABLE 4

VITAMIN/MINERAL SUPPLEMENT (per kg feed)

Vitamin A	-	16,000iu	Iron	-	20mg
Vitamin D_3	-	3,000iu	Cobalt	-	1mg
Vitamin E	-	250iu	Maganese	-	100mg
Vitamin B_1	-	3mg	Copper	-	10mg
Vitamin B_2	-	10mg	Zinc	-	80mg
Vitamin B_6	-	3mg	Iodine	-	1mg
Vitamin B_{12}	-	15µg	Selenium	-	0.2mg
Vitamin K	-	5mg	Molybdenum	-	0.5mg
Nicotinic Acid	-	60mg			
Pantothenic Acid	-	15mg			
Folic Acid	-	1.5mg			
Biotin	-	125µg			
Choline Chloride	-	200mg			

Virginiamycin added 20ppm in starter/grower, 10ppm in finisher

Elancoban (Monensin) coccidiostat added, 40 ppm in all diets

APPENDIX TABLE 5

ANALYSIS OF CHILEAN FISH MEALS

	PORT		
	SELBY	**COLCHESTER**	**HULL**
Protein (%)	62.9	68.6	68.0
Oil (ether ext.) (%)	8.9	9.6	8.3
Histamine (ppm)	318	886	1352
Cadaverine (ppm)	284	462	831
Putrescine (ppm)	112	145	422
Tyramine (ppm)	84	126	342

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