

Maintenance

A. Definition and significance

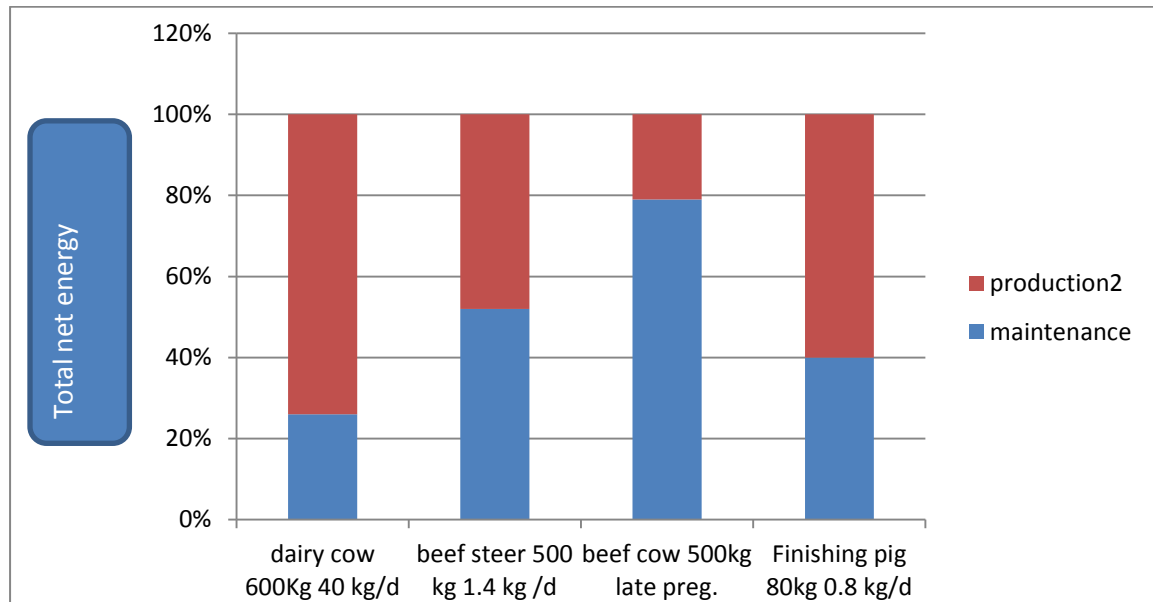
1. Definition

(a) Maintenance energy (protein etc) requirement is the amount of dietary energy (protein etc.) needed to; maintain an animal in zero energy (protein etc.) balance.

(b) Strictly speaking, this definition applies only to a mature, non-pregnant, non-lactating, animal, but in practice the concept is widely applied to productive animals.

2. Significance

Maintenance feed requirements have a major effect on the overall efficiency of feed utilization because in most productive animals, > 40% of the energy intake is used to support maintenance.



B. Maintenance Energy Components

1. Basal metabolism

(a) Defined as metabolic rate (= heat production) in the postabsorptive state, with minimal physical activity and psychic stress, and thermal neutrality.

(b) Factors affecting basal metabolic rate:

I. Body size

Clearly, the bigger an animal, the more heat produces.

However, the relation between heat production (metabolic rate) and body weight is curvilinear because weight –specific metabolic rate (kcal/kg/ day) declines with increasing mature body size.

II. Species

There is considerable variation among species around the interspecific mean for basal heat production of 69 kcal/kg/d e.g. sheep <60 vs. cattle >75.

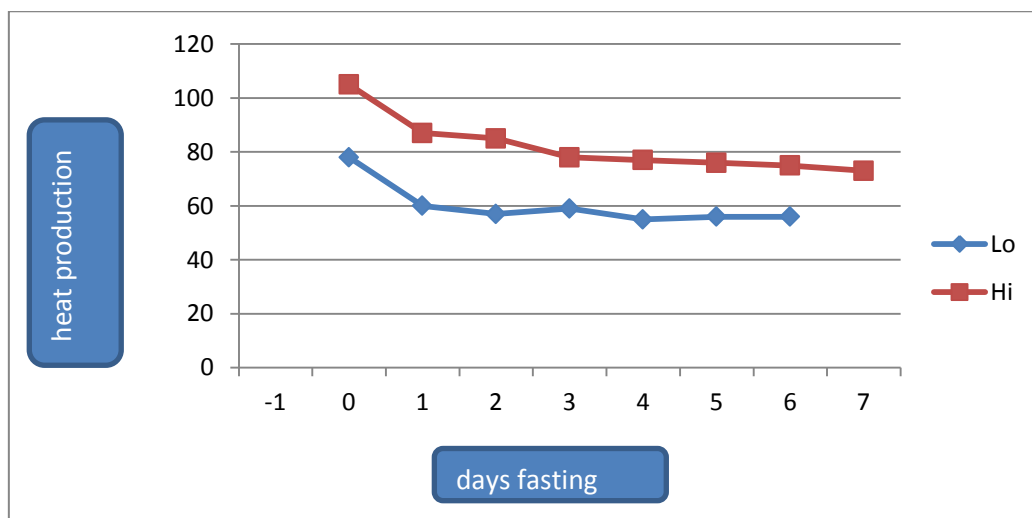
III. Age

Basal heat production, corrected for metabolic body weight, declines quickly during early postnatal life, then more slowly through maturity and old age.

IV. Sex

Basal heat production of males exceeds that of females, especially after puberty.

V. Previous level of nutrition



VI. Climate

Prolong cold increases basal heat production; prolonged heat decreases basal heat production.

2. Muscular work

(a) Effect of exercise on maintenance energy requirements depend on :

- I. Work intensity
- II. Work duration

(b) NRC tables usually add a correlation factor of 10% fasting heat production to account for effects of activity on the maintenance energy requirements of animals in intensive and semi- intensive production systems. This factor is modified for grazing animals according to distance walked per day.

3. Temperature regulation

Relation between environmental temperature, heat loss, and heat production in a hypothetical homeothermic animal

- (a) When environmental temperature falls below the animal's **lower critical temperature**, heat production must increase if normal body temperature is to be maintained.
- (b) In most adult animals, this is done by **shivering**, in neonates and adults of some cold- adapted species e.g. rodents, extra heat is produced by activation of **brown adipose tissue**.
- (c) The lower critical temperature is affected by body size, tissue insulation (body condition), and coat insulation.
- (d) Lower critical temperature decreases (i.e. animal becomes more cold resistant) with increasing level of feed intake e.g. sheep fed at different levels at different environmental temperature.