What is water-holding capacity (WHC) and why should I care?

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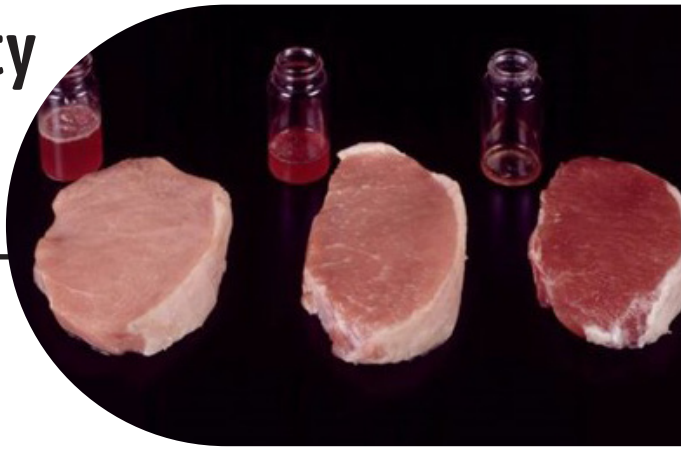


Meat contains approximately the following proportion of water, protein, and fat depending on the muscle and other factors. On average meat contains:

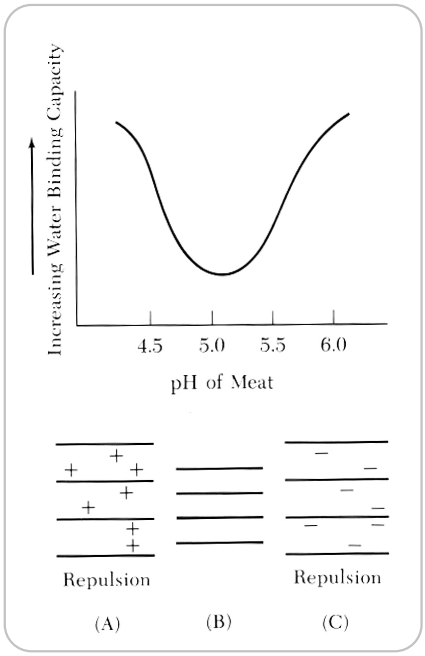
- 75% water
- 20% protein
- 5% fat

Of the water found in meat, it is found in the following states of containment:

- ~5% of water is chemically bound to proteins in the meat and is not able to exit the meat even under cooking or freezing conditions.
- ~15-17% is immobilized water. It is trapped inside the muscle between various protein structures.
- ~80% is free water. This is water that is only bound by capillary or water tension forces but has no physical binding to anything in the meat and freely exits the meat. Think about the drop of liquid that remains at the end of your straw when you

Making room.

- *Just like cleaning out a closet or the garage, to hold more water, we must make room for it.*
- *So how do we make more room for water in something as small as a muscle cell?*
  - It is called the net charge effect. Think about a magnet that has a + end and a – end.
  - We know that the + and – are attracted to each other, but that if we try to put the – of one magnet with the – end of another magnet, they will repel each other.
  - In meat the pH of the meat determines how many + and – charges we will have in the meat. At a pH of about 5.1 we have an equal number of + and – charges.
  - A normal pH of meat is about 5.6, with a range of about 5.0 to 6.0.
  - As the pH of meat rises above 5.1, there are more and more – charges.
  - The further away from the pH of 5.1, the more – charges that are present.
  - This creates repulsion as the pH rises just like the magnets and creates more room.
  - The higher the pH of the meat, the more water that it will hold.



Relationship between pH and charges The higher the pH, the more like charges.

Price and margin

- *We sell meat based on weight at the:*
  - Carcass
  - Large or wholesale cut
  - Retail cut
  - Cooked product
- Whenever we lose weight we must increase the price per pound to account for the loss of weight from water loss.
- For example: We pay $10/pound for a wholesale cut of meat that the packer said weighed 50 pounds ($500). There is 5% purge loss in the vacuum package which means that we only have 95% of that cut to turn around and cut into smaller pieces for retail sales. So instead of having 50 pounds to sell, we now have 47.5 pounds to sell. If we sold our new cuts at $10/pound, we would be losing $25.00. To calculate our new break even price we would simply take:

$$\frac{\$10.00}{\$0.95} = \$10.53/\text{pound}$$

OR

$$\frac{\$500.00}{\$47.50} = \$10.53/\text{pound}$$

THE MEAT LOCKER
BY AMERICAN MEAT SCIENCE ASSOCIATION

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Yield

Every step in the process of storing meat from the time that the carcass rolls into the cooler is a potential loss of weight:

- *Cooler storage of the carcass*
  - Cooler shrink (loss of carcass weight from evaporation of water from the carcass in the cooler) 1 to 5 % in the first 48 hours.
  - The longer that we store the carcass, the more moisture that will be lost.
- *Packaging of meat cuts*
  - In the U.S. most large meat cuts are vacuum-packaged.
  - Purge or moisture leaking from the meat during vacuum-packaged storage – 5 to 10% weight loss.
  - A small percentage of cuts are dry-aged or stored without packaging – 25 to 30% weight loss.
- *Re-packaging of meat cuts*
  - Most cuts of meat in stores in the U.S. are cut in individual-sized portions and then put in a package that will feed anywhere from 2 to 6 people.
  - Most of these packages are susceptible to purge losses and even contain an absorbent pad to soak up the purge.
- *Cooking*
  - The process of cooking changes the texture of the meat and opens up many of the places where water was trapped and allow it to escape.
  - ~20 to 25% cook loss.
  - 5 to 10% loss. Most times the consumer realizes this loss.

What is pH?

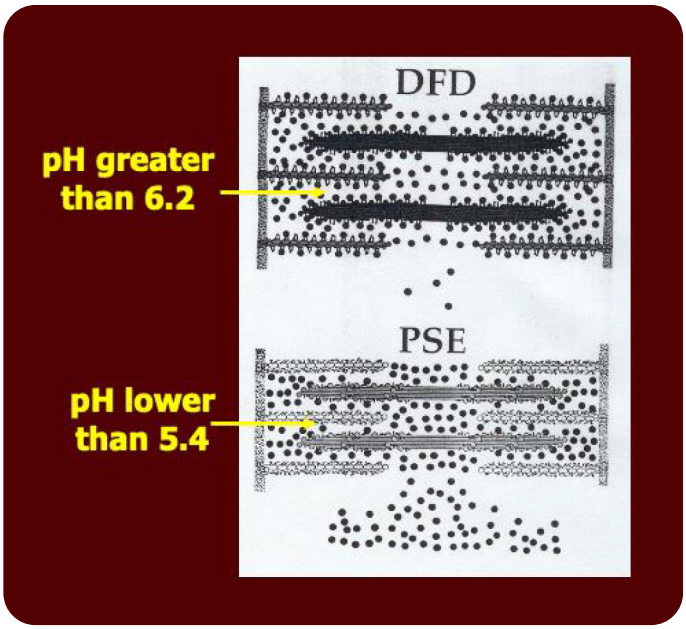
It is the relative concentration of hydrogen ions present in given conditions. This figure shows the relative concentration, the pH, and examples of products found with a given pH.

More alkaline

Concentration of Hydrogen ions compared to distillled water

More acidic

Hydrogen ions	pH	Examples of products and their respective pH
1/10,000,000	14	Liquid drain cleaner, Caustic soda
1/1,000,000	13	Bleach, Oven Cleaner
1/100,000	12	Soapy water
1/10,000	11	Household ammonia (11.9)
1/1,000	10	Milk of magnesia (10.5)
1/100	9	Toothpaste (9.9)
1/10	8	Baking soda (8.4), Seawater, Eggs
0	7	Pure water (7.0)
10	6	Urine (6.0), Milk (6.5), **DFD Meat (6.0)**
100	5	Black coffee (5.0), **Meat (5.1-5.7)**
1,000	4	Tomato Juice (4.1)
10,000	3	Grapefruit and Orange Juice, Soft drink
100,000	2	Lemon Juice (2.3), Vinegar (2.9)
1,000,000	1	Hydrochloric acid from stomach lining (1.0
10,000,000	0	Battery acid



Depiction of the interior of meat at different internal pH measurements. Lower pH results in less 'room' inside the muscle for water.