

Proximate Analysis

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- Combination of Analytical Procedures: Germany, 1860
 - Moisture (dry matter)
 - Ash
 - Crude Protein
 - Crude Fat (ether extract)
 - Crude Fiber
 - Nitrogen-free Extract

No relationship to nutritional value, other than diagnostic

Proximate Analysis

- Moisture/DM
 - Heat sample above boiling point of water
 - $\text{End wt./Initial wt.} \times 100 = \text{DM}$
 - or
 - $100 - \%H_2O = \%DM$

Proximate Analysis

- Ash (mineral component)
 - heat sample for 6h at 600°C

Proximate Analysis

- Crude Protein (CP)
 - Acid digestion destroys organic matter and releases Nitrogen (N) as ammonium sulfate.
 - Neutralized with NaOH, distilled to release free ammonia, which is captured with a standard acid (boric acid).
 - Titrated with dilute base and quantity measured to calculate %N.

Proximate Analysis

$$\text{Crude Protein, \%} = \%N \times 6.25$$

Amino acids, on average, contain 16% N
 $100/16 = 6.25$

Proximate Analysis

- Ether Extract (EE)
 - Sample extracted with ether to remove lipids
 - Calculation based on weight difference

Crude Fiber

- Crude Fiber
 - After EE fractions are removed:
 1. Weak Acid Proteins/sugars/starches removed
 2. Weak Base
 3. Ashed – cellulose, lignin burned, ash remains

Crude Fiber

$$\frac{(\text{Extracted and acid/basic digested sample} - \text{ash residue})}{\text{Initial sample weight}} \times 100\% = \%CF$$

[Nitrogen-Free Extract (NFE)]

- NFE (nonstructural sugars/starches)
- No chemistry, just arithmetic

$$100 - (\%H_2O + \%CP + \%EE + \%CF + \%Ash)$$

[Gross Energy...]

- Determined by bomb calorimetry



[Energy]

I. Definition

A. The energy content of feedstuffs

1. In animal nutrition, we are interested in the chemical (molecular) energy of feedstuffs
2. Heat energy can be determined by bomb calorimetry
3. One calorie raises the temperature of 1 g of water 1°C (i.e., 14.5 to 15.5 °C); a kilocalorie (kcal) raises 1000 g of water 1 °C