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Lecture title: **Animal nutrition: evaluation of food digestibility**

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Summary:

Evaluation of foods: digestibility

Digestibility trials

In a digestibility trial, the food under investigation is given to the animal in known amounts and faecal output is measured. More than one animal (typically four) are used because:

1. Animals, even of the same species, age and sex, differ slightly in their digestive ability
2. Replication allows more opportunity for the detection of experimental error.

The following points should be put in consideration during digestibility trials

1. Castrated animals are preferred to females
2. Small animals can be confined in metabolism cages, which facilitate the separation of faeces and urine
3. larger animals such as cattle and sheep are fitted with faeces- collection bags made of rubber or a similar impervious material
4. The food required for the trial should be mixed thoroughly to ensure a uniform composition.
5. In all digestibility trials, and particularly those with ruminants, it is desirable that meals should be given at the same time each day and that the amounts of food eaten should not vary from day to day.
6. In a typical digestibility trial, the food under investigation is fed to animals for 21–30 days, with faeces being collected for the last 7–10 days.

Digestibility trials periods

Typically a digestibility trial consists of three periods, each lasting for 7–10 days.

1. **Adaptation period** : animals are gradually adapted to the experimental diet. Once adapted,
2. **preliminary period** :animals are then maintained on the experimental diet to ensure that they are fully accustomed to the experimental diet and to clear the digestive tract of previous food residues.
3. **Collection period**: food intake and faecal output are recorded.
   A longer collection period generally provides more accurate results.

Determination of nutrient digestibility coefficients of hay fed to sheep

Example:

A digestibility trial was carried out using three sheep to determine the digestibility of hay. During the 10-day faecal collection period, feed intake and faecal output were recorded. Samples of hay and faeces were analysed in the laboratory:

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Nutrient analysis (g/kg DM)	Dry matter (DM)	Organic matter (OM)	Crude protein	Ether extract	Crude fiber
Hay		919	93	15	350
Faeces		870	110	15	317
Nutrient flux (kg/day)					
Consumed	1.63	1.50	0.151	0.024	0.570
Excreted	0.76	0.66	0.084	0.011	0.240
Absorbed	0.87	0.84	0.067	0.013	0.330
Digestibility coefficients	0.534	0.560	0.444	0.541	0.579
Digestible nutrients (g/kg DM)		515	41	8	203

- From the differences between the quantities of individual nutrients consumed and excreted the absorbed nutrients can be calculated. e.g. from the table above

Organic matter

- The organic matter absorbed = OM consumed – OM excreted
  = 1.50 – 0.66
  = 0.84 kg/day
- Digestibility coefficients = the weight of OM absorbed / the weight consumed
  = 0.84 / 1.50
  = 0. 560
- digestible nutrients = OM of Hay x Digestibility coefficients of OM
  = 919 x 0.560 = 515 g/kg DM

Crude protein

- The crude protein absorbed = CP consumed – CP excreted
  = 0.151 – 0.084
  = 0.067 kg/day
- Digestibility coefficients = the weight of CP absorbed / the weight consumed
  = 0.067 / 0.151
  = 0. 444
- digestible nutrients = CP of Hay x Digestibility coefficients of CP
  = 93 x 0.444 = 41 g/kg DM

Ether Extract

- The ether extract absorbed = E.E consumed – E.E. excreted
  = 0.024 – 0.011
  =0.013 kg/day
- Digestibility coefficients = the weight of E.E. absorbed / the weight consumed
  = 0.013 / 0.024
  = 0. 541
- digestible nutrients = E.E. of Hay x Digestibility coefficients of E.E.
  = 15 x 0.541 = 8 g/kg DM

Crude fiber

- The crude fiber absorbed = CF consumed – CF excreted
  = 0.570 – 0.240
  = 0.33 kg/day
- Digestibility coefficients = the weight of CF absorbed / the weight consumed
  = 0.33 / 0.570
  = 0. 579

- digestible nutrients = CF of Hay x Digestibility coefficients of CF
  = 350 x 0.579 = 203 g/kg DM