Chapter III: Energy Supply

The energy intake holds the first place of importance in the ration, because:

- It constitutes the main element conditioning the ingestion of rations.
- It allows, as with other nutrients, to adapt food intake to the needs necessary for the maintenance of animals and the synthesis of their different productions.

- It influences the use of other categories of nutrients.

1. Importance

The chemical energy in food is the only form of energy that can be used by domestic animals for their maintenance and production. Combustion, in the presence of oxygen, of the organic matter contained in nutrients allows the release of energy, capable of covering the various needs of the animal: tissue renewal, thermal regulation, muscular work expenditure and product development.

2. Dietary requirements

The activities of the animal organism are the origin of expenses from which one can define the needs of an animal, on the one hand in energy, on the other hand in materials: glucose, amino acids, mineral elements; these expenses correspond to the maintenance of the animal (basic metabolism, thermoregulation, physical activity) and possibly to the realization of production: growth, fattening, gestation, lactation, laying, work.

3. Effects of nutritional deficiency or excess

Whenever the food intake is insufficient, there is a decrease in the level of production and appearance of disorders in animals. Starvation leads more or less quickly to the death of individuals. A sufficient supply of energy is therefore the first condition for a rational diet.

However, excess is not desirable because, in addition to its high cost, the elimination of unused energy causes fatigue in the body and can disrupt the animal's metabolism.

4. The stages of using energy from food

The use of food by animals is accompanied by numerous transformations in the digestive system and then in the tissues. The organic components are gradually degraded and each stage results in organic and calorific losses; these vary greatly depending on the food and the animal.

4.1.Step 1: Digestible Energy (DE)

The amount of energy contained in food is called gross energy.

Digestible energy is obtained by the difference between gross energy and the energy contained in feces (EF)

$$ED=EB-EF$$

Energy digestibility (dE) is the ratio between digestible energy and gross energy, it allows to calculate the part of the energy contained in the food (EB) which passes into the blood of the animal, which is absorbed (ED).

4.2. Step 2: Metabolizable Energy (ME)

Metabolizable energy is equal to digestible energy less the energy contained in combustible gases, especially methane, from digestive fermentation (EG) and the energy contained in urine (EU):

EM=ED–
EG-EU;
EM=EB-
(EF+EG+EU)

Metabolizable energy is the amount of food energy that can be used by the body's tissues. It is used to meet energy costs related to maintenance and production.

Total EM (or EMT) = EM maintenance + EM production

4.3. Step 3: Net Energy (NE)

Only a portion of the metabolizable energy contributes to covering maintenance and production costs: this is net energy. The other portion is dissipated in the form of heat, this is extra-heat:

EN= EM- extra heat or EN =kx EM

kis the overall efficiency of the transformation of metabolizable energy into net energy: Net energy is obtained from the gross energy of food, taking into account all easily measurable energy losses (feces, urine and gas) and extra heat losses:

EN = EB – (EF+EU+EG) – extra heat

Extra heat losses vary greatly depending on the physiological function performed by the animal and the composition of the food.