

International Fishmeal & Oil Manufacturers Association

I. EFFECT OF DIETARY FISH MEAL OR FISH OIL ON BROILERS CHALLENGED WITH VIRULENT INFECTIOUS BRONCHITIS VACCINATION - TRIAL AT LINCOLNSHIRE COLLEGE OF AGRICULTURE

II. FEEDING FISH MEAL AND FISH OIL TO INCORPORATE OMEGA-3 FATTY ACIDS IN POULTRY MEAT - EFFECT ON MEAT LIPID COMPOSITION AND MEAT QUALITY

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EXTENDED SUMMARY

I. EFFECT OF DIETARY FISH MEAL OR FISH OIL ON BROILERS CHALLENGED WITH VIRULENT INFECTIOUS BRONCHITIS VACCINATION - TRIAL AT LINCOLNSHIRE COLLEGE OF AGRICULTURE

BACKGROUND

A broiler trial was carried out in a commercial broiler house at the Lincolnshire College of Agriculture. Standards of hygiene were regarded as adequate and typical of a commercial unit rather than of the high standard of many research facilities with high labour input.

To challenge these birds a virulent infectious bronchitis vaccination (IB) (H52) recommended for adult birds but considered too severe for young birds, was given to chicks of 17 days of age. It is known to produce a strong reaction in young growing birds.

Details of the birds weight gain, feed intake and conversion and veterinary records were taken. In addition, to provide more information about the birds' reaction to the IB vaccination, feed intake was measured daily or at two to three day intervals following this vaccination. Blood samples were taken from birds on each treatment (12) on three occasions during the trial to follow antibody titres for IB and Newcastle disease to check immunity and the likelihood birds had been challenged. Detailed veterinary records were kept, including post-mortems on any birds that died.

The diets used were designed to reflect typical commercial broiler diets balanced for energy, protein and total amino acids for each of the three phases - starter, grower and finisher, for each treatment.

Further details of the trial facilities, data recorded and diets, etc., are given in the report which follows (Appendix 1). Analyses of the fish meal and composition of the fish oil are given in Tables 1, 2 and 3.

RESULTS OF THE TRIAL

MORTALITY

Overall mortality of around 10% was higher than usual for the Lincolnshire unit. Some commercial units reach or even exceed this mortality level. The virulent IB vaccination appeared to produce a strong reaction and a secondary respiratory infection which was not treated with antibiotics.

Mortality was lowest on the control treatment (without fish meal or fish oil) and the difference was statistically significant (see Appendix 1, Table 2, page 1.7). Higher mortality with fish meal and fish oil feeding was not expected. The statistical treatment of these results needs further examination in relation to pen effects.

In spite of the high mortality, weight gain was significantly higher for the fish meal fed birds; feed conversion was also significantly better for the fish meal fed birds (Appendix 1, Table 2, page 1.7). For the fish oil fed birds, growth and feed conversion were similar to the controls. However, in formulating the diets the energy value of fish oil was over-estimated by around 10%. As approximately 5% of dietary energy came from this source, the energy content of this diet may have been around 0.5% lower than that of the other diets. Had dietary energy been equated, growth and feed conversion may have been improved for this treatment.

Following vaccination, feed intake was better with fish meal and fish oil treatments (Appendix 1, Table 3, page 1.9 and Figure 2, page 1.10). The better feed intake may account for the better weight gain the fish oil fed birds.

BLOOD TITRES

The blood titres indicated no difference in immunity between treatment groups, though replication was insufficient for satisfactory statistical analysis (Appendix 1, Table 5, page 1.14).

It is interesting to note that the Newcastle disease titres suggest cross contamination at the hatchery or during transit as the birds were not vaccinated against this disease (vaccination could have accounted for the titre). The combined challenge of Newcastle disease and the infectious bronchitis vaccination may have been much more severe than expected and resulted in the high mortality (see Appendix 1, Table 2, page 1.7 and Discussion and Conclusions, page 1.12).

RECOMMENDATIONS

It is recommended that this trial is repeated using a less severe disease challenge. The repeat trial should be done at the Lincolnshire unit with diets balanced for protein and energy. In balancing energy, the lower energy value for fish oil relative to soyabean oil should be taken into account. However, in view of the efforts to market fish oil in poultry diets, new work should be done to evaluate the energy value of fish oil at a recognised centre of excellence for this type of work.

In repeating the trial, it should be followed by a more comprehensive study of carcass quality. Numbers of birds to be used for this purpose should be sufficient for satisfactory statistical analysis. Whilst the treatment levels of fish meal and fish oil should be the same as in the first trial, consideration should be given to using two types of fish meal and fish oil, e.g. South American and European.

II FEEDING FISH MEAL AND FISH OIL TO INCORPORATE OMEGA-3 FATTY ACIDS IN POULTRY MEAT - EFFECT ON MEAT LIPID COMPOSITION AND MEAT QUALITY

Following the above feeding trial in which broilers received diets with no marine products (control), 10% fish meal or 2% fish oil, the meat from these birds was made available to study its fat composition and flavour, although the trial was not primarily designed for this purpose. Arrangements were made with the University of Bristol's Division of Food Animal Science to analyse this meat and subject it to evaluation by a professional taste panel after cooking. A brief report of the work by the Bristol group is given in Appendix 2.

Manipulating fat composition of poultry meat through feeding fish meal and/or fish oil has been demonstrated in numerous trials (Barlow and Pike, 1991). However, in so doing the risk of producing off-flavours in the meat is a concern. The Association recommended that broiler diets in the finishing stages should contain no more than 0.8% fish lipids, setting a maximum of 8% to 10% fish meal (Technical Bulletin number 4).

Since the earlier review (Barlow and Pike, 1991), it has been shown that by boosting dietary vitamin E, up to 2% fish oil could be fed to broilers without affecting meat quality (Miller and Huang, 1993).

In the feeding trial at Lincolnshire Agricultural College the birds were fed diets supplemented with 100iu/kg of vitamin E. The fish meal used was a prime quality Chilean meal, treated with antioxidant during processing. The fish oil was an antioxidant stabilised menhaden oil high in omega-3 fatty acids. It was from the same batch used in the trials at the University of California, Davis. Details of their composition are given in Tables 1, 2 and 3.

REARING OF THE BIRDS

Details of the rearing of the birds are given in the report on the Lincolnshire trial in Appendix 1. For the meat quality work the samples used were breast meat taken from the birds used at the end of the study (30 per treatment) for carcass meat yield analysis. They were selected by taking one bird from each pen selected to be approximately average size for the pen. The breast was removed from these birds and stored in a deep freeze for about six months. Further details of methods used are given in Appendix 2.

EATING QUALITY OF THE CHICKEN MEAT

As the number of samples available for this work was not considered optimum for satisfactory statistical analysis, this work was done as a preliminary assessment. Approximately twice as many birds would have been required to satisfy requirements for satisfactory statistical analysis.

The results from the taste panel indicate that the dietary treatments had no adverse effect on meat quality. In general the chicken breast meat was of good eating quality with low values for abnormal flavour intensity and high values for tenderness. It should be noted that these results were obtained on meat that had been deep frozen for six months. If residual lipids from fish meal or oil treatments tended to undergo flavour reversion through oxidation, this is more likely to happen during prolonged storage.

The results from this trial are sufficiently encouraging to justify repeating the work on a larger scale, noting the recommendation to vacuum pack the breasts.

MEAT LIPID COMPOSITION - OMEGA-3 FATTY ACID CONTENT

Lipids were extracted from a sample of cooked breast meat prepared for the taste work (internal pectoralis muscle). Skin was excluded though some drip loss may have been included. Lipids were extracted by the Folch *et al* (1957) procedure. Further details of the methods used are given in Appendix 3.

The lipid and moisture content of the muscle is shown in Table 4. Lipid content ranged from 2.3% to 4.0%. The composition of the lipids are shown in Tables 2 and 3, the long chain $(C_{20}+)$ fatty acid content being given in Table 4. The composition is given as mg fatty acid per 100g meat.

The fish meal and fish oil dietary treatments resulted in increased omega-3 fatty acid content as expected. However, the 'control' birds which received only vegetable oil had a surprisingly high content of longer chain $(C_{20}+)$ omega-3 fatty acids. This must have been produced by the C_{18} :3 omega-3 fatty acid in the soyabean oil being chain elongated. Chain elongation is more likely to occur in the later stages of growth. Nevertheless, levels of $C_{20}+$ omega-3 fatty acids were significantly higher for the fish meal and oil treatments, the total being 137.9 and 171.2mg per 100g meat respectively compared with 77.4mg in the controls.

It is interesting to note the slightly higher values resulting from 2% fish oil in the diet compared with 10% fish meal. The fish meal provides only half the lipid, yet the omega-3 content in the meat was around 80% of that from fish oil. This may reflect the higher concentration of omega-3 fatty acids in the lipid in fish meal due to its higher content of phospholipids.

Comparing the lipid content of the breast meat with that found by other workers, the Bristol results showed high content - 2.3% to 4.0%. Miller and Huang (1993) found 1.3% and 1.1% and Ratnayake et al (1989) found 0.9%. Sinclair and O'Dea (1987) found 1.4% and Ang and Lyon (1990) give a value of 1.2% in cooked breast meat. Lipid from skin and possibly adipose tissue also may have been picked up, possibly in the drip loss - see Appendix 2. The high content of C_{20} :4 n-6 supports this explanation. Consequently the absolute values for the lipid and fatty acid content of the meat from these analyses cannot be taken as representative of the breast meat. It is recommended that in further work, both cooked and uncooked breast meat without skin is analysed. This was not possible in the present work.

RECOMMENDATIONS FOR FURTHER WORK

The current work was preliminary. Results were sufficiently encouraging to justify repeating the work on a larger scale to give a more satisfactory statistical assessment of treatments

The high omega-3 fatty acid content of the control birds, as mentioned, may have come partly from soyabean oil; there may have also been a contribution from the tallow, the other source of fat used if it partly originated from poultry. Future work should include fatty acid analysis of dietary fats.

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TABLE 1

FISH MEAL¹ ANALYSIS FOR BIOGENIC AMINES

(mg free base per kg [ppm])

Tyramine 22

Putrescine 39

Cadaverine 65

Histamine 49

¹Chilean 'prime' fish meal

TABLE 2

FISH MEAL ANALYSIS (CHILEAN PRIME MEAL) - FATTY ACID COMPOSITION OF EXTRACTED LIPIDS

Results from FIRI:

As % of total fatty acid method esters:

Total saturates

Total monoenes

20.9

Total polyunsaturated

40.3

Total n-3

37.4

Ethoxyquin in meal

108mg/kg

Ethoxyquin quinolone in meal

18mg/kg

Results from Torry:

n-3 fatty acids as % of total fatty acids in lipid extracted 45.4

TABLE 3 ANALYSIS OF FISH (MENHADEN) OIL

Free fatty acids	0.11%
Moisture	0.12%
Iodine value	188
Colour	6.75
Cold test	5.5 hours
Fatty acid analysis as % of oil:	
Total saturates	25.5
Total monoenes	21.8
Total polyunsaturated	42.6
Total n-3	33.6
Total n-6	2.7

CHICKEN BREAST MUSCLE FATTY ACIDS AS % BY WEIGHT OF TOTAL FATTY ACIDS

TABLE 4

Fatty Acid	Control	Treatment Fish Meal (10%)	Fish Oil (2%)	SED	Р
C12:0	0.41	0.44*	0.30 ^b	0.02	<.001***
C14:0	0.87	0.93*	1.32 ^b	0.05	<.001***
C16:0	22.9	23.5	23.3	0.69	0.85
C16:1 n-7	4.5	5.2	4.9	0.48	0.44
C18:0	8.0	7.7	8.2	0.34	0.36
C18:1 n-9	29.4	29.9	27.2	1.13	0.09
C18:1 n-7	2.6	2.7	2.4	0.20	0.41
С18:2 п-6	19.3*	16.5 ^b	16.6 ^b	0.97	0.03*
C18:3 n-3	1.9*	1.5 ^b	1.7⁵	0.12	0.03*
C20:1	0.44	0.43	0.49	0.03	0.09
C20:2 n-6	0.50	0.38	0.41	0.06	0.17
С20:3 п-6	0.68	0.57	0.53	0.09	0.29
С20:4 п-6	2.0	1.5	1.3	0.27	0.08
C20:5 n-3	0.66	1.0	1.7	0.06	<.001
C22:4 n-6	0.40	0.22b	0.16 ^b	0.05	.002**
C22:5 n-3	0.87*	1.12*	1.83 ^b	0.18	.001***
С22:6 п-3	1.2	2.9 ^b	3.5b	0.40	<.001***
ΣC20,C22 n-3	2.7	5.0	7.0		<.001***
Ratio <u>Σ n-3</u> Σ n-6	0.20	0.34	0.49		

Numbers within a line with different superscript letters differ significantly, P < 0.05. E N C E S

3,

AN INVESTIGATION UNDERTAKEN ON BEHALF OF THE INTERNATIONAL FISH OIL AND MEAL MANUFACTURERS ASSOCIATION LOOKING AT THE INCLUSION OF FISHMEAL OR FISH OIL IN THE FEED OF BROILER CHICKENS BETWEEN O AND 44 DAYS OF AGE

JULY 1994



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OBJECTIVES

The aim of the study was to evaluate the inclusion of either fishmeal or fish oil in the diets of broilers across the starter, grower and finisher feeds with particular emphasis on physical performance, carcass yield and response to vaccination.

STOCK

The batch comprised of 4320 sexed, Ross broiler chicks supplied by Mayfield chicks Limited. At the end of the trial (49 days) the birds were processed by Penwood Country Chicken Limited.

On arrival, all papers from the trays were put into a plastic bin bag and were sent for salmonella testing. There was one dead chick on arrival.

ACCOMMODATION

The birds were distributed across the 72 pens in the rearing house as shown in Figure 1. The pens were stocked at 60 birds to a pen for both sexes and bird numbers per pen were checked within 24 hours of the start of the trial. Each pen measured 5 x 7 feet (1.54m x 2.15m) providing 0.58 sq. ft. of growing space per bird (18.1 birds per square metre). Pens were separated by wood and wire divisions. Each pen had a single tube feeder and a bell type drinker. White wood shavings were used for litter. The house was heated by means of a gas fired, hot air heater.

EXPERIMENTATION

The birds were used for a replicated, nutrition trial on behalf of The International Fish Oil and Meal Manufacturers Association. There were three treatments. A treatment and feed schedule is shown in table 1.

TABLE 1

TREATMENT AND FEED SCHEDULE

Treatment	Diet	Fishmeal	Fish oi
1	FMS/G1		-
2	FMS/G2	10%	-
3	FMS/G3	_	2%

FIGURE 1

DISTRIBUTION OF TREATMENTS IN THE GROWING SHED

ļ			
P18 T3M	P19 T1M	P54 T2F	P55 T1F
P17 T2F	P20 T3M	P53 T2M	P56 T3M
P16 T3F	P21 T2F	P52 T1F	P57 T3F
P15 T2M	P22 T1F	P51 T3M	P58 T1M
P14 T1F	P23 T3F	P50 T3F	P59 T2F
P13 T1M	P24 T2M	P49 T1M	P60 T2M
P12 T2F	P25 T1F	P48 T1F	P61 T3M
P11 T2M	P26 T2F	P47 T2M	P62 T1M
P10 T1F	P27 T2M	P46 T3M	P63 T2M
Р9 ТЭГ	P28 T3F	P45 T2F	P64 T3F
рв тэм	P29 T1M	P44 T3F	P65 T1F
P7 T1M	РЭО ТЭМ	P43 T1M	P66 T2F
P6 T2M	P31 T1F	P42 T2M	P67 T3M
Р5 ТЗМ	P32 T2F	P41 T3F	P68 T2F
P4 T1F	P33 T3F	P40 T1M	P69 T2M
P3 T2F	P34 T1M	P39 T2F	P70 T1F
P2 T1M	P35 T3M	РЭВ ТЭМ	P71 T3F
Р1 ТЭГ	P36 T2M	P37 T1F	P72 T1M
STORE		· · · · · · · · · · · · · · · · · · ·	STORE

Where included, fishmeal replaced soyabean meal and fish replaced soyabean oil.

Each treatment was fed to the relevant pens as shown in figure 1. There were twenty-four replicate pens of birds (12 female, male) per treatment. Therefore, there were 72 pens in total the trial.

FEEDING

The trial diets were manufactured by Farm Nutrition Limited. Formulations were prepared in collaboration with IFOMA. Feed delivered in clearly labelled bags. The feeding programme for treatments was based on starter, grower and a standard finisher diet from day old to 44 days. Diet formulations, specifications and laboratory analyses of the finished feeds alongside calculated values are shown in appendix 1.

All diets were fed ad libitum and diet changes took place at the same time (age) across all treatments. The labelling was checked on the bags before feeding.

A routine feed weighback was undertaken for each pen at 10, 37 and 44 days and also at more regular intervals during the period following the vaccination (see later). A weekly check of feed stocks was undertaken to reconcile feed used with feed delivered. Approximately 0.600 tonnes of each starter diet and 4.200 tonnes of each grower diet were manufactured. A total of 4.250 of the standard finisher feed was made.

LIGHTING

The birds received the following light pattern:

0 to day 44

23.5h light

VACCINATIONS AND MEDICATIONS

The birds received soluble vitamins for two days after arrival. A virulent IB vaccination (H52) via the drinking water was given at 17 days of age. No further vaccinations were given during the trial. Blood samples were taken on day 16 prior to the vaccination and again on day 33 and at the end of the trial for testing for ND and IB titres along with mycoplasma, chick anaemia agent, TRT and gumboro disease in the final samples. On each occasion twelve separate blood samples were taken per treatment and these were taken from the same twelve pens each time.

General comments about the birds welfare and general health were also noted as and when appropriate in the crop diary which was kept to record general information and observations about the progress of the trial.

RECORDING

The quantity of food supplied and daily mortality and culls for each of the pens was recorded for the entire growing period. All dead and cull birds were weighed. Any drinker floods that occurred were noted as was any feed wastage if it occurred.

Body weights and litter scores

All the birds from each pen were manually weighed on days 2, 10, 33 and 44. At the time of weighing, care was taken to minimise bird damage. Also, when handling birds at 44 days of age the presence of any hock lesions was noted in a sample of 20 birds per pen and any scoring higher than 3 using the procedure established by ADAS were noted for reporting at the end of the trial.

The litter condition in each pen was scored on days 21 and 42 on the basis of 1 (good) to 5 (bad).

Additional feed weighbacks

During the trial additional feed weighbacks to those mentioned above were undertaken across all pens to assess the effects of the vaccination on feed intake. Residual feed was weighed for each pen prior to the vaccination on day 17. The procedure was repeated 24h later and again for four further 24h-periods after that. Further weighbacks were completed after an additional 48h and then again 7 days later. Final weighbacks were undertaken after further 5-day, 2-day and 7-day periods. This provided accurate, replicate feed intake data for twelve "sub-periods" over the period of the trial.

Carcass meat yield analysis

At the end of the study 30 birds (15 males, 15 females) were taken from each treatment by selecting at least one bird per pen and were weighed, wing banded and killed for meat yield analysis.

After killing and plucking the birds were weighed again to give New York Dressed weight and were then chilled over night. They were then eviscerated and dissected according to the WPSA method for arriving at a meat yield analysis.

Environmental factors

The following factors were recorded daily:

- 1) minimum and maximum house temperatures:
- 2) brooder heat;
- 3) use of fans:
- 4) area of ventilation inlet opening.

RESULTS

The results are summarised in tables 2, 3, 4, 5 and 6 and figures 2 and 3. Table 2 summarise the performance of the birds for the treatment groups within the study. Table 3 and figure 2 summarise the results of the detailed feed intake data during the period of the vaccination and table 4 the results of the meat yield analyses. Table 5 summarises the results of the blood tests and table 6 results of post mortem examinations. The data were lysed using the GENSTAT program to test treatment differences for statistical significance.

The chicks were negative for salmonella on arrival and the terminal blood test showed no signs of any disease challenge during the study (see appendix 2). The average minimum house temperature during the study was 22.3 deg C and the average maximum 26.5 deg C. Corresponding outside temperatures were 7.0 and 18.7 deg C. Results of the analyses of the trial diets showed them to be within acceptable tolerances of the calculated values.

Performance

Mortality was highest for the males (p<0.001) and lowest on diet 1 the control treatment (p=0.01).

Feed consumption per bird housed was most for the males (p<0.001). On a survivor basis it was also greatest for the males (p<0.001) and least for the control treatment (p=0.002). There was also variation amongst replicates with replicate 2 being low (p<0.001).

Final liveweight and weight gain were least for replicate 2 (p<0.001), most for the males (p<0.001) and most for treatment 2, the fishmeal group (p<0.001). Total weight of chicken produced was least for replicate 2 (p=0.001) and most for the males (p=0.001) and there was an interaction between bird sex and (p=0.038). The weight of females produced was least for the oil group (treatment 3) but the weight of males produced was greatest for the same treatment.

Feed conversion when based on either liveweight or weight gain was poorest on treatment 3 (fish oil group) and there were ferences between replicates (p=0.048). When feed conversion based on total weight of chicken produced it was poorest for females (p<0.001) and there was a significant treatment effect (p<0.001) with the best feed conversion resulting from the fishmeal diet and the worst from the fish oil diet. There was a significant replicate effect (p=0.005).

Litter condition was affected by bird sex (p=0.005) and diet (p<0.001). Litter was poorest in the male pens and the control diet and was best where fishmeal was included in the diet. Male

TABLE 2

THE EFFECTS OF INCLUDING FISHMEAL OR FISH OIL IN THE DIET ON THE PERFORMANCE OF BROILERS BETWEEN 0 AND 44 DAYS OF AGE

	Male	Control Female	Overall	T Male	Treatment Fishmeal Female	Overall	Male	ish oil Female	Overall
Mortality (%) Culls (%) Feed cons/bird/housed (kg) Feed cons/survivor (kg) Final liveweight (kg) Liveweight gain (kg) Total weight prod.(kg) FCR based on l'weight FCR based on gain FCR based on wt. produced Av. litter score Hock lesions (%)	9.07 0.14 4.315 4.755 2.378 2.324 134.522 2.000 2.046 1.917 3.21	6.11 0.14 3.778 4.033 2.004 1.951 114.930 2.014 2.014 2.014 3.15 3.15	7.59 0.14 4.047 4.394 2.191 2.007 2.058 1.945 3.18	12.84 0.14 4.229 4.863 2.427 2.372 134.238 2.005 2.005 2.052 1.880 72.1	9.90 0.00 3.777 4.198 2.074 2.019 116.132 2.024 2.024 2.079 1.944 2.67	11.37 0.07 4.003 4.530 2.250 2.195 1.25.185 2.066 1.912 2.80 64.4	13.29 0.14 4.180 4.835 2.330 2.276 129.461 2.076 2.125 1.943 3.17	6.69 0.28 3.860 4.154 2.026 1.972 2.052 2.052 2.052 2.052 2.052 2.052 2.052	9.99 0.21 4.020 4.495 2.178 2.124 122.882 2.064 2.116 1.965 3.05

FCR - kg feed per kg weight or gain

birds had the most hock lesions (p=0.01).

There were no other significant treatment effects on performance.

Detailed feed weighback data

The twelve periods over which weighbacks were undertaken varied in length and so the data have been expressed and analysed on an average intake per surviving bird per day basis (see table 3 and figure 2). The vaccination took place immediately at the end of period 3.

The data were analysed as a split plot with the pens being regarded as main plots and the data for the different periods within the pens as the sub-plots. The overall effects of sex and diet were considered as main plot treatments and the differences between periods and their interactions with sex and diet as sub-plot treatments. Data for pen 32 (treatment 2, female) for periods 10 and 11 were identified as being outliers and were excluded.

The increase in feed intake with time was greatest for the male birds (p<0.001) and the pattern with time differed between the three treatment groups (p<0.001). In particular, intake increased more for treatments 2 (fishmeal) and treatment 3 (fish oil) than for the control group between periods 3 and 4 (straight after the vaccination). Feed intake on treatment 3 then decreased for periods 5 and 6 and intakes for all three treatment groups were similar to each other again by period 9 (see figure 2).

Meat yield analysis

The data were analysed as a completely randomised three diet, two sex factorial assuming the fifteen birds of each sex to be replicates although strictly speaking there were only twelve true replicates by sex per treatment.

With the exceptions of fat and breast skin, yield was greatest (p<0.001) from the male birds for all parameters. Fat yield was greatest for the females (p=0.007) and there was a suggestion (p=0.054) of a treatment effect with treatments 2 and 3 yielding more than treatment 1 an effect which appeared strongest in the males (interaction p=0.098).

There was a suggestion that for breast meat (p=0.057) and breast skin (p=0.08) there was a treatment effect with treatment 2 (fishmeal) giving a higher yield than treatment 3 (fish oil). Treatment 2 produced the greatest yield of wing meat (p=0.04).

TABLE 3

MEASURED FEED INTAKES (g/survivor/day) DURING TWELVE PERIODS IN THE TOTAL GROWING CYCLE INCLUDING A PERIOD WHEN A VACCINATION WAS GIVEN

Mean	31 63 75 99 105 1126 1145 1145
Overall	31 62 102 102 1102 145 150
Fish oil Female	30 59 76 91 88 88 105 120 139 139
Male	31 733 1112 193 115 153 153
Overall	32 63 75 100 104 128 149 152
Treatment Fishmeal Female	31 60 709 901 121 131 141
T Male	32 67 100 100 1113 1113 1113 1160
Overall	32 63 63 94 101 103 146 152
Control Female	31 60 77 77 86 90 95 114 135 135
Male	32 66 71 101 101 100 110 110 110 156
No. of days	782785550
Period no.	1264887890111 12101

Note: the vaccination was given at the end of period 3

Figure 2

Average daily feed consumption (q/survivor/day) during nine "periods" for the three treatments in the study

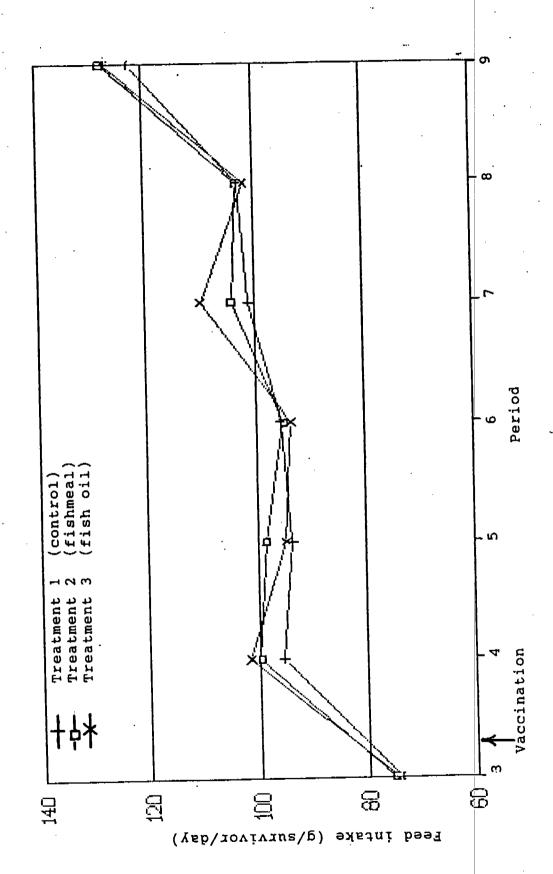


TABLE 4

RESULTS OF MEAT YIELD ANALYSIS OF 30 BIRDS PER TREATMENT

	М	lale		treatment	Ove	rall	
	Weight (g)	% evisc. weight	Weight (g)	% evisc. weight	Weight (g)	% evi	
Live weight	2475		2067	······································	2271		
NYD weight	2124		1784		1954		
Eviscerated wt	1623		1355		1489	•	
Breast meat	377	23.2	317	23.4	347	23.	Э
Breast skin	40	2.5	40	2.9	40	2.	7
Thigh	264	16.3	209	15.4	236	15.	9
Drumstick	274	16.9	210	15.5	2:42	16.	3
Wing	179	11.1	151	11.1	165	11.	1
Giblets	140	8.6	116	8.6	128	8.	6
Fat	27	1.7	43	3.1	35	2.	4
Carcass	429	26.4	369	27.2	399	26.	
Waste ·	365		316		350		

	M	Tale		treatment male	Ove	rall
	Weight (g)	% evisc. weight	Weight (g)	% evisc. weight	Weight (g)	% eviso weight
Live weight	2525		2152		2339	
NYD weight	2155		1853		2004	1
Eviscerated wt	1647		1410		1529	
Breast meat	382	23.2	332	23.5	357	23.4
Breast skin	41	2.5	43	3.0	42	2.8
Thigh	262	15.9	216	15.3	239	15.6
Drumstick	275	16.7	219	15.5	247	16.2
Wing	190	11.6	155	11.0	173	11.3
Giblets	141	8.6	121	8.6	131	8.6
Fat	39	2.4	47	3.4	43	2.8
Carcass	432	26.2	379	26.9	405	26.5
Waste	383		330		356	!

	M	lale		treatment male		rall
	Weight (g)	% evisc. weight	Weight (g)	% evisc. weight	Weight (g)	% evisc weight
Live weight	2440	<u> </u>	2053		2246	
NYD weight	2088		1753		1920	
Eviscerated wt	1591		1323		1457	i I
Breast meat	353	22.2	307	23.2	330	22.7
Breast skin	39	2.5	35 .	2.7	37	2.6
Thigh	251	15.8	205	15.5	228	15.7
Drumstick	272	17.1	212	16.0	242	16.6
Wing	178	11.2	149	11.3	164	11.2
Giblets	137	8.6	119	9.0	128	8.8
Fat	39	2.4	39	2.9	39	2.7
Carcass	429	27.0	352	26.6	390	26.8
Waste	379		322	23.0	351	20,70

DISCUSSION AND CONCLUSIONS

The sex effects identified in the data as being significant could have been anticipated.

The administration of H52 infectious bronchitis vaccine had a marked effect producing a strong reaction and secondary infection which was not treated with antibiotics. Figure 3 shows the trend for mortality for the three treatment groups by week, expressed as average losses per pen as bird numbers. Following the vaccination in week 3 a marked rise in mortality occurs and particularly in treatments 2 (fishmeal) and 3 (fish oil). Mortality was clearly decreasing as the trial progressed but the low value for week 7 is indicative of the fact that it was a "short" week (two days).

Mortality was higher in treatments 2 and 3. The blood titres (table 5) could not be analysed statistically because difficulties with replication i.e. bleeding the same birds from each treatment on each occasion and for some tests, blood samples were pooled within treatment groups. The results of the blood tests did not suggest a marked difference in immunity between the three treatment groups, but a more detailed veterinary is required to confirm this. The presence of Newcastle disease titres suggests a cross contamination at the hatchery or during transit as the birds were not vaccinated against disease.

Birds were submitted for post mortem examinations and the results these are summarised in table 6 and detailed in appendix The number of birds examined reflects the trend for mortality across the treatment groups. There was no indication of any field disease challenge (as distinct from a vaccine challenge) includgumboro disease or TRT against which the birds were vaccinated. The virulent vaccination appears to have triggered respiratory distress followed by a secondary bacterial infection leading to mortality resulting from heart failure in some birds. The majority of birds examined showed lung problems of some sort. Gizzard lesions were apparent in a number of birds particularly from treatment 2 the fishmeal group. However, should be noted that one in three of the birds examined from group also showed evidence of gizzard lesions. the lesions were not so severe that they affected performance or caused a problem in the processing plant.

In terms of physical performance characteristics there was dence that including fishmeal in the diet improved liveweight and feed conversion when expressed on the basis of total weight of chicken produced. The greater weight gain may have contributed to the increased mortality. Had this not occurred, it is likely that the overall performance of this group would have been superior for most parameters measured. The use of fish oil did not seem to

Figure 3

Weekly mortality by treatment expressed as average losses per pen

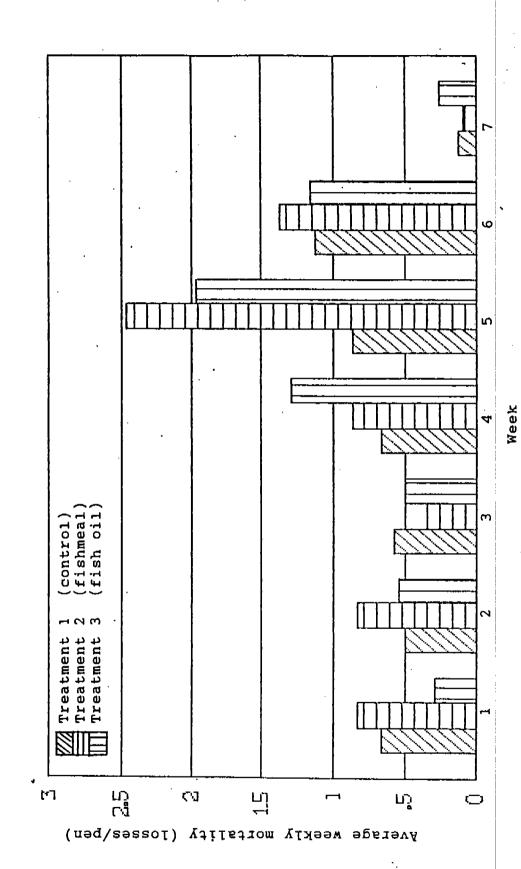


TABLE 5

AVERAGE BLOOD TITRES FOR NEWCASTLE DISEASE, INFECTIOUS BRONCHITIS AND VARIANT IB 793B SUMMARISED BY AGE AND TREATMENT (see appendix 2)

	1	Newcastle disease	36 28 6	Infect	Infectious bronchitis	nchitis	Varia	
Treatment	to days	33 days .	43 days	IO GAYS	33 days 43	43 aays	33 days	43 days
Control	4.0	3.6	2.8	3.8	5.7	7.3	6.0	2.5
Fishmeal	ი ი	ღ	9.0	3.7	ນ.	6.7	9.0	3.0
Fish oil	4.2	2.8	3.1	2.9	ნ. მ	7.3	1.6	3.2

TABLE 6
SUMMARISED RESULTS OF THE POST MORTEM EXAMINATIONS (see appendix 2)

	Control		Treatmen Fishmea		Fish oil	·
No. birds exam.	12		31	•	12	
Diagnosis	No. birds	%	No. birds	*	No. birds	%
Tracheitis Airsacculitis	3 1	25.0 8.3	12	38.7 3.2	6 0	50.0 0.0
Bacterial infection Pneumonia	5 5	41.7 41.7	19 12	61.3 38.7	9 4	75.0 33.3
Lung congestion /oedema Heart failure	6 3	50.0 25.0	26 16	83.9 51.6	9 3	75.0 25.0
Abnormality of Bursar	5	41.7	9	29.0	8	66.7
Abnormality of bone marrow Gizzard lesions	0 4	0.0 33.3	2 15	6.5 48.4	2 3	16.7 25.0

Note: a single bird could show more than one diagnosis so the total of the bird number columns will not equal the number of birds examined.

be as beneficial as the use of fishmeal.

The specific feed intake data indicated a marked effect of the vaccination with a reduction in feed consumption after period 3. There was a suggestion of a "delayed reaction" in the treatment 3 (fish oil) group but clear evidence that the fishmeal treatment maintained feed consumption better than the other groups. Whether this is a palatability effect or some other factor is not clear.

There were few significant beneficial effects of treatment on meat yield. Why the fishmeal group had larger wings is not clear but it was a real effect. Although breast meat yield tended to be lower for the fish oil group, there was no difference between the control and fishmeal groups.

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stı	0.000	Tonnesi	0.000		221an 1	0.00	Gr out	1047	Туре	1
	Raw	Material			×		Kg	<u>_</u> .	Tonnes	_
	43 Wheat	11% 7 76kg/	/h1	*	59.1	447	355.0	00	0.000	,
	416 Fleid		.,,		-	0000	30.0		0.000	
	423 Soys 4			*	27.		165.0		. 0.000	
	474 Meat'& 703 Limest	Bone 50/10	,	H		2333 2000	15.0		0.000	
	704 Salt	au 4		*		5083	1.2		0.000	
-	709 Tripho	R.		•		1417	6.2	50	0.000	-
		Bicarbonal	t e	M		500	0.7		0.000	· _
	712 DL-Met 713 Lysine			,		2833 1667	1.7	- A	0.000	
	802 Soya R			#		333	17.0		0.000	
	912 Farmfa			Ħ		3333	5.0		0.000	
•	1636 Poultr 1905 VIt E		P137		. 0.0	2500	0.0		0.000	
_	1724 Cholln		50%	Ħ		0400	0.0		0.000	
,	1942 Elanco			*		າສຄາ	0.3		0.000	
	.1983 Retard	φ×		#	0.0	0250	0.1	50 	0.000)
			Totals		100.	2766	601.7	80	0.000	,
:	•								 :	-
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			100.0000			HETH	1	0.6064		
	•	. EE 1	4.8373		-	M+C	•	0.9549 12.7875		
	. F18	TEIN :	22.1863 3.1179			MEP C18:2	;	2.2177	-	•
	ASH		5.3675			VITA		14.9556		
		CIUM I	0.8752			VIT D3	1	3.7882		
	. PHO	HOS !	0.7423 0.4490			VIT E SELÐ√	:	77.7042		
	SAL		0.3291			PIOTIN	1	0.1745	•	
	ຮາກ	NUM t	0.1778			POTASS	1	0.8812		
		ORIDE	0.1507			C1813		0.4773		
		'SINE 1 .YSINE 1	1.3072			DEB	1 2	46.7032		-
			1.1344			C18:0	1	0.1198		
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111	ia [1060]	Nacolni Marolni	ame: FMS2	FI	shmeal %Cst:	0.00		Upda h size	teds 21:	 400.0
	0.000 0.000	N: Margint Tonnesi	/ ame: FMS2	FI	shmeal %Cst: %Cst:	0.00 0.00	Grou	Upda	tedi 21: [Kg]; Typ:	600.0
111	0.000 0.000	Nacolni Marolni	ame: FMS2	F1-	shmeal %Cst:	0.00 0.00	Grou Kg	Upda h size p: 1047	tedi 21: [Kg1: Typ:	 &00.0 ♠1
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111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Meat & 481 Coloso	Margini Tonnesi Material 11% = 76kg beans 8 Hipro Bone 50/1	0.000 0.000 /h)	* * *	%Cstr 32lar1 % 67. 5. 12. 2.	0.00 0.00 0.00 5000 5000 5000	405.0 30.0 75.0 400.0	Upda h size pt 1047 00 00	ted: 21- [Kg]: Typ. Tonnes 0.00 0.00 0.00 0.00	- - 0 0 0 0
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest	Margint Tonnest Material 11% 7 76kg beans 8 Hipro 8 Hipro Chilean f	0.000 0.000 /h)	***	%Cstr 321an1 % 67. 5. 12. 20.	0.00 0.00 0.00 5000 0000 5000 0000 0000	6rou Kg 405.0 30.0 75.0 17.0 40.0	Upda h size pi 1047 00 00 00 00	Tonnes 0.00 0.00 0.00 0.00 0.00	- 0 0 0 0 0 0 0
111	1a [1060] 0.000 Raw 43 Whrat 416 Field 423 Soya 4 474 Heat 4 481 Colose 703 Limest 706 Sait	Hargint Tonnesi Material 11% 7 76kg beans 8 Hipro Bone 50/1 Chilean f	0.000 0.000 /hl	* * *	### ##################################	0.00 0.00 5000 6000 6000 6000 6000 4000 0417	405.0 30.0 75.0 400.0	Upda h size pt 1047 00 00 00 00 00	ted: 21- [Kg]: Typ. Tonnes 0.00 0.00 0.00 0.00	
111	1a [1060] 0.000 Raw 43 Whrat 416 Field 423 Soya 4 474 Heat 4 481 Colose 703 Limest 706 Sait	Margini Tonnesi Material 11% # 76kg beans 8 Hipro Bone 50/1 Chilean f	0.000 0.000 /hl	非特殊等等	%Cstr :21ar:	0.00 0.00 0.00 5000 0000 5000 0000 0000	6rou K9 405.0 30.0 75.0 17.0 40.0 2.4 4.0	Upda h size pt 1047 00 00 00 00 00 00 00 00 00	tedi 21: [Kgl] Typ: Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	- 0 0 0 0 0 0 0 0 0
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine	Margin: Tonnes: Material 11% = 76kg: heans 8 Hipro Rone 50/1: Chilean fone Bicarbona hionine	0.000 0.000 /hl	医特殊斯斯氏试验氏征	### ### ##############################	0.00 0.00 0.00 5000 5000 5000 0000 4000 0447 4447 1447	6rou K9 405.0 30.0 75.0 17.0 60.0 2.4 0.2 4.0 0.2	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00	Tonnes 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	- 0 0 0 0 0 0 0 0 0
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Meat & 481 Coloso 703 Limest 710 Sodium 712 DL—Met 713 Lysine 802 Soya E	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Chilean f one Bicarbona hionine	0.000 0.000 /hl	非特殊等等的基件等	%Cstr 32lar1 % 67. 5. 12. 2. 10. 0. 0.	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	6rou K9 405.0 30.0 75.0 12.0 40.0 2.4 0.2 4.0 0.2 5.0	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	tedi 21: [Kgl] Typ: Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	- 0 0 0 0 0 0 0 0 0 0
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Rone 50/19 Chilean f cone Bicarbona hicolhe HCI lean OII	0.000 0.000 /hl d ish meal	医特殊斯斯氏试验氏征	%Cstr 22lar1 % 67. 5. 10. 0. 0.	0.00 0.00 0.00 5000 5000 5000 0000 4000 0447 4447 1447	Grou Kg 405.0 30.0 75.0 12.0 40.0 2.4 0.2 4.0 0.2 7.5	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00	Tonnes 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	- 0 0 0 0 0 0 0 0 0 0 0 0
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine 802 Soya E 812 Farmfa 1634 Poul tr 1705 Vit E	Margin: Tonnes: Material 11% # 76kg: beans # Hipro Hone 50/1: Chilean fone # Bicarbona hionine HC1 lean 011 at 55 y Breeder 50	0.000 0.000 /hl ish meal	非特殊 新 新 新 斯 斯 斯 斯 斯 斯 斯 斯 斯	### ##################################	0.00 0.00 0.00 5000 0000 0000 4000 0417 4447 1447 1833 2500 2500 0150	K9 	Upda h size pi 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 7.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	-000 00 00 00 00 00 00 00 00 00 00 00 00
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 706 Salt 710 Sodium 712 DL-Met 713 Lysine 802 Soya E 812 Farmfa 1635 Poul tr 1704 Cholin	Margin: Tonnes: Material 11% 7 76kg: beans 8 Hipro Bone 50/1: Chilean fone Bicarbona hionine HC1 lean Oll at 55 y Breeder 50 ie Chioride	0.000 0.000 /hl dish meal te	医特殊斯特氏 地名英英英英	### ##################################	0.00 0.00 0.00 5000 5000 5000 0000 0000	8700 405.0 30.0 75.0 17.0 40.0 2.4 0.2 5.0 7.5	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	-000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine 802 Soya E 812 Farmfa 1634 Poul tr 1705 Vit E	Margini Tonnesi Material 11% = 76kg heans 8 Hipro Bone 50/10 Chilean f one 18 icarbona hionine HC1 lean Oil t 55 y Breeder 50 10 Chiloride bban Fremix	0.000 0.000 /hl dish meal te	非特殊 新 新 新 斯 斯 斯 斯 斯 斯 斯 斯 斯	### ### ##############################	0.00 0.00 0.00 5000 0000 0000 4000 0417 4447 1447 1833 2500 2500 0150	6rou K9 4030.0 75.0 17.0 60.0 2.4 0.2 4.0 7.5 0.7 1.5 0.7	Upda h size pi 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 7.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	-000 -000 000 000 000 000 000 000 000 0
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya d 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Mest 713 Lysine 802 Soya E 812 Farmfa 1636 Poultr 1905 Vit E 1924 Cholin 1942 Elanco	Margini Tonnesi Material 11% = 76kg beans 8 Hipro Bone 50/10 Chilean f one 18 icarbona hionine HC1 lean Oil t 55 y Breeder 50 10 Chiloride bban Fremix	0.000 0.000 /hl d ish meal te P137	非特殊特殊的效益的关系的关系的	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	405.0 30.0 75.0 17.0 40.0 2.4 0.2 4.0 0.2 1.5 0.0	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya d 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Mest 713 Lysine 802 Soya E 812 Farmfa 1636 Poultr 1905 Vit E 1924 Cholin 1942 Elanco	Margini Tonnesi Material 11% = 76kg beans 8 Hipro Bone 50/10 Chilean f one 18 icarbona hionine HC1 lean Oil t 55 y Breeder 50 10 Chiloride bban Fremix	0.000 0.000 /hl dish meal te	非特殊特殊的效益的关系的关系的	### ##################################	0.00 0.00 0.00 0.00 0000 0000 0000 000	405.0 30.0 75.0 17.0 60.0 2.4 0.2 4.0 0.2 5.0 7.5 0.0	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	-0000000000000000000000000000000000000
111	1a [1040] 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya d 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Mest 713 Lysine 802 Soya E 812 Farmfa 1636 Poultr 1905 Vit E 1924 Cholin 1942 Elanco	Margini Tonnesi Material 11% = 76kg beans 8 Hipro Bone 50/10 Chilean f one 18 icarbona hionine HC1 lean Oil t 55 y Breeder 50 10 Chiloride bban Fremix	0.000 0.000 /hl d ish meal te P137	非特殊特殊的特殊特殊的特殊等等	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	405.0 30.0 75.0 17.0 40.0 2.4 0.2 4.0 0.2 1.5 0.0	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	1a [1040] 1 0.000 1 0.000 Raw 43 Wheat 416 Field 423 Soya 6 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysin 802 Soya 6 812 Farmfa 1634 Poultr 1905 Vit E 1924 Cholin 1942 Elanco 1983 Retarn	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Rone 50/10 Chilean f cone Bicarbona Hicarbona Hicarbona Chilean oli t 55 y Breeder 50 te Chioride bban Premix fox	0.000 0.000 /h) 0 sh meal te P137 50% Total: A n a	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	405.0 30.0 75.0 17.0 60.0 2.4 0.2 4.0 0.3 5.0 0.3 0.3 60.4	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	Tennes 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	-0000000000000000000000000000000000000
111	18 [1060] 1 0.000 2 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 706 Sodium 712 DL-Met 713 Lysine 802 Soya B 812 Farmfa 1636 Poultr 1705 Vit E 1724 Cholin 1742 Elanco 1783 Retarn	Margini Tonnesi Material 11% # 76kg beans # Hipro # Hone 50/1 Chilean f cone # Bicarbona hionine HC1 lean Oll t 55 Y Breeder 50 ie Chioride bban Fremix fox	7.000 0.000 7hl 0 ish meal te Pi37 50% Total: A n a	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 5000 5000 5000 0000 0000	8700 890.0 30.0 75.0 17.0 40.0 2.4 0.2 4.0 0.3 0.3 0.3 0.3 0.3 0.4	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	tedi 21- Kgi; Typ Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	18 [1060] 1 0.000 2 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 706 Sodium 712 DL-Met 713 Lysine 802 Soya B 812 Farmfa 1636 Poultr 1705 Vit E 1724 Cholin 1742 Elanco 1783 Retarn	Margin: Tonnes: Material Tonnes: Material 11% # 76kg: beans Hipro Bone 50/1: Chilean f one Bicarbona hionine HC1 lean OII at 55 y Breeder 50 ie Chioride bban Fremix fox	0.000 0.000 /h) 0 sh meal te P137 50% Total: A n a	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	405.0 30.0 75.0 17.0 60.0 2.4 0.2 4.0 0.3 5.0 0.3 0.3 60.4	Upda h size pt 1047 00 00 00 00 00 00 00 00 00 00 00 00 00	tedi 21: Kgli Typ: Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	1a [1040] 1 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya d 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine 802 Soya E 812 Farmfa 1636 Poultr 1905 Cholin 1942 Elanco 1983 Retard	Margini Tonnesi Material 11% 2 76kg beans 8 Hipro Bone 50/10 Chilean f one Bicarbona hionine HC1 lean Oil kt 55 y Breeder 50 10 Chioride bban Premix lox OilPED1 FF 1 JTEIN 1 RRE 1 H 1	0.000 0.000 /h) 0 ish meal te P137 50% Total: A n a 100.0000 3.6724 22.3929 2.8633 5.4796	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	8700 405.0 30.0 75.0 17.0 60.0 2.4 0.2 5.0 0.3 0.1 60.4	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	ted: 21: [Kg1: Typ: Tonnes 0.00 0.0	-0000000000000000000000000000000000000
111	1a [1040] 1 0.000 1 0.000 Raw 43 Wheat 416 Field 423 Soya 6 474 Meat A 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine 802 Soya 6 812 Farmfa 1636 Poultr 1905 Vit E 1924 Cholin 1942 Elanco 1983 Retard	Margini Tonnesi Material 11% # 76kg beans 8 Hipro Bone 50/10 Chilean f one Bicarbona hionine HC1 lean Oil kt 55 y Breeder 50 ie Chioride bban Fremix fox	0.000 0.000 /h) 0 ish meal te P137 50% Total: A n a 100.0000 3.6724 22.3929 2.8653 5.4796 0.8759	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	6rou K9 405.0 30.0 75.0 60.0 2.4 0.2 4.0 0.3 5.0 0.3 0.3 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	ted: 21: [Kg]: Typ: Tonnes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 6 481 Coloso 703 Limest 706 Sait 710 Sodium 712 DL-Met 713 Lysine 802 Soya 6 812 Farmfa 1636 Poultr 1905 Vit E 1924 Choice 1983 Retarn [Units of the coloso I for the coloso	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Bone 50/10 Chilean f one Bicarbona hionine HCI lean OII at 55 y Breeder 50 ie Chioride boan Fremix fox 01.191611 FF 1 OTEIN 1 RRE 1	O.000 /h) O.000 /h) Ish meal te P137 50% Total: A n a 100.0000 3.6724 22.3929 2.8633 5.4726 0.8759 0.6842	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	6rou K9 405.0 30.0 75.0 60.0 2.4 0.2 4.0 0.3 0.3 0.3 0.4 0.4 0.7 1.5 0.6 0.7 1.5 0.6 0.7 1.5 0.6 0.6 1.5 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	ted: 21- IKg1: Typ: Tonnes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	1a [1040] 1 0.000 Raw 43 Wheat 416 Field 423 Soya 6 431 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysin 1634 Poultr 1795 Vit E 1724 Choin 1793 Retard 1793 Retard AUI	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Bone 50/10 Chilean f one Bicarbona bionine HCI lean Oll kt 55 y Breeder 50 ine Chioride boan Premix fox 01.191611 EF 1 OTEIN 1 RRE 1	0.000 0.000 /h) 0 sh meal te P137 50% Total: A n a 100.0000 3.6724 22.3728 2.8633 5.4726 0.8757 0.6842 0.4494	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	6rou K9 405.0 30.0 75.0 60.0 2.4 0.2 4.0 0.3 5.0 0.3 0.3 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	ted: 21: Typ: Typ:	-0000000000000000000000000000000000000
111	18 [1060] 1 0.000 2 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limest 710 Sodium 712 DL-Met 713 Lysine 802 Soya B 812 Farmfa 1636 Poult 1705 Vit E 1724 Cholin 1742 Elanco 1783 Retarn [Uf 0116 PRO FIE ASS	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Bone 50/10 Chilean f one Bicarbona bionine HCI lean Oll kt 55 y Breeder 50 ine Chioride boan Premix fox 01.191611 EF 1 OTEIN 1 RRE 1	O.000 /h) O.000 /h) Ish meal te P137 50% Total: A n a 100.0000 3.6724 22.3929 2.8633 5.4726 0.8759 0.6842	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	405.0 405.0 75.0 17.0 60.0 2.4 0.2 4.0 0.3 0.3 0.3 0.4 0.4 0.5 0.6 0.7 1.5 0.6 0.7 1.5 0.6 0.7 1.5 0.6	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	tedi 21: Kgli Typ Tennes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000
111	18 [1040] 1 0.000 0.000 Raw 43 Wheat 416 Field 423 Soya 4 474 Heat & 481 Coloso 703 Limet 710 Sodium 712 DL-Met 713 Lysine 802 Soya E 812 Farmfa 1636 Poultr 1902 Soya E 1924 Cholin 1942 Elanco 1983 Retarn	Margini Tonnesi Material 11% 7 76kg beans 8 Hipro Bone 50/1 Chilean f one Bicarbona hionine HCl lean Oll kt 55 cy Breeder 50 le Chioride boan Fremix fox DLIMEJI FF 1 JTEIN 1 RE 1 LCIUM 1 JS 1 PHOS 1 LT 1	me: FHS2 0.000 0.000 7h) 0 ish meal te Pi37 50% Total: A n a 100.0000 3.6724 22.3729 2.8453 5.4776 0.8757 0.6842 0.4474 0.3377	医特殊斯斯氏管 斯斯斯斯 医异种毒素	### ##################################	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	6rou K9 405.0 30.0 75.0 17.0 60.0 2.4 0.2 5.0 0.3 0.1 604.6	Upda h size pt 1047 000 000 000 000 000 000 000 000 000	tedi 21 Kgli Typ Tonnes 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	-0000000000000000000000000000000000000

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•	Raw Material			*		Kg	T	00004	
	43 Whest 11% 2 76kg/h	1		57.1		355.000		0.000	
	416 Field beans			5.0	000	30.000		0.000	
	423 Boya 48 Hipro 474 Meat & Bone 50/10			27.5 2.5		145.000		0.000	
	703 Limestone		•	0.2	333	1.400		0.000	
	704 Salt - 709 Triphos			0.2 1.0		1.250 6.250		0.000	
	710 Sodium Bicarbonate 712 DL-Methionine	•		0.1	500	0.900	,	0.000	
	713 Lysine HC1		*	0.2 0.1		1.700		0.000 0.000	
	902 Soya Bean Oll 812 Farmfat 55		#-	0.8	333	5.000		0.000	
	833 Menhaden oll		*	0.9 2.0		5.000 12.000		0.000	
	1636 Poultry Breeder Pl 1905 Uit E 50	37		0.2	500	1.500		0.000	
	1924 Chaline Chioride 5	0%	F	0.0		0.090 0.240		0.000	
	1942 Flancoban Premix 1983 Retardox		*	0.0	200	0.300	٠.	0.000	
			*	0.0	25U	0.150		0.000	
	· .	Totali		100.2	966 	601.780		0.000	
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		0.0000		<u></u>	ETH	1 0	.6044		
		4.8174		Н	+¢	. 0	.9548		
_	FIBRE 1	2.1864 3.1197			EP 19:2		.7825 .1807		
-		5.5625		V	IT A	1 14	. 7556		
-		0.8752 0.7423			IT E		.9882 .7043	•	
	.	0.4470 0.3291			FLEIN		.1496		ĺ
		0.1778			10TIN SEATO		.1745 .0812		
		0.1507		-	គ្រោះ		.2407	•	
	AULYSINE:	1.3072 1.1344			FB 18:0		.7014 .1482		
Selli	0.000 Margini	• 1 FMG1 0.000	Co	ntrol XCsti	0.00	Patch		di 21-AF gJ: 2150	
	0.000 Margin: 0.000 Tonnes:		Co	ZOSti Zdani	0.00 0.00	Group I	1047	7)1 2150 Type:	
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Selli	0.000 Margin: 0.000 Tonnes: Raw Material 43 Wheat 11% # 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Dry 474 Meat & Bone 50/10	0.000	* * *	XCsti XHari X 61.1 27.3 6.3 2.3	0.00 628 256 953 256	6roup1 Kg 1315.000 480.000 137.500 50.000	1047	0.000 0.000 0.000 0.000 0.000	
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Selli	0.000 Margin: 0.000 Tonnes: Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Pry 474 Meat & Bone 50/10 703 Limestone 704 Sait 709 Triphos	0.000	****	%	0.00 628 256 953 256 558 209 930	Recupi Kg 1315.000 480.000 137.500 50.000 5.500 4.750 23.500	1047	0.000 0.000 0.000 0.000 0.000 0.000	
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Selli	0.000 Margin: 0.000 Tonnes: Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Pry 474 Meat & Bone 50/10 703 Limestone 704 Sait 709 Triphos 710 Sodium Bicarbonate	0.000	****	%Cst: 2Har: % 41.1 27.3 4.3 2.3 0.2 0.2 1.0 0.7 0.1	0.00 628 256 953 256 558 209 465 093 512	Republication of the state of t	1047	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	
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Selli Costi	0.000 Margini 0.000 Tonnesi Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Pry 474 Meat & Bone 50/10 703 Limestone 704 Salt 709 Triphos 710 Sodium Bicarbonate 712 DL-Methionine 713 Lysine HC1 802 Soya Rean Oil 812 Farmfat 55 1436 Poultry Breeder P1 1905 Vit E 50 1924 Choline Chioride 5	0.000 0.000 1 Extru	化等异共聚基异苯甲酰胺 化导导等	%	0.00 	Rg	1047	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	
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Selli Costi	0.000 Margini 0.000 Tonnesi Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy ~ Dry 474 Meat & Bone 50/10 703 Limestone 704 Sait 709 Triphos 710 Sodium Bicarbonate 712 DtMethionine 713 Lysine HC1 802 Soya Rean Oil 812 Farmfat 55 1636 Poultry Breeder Pi 1905 Vit E 50 1924 Choline Chicride 5 1942 Elancoban Premix 1983 Retardox (VOLUME): 10 01L EE: PROTEIN: 2 FIRRE: 1 ASH: 1 CALCIUM: PHOS: 1 AUPHOS: 1 SODIUM:	0.000 0.000 1 Extru 37 0% Total: A n a 0.0000 6.6658 1.0608 3.3257 3.6012 0.7327 0.7327 0.7493 0.3403 0.1538	化香芹芥壳等货币货品 计导导转换	XCsti 271aci 27.33	0.00 -6286 -	### Groups Kg	51re [Ki 1047 Ti 5249 8575 3150 -7004 9778 9778 941 4499 1747	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	
Selli Costi	0.000 Margini 0.000 Tonnesi Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Dry 474 Meat & Bone 50/10 703 Limestone 704 Sait 709 Triphos 710 Sodium Bicarbonate 712 DtMethionine 713 Lysine HG1 802 Soya Rean Oil 812 Farmfat 55 1636 Poultry Breeder Pi 1905 Vit E 50 1924 Choline Chicride 5 1942 Elancoban Premix 1983 Retardox (VOLLME): 10 01L EE: PROTEIN: 2 FIBRE: 1 ASH: 1 CALCIUM: PHOS: 1 AUPHOS: 1 AUPHOS: 1 SOLUM: 1 CHLORIDE:	0.000 0.000 1 Extru 37 0% Total: A n a 0.000 6.4659 1.0608 3.3257 3.6012 0.9017 0.7327 0.4493 0.3403	化香芹芥壳等货币货品 计导导转换	XCsti XMari X 61.13 6.33 0.22 0.00 0.00 0.00 100.11	0.00 -6256 -62	### Groups Kg	5249 8575 3150 7004 9778 98141 41499 11747 8383 5125	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	
Selli Costi	0.000 Margini 0.000 Tonnesi Raw Material 43 Wheat 11% 7 76kg/h 423 Soya 48 Hipro 432 Farm Nut Soy - Pry 474 Meat & Bone 50/10 703 Limestone 704 Sait 709 Triphos 710 Sodium Bicarbonate 712 DL-Methionine 713 Lysine HG1 902 Soya Rean Oil 812 Farmfat 55 1434 Poultry Breeder Pi 1905 Uit E 50 1924 Choline Chicride 5 1942 Elancoban Premix 1983 Retardox [VOLLME]: 10 01L EE: PROTEIN : 2 FIRRE: 1 ASH : CALCIUM: PHOS: 1 AUPHOS: 1 AUPHOS: 1 AUPHOS: 1 AUPHOS: 1 CHLORIDE: TLYSINE:	0.000 0.000 1 Extru 37 0% Total: A n a 0.000 6.4459 1.0459 1.0459 2.3257 3.4012 0.70127 0.7427 0.4493 0.1538 0.1538	化香芹芥壳等货币货品 计导导转换	% 51.1 27.3 3 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2	0.00 -6286 -	### ##################################	51re [Ki 1047 Ti 5249 8575 3150 -7004 9778 9778 941 4499 1747	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	

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111	0,000 0.000 Rau 43 Wheat 423 Soya 474 Meat 703 Limes 704 Sait 707 Triph 710 Sodiu 712 DL-Ma 713 tysin	Margini Tonnesi W Material 11% 9 76kg 48 Hipro & Bone 50/1 tone 05 m Bicarbons thionine e HC1 Bean Oll at 55	(ame i FHG3 0.000 0.000 1 2/h1)) ******	%Cst: 0 %Alar: 0 % 62.325 26.776 2.325 0.255 0.256 0.266 0.1070 0.151		Ratch 8 Group: Kg 340.000 580.000 5.500 4.750 23.500 4.500 3.250 35.000 50.000 43.000	Tye fK 1047	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
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111 111	0,000 0,000 0,000 Rau 43 Wheat 423 Soya 474 Meat 703 Limes 704 Sait 707 Triph 710 Sodiui 712 DL-Mé 713 Lymin 802 Soya 817 Farmf 833 Menha 1436 Poult 1903 Vit E 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 7 76kg 48 Hipro & Rone 50/1 tone os m Bicarboni thionine e HC1 Bean Oil at 55 den Oil ry Greeder 50 ne Chlorid oban Premi: dox	0.000 0.000 0.000 1 3/h1 10 8te P137 = 50% x Total:)) ***********************************	%Cst: 0 201ar: 0 % 62.325 24.976 2.325 0.256 0.256 0.046 0.203 0.151 1.625 2.000 0.250 0.019 0.040 0.050 0.07	1.00 	Ratch 8 Group1 Kg 340.000 50.000 50.000 4.750 23.500 1.000 4.500 35.000 50.000 43.000 5.375 0.325 0.840 1.075 0.550	T T T T T T T T T T T T T T T T T T T	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0,000 0,000 Rau 43 Wheat 423 Soya 474 Meat 703 Limes 706 Sait 707 Triph 710 Sodium 712 DL-Me 713 Lymin 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit E 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 7 76kg 48 Hipro & Bone 50/1 tone os m Bicarboni thionine e HG1 Bean Oil at 55 den Oil ry Breeder 50 ne Chlorid oban Premi dox	100.0000 3,4070 21.0112	3)) 技术有关并有关的关系是是关系	%Cst: 0 201ar: 0 201ar: 0 201ar: 0 2025 26.976 2.375 0.257 0.257 0.262 2.000 0.151 0.040 0.050 0.07 99.93	5.00 56 1 56 1 57 58 59 69 69 69 69 69 69 69 69 69 6	Ratch 8 Group1 Kg 340.000 580.000 50.000 4.750 23.500 1.000 4.500 35.000 50.000 43.000 5.375 0.325 0.840 1.075 0.550	17e fK 1047 T	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0,000 0,000 Rat 43 Wheat 423 Soya 474 Meat 703 Limes 706 Sait 707 Triph 710 Sodium 712 DL-M6 713 Lyain 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit E 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 7 76kg 48 Hipro & Rone 50/1 tone os m Bicarboni thionine e HG1 Bean Oil at 55 den Oil ny Breeder 100 Dan Premi dox	100.0000 2.000 0.000 0.000 0.000 0.000 0.000 0.000 0.400 21.0112 3.0584)) ***********************************	%Cst: 0 201ar: 0 201ar: 0 201ar: 0 20.255 0.255 0.255 0.201 0.015 1.625 2.000 0.151 0.044 0.050 0.07 97.93	1.00 -56 1 -56 1 -56 1 -57 5 -58 9 -36 5 -57 9 -60 0 -60 0 -	Ratch 8 Group1 Kg 340.000 580.000 5.500 4.750 23.500 4.500 35.000 50.000 43.000 43.000 5.375 0.325 0.840 1.075 0.550	T 1047 T 15278 18634 13151 17089	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0.000 0.000 Rat 43 Wheat 423 Soya 4 743 Limes 703 Limes 704 Sait 707 Triph 710 Sodiu 712 DL-Me 713 Lykin 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit Fi 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 2 76kg 48 Hipro & Bone 50/1 tone os m Bicarboni thionine e HC1 Bean 011 at 55 den 011 ry Breeder 50 ne Chiorid oban Premi dox	P137 = 50% Total: A n 100.0000 3.4070 21.0112 3.0584 5.5187	3.7	%Cst: 0 201ar: 0 % 62.325 26.976 0.256 0.256 0.261 0.044 0.256 0.015 0.05 0.07 99.93 ME M+ ME M+ MC Ct Ut	1.00 -56 1 -56 57 -58 19 -56 57 -57 27 -56 000 -57 27 -57 000 -57	Ratch 5 Group: K9 340.000 580.000 5.000 4.750 23.500 4.500 35.000 50.000 43.000 5.375 0.325 0.840 0.1.075 0.550 21.48.485	17e fK 1047 T	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0.000 0.000 Rai 43 Wheat 423 Soya 474 Meat 703 Limes 706 Sait 707 Triph 710 Sodiu 712 DL-Me 713 Lymin 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit El 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 7 76kg 48 Hipro & Rone 50/1 tone os m Bicarboni thionine e HG1 Bean Oil at 55 den Oil ny Breeder 100 Dan Premi dox	100.0000 2.000 0.000 0.000 0.000 0.000 0.000 0.000 0.400 21.0112 3.0584	3.7 新光年美华男子阿男子的男子的母	%Cst: 0 201ar: 0 201ar: 0 201ar: 0 201 2020 2020 2020 2020 2020 2020 202	1.00 -56 1 -567 -589 -996	Ratch 8 Group1 Kg 340.000 50.000 50.000 4.750 23.500 4.500 3.250 35.000 4.500 50.000 43.000 5.375 0.325 0.840 1.075 0.355 0.840 1.075 0.550 2148.485	T20 K 1047 T 1	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0,000 0,000 0,000 Rau 43 Wheat 423 Soya 474 Meat 703 Limes 704 Sait 707 Triphe 713 Lymin 802 Soya 817 Farmf 833 Menha 1436 Poult 1903 Vit E 1924 Choil 1942 Elanc 1983 Retar	Margini Tonnesi Material 11% 2 76kg 48 Hipro & Bone 50/1 tone 05 m Bicarboni thionine e HCI Bean Oil at 55 den Oil at 55 den Oil ry Breeder 50 ne Chiorid oban Premi dox	P137 e 50% x Total: A n 100.0000 3,4070 21.0113 3.0584 5.5184 0.7026	37	%Cst: 0 201ar: 0 201ar: 0 201ar: 0 2025 26.976 2.375 0.255 0.255 0.262 2.000 0.151 0.040 0.055 0.07 97.93 ME M+ ME Ct Ut Ut Ut SE	5.00 5.00	Ratch 8 Group1 Kg 340.000 50.000 50.000 4.750 23.500 1.000 4.500 35.000 50.000 43.000 5.375 0.325 0.840 1.075 0.550 2148.485	T278 .8634 .3151 .7089 .0024 .6429 .1501	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0,000 0,000 Rat 43 Wheat 423 Soya 474 Meat 703 Limes 706 Sait 707 Triph 710 Sodium 712 DL-M6 713 Lywin 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit E 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 2 76kg 48 Hipro & Rone 50/1 tone os m Bicarboni thionine e HC1 Bean Oil at 55 den Oil ry Breeder 50 ne Chlorid oban Premi dox VOLUMFJI L EE I ROTEIN I BRE	P137 e 50% x Total: A n 100.0000 3.4070 21.0112 3.0584 5.5187 0.7029 0.4474 0.3423	3)	%Cst: 0 201ar: 0 201ar: 0 201ar: 0 20.325 26.976 0.255 0.255 0.255 0.262 2.000 0.151 0.040 0.050 0.07 99.93 Y	5.00 5.60 5.70 5.70 5.70 5.70 5.70 6.70	Ratch 8 Group1 Kg 340.000 580.000 5.500 4.750 23.500 1.000 4.500 35.000 5.375 0.840 1.075 0.550 2148.485	178 [K 1047] T 	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0.000 0.000 Rai 43 Wheat 423 Soya 474 Meat 703 Limes 706 Sait 707 Triph 710 Sodim 712 DL-Me 713 Lyain 802 Soya 817 Farmf 833 Menha 1636 Poult 1903 Vit E 1924 Choil 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 7 76kg 48 Hipro & Bone 50/1 tone os m Bicarboni thionine e HG1 Bean 011 at 55 den 011 ry Breeder 50 ne Chlorid oban Premi dox	P137 = 50% Total: A n 100.0000 3.4070 21.0112 3.0584 5.5187 0.7028 0.7297 , 0.4474 0.3423 0.1547	37	%Cst: 0 201ar: 0 % 62.325 26.976 0.250 0.250 0.250 0.251 0.044 0.251 0.015 0.015 0.05 0.07 99.93 ME M+ ME M+ MC UI UI UI SE	1.00 -56 57 58 58 58 58 58 58 58 60 60 60 60 60 60 60 60 60 60	Ratch 5 Group: K9 340.000 580.000 5.000 4.750 23.500 4.500 35.000 50.000 43.000 5.375 0.325 0.3	17e [K 1047] T 15278 18634 19151 17089 10092 10092 14301 1751 18269	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
111 111	1a [1064] 0.000 0.000 Rat 43 Wheat 423 Soya 4 474 Mimes 703 Limes 704 Sait 707 Triph 710 Sodiu 712 DL-Me 713 Lykin 802 Soya 817 Farmf 833 Menha 1436 Poul t 1903 Vit E 1924 Choll 1942 Elanc 1983 Retar	Margini Tonnesi W Material 11% 2 76kg 48 Hipro & Rone 50/1 tone os m Bicarboni thionine e HC1 Bean Oil at 55 den Oil ry Breeder 50 ne Chlorid oban Premi dox VOLUMFJI L EE I ROTEIN I BRE	P137 e 50% x Total: A n 100.0000 3.4070 21.0112 3.0584 5.5187 0.7029 0.4474 0.3423	3.7 新光年的共享年间开发发展, 3.7 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2	%Cst: 0 201ar: 0 201a	5.00 5.60 5.70 5.70 5.70 5.70 5.70 6.70	Ratch 8 Group: Kg 340.000 580.000 5.000 4.750 23.500 4.750 35.000 55.000 55.000 60.000 43.000 5.375 0.840 0.550 0.840 1.075 0.550 0.840 1.075 0.550 0.840 1.075 0.550 0.840 0.050 0	178 [K 1047] T 	91: 2150.1 Type: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

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C18:0

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. AVLYSINE:

APPENDIX 1 CONTINUED

RESULTS OF LABORATORY ANALYSES OF THE TRIAL DIETS

				Nutrie	ent '			
	Oil	CP	Fibre	Ash	Ca	P	Na	Mang
Diet	(%)	(%)	(%)	(%)	(%) 	(%) 	(%)	mqq)
FMS1	4.33	20.95	2.80	5.34	0.86	0.68	0.14	
Expected	4.84	22.19	3.12	5.56	0.90	0.74	0.18	
FMS2	3.45	20.32	2.08	4.68	0.80	0.59	0.23	
Expected	3.67	22.39	2.87	5.48	0.90	0.68	0.33	
FMS3	4.48	20.87	2.70	5.36	0.93	0.65	0.16	
Expected	4.82	22.19	3.12	5.56	0.90	0.74	0.18	_
FMG1 (mix 1)	5.84	20.77	3.00	5.26	0.89	0.64	0.14	
Expected	6.67	21.06	3.33	5.60	0.90	0.73	0.15	
FMG2 (mix 1)	4.88	19.33	2.30	4.94	0.96	0.63	0.23	
Expected	5.22	21.61	2.78	5.44	0.90	0.69	0.29	
FMG3 (mix 1)	5.79	19.62	2.55	5.32	0.97	0.65	0.14	
Expected	6.41	21.01	3.06	5.52	0.90	0.73	0.15	
FMG1 (mix 2)	6.15	20.56	2.90	5.12	1.03	0.73	0.14	
Expected	6.67	21.06	3.33	5.60	0.90	0.73	0.15	
FMG2 (mix 2)	5.17	20.50	2.47	4.54	0.98	0.68	0.23	
Expected	5.22	21.61	2.78	5.44	0.90	0.69	0.29	
FMG3 (mix 2)	5.93	20.52	2.67	4.86	0.96	0.68	0.15	
Expected	6.41	21.01	3.06	5.52	0.90	0.73	0.15	
FMF	6.11	18.01	2.87	5.26	1.14	0.73	0.17	
Expected	6.49	19.09	3.25	5.87	1.05	0.77	0.18	3 –

40 ETNAM STREET LEOMINSTER HEREFORDSHIRE HR6 8AQ Tel: (0568) 3232

Tel: (0568) 3232 VAT Reg. No. 549 5782 88



Food and Veterinary Laboratory Services

Salmonella Testing. Submission Form and Report

Name and Address	CHRIS BELYAVIN (TECHNICAL) LTD 2 PINEWOODS CHURUH ASTON NEWFORT SHROPS TF10 9LN
TELEPHONE NUMBER	09.52 813418
SITE HOUSE OR FLOCK CODE NUMBER OF BIRDS IN HOUSE OTHER STOCK ON SITE	LUANI 10 4320 BROILERS, REIZACEMENT PULLETS
TYPE OF SAMPLE NUMBER OF SAMPLES DATE SAMPLED	UNICK BOX LINERS 28/4/94

This sample/These samples was/were tested for Salmonella by the method described in the Poultry Laying Flocks (Registration and Testing) Order 1989, and was/were.

Signed: M. J. Thomas

Date: 11/5/94

Date when next samples are due:

INVOICE

Saluonalla Testino		9	00
·			
•	Invoice Total	9	00_
	VAT	1	42
	Amount Due	10	42

Tel: (0568) 3232

VAT Reg. No. 549 5782 88



Food and Veterinary Laboratory Services

Salmonella Testing. Submission Form and Report

Name and Address	CHRIS BELYANIN (TECHNICAL) LTD 2 PINEWOODS CHURUH ASTON. NEWPORT SHROPS THIO 9LN	_
TELEPHONE NUMBER	0952 813418	
SITE HOUSE OR FLOCK CODE NUMBER OF BIRDS IN HOUSE OTHER STOCK ON SITE	LOAH 10 4320 BROILERS, REPLACEMENT PULLETS	
Type of Sample Number of Samples Date Sampled	DOA	

This sample/These samples was/were tested for Salmonella by the method described in the Poultry Laying Flocks (Registration
and Testing) Order 1989, and was/were Negetive	

Signed: M. J. Thomas

Date: 11 5 196

Date when next samples are due:

INVOICE

Salvonalla Testing		11	90
			<u> </u>
	<u> </u>		<u> </u>
	Invoice Total	11	00
	VAT	1	73
	Amount Due	12	73

... may be deducted if account is paid by Serial number.....

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VAT Reg. No. 136 4082 81

P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

Blood Test Report and Invoice

NAME AND ADDRESS OF COMPANY C. Belyouin		••••
NAME AND ADDRESS OF COMPANY C. Reliquin Lish Meal tral (18/5/94) THEPHONE NUMBER DATE	. 18]:	5/94
FLOCK REFERENCE AND AGE TI 16 do 600 LOS		• • • • • • • • • • • • • • • • • • • •
NUMBER OF SAMPLES		
RESULTS	Co	st
MYCOPLASMA GALLISEPTICUM PLATE TEST + VE - VE M. SYNOVIAE + VE - VE		
- GUMBORO AGP ANTIBODY + VE - VE ANTIGEN + VE - VE		
OTHERS TESTS		
Infectious Bronchitis—HA Variant Infectious Bronchitis—HA	28	08
1	24.	30
6 × 1 1 NVOICE TOTAL	5~2	38
10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9	17
AMOUNT DUE	6/	55
INTERPRETATION: Does hot his with head		<u> </u>
INTERPRETATION: Does not fit in with maternal minumity decay is consistent with all the other batcher of birds tested from deliver from the later	. III. P	(-)
deliver from the hatcher. Follow-on texts will throw mo as the situation. Discount of	ve ligit	·+
Discount of may be deducted if account is paid by Serial number	1348	•••••
1.24		

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NAME AND ADDRESS OF COMPANY C. BOLLOUNA

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

Blood Test Report and Invoice

foliment trial (red 18/6/94 TELEPHONE NUMBER DATE	18/5	196
FLOCK REFERENCE AND AGE T2 16 do broiles		
NUMBER OF SAMPLES12.		
RESULTS	Cos	
MYCOPLASMA GALLISEPTICUM PLATE TEST + VE - VE M. SYNOVIAE + VE - VE	-	1
GUMBORO AGP ANTIBODY + VE - VE ANTIGEN + VE - VE		
OTHERS TESTS		1
Infectious Bronchitis—HAI Variant Infectious Bronchitis—HAI Others—HAI	28	08
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	24	30
1 Invoice Total	52	38
9	9	17
AMOUNT DUE	6 /	55
Interpretation: Sou other report		·
Discount of may be deducted if account is paid by Serial number	1349	,
1.25		

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

Blood Test Report and Invoice

NAME AND ADDRESS OF COL	MPANY C. B	eljaurin	·		*****		•••••
NAME AND ADDRESS OF COL	al (rech 181	5/94 TEL	EPHONE	NUMBER	DATE	. 18 1 51	ገ ፋ
FLOCK REFERENCE AND AG	е. ТЗ	16	do	broiles			*********
NUMBER OF SAMPLES1.2		•	**********	······································	******	• • • • • • • • • • • • • • • • • • • •	
TYOMBER OF SAMILES		·		<u></u>			-
		RESULTS				Cos	т
MYCOPLASMA GALLISEPTIC	CUM PLATE TEST	r +VE	– VE	M. SYNOVIAE	+VE -VE		T
GUMBORO AGP ANTI	вору	+ VE	→ VE	ANTIGEN	+VE -VE		
OTHERS TESTS							
1		1 2 1 4	(hers—)	ronchitis—HAI 9 10 11 12 13 14 15		28	30
3 K K X X X X X X X X X X X X X X X X X		- <u>4</u> - <u>6</u>					
		<u>7</u>	-		INVOICE TOTAL	5.2	38
10 11 12		10			VAT	9	17
		12			AMOUNT DUE	61	55
INTERPRETATION:				•			
Discount of		oltser re		·	Serial number	1350	
	•	1.26					

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS	OF COMPANY	Belyavia				••••••		
ATO Wood trial TELEPHONE NUMBER DATE								
FLOCK REFERENCE AND AGE TO 33 do 5								
NUMBER OF SAMPLES	12							
RESULTS								
MYCOPLASMA GALL	ISEPTICUM PLATE TI	:ST O+ VE 12 -	VE M. SYNOVIAE	O + VE 4 - VE	518	45		
GUMBORO AGP	ANTIBODY		VE ANTIGEN	I VE VE	210	00		
Others Tests			•					
Infectious Bron	1chitis—11A1 8 9 10 11 12 13 14 15	0 X X X	793 B s Bronchitis—HA1	15 	28 57	08 50		
Newcastle Dis			<u> </u>					
1 2 3 4 5 6 7 1 2 3 4 5 6 7 2 3 4 5 6 7	8 9 10 11 12 13 14 15	Other	5—11/1 7 8 9 10 11 12 13 14 1	[5]	24	30		
7	- - - - - - - - - - - - - - - - - - - -	67		INVOICE TOTAL	138	33		
9 10				VAT	24	21		
				AMOUNT DUE	162	54		
INTERPRETATION:		 -						
Discount of	, may be deduc	ted if account is paid	t by	Serial number	(3.5 <u>3</u>			
		4	07					

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS O	PF COMPANY	· Belyania		*****************				
Figh Meal To	5. I	O TELEPHONI						
FLOCK REFERENCE AN	D AGE	33 do	**					
NUMBER OF SAMPLES.			•					
RESULTS								
MYCOPLASMA GALLIS	SEPTICUM PLATE TI	EST 0 + VE 12 - VE	M. SYNOVIAE	> + VE 4 - VE	518	45		
GUMBORO AGP	ANTIBODY	+ VE - VE	Antigen	+ VE – VE	210	00		
OTHERS TESTS						†		
Infectious Bronc 1 2 3 4 5 6 7 8	hitis—HAI	Variant Infectious B	3 B ronchitis—HAI	·	28	08 50		
Newcastle Disease 1 2 3 4 5 6 7 8 0 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	9 10 11 12 13 14 15	Others—I	9 10 11 12 13 14 15		24	30		
8 9		R 9		INVOICE TOTAL	123	33		
10 11 12		10		VAT	21	58		
		12		AMOUNT DUE	144	91		
INTERPRETATION:	may be deduct	ed if account is paid by		Serial number	354			

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS	OF COMPANY	Belyausia	***************************************	-,		
Figh Moal	trial	Тегерном	NUMBER	DATE	301519	14
FLOCK REFERENCE AI	ND AGE T3	33 d	٥	· · · · · · · · · · · · · · · · · · ·		
NUMBER OF SAMPLES	12					
	Cost	r				
MYCOPLASMA GALL	ISEPTICUM PLATE TI	EST 0 + VE 12 - VE	M. SYNOVIAE	+ VE 4- VE	518	45
GUMBORO AGP	Амтівору	r VE - VE	ANTIGEN	ı ve — · ve	r 10	00
OTHERS TESTS						
Infectious Bron	ichitis—HAI	Variant Infectious E	743 i3 Bronchitis—HAI			
0 1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	0 1 2 3 4 5 6 7	R 9 10 11 12 13 14 15	•	Z &	08
2		1 X X X X X X X X X X X X X X X X X X X			42	50
46.45		3				
		- 2				
9						
10				;		
Newcastle Dis	ease—IIAI	Others—	HAI	,		
1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	1 2 3 4 5 6 7	9 10 11 12 13 14 15			
1 X X X X X X X X X X X X X X X X X X X		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		•		30
		4			24	"
6 7 - x		677.8		INVOICE TOTAL	/23	33
7 9 10		8 		VAT	21	2.8
12				AMOUNT DUE	144	91
INTERPRETATION:						
	•					
				•		
Discount of	may be dedu	cted if account is paid b	ν	Serial number	1355	
	may in unimu	area of sectioning to have the	,	verm number.		

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS OF COMPANY C. Belyavia (Figh Moal trial) TELEPHONE NUMBER DATE:	9161	 94
FLOCK REFERENCE AND AGE 43 do - endofrial (TI)		
NUMBER OF SAMPLES. 12		•••••
RESULTS weak.	Cos	
MYCOPLASMA GALLISEPTICUM PLATE TEST + VE - VE M. SYNOVIAE O + VE 12 - VE	218.	45
GUMBORO AGP ANTIBODY I VE VE ANTIGEN I VE VE	723	40
OTHERS TESTS Chich Anaemia ELISA - LE TRT Elisa - LE	539	50
- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	<u> 538</u>	30
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	28 29 21	08 30
	24.	30
	122	93
	39	01
AMOUNT DUE 2	6 1	94
Discount of	359	

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS OF COMPANY C. Bolyour's	• • • • • • • • • • • • • • • • • • • •	
(Figh Meal trial) DATE	.9 6 k	74
FLOCK REFERENCE AND AGE T2 - 43 do - end of tral		
NUMBER OF SAMPLES12		*********
RESULTS	Cos	
MYCOPLASMA GALLISEPTICUM PLATE TEST O + VE 12 - VE M. SYNOVIAE O + VE 12 - VE		45
GUMBORO AGP ANTIBODY + VE VE ANTIGEN + VE VE	2 23	40
OTHERS TESTS Chick Anaquia Elisa - Le TRT Elisa - Le	539	50
7 2028	5 38	30
Infectious Bronchitis	28	30
Newcastle Disease—HAI 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1 3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	21 24	30
S	222 39 261	93 01 94
INTERPRETATION:	1360	···

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P.W.LAING

B.Sc, F.R.S.H., M.R.C.V.S.

NAME AND ADDRESS	_	7.3	***************************************	•	016	
_			ONE NUMBER		:7 <u>(</u> 0.1	<u> </u>
FLOCK REFERENCE A		a/- 3 clo	- end of	ma		•••••
NUMBER OF SAMPLES	12					
		RESULTS			Cos	r
MYCOPLASMA GALL	ISEPTICUM PLATE TI		VE M. SYNOVIAE	J + VE 12 - VE		45
GUMBORO AGP	Антівору	+ VE	VE ANTIGEN	+ VE VE	5.53	40
OTHERS TESTS	Chich Anaeum	a Elisa -ve	The Elisa	-ve	539	50
, Infectious Bros	nchitis—HAI	구역3 Variant Infection	B s Bronchitis—HAI		38	30
1 2	33 e		37 67 10 10 12 13 14 15 - X X X X X X X X X X X X X X X X X X X		28	08
3 4 5					29	30
		6 X -				
10 × × × 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						
		12				
Newcastle Dis		N.D. 1620:53	s—HAI			
0	8 9 10 11 12 13 14 15	<u>1 2 3 4 5 6</u>	7 8 9 10 11 12 13 14 15		24	30
2 × 3 × × × × × × 4 × ×	* * * * * * * * * * * * * * * * * * *	1 X X X X X X X X X X X X X X X X X X X		Gundoro:	21	60
6 7 - 1		7 - -		INVOICE TOTAL	222	93
9 10 11		10		VAT	39	01
12				AMOUNT DUE	261	94
INTERPRETATION:	Comments	for all three	thals. TI,	T2 T3:	_	
There is he	evidence of	- a field	challenge (as	district to	m a	
	menar 1 -ti	A. Louting	Donal A. M.	1 1 m 3 2 2 2 1	2 45	
New eastle o	liserie.	el a a la a da	ca of CAAA	~TOT	,	
بنان.	un uny like	i i	ce of CAA o	Serial number.	13.6.1	
Note: - End	of trial bloom	ds from al	13 were Sc	reened fo		
Note: - End expanse that the	to gumbo	orb disease	and the	est which	ake(
inau in	ire had no	1 Deen au	y field to	poure		

APPENDIX 2 CONTINUED

RESULTS OF POST MORTEM EXAMINATIONS

KEY

- indicates a severe infection or abnormal condition 1. present.
 - means no lesion present.
 - means a slight but definite infection or abnormal condition present.

means normal. N

Blank left where there was no additional significance to the trial results.

Individual weights do $\underline{\text{not}}$ necessarily relate to the individual findings but are listed so that you can assess 2. variations within test groups on particular days.

Wt. = weight

Trach. ≈ tracheitis

Air sac = airsacculitis

Gen. E.coli = generalised bacterial infection

Pneu. = pneumonia

Cong. or oedema

of lung = congestion or oedema as distinct from

primary pneumonia

Heart flre. = heart failure, including all types of

the broiler-dropsy syndrome

Hyper k

& HK (gizzard) = hyperkeratinisation

slt. = slight

Svre. = severe

Comments			Gizzards all small & atonic	Nasal conges- tion	
Gizzard	4 normal 1 hyper k 2 hyper k + ulceratjon	2 normal 1 discrete healing ulcer	Slt. hyper k Svre HK & haem. HK ridges N N	N Severe hyper k N Slt. hyper k	Slt. hyper k N N N N N
Bone			ZZZZZZ	1 + Z Z Z Z	1 ZZ + Z Z Z
Bursa			large N N N large small	small large N N Small	N Small Small Small large N
Heart flre.			+ 1 1 + 1 1	1 + + + 1	1 1 1 1 1 1
Cong. or oedema of lung		+ + +	+ 1 1 + 1 +	+++++	+ + + + +
Pneu.			1 + + 1 + 1	+ + +	1 + + 1 1
Gen. E.coli	+++++11	1 1 1	(++ + + +	+ + + +	+++++
Air	++++++	+++	+	111+1	
Trach.	1 1 1 1 1 1 1 1 + + + + + + + + + + + +	+ acute + acute + acute		1 1 1	1 1 1 1 1 + + +
wt.	792 802 812 832 889 923 983	1143 1265 1410	1197 955 940 735 876 685	690 842 1074 1103 1408	812 992 1089 1089 1274 1285
Number exmnd	10		9		9
Age	28				
Date	26/5		28/5	28/5	28/5
Trial No•	Unknawn		11	12	13

Comments		Mainly good birds	Very small gizzards
Gizzard	2	Mod. hyper k N N Slt. hyper k 1 ulcer + HK N Mod. hyper k N	222
Bone marrow	z	ZZZZZZZZZ	ZZZ
Bursa	small	N N N N N N N N N N N N N N N N N N N	small N small
Heart flre.	1	++;++;;+;	ı + +
Cong.or oedema of lung	ı	+ + + + + + + + +	+ + +
Pneu•	+	1 1 1 1 1 1 1 1 1 1	+ 1 1
Gen. E.coli	+	1 1 + + 1 1 + + 1 +	+ 1 1
Air			
Trach.	1		1 1 1
Wt.	818	945 1012 1094 1117 1118 1172 1235 1398 1418	976 1380 900
Number exmnd.	_	0	٣
Age			
Date	29/5	29/5	29/5
Trial No.	11	. 21	13

Comments			
Gizzard	7.	N Mod. hyper k N N N N Slt. hyper k Mod. HK + ulcers Small ulcers Mod. hyper k Slt. hyper k	Slt. hyper k
Bone		 +2222222	1 +
Bursa		N N Small N Small N N N N N N	z
Heart flre.		+ + + + + + 1 + + + + + + + + + + + + +	ı
Cong. or oedema of lung		1 + + + + + + + + + + + + + + + + + + +	ı
Pneu•		: :++++:::+	1
Gen. E.coli		1 1 1 + + + + + 1 + + 1	+
Air			•
Irach.		11 11 1 1 + + + + + + + + + + + + + + +	+
wt.	,	832 873 979 1132 1142 1254 1256 1297 1309 1333	1062
Number exmnd.	Nil	7	—
Age			
Date	30/5	30/5	30/5
Trial No.	1 1	12	13

Commonte								
,	Gizzard	ā	N N Slt. hyper k N	-	Severe hyper K N N		Sit. nyper k	
	Bone		zzzz		z z z		z z 	
	Bursa		Small N N		small N N		small small	
	Heart flre.		1 + 1 1 1		1 1 1		+ 1	
	Cong. or oedema of lung		1 + + + 1		ı + +		+ 1	
	Pneu•		11+11		+ + !		1 +	
	Gen. E.coli		1 1 1 1 1		+ + 1		1 +	
	Air sac					_		
	Trach.		+ 1 + + 1		+ + 1		1 +	
	wt.		2230 796 2175 2020	222	844 1690 2420		1080	
	Number exmnd.		\$		3		2	
	Age							
,	Date		9/60		9/60		9/60	<u>. </u>
	Trial No.		11		12		13	

Influence of Diet on the Eating Quality of Cold Roast Chicken Breast

Objective

To investigate the influence of diet on the sensory characteristics of cold roast chicken breast.

Materials & Methods

Thirty six frozen breast samples were received from Chris Belyavin (Technical) Limited. The samples comprised 12 samples from each of 3 treatments (Groups 1 to 3) and within each group there were six male and 6 female chicken breasts.

Breast samples were thawed overnight prior to cooking, wrapped in aluminium foil and then roasted in electric computer controlled ovens set at 180 °C, until the internal temperature of the chicken breast reached 85°C.

Samples were allowed to cool at room temperature and were then placed in a refrigerator overnight. One centimetre slices were cut, at right angles to the muscle fibre direction, from each chicken breast and then served at room temperature to a panel of 10 assessors experienced in the sensory assessment of chicken. Assessments were made under red light to mask any appearance differences that might have influenced the results.

Assessors were instructed to taste the samples in the order given and record their opinions on a computer generated form as shown in appendix 1. Assessors were not given any indication of the nature of the treatments under test.

At each session panellists assessed three samples, comprising one sample from each group within a single sex.

Results

Analysis of variance models were used to analyse the data. The results for male chickens are shown in Table 1 and show that all samples were in the categories moderately tender to very tender. However, the meat was significantly more tender from groups 1 and 3 than from group 2.

There were no significant differences between the groups for juiciness, flavour intensity or abnormal flavour intensity. Values for abnormal flavour intensity were generally low, falling within the categories weak to moderately weak abnormal flavour intensity.

In terms of overall liking there was no significant differences between the chickens.

The results for female chickens are shown in Table 2. There were no significant differences for any of the categories used and values in general were lower than those for the male chickens.

The data for male and femule chickens were combined and re analysed using diet, sex and assessor as factors and the results are shown in Table 3.

Meat from groups 1 and 3 was significantly more tender than that from group 2. There were no significant differences in terms of juiciness, flavour, abnormal flavour or overall liking between the groups.

There were differences between the sexes for each of the sensory categories. Meat from male chickens was more tender and juicy with increased flavour intensity and reduced abnormal flavour intensity and was preferred over the meat from female chickens.

Assessors have the option to make and record unsolicited comments concerning any other characteristics that they have perceived. In this trial there were comments concerning fish/fish oil/ cod liver oil. For group 1 there were 3 comments, group 2, 2 comments and group 3, 11 comments. These comments were only given by a small subset of the panel (5 assessors) and were not given by these panellists at every session.

Conclusion

In this experiment, the effects due to treatment group were limited to the texture effects in male chickens with groups 1 and 3 being significantly more tender than group 2. This trend was also shown with female chickens although the results were not statistically significant.

When the results for males and females were compared, it was found that meat from male chickens was rated higher than that from female chickens. Although there was not a direct comparison between the sexes within panel, the linking factor of the same assessors being present at all panels suggests that this would be the result if they had been compared within panel.

The number of unsolicited comments made by the panel concerning fishy type notes was small when placed in the context of the total number of comments that could have been made. For example if ten assessors tasting 36 chicken each made a comment there would be a total of 360 comments. In this trial the total number of comments concerning fishy notes was limited to 16. Therefore although some assessors picked up the fishy notes the majority did not comment. In general the chicken breast meat was of good eating quality with low values for abnormal flavour intensity and high values for tenderness

Treatments

Group 1	Control
Group 2	10% fish meal
Group 3	2% fish oil

bild Junear Total

Table 1. Influence of Diet on the Eating Quality of Cold Roast Chicken Breast

Values are the means derived from analysis of variance using diet and assessor as factors and panel as a block for 6 replications.

Male chickens

Diet

Attribute	Group 1	Group 2	Group 3	vr	sed	signf
-	. 6			-		
Texture	7.13 ^b	6.70 ^a	6.98 ^b	9.10	0.103	***
Juiciness	4.48	4.33	4.32	0.47	0.190	ns
Flavour intensity	4.18	3.68	4.02	2.47	0.229	ns
Abnormal flavour						
intensity	2.68	2.97	2.72	0.88	0.233	ns
Overall liking	4.77	4.52	4.87	1.43	0.214	ns

vr = variance ratio

sed = standard error of differences of means

signf = significance value, where * = p>0.05, ** p>0.01, *** p>0.001

Means with the same superscript do not differ significantly

Table 2. Influence of Diet on the Eating Quality of Cold Roast Chicken Breast

Values are the means derived from analysis of variance using diet and assessor as factors and panel as a 'block' for 6 replications.

Female chickens

Attribute	Group 1	Group 2	Group 3	Vr_	sed	signf
Texture	6.81	6.64	6.75	0.99	0.120	ns
Juiciness	3.89	4.03	3.85	0.50	0.196	ns
Flavour intensity	3.60	3.71	3.54	0.43	0.182	ns
Abnormal flavour		÷				•
intensity	2.74	3.00	3.07	1.08	0.238	ns
Overall liking	4.09	4.22	4.07	0.30	0.210	ns
	•		* .			

vr = variance ratio

sed = standard error of differences of means

signf = significance value, where * = p>0.05, ** p>0.01, *** p>0.001

Table 3. Influence of Diet on the Earing Quality of Cold Roast Chicken Breast

All chickens

Values are the means derived from analysis of variance using diet, sex and assessor as factors for 12 replications.

I Note	٠

Attribute	Group 1	Group 2	Group 3	νţ	sed	signf
	•					<u> </u> -
Texture	6.94 ^b	6.66 ²	6.84 ^b	6.55	0.080	**
Juiciness	4.19	4.17	4.06	0.40	0.145	ns
Flavour intensity	3.82	3.71	3.78	0.33	0.137	ns
Abnormal flavour	. 1		, -	•		
intensity	2.69	2.83	2.79	0.48	0.154 💉 🗆	. ns -
Overall liking	4.38	4.38	4.47	0.25	0.150	ns
·						
		Sex				 - -
Attribute		Male	Female	VŢ.	sed	signf
					•	
Texture	6.89	6.74	5.11	0.066		* .
Juiciness	4.32	3.96	8.85	0.118		**
Flavour intensity	3.91	3.63	6.46	0.112		* .
Abnormal flavour inten	sity 2.60	2.94	7.25	0.126		**
Overall liking	4.69	4.13	20.91	0.123		***

vr = variance ratio

sed = standard error of differences of means

signf = significance value, where * = p>0.05, ** p>0.01, *** p>0.001

Means with the same superscript do not differ significantly

Appendix 1

Category rating scales used in the assessment of cold roast chicken breast

Values subsequently awarded.

	Texture	Juiciness	Chicken flavour intensity	
Rati	ng		. **	
1	extremely tough	extremely dry	extremely weak	
2	very tough	very dry	very weak	
3	moderately tough	moderately dry	moderately weak	
4	slightly tough	slightly dry	slightly weak	
5	slightly tender	slightly juicy	slightly strong	i
6	moderately tender	moderately juicy	moderately strong	
7	very tender	very juicy	very strong	1804 C
8	extremely tender	extremely juicy	extremely strong	
	-		-	

	Abnormal flavour intensity	Overall Liking (Hedonic)
1	extremely weak	dislike extremely
2	very weak	dislike very much
3	moderately weak	dislike moderately
4	slightly weak	dislike slightly
5	slightly strong	like slightly
6	moderately strong	like moderately
7 .	very strong	like very much
8	extremely strong	like extremely



APPENDIX 3

UNIVERSITY OF BRISTOL

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FACSIMILE MESSAGE

TO:

DR IAN PIKE

INTERNATIONAL FISHMEAL AND OIL

MANUFACTURERS ASSOCIATION

FROM:

DR M ENSER

DATE:

29.11.95

FAX NO:

01727 842866

NO OF

PAGES:

2

Dear Ian.

In reply to your fax of 28 November 1995 concerning the lipid analysis of the cooked chicken I am supplying the following data:

- 1. The chicken breasts were cooked in foil with the skin on. The skin was removed before taking samples for the taste panel but the residue of the breast muscle was left in the foil with the cooking drip and frozen. It was this muscle residue, which had absorbed the drip on cooling, that we were asked to analyse for fat content and fatty acid composition, although we were not aware of its history until we observed unusually high fat contents which were apparently the result of uptake of lipid from the drip. Hence the lipid analysed included the endogenous muscle lipid and lipid rendered from the skin and subcutaneous adipose tissue during cooking. The addition of these extraneous fats to the muscle will dilute the fatty acids of the phospholipids if the data is expressed on a % of total fatty acid basis. However, it will not have such an effect using the data expressed as mg/100g muscle since in this case the effect will be additive if the same fatty acids are present in lipid from all sources or there will be no effect if the fatty acid in question is only present in muscle phospholipid.
- 2. The fat content of the tissue was determined using the procedure of Folch, J., Lees, M. and Stanley, G.H.S. (1957). Journal of Biological Chemistry 226, 497-509. A simple method for the isolation and purification of lipid from animal tissues. This is the gold standard for quantifying lipids (see Enser, M. (1988) Food Science and Technology Today 2, 200-203). Sample size for extraction was 10g.
- 3. Fatty acid composition was determined on samples of minced muscle, 1g, saponified in 6ml of 5M potassium hydroxide in water: methanol (1:1, v/v) containing 1mg/ml hydroquinone as antioxidant. After dilution with distilled water the non-saponiflables were extracted with three washes of petroleum spirit BP 40° - 60°C. The hydrolysate was then acidified to pH 1.0 and the fatty acids extracted into petroleum spirit with three washes.

The extracts were neutralized with sodium hydrogen carbonate, dried with anhydrous sodium sulphate and the fatty acids converted to methyl esters using a solution of diazomethane in ether. The methyl esters were analysed by gas-liquid chromatography on a 50m x 0.25mm CP Sil 88 FAME column, using a split injection optimized to give a linear response from C12 to C24 fatty acids using a Carlo Erba 5160 mega GC with an A200S autosampler.

Samples of lipid from the Folch extraction were also hydrolysed, except that the alkali concentration was reduced to 2M, and gave the same fatty acid composition as direct hydrolysis of the tissue. Fatty acids were quantified using heneicosanoic acid methyl ester, added before hydrolysis, as the internal standard.

4. I will compare the results for the three treatments, combining the male and female groups to give four samples per treatment, by analysis of variance. However, there will be a short delay since the assistant who does this work and has details of the computer file holding the raw data is not available at the moment. I will send them as soon as possible.

I hope this answers all your queries except 4 but please let me know if you need more data. Best wishes,

M.B. ENSER