# METABOLISABLE ENERGY

## Testing at Hill Laboratories

### Introduction

"Metabolisable Energy" (ME) is a concept used to characterise the nutritional value of animal feedstuffs. It is an estimate of the energy available to an animal from digestion of a feed material, expressed in units of megaJoules per kilogram of feed (MJ/kg DM). Feed materials are comprised of a number of chemical components (fats, proteins, carbohydrates etc), each of which are potentially metabolisable by an animal and contribute to the energy content of the feed. These components do not all contribute equally (for instance fats have higher energy content than proteins) and the concept of ME has been developed to account for these differences.

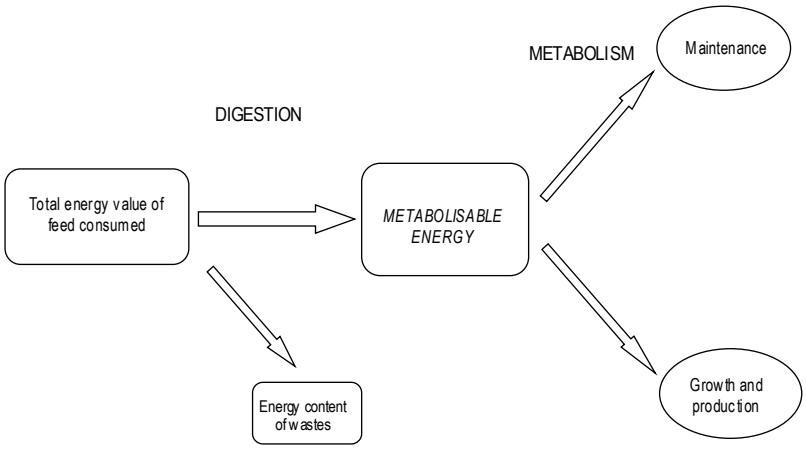


Figure 1. The total energy value of feed consumed by the animal is partitioned into waste and metabolisable energy by the digestion process, and then partitioned into energy for maintenance and for growth/production by metabolic processes.

Testing for ME has become important to New Zealand farmers as a means of comparing the nutritive value of animal feed materials. It is considered that ME is a better indicator of a feed's ability to support animal production than the simple measure of dry matter content.

### The measurement of ME

ME can only be measured directly using carefully designed animal feeding trials. In these experiments, measurements of feed intake, wastes excreted, liveweight changes, and heat evolved are combined to calculate the total energy produced through digestion and metabolism of the feed.

Research has shown a strong relationship between the *in-vivo* digestibility of a feed (i.e. the proportion of the feed assimilated by the animal) and its ME value, and conversion equations have been derived relating the two. Feed digestibility can also be measured in the laboratory using synthetic enzymes to emulate the digestion process within the animal. This *in-vitro* digestibility can be converted to an *in-vivo* digestibility by calibration against standard materials used in animal feeding trials.

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There are some limitations with this approach.

- The laboratory *in-vitro* digestibility measurement mimics the feed digestion that might be achieved by animals, but it cannot take account of factors such as palatability, animal species and condition, dietary balance, etc.
- The standard materials used to convert *in-vitro* digestibility results to *in-vivo* values are a source of inconsistency in results, with some laboratories still using in-house proprietary standards.
- Components in some feed materials may not be effectively digested by synthetic enzymes, leading to an under-estimation of feed digestibility (and hence ME).

## The measurement of digestibility/ME at Hill Laboratories

Hill Laboratories has adopted the procedure developed by the Australian Fodder Industry Association (AFIA), which uses a pepsin-cellulase digestion method to give an Organic Matter Digestibility (OMD%) measure. The *in-vitro* OMD% result obtained form this method is adjusted to predict an *in-vivo* OMD% value using a linear regression that is based on a series of samples with reported *in-vivo* results from Lincoln University. Digestibility results are reported on a dry weight basis as DOMD%. ME is then derived from the DOMD% of feed samples by published calculation and is also reported on a dry weight basis. For forage and silage samples the calculation is:

ME = 0.16xDOMD%

For compound feeds (meals, pellets) and grains a Crude Fat test is also carried out and where Crude Fat is greater than 5%DM then the calculation adopted is:

ME = (0.14 x DOMD%) + (0.25 x CFat%DM).

The AFIA digestibility test requires 5 days to complete. However, NIR technology provides a rapid alternative, provided the feed sample is similar to those present in the NIR calibration set.

Note that feeds based with palm kernel expeller, copra meal and liquid feeds are excluded from this method.

## Typical Feed Values

The following table gives general information on the feed quality of a range of typical forages.

**Table 1** **Feed Quality for Forage Samples**

| Feed Type | Dry Matter (%) | Crude Protein (%) | Acid Det. Fibre (%) | Neutral Det.Fibre (%) | Digestibility (%DOMD) | Metabolisable Energy (MJ/kg) |
|---|---|---|---|---|---|---|
| Mixed Pasture | 12 – 25 | 20 – 30 | 20 – 30 | 30 – 45 | 65 – 80 | 9 – 12 |
| Pasture silage | 25 – 30 | 14 – 20 | 20 – 35 | 30 – 45 | 65 – 75 | 9 – 11 |
| Cereal Silage | 35 – 40 | 8 – 12 | 25 – 40 | 35 – 60 | 55 – 65 | 9 – 10.5 |
| Maize Silage | 25 – 35 | 6 – 9 | 25 – 35 | 35 – 50 | 60 – 70 | 9.5 – 11 |
| Lucerne Foliage | 15 – 25 | 20 – 30 | 25 – 30 | 35 – 45 | 60 – 70 | 9 – 12 |
| Lucerne Hay | 85 – 90 | 18 – 25 | 25 – 35 | 35 – 45 | 55 – 65 | 8 – 11 |

## Summary

- ME is a concept, rather than a directly measurable chemical component.
- ME can only be measured using animal feeding trials, but may be estimated with an enzyme “digestibility” procedure.
- ME results from different laboratories may vary.
- Hill Laboratories uses the digestibility method recommended by the AFIA.
- NIR is used to give rapid estimates of AFIA digestibility and in turn ME.

## Further reading

1. AFRC (1993) Energy and Protein Requirements of Ruminants. An advisory manual prepared by the AFRC Technical Committee on Responses to Nutrients. CAB INTERNATIONAL, Wallingford, UK.
2. NRC Nutrient Requirements of Dairy Cattle. National Academy Press, Washington DC. 7th Revised Edition, 2001
3. Givens, D.I et al (editors) Forage Evaluation in Ruminant Nutrition. CABI, Wallingford, UK, 2000 Holmes, C.W., Brookes, I.M., Garrick, D.J., MacKenzie, D.D.S., Parkinson, T.J., Wilson, G.F. Milk Production from Pasture – Principles and Practices. Massey University, NZ, 2002

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