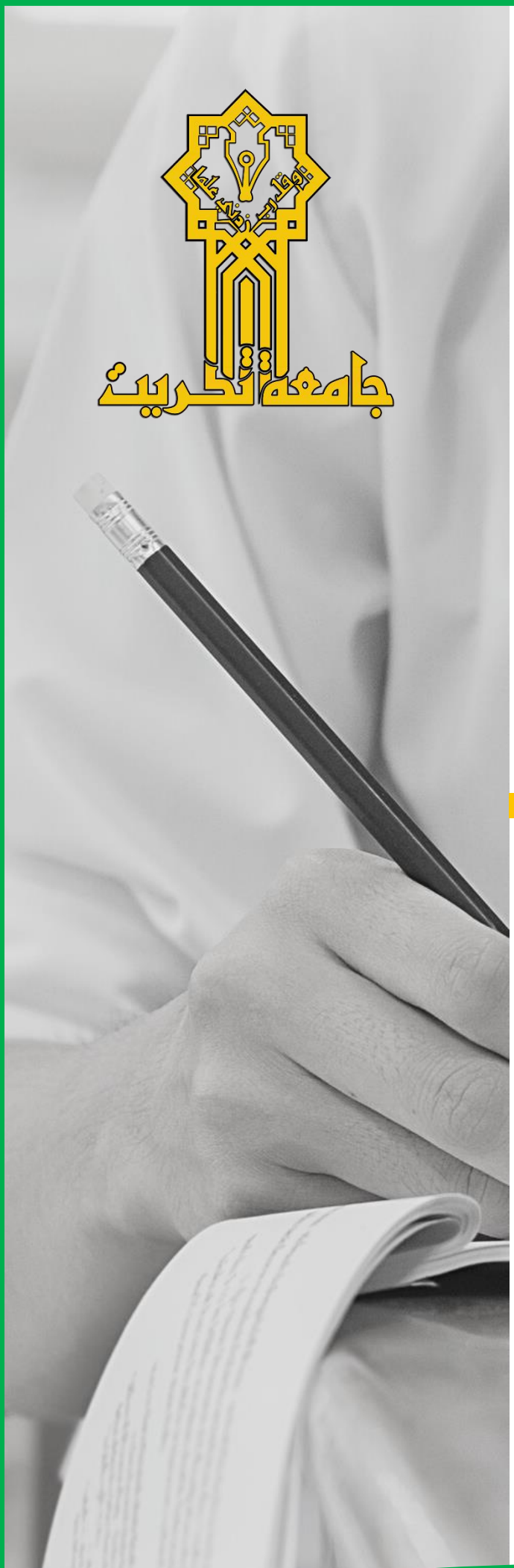

Tikrit University
College of Veterinary Medicine

Lecture Title:
Determination of crude fat in feedstuffs.

Subject name: Animal Nutrition

Subject year: Second Year

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Determination of crude fat in feedstuffs.

The crude fat is an organic compound that is present within animal and plant tissues. Also, the term " fat" refers to all compounds of fat origin or those that dissolve in organic solvents, e.g., ether, hexane, benzene, chloroform, etc.)

The crude fat includes true fat as well as other compounds such as free fatty acids, waxes, vegetable or plant pigments, sterols, chlorophyll, and carotenes. At fat extraction, the true fat is extracted alongside these substances, and for this reason, all these substances are called "ether extract", " E.E".

In the lab. practice, it is observed that the best organic solvent is ether because ether can dissolve all types of fats as well as all fat- fat-conjugated substances such as plant pigments and acids. Also, ether boils at a low temperature.

There are many types of ether, e.g., Diethyl ether, Petroleum ether, which boil and evaporate at low temperatures, about 34 °C°. In the lab practice, determination of crude fat is carried out using the "Soxhlet apparatus".

The sample should be prepared for crude fat determination. The sample is prepared by grinding the sample. Fine grinding of the sample is important to facilitate the exposure and contact of the organic solvent with all fractions of the feedstuff sample.

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The Soxhlet apparatus is composed of three major parts: • 1. The receptor: it is the part that the organic solvent is put in. • 2. The body of the apparatus: it is the part in which the feedstuff sample is put. • 3. The condenser: it is made to condense the evaporated organic solvents

This part contains the inlet and outlet. Cool water enters from the inlet, with subsequent drainage of water. The condenser plays a role in the extraction of fat from the sample.

Notebook: as a tradition practiced in the lab, an important condition for successful crude fat determination, smoking is strictly forbidden and inflammable sources

should be kept away from the organic solvent. Smoking, inflammation, and any electrical charge could lead to the explosion of the organic solvent. Therefore, safe electrical resources should be used as a water bath, which depends on water vapor for heating.

Methods of determination of crude fat of the sample. There are two methods for the determination of crude fat of the feedstuff of the sample:

First: the old method (the classical technique)

1. The receptor part of apparatus is thoroughly and carefully washed with distil water. Then, it is put in the drying oven at 100 °C for one hour. Later, it is cooled and is weighed.

2. About (1-2gm) of air-dried feedstuff sample is weighed on filter paper. The weight is recorded.

3. The filter paper containing the sample is thoroughly twisted. Later, the paper is gradually twisted, pressed. The sample is weighed, and this weight is regarded as "the weight before the extraction".

4. The filter paper with the sample is conveyed into the Soxhlet apparatus.

5. The receptor part of the apparatus is filled with about three-quarters (3/4) of its volume with organic solvent. The apparatus is operated, and the water passing within the condenser is opened. The flowing water should be cool to condense the evaporative organic solvent rapidly. Later, the apparatus is held in a water bath.

6. The organic solvent starts to evaporate and is elevated into the condenser. Then, a condensation and distillation of the organic solvent on the sample within the apparatus with an elevated level of organic solvent. Crude fat is extracted from the sample when the vapor reaches the end of the side tube of the apparatus body,

syphon, process takes place. In this process, the organic solvent containing the dissolved fat is repeated to the receptor part. This process is repeated in an average of five syphons per hour. The process continues for (6) hours.

7. After the termination of the period of extraction and before the Soxhlet process occurs, the parts of the Soxhlet apparatus are dissociated. The organic solvent is conveyed from the apparatus body into the flask to reuse the solvent again.

8. The receptor part is dissociated and is dried at 100 °C for three hours. Then, it cools and weighs. • 9. After extraction, the filter paper with the sample is taken and the organic solvent is dried at 60c° for 24 hours. Then, it cools and weighs. Heating may be at (150°C) for half an hour.

The second: the modern method:

• This method is carried out in a new apparatus, which is composed of the receptor, apparatus body, and the condenser, as well as the steam generator.

A steam generator contains two poles as well as copper plates located inside a cylinder filled with water. Also, the steam generator has a storage for re- re-collection of ether. This recent method differs from the old method as follows

• 1. Time saving and the ability to operate (6) samples instead of one feedstuff sample.

• 2. High accuracy due to the lessening of the experimental error.

• 3. The capability of re-use of the organic solvent in the last stage of extraction for another reservoir.

Calculations:

• 1. Weight of empty filter paper.

• 2. The weight of the filter paper with the weight of the sample (1-2 g).

• 3. The weight of the original sample • = weight of filter paper with the sample – weight of empty filter paper.

• 4. Pressing of the paper with the sample and recording of the weight. This weight is regarded as " weight before extraction".

• 5. The weight of the empty receptor part," the weight before extraction".

• 6. Insertion of the filter paper with the sample inside the Soxhlet apparatus for a whole hour.

• 7. Pulling the paper with the sample. The paper and the sample are weighed, and this weight is called • " weight after the extraction".

• 8. The receptor part is weighed. This weight is considered as • " weight after the extraction".

• 9. To find the weight of crude fat, which can be known by one of the following methods

Either the weight of the paper or the sample before

Extraction - the weight of the paper and the sample after the extraction.

· Or) weight of the receptor after extraction - weight of the receptor before extraction.

· 10. Percentage of crude fat = $\frac{\text{weight of crude fat}}{\text{weight of original sample}} * 100$

Example: • Empty filter paper is weighed, which was (1gm). The weight of the paper with the barley sample is 2.5 g. The weight of the empty receptor part is (50gm). After the extraction of fat and drying, the weight of the paper with the sample was 2.3 g. The weight of the receptor after extraction was 50.2 g. Find the percentage of crude fat of the sample in both methods.

The solution:

• The weight of the original sample = the weight of the filter paper + With the sample – the weight of empty filter paper.

• = 2.5 -1

• = 1.5 gm.

· **The first method:-**

· The percentage of crude fat = $\frac{\text{weight of crude fat}}{\text{weight of original the sample}} * 100$

$= \frac{\text{w.t.of the receptorpart after extraction} - \text{w.t.of the receptorpart before extraction}}{\text{weight of original sample}} * 100$

$= \frac{50.2-50}{1.5} * 100$

$= \frac{0.2}{1.5} * 100$

$= 13.3\%$

· **The second method :-**

· The percentage of crude fat = $\frac{weight\ of\ crude\ fat}{weight\ of\ original\ sample} * 100$

$= \frac{\boldsymbol{w.t.of\ the\ paper\ with\ the\ sample\ before\ extraction} - w.t.of\ the\ paper\ with\ the\ sample\ after\ extraction}{weight\ of\ original\ sample} * 100$

$= \frac{2.5-2.3}{1.5} * 100$

$= 13.3\%$