Methods for measuring water holding capacity (WHC) of meat

Water Holding Capacity

o In muscle, water present as 3 forms:

         i. Bound water

         ii. Immobilized water

         iii. Free water

o Water is lost after slaughter in the form of **drip** while the carcass is still in the chilling room.

o Water loss also occurs during the **cooking** and **processing** of meat

Methods to Measure Water-holding Capacity

o The measurement of WHC usually involves **the application of force to measure the water released**.

1. **Natural** through gravimetric means

2. **External** force as pressure, through
   ✓ Centrifugation,
   ✓ compression, or
   ✓ taking advantage of capillary action

Methods Natural (no external force applying)

1. Drip loss

o The evaluation of drip loss is vitally important

✓ An economic problem due to the loss of weight, accumulation of fluid around the meat at the point of sale causing rejection by consumers.

✓ Effects the color, tenderness and loss of some nutrients.

o Meat weight losses is range from 1- 3%, and can be up to 10% in PSE products.

1. Bag method

1. 20 g of muscle samples are collected, weighed individually and recorded as initial weight (W1).

2. After weighing, samples are put in polyethylene bags then vacuum packaged and **<u>stored</u>** in a 4ºC chiller.

3. After the completion of designated aging period, samples are removed from the polyethylene bags, blotted gently to dry, reweighed and recorded as W2.

4. The percentage drip loss isestimated using the following formula:

$$\text{Drip loss (\%)} = [(W1 - W2) \div W1] \times 100$$

Where:

W1 = initial sample weight at d 0

W2 = sample weight after storage.

Figure Image of the gravimetric method for measuring drip loss, involving suspension of a meat sample in an inflated bag and storage at 2–4 °C for 1–2 days.

2. Drip Tube (EZ- Drip Loss method) has been developed as a simplified, convenient, and **standardized** variation of the procedure.

1. A 25-mm slice is removed at a right angle to the muscle fiber direction.
2. The sample is immediately cut using a **25-mm cork borer** in the fiber direction. It is then placed in a special pre-weighed container equipped with a cover to avoid evaporation and loss of meat juice.
3. The container is stored for 24 h at 4–6 °C, and then the meat is removed and weighed from the container and carefully dried with absorbent paper and weighed.
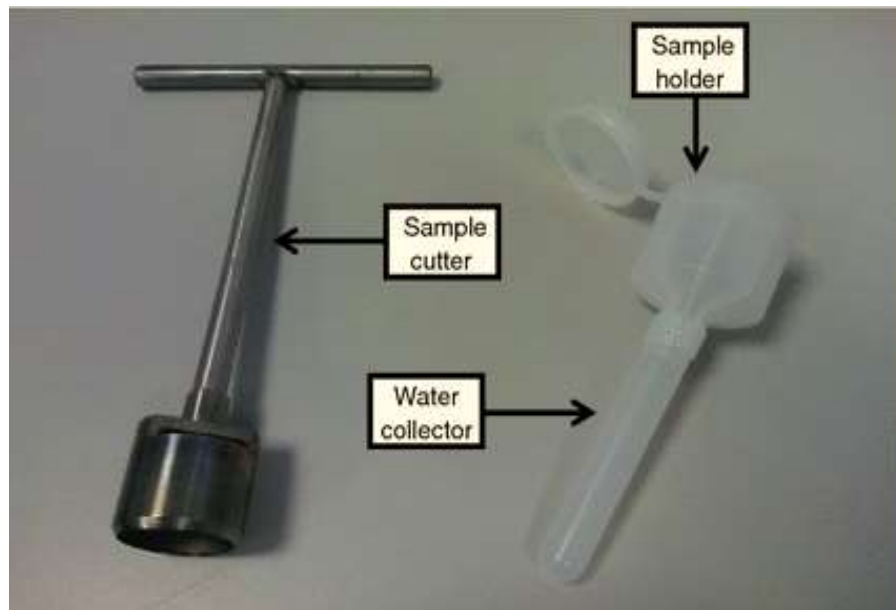
3. Weep or purge: it is defined as water lost from meat or muscle during storage, in trays (overwrap or modified atmosphere packs) on retail shelves.

1. The meat is weighed before being placed in the bag or tray,
2. At the end of the storage, meat is weighed again once the bag is opened or the packaging is removed,.
3. This is a method that can be used when the meat is stored in a retail-ready tray.

Methods applying using mechanical pressure (External force)

1- Centrifugation methods

A. High-speed centrifugation:
1. This involves subjecting samples of 1–20 g to centrifugal forces of 6000–40000g for 30 min .
2. Water release is determined by weighing the water or the sample before and after centrifugation.
3. the results obtained are influenced by the texture of the meat.

B. Low-speed centrifugation:
1. This method involves subjecting 3–15 g samples at 200–5000g for 30 min (or even longer) and measuring the weight loss of the sample or weight of the exuded fluid.

2- Filter Paper Press Method or Compression

1. Approximately 3 g of meat is weighed and placed on a previous dry and weighed filter-paper with two thin plastic films.

2. After weighing the meat sample, the filter-paper and plastic film with meat sample were placed between plastic plates

3. Loads of 1.5 kg, 2.0 kg, 2.5 kg, 3.0 kg, and 3.5 kg were applied for 5 min using dumbbell weights

4. The released water is absorbed by the filter paper and the amount of water released is either measured
   A. Directly by weighing the filter paper

$$RW\% = \frac{(\text{Damp filter-paper and plastic films weight}) - (\text{Filter-paper and plastic films weight})}{\text{Meat sample weight}} \times 100$$

   A. Indirectly as the area of the ring of expressed juice

$$H_2O \ (mg) = \frac{\text{wet area (cm}^2)}{0.0948} - 8.0$$

$$H_2O \ (\%) = \frac{H_2O \ (mg)}{300 \ (mg)} \times 100\%$$

(A)

(B)

(C)

3. Cooking loss

o A mixture of water and soluble substances lost from the meat during cooking.

o Product weight losses is range from 10- 30%, and can be up to 50% in PSE products.

1. Samples of meat are weighed (W1), placed in polyethylene bags and vacuum packed.
2. The samples are cooked in a pre-heated water bath set at 80 °C for 10 min once the internal temperature of the samples is reached 78 °C as monitored using a stabbing temperature probe.
3. After removal of the cooked samples from the water bath and subsequent cooling to room temperature, the samples are blotted gently dry and reweighed (W2).
4. The percentage of cooking loss is estimated using the following formula:

Cooking loss (%) = [(W1- W2) ÷ W1] × 100

Where:

W1= initial sample weight before cooking
W2= sample weight after cooking.