

Energy Requirements of Birds

By Debra McDonald

Energy itself is not classified as a nutrient but it is used to fuel the body's metabolic functions. Nutrients such as carbohydrates, fats and proteins contain energy in the form of chemical bonds that is released when the bonds are broken in the process of digestion.

Units of Energy

The units of energy are calculated in either calories or joules. One kilojoule is equal to 4.184 kilocalories or one kilocalorie is equal to 0.239 kilojoules. When calculating the energy value of a food we use the following 'Atwater' factors:

- 1 gram of fat = 37 kJ (8.8 kcal),
- 1 gram of protein = 17 kJ (4 kcal),
- 1 gram of carbohydrate = 16 kJ (3.8 kcal).

However, the calculated energy value does not reflect the energy available to every bird as not all carbohydrates are digestible and digestibility of various ingredients varies among species, gender, age and with gut transit time. When calculating energetic requirements of birds the following equations are generally used to calculate the basal metabolic rate (BMR):

Passerine BMR

$$\begin{aligned} \text{kcal day}^{-1} &= 114.8 \times \text{kg}(\text{body weight})^{0.726} \\ \text{kJ day}^{-1} &= 480 \times \text{kg}(\text{body weight})^{0.73} \end{aligned}$$

Non-passerine BMR

$$\begin{aligned} \text{kcal day}^{-1} &= 73.5 \times \text{kg}(\text{body weight})^{0.734} \\ \text{kJ day}^{-1} &= 308 \times \text{kg}(\text{body weight})^{0.73} \end{aligned}$$

The basal metabolic rate (BMR) is calculated from energy expended when a bird is sleeping so is only used as a guide. Perching alone can account for more than 90% of a bird's time in a cage and increases energy expenditure two-fold. Preening, eating and shuffling locomotion also increase energy expenditure, with energy required for flight as much as 11-20 times the BMR.

Climate can also influence BMR, with birds from temperate climates having significantly higher BMRs than tropical species. Birds in the wild require far more energy than those in captivity as they do not have protection from the elements and need energy to regulate the temperature of their body. They also require more energy to search out and procure food as well as for territorial defence.

Although greater food intake may be required to meet increased energy requirements, the daily needs for amino acids, minerals and vitamins are relatively constant regardless of energy expenditure. This is why the preferred method of calculating daily nutrient requirements is based on the energy value of the food rather than the weight of the food that is fed. Birds will consume less of an energy dense food than they will a food that is low in fat and carbohydrates.

Feed Intake

Birds will consume approximately 3-7% of their body weight of commercial seed mixes. This intake can double in cold temperatures. Intake of commercial diets will depend on the formulation and the method used for processing. Although feed intake will vary considerably among species and individuals, a useful guide is to feed 1-2 tablespoons of Dr Mac's pellets per 100g of body weight.

Diets for Weight Loss

When developing diets for weight loss it is important not to restrict food intake, as this will reduce intake of other key nutrients. As the daily requirement for protein, essential fatty acids, vitamins and minerals will not vary significantly, it is the overall energy intake that needs to be decreased. Energy reduction diets generally contain lower levels of fat with simultaneous increase in indigestible fibre, air or moisture.

Energetic Costs of Moulting

Energy requirements increase with moulting of feathers. Nutrients are required for the new feather and feather sheath, energy is required for synthesis of feathers, and energy is also required to produce and maintain the tissues involved in feather production (i.e., feather pulps). During this period, the protective barrier that plumage generally offers is not fully maintained and additional energy is required for thermoregulation.

Approximately 3-10% of total body mass is replaced during a complete moult and at the peak of moult this may be as much as 20%, significantly increasing BMR. Increases in energy expenditure due to rapid moult can be partly offset by reductions in other activities such as locomotion or singing.