IAFMM FISH MEAL FLYER

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METABOLISABLE ENERGY VALUES FOR FISH MEALS CONFIRMED FROM TRUE METABOLISABLE ENERGY DETERMINATIONS IN POULTRY

SUMMARY

More interest is now being shown by feed compounders in the modified Sibbald technique of assessing energy values of ingredients for poultry feeds. These values are being converted to metabolisable energy values (apparent) for inclusion in tables of ingredient specification used in feed formulation.

Using Sibbald's technique which had undergone some modification, the Poultry Research Centre determined the true metabolisable energy values of 12 fish meals representing the main types in world trade. The values obtained were converted to metabolisable energy values (apparent) and compared with values in the Association's 'Nutrient Analysis Tables for the UK'. Agreement is good.

It is concluded that there appears to be no basis for changing the values in the Association's Tables, but rather the values are reinforced and confirmed.

The Energy Content of Poultry Feeds

Energy can be the most expensive nutrient to provide in a poultry diet. With the development of diets for broilers and turkeys with a higher nutrient concentration, the cost of providing energy has increased. This has resulted in a greater value being placed on those ingredients with a high energy concentration, such as fish meal. Correct assessment of the energy contribution of ingredients, even those included in relatively small amounts (2% to 5%) is important. This necessitates regular testing of raw materials.

Apparently Metabolisable Energy (AME)

The metabolisable energy system has been widely adopted for poultry diet formulation. Measured as gross energy fed less energy excreted in faeces and urine, it is more correctly defined as apparently metabolisable energy because it does not take into account energy excreted which does not come directly from feed but originates from animal tissues.These losses are referred to as endogenous and the energy they contain 'endogenous energy loss' or EEL.

Determination of apparently metabolisable energy involves restraining birds, measuring feed consumed and collecting faeces and and urine quantitatively for a week or longer - a time consuming and expensive test not appropriate for routine quality control.

Consequently nutritionists have tended to use sets of ingredient analysis tables based on few actual determinations of metabolisable energy.

True Metabolisable Energy (TME) - Sibbalds Technique of Measuring TME

A technique devised by Sibbald in Canada measures true metabolisable energy by taking into account endogenous energy losses. Furthermore, it is a rapid method, which in its original form, involved a collection period of only 24 hours for faeces and urine. Initially it attracted much attention in the feed industry because of its potential for routine assessment of the energy value of feeds.

In Sibbalds technique TME is measured by feeding only the ingredient under test to adult birds for a short period of time (24 hours) and determining energy excreted in faeces plus urine. In addition, using similar birds which for a short period of time receive no feed, and measuring energy excreted, this is taken to represent endogenous energy losses, which can be subtracted from the results obtained with the birds fed the test diet and the true metabolisable energy calculated.

Sibbald's original technique has been the subject of some criticsm. Much of this has been answered following modifications, a number of which resulted from a collaborative project at the Poultry Research Centre (PRC) in Edinburgh with Dr Sibbald. More details of the modified method are given in the paper presented by Dr J M McNab to the Associations symposium in Budapest in October 1984.

Calculation of AME from TME Determined using Sibbald's Technique

More interest is now being shown by feed companies in Sibbalds modified technique. Several national compounders in the UK., for example have raw materials screened by the PRC using the modified TME method to compile metabolisable energy tables for use in their computer feed formulation.

Sibbald's technique measures true metabolisable energy (TME) which is related to apparent metabolisable energy (AME) as follows:

$$TME = AME - \frac{EEL}{FI}$$

because the endogenous energy loss (EEL) changes little over the range of feed intakes (FI) normally encountered in commercial broiler units,a fixed value for EEL for broilers, can be used to convert TME to AME as follows:

assuming EEL = 10kJ/day

and FI = 75g/day

then $\frac{EEL}{FI}$ = 0.1 (approx)

Hence AME = TME - 0.1

Use of TME Determinations on Fish Meals to calculate AME

Samples of fish meals (12) representing the main types available commercially worldwide were subjected to TME determination using the modified Sibbald technique at the Poultry Research Centre in Edinburgh. Details of the technique and the results obtained were given by Dr. J M McNab at the Association's Budapest Symposium. The fish meals representing each main type (South American, Scandinavian and Northern European) were selected to cover the range of protein and oil contents which occur in practice in commercial meals. Oil contents were determined by extraction with petroleum ether. Proximate analysis (dry matter, oil, protein and ash) are given in table 1.

Table 1

Origin, and proximate analyses of fish meal samples (% as received)

	Sample	Dry matter	Oil	Crude Protein	Ash
A	Denmark	90.9	9.1	71.1	10.9
B	Denmark	90.1	7.5	72.0	11.5
C	Denmark	92.2	12.0	71.5	10.6
D	Denmark	92.5	5.9	69.1	16.3
E	Ireland	93.7	12.9	68.9	12.5
F	Chile	91.9	9.7	67.7	15.1
G	Chile	92.2	9.3	67.4	14.7
H	Peru	91.8	10.7	65.9	15.4
J	UK	92.2	4.6	62.6	24.3
K	Norway	90.0	8.7	68.4	11.0
L	Norway	89.9	7.2	69.1	16.3
M	Chile/UK	92.8	8.4	64.3	19.3
	Mean (±SD)	91.7±1.2	8.8±2.4	68.1±2.8	14.8±4.0

Energy values determined (gross energy [GE] and true metabolisable energy [TME]) are given in table 2. Also given are the metabolisable energy values corrected to zero nitrogen retention. All values in this table are based on dry matter. In table 3 calculated true and apparently metabolisable energy values corrected to zero nitrogen (TME and AME) and expressed on an as received basis are presented.

The protein, oil (petroleum ether extract) TME no and AME no average values for the main types of fish meal are given in table 4. For comparison the metabolisable energy figures from the Association's Nutrient Analysis Tables for the UK are also given. These values are also apparently metabolisable energy figures corrected to zero nitrogen retention, derived by the direct measurement of apparently metabolisable energy. Agreement between the ME figures (AME no) is good. The figures derived from TME no data tend to be lower; this probably reflects the drop in TME with nitrogen correction for high protein feds in general and fish meal in particular.

Conclusion

The metabolisable energy values determined for fish meals representing the main types traded, calculated from determined true metabolisable energy values agree well with values in the Association's Publication 'Nutrient Analysis of Fish Meals for the UK'. There would appear to be no basis for changing the values in the Association's Tables, but rather the values are reinforced and confirmed.

Table 2

Gross energy, SE and true metabolisable energy(TME) of fish meal samples (MJ/kg dry matter)

Sample	Origin	GE	TME
A	Scandinavia	21.98	16.35±0.43
B	Scandinavia	21.35	16.38±0.54
C	Scandinavia	22.58	17.07±0.25
D	Scandinavia	20.37	15.09±0.43
E	Ireland	22.30	17.51±0.35
F	S America	20.89	15.39±0.37
G	S America	21.02	15.26±0.24
H	S America	21.16	16.37±0.36
J	UK	18.11	13.98±0.17
K	Scandinavia	22.38	16.66±0.43
L	Scandinavia	21.07	16.50±0.32
M	S America UK	19.95	15.19±0.33
	Mean (±SD)	21.10±1.24	15.98±1.00

Table 3

True and apparent metabolisable energy values (TME_{no} and AME_{no}) (MJ/kg as received)

Sample	Origin	TME_{no} as received	AME_{no} as received
A	Denmark	13.5	13.4
B	Denmark	13.5	13.4
C	Denmark	14.4	14.3
D	Denmark	12.3	12.2
E	Ireland	14.8	14.7
F	Chile	12.9	12.8
G	Chile	12.8	12.7
H	Peru	13.7	13.6
J	UK	11.7	11.6
K	Norway	13.7	13.6
L	Norway	13.2	13.1
M	Chile/UK	12.7	12.6

Table 4

The apparently metabolisable energy of fish meals - comparison of values derived from true metabolisable energy with those in the Association's Nutrient Analysis Tables

Type of Meal	Protein %	Oil[1] %	AME_{no} from TME_{no}	AME_{no} from IAFMM Nutrient Analysis
Scandinavian	70.0	9.0	13.5	13.7
S American	67.0	9.1	13.0	13.5
Offal	62.5	4.6	11.6	11.6

1 All values on 'as received' basis determined by extraction with pet. ether.

2 AME no - apparently metabolisable energy (MJ/kg) converted to zero nitrogen retention.

3 Values calculated from TME_{no} figures determined by the PRC Edinburgh. These values are the averages for the meals based on figures in tables 1 and 3 earlier.

4 Values taken from table 5 in the Association's publication 'Nutrient Analysis for UK).