“Brining And Brine Curing A Whole Muscle Meat”

For years, brine-soaking whole-muscle meats to preserve them was just about the only method used by home hobbyists. Often their centers would begin to spoil before the salt-cure penetrated the meat sufficiently, especially if the cut contained a bone. Worse, the unquestionable barriers of skin and fat allow only slow penetration of the curing agent. For smaller cuts of meat, simple brine soaking arguably may be sufficient and remains a widely used practice today by hobbyists. However, in curing larger hams or cuts of meat, the curing brine must be forced or injected into the cells of the meat to provide complete penetration within the short time allotted before spoilage occurs. Traditionally this has been done by curing solution being introduced through the main artery of a leg or ham and this “nature's pipeline” literally distributes curing pickle to every cell including bone marrow. Perhaps you’ve purchased a brine injector having two different needles. The one with a slanted, sharpened end is the one to use for injecting an artery. The needle is usually 5-3/8 inches in length, 3/16 of an inch in diameter, and is made of chrome-plated brass.

Don’t confuse arteries (carrying blood to the animal's cells) with veins, which return blood to the heart. Pumping a vein will simply not work as it collapses the vein and will not carry the brine solution. How will you know the difference? Veins are larger than and not as flexible as arteries. Because an artery is sometimes hard to locate after an animal has been butchered, and since time equals money in a commercial operation, these days most often a curing solution is injected quickly into the flesh using a gang of smaller needles. A variety of "stitch pumping" gang needles are available to commercial processors, but generally, we home hobbyists are “stuck” (no pun intended) with the second type “perforated” single needle that comes with your brine injector. It is usually 5-1/2 inches long, 3/16 of an inch in diameter, and contains a dozen perforations. This needle is withdrawn slowly as the cure is distributed throughout the meat. Care must be taken not to "overpump" the meat as it may become mushy since salt removes some protein. For this reason, only six to twelve percent of the meat’s weight is injected and then it is left to soak in the remaining refrigerated brine. Recipe instructions usually carefully indicate the exact amount of brine to be used and the recommended amount of time for soaking. Anyone can "give a piggy a shot" and injection pumping a ham before soaking, is by far, preferred over simple brine soaking alone. Weighing brine cure is simple. Simply move the decimal point left one place as you weigh the meat. This gives you the 10% brine weight. If the item contains a shank or bone, be sure to inject sufficient cure along the bone.

Let’s take a look at how we make a “boiled ham”. Generally, only hams of 14 pounds or less are selected for this type of water-cooked ham. Following the curing process, the ham is smoked then prep-cooked in water until the IMT (internal meat temperature) reaches about 150° F. (66°C.) before it is finally baked and served. This “preparatory cooking” ensures protection against all sorts of pathogenic bacteria as well as microbial parasites such as trichinella spiralis. “Boiled Ham” is by far, the most common type of ham made worldwide. But “boiled ham” is never boiled. Preparatory cooking in heated water has undoubtedly given this ham its name. Please note that a water temperature of only 170°F. (77°C.) is required to safely prep-cook the ham by reaching 150°F.(66°C.) IMT. (Water boils at 212° (100° C.).

Making A Brining Solution Using Salt

(1.) How much brine is needed?

We must consider three separate qualities in the brine we are about to make. First, the volume of liquid must be determined. Second, we must note the strength of the nitrite “pickup” in parts per million.

Third, the amount of salt in the pickling solution will partially determine how quickly the pork will turn to ham.

Begin making a brine-curing solution by determining how much water is going to be needed. The liquid must cover the meat yet it is important to use a container that is not too large. The size and shape of the container should definitely be taken into account in order to use a minimum volume of brine. When the volume has been determined, the weight of that volume will be used in a formula to determine the salinity strength of the liquid. There's a simple ol' timer's adage that reads, "The amount (weight) of brine should equal about forty or fifty percent of the weight of the meat being cured". In other words, you don't need a barrel-full of brining cure to baptize one duck! Simply use enough brine to equal forty percent of the duck's weight. I like to get a "ballpark" figure by placing the ham into the receptacle used for brining and cover it with cold water with just a little to spare. This gives me 100%. It's simple to divide it in half and weigh it. Once this volume of water is determined, it is weighed to use the sum in a mathematical formula.

Remember to pat the ham completely dry and place it back into the refrigerator. And remember to record both the volume and weight of the water in your notes. For reference, one U.S. gallon weighs 8.33 lbs.

Let's say you wanted to cure 20 pounds and 12 ounces of ham using enough brine to equal 40% of the weight of the meat. (20 pounds and 12 ounces is 20.75 lbs.). Twenty and three quarters pounds multiplied by .40 is 8.3 pounds. That is how many pounds of water you'll need. That happens to be the weight of one gallon of water. That means if you cure ten pounds of ham, you'll only need half a gallon of water, which weighs 4.1 pounds. If one gallon of water weighs 8.33 pounds, then we can simply divide 5.6 by 8.33 to get .67 or simply gallons of water.

Remember, we're just measuring an "adequate" amount of liquid at this point. A rough estimate. I like to use 50% of the weight of the meat being cured for a formula because it makes the math easier! For instance, if I am going to brine 14 pounds of meat, I know I'll have to use 7 pounds of water – or just a little less than a gallon. The amount of brine is wholly determined by your own judgment. We'll determine the amount of salinity later. Right now be concerned with making enough brine to cover the meat.

Now, test yourself! You'd like to brine a ten pound ham and you've found a snug container for the brine, so you've decided to use 0.40% of the weight of the meat. How much water will you need? Grab a pencil and figure it out. Next compare your math with mine. Ten pounds of ham multiplied by 0.40 equals 4 pounds. That's the weight of half-a-gallon of water.

<u>(2.) How much cure #1 is needed?</u>

How strong must the curing capability be? Note that for immersion, pumped, or massaged products, the legal maximum in-going nitrite limit is 200 part per million. (In comminuted sausage, the legal maximum is only 156 ppm.) In a brine-cure, 200 ppm pickup is achieved when 4.2 ounces of Cure #1 is added to ONE GALLON of water. In other words, to achieve 200 parts per million, 8.33 pounds of water (1 gallon) must contain 4.2 ounces (120 grams) of Cure #1. This is much more cure than is added to comminuted sausage simply because after the sodium nitrite has worked its magic, the remaining brine is poured down the drain. This is not done in comminuted sausage where the nitrite remains in the sausage until it has been completely reduced to nitric oxide. Note the volume amount in 4.2 ounces is 20 teaspoons or a little more than 6 tablespoonsful!

In our recipe for brine-curing a ten pound ham, we need to use ½ gallon (0.5 gallons) of water, so we must multiply 120 (grams) by .5 which gives us 60 grams – the total amount of Cure #1 needed in half a gallon of water to cure our ten-pound ham at 200 parts per million sodium nitrite.

(3.) How much salinity is recommended?

There is no all-inclusive, all-purpose brine. A solution's strength is entirely up to the sausage maker. However, there are some practical applications with the use of salt and many recommended strengths have been made by experienced sausage makers for a variety of reasons. For instance, it has been found that generally, poultry is best when brined in a solution of only 21° to 25° SAL. On the other end of the scale, fish are usually brined in a solution of 70° to 80° SAL. What about pork and beef? Anywhere from about 40° to 70° SAL is effective. A brine of 40°SAL is most popular because the formula is so simple to remember (one pound of salt to one gallon of water). If you are racing the clock to cure a ham before it begins to sour, a brine of 75° SAL is not out of the question. All things considered, a stronger brine may be used for a shorter period of time, while a weaker brine takes longer to effect the same result. Why do we bother to measure the strength of the brine each time we make it? In a nutshell… consistency! We like to be able to predict the outcome and be sure of its unvarying success time after time.

If you study the brining tables, you'll see that the first column designates Salinometer Degrees in which water is measured from a point containing no salt whatsoever, to a point where it becomes totally "saturated" and cannot dissolve more added salt. The scale is divided into 100 degrees for convenience. Note that 14°SAL is the strength of seawater, while 100° represents saturated salt water brine. The second column indicates the percentage of salt by weight in the solution, while the third column specifies the number of pounds of salt (per gallon of water) needed to attain that particular degree of brine strength. It is this third column you'll need to use to determine just how much salt (by weight) must be added to make the brine strength of your choice, indicated in the first column.

Let's make a 40°SAL brine-cure solution for our ten-pound ham. That's a lighter-end brine strength for pork and should require only about five day's brining time to pickup 200 parts per million sodium nitrite providing we inject it also. Begin by looking in the left column of the brining chart (below) to find 40°SAL. In the third column we find that it corresponds with .98 (one pound) of salt for ONE GALLON of water. One pound equals 453.5 grams. We've already determined that our 10-pound ham needs 0.5 gallons of ice water, so we'll multiply 453.5 grams by .5 to get 226.75 grams needed for a half-gallon of water. This is 8 ounces (½ lb.) of salt. However, at this point, it becomes necessary to take into consideration, the salt content in the Prague Powder Cure #1. As we are adding 60 grams of Cure #1 to the brine, we must deduct that amount from the weight of the kosher salt we are about to add. With this adjustment, we are ready to proceed. Here's the recipe:

Hobble Creek Hog Leg
Brining Cure For 14 lbs. Of Boiled Ham
(also posted separately)

- 1/2 gallons ice water (32°F.)
- 60 grams Cure #1 (also called Prague Powder #1, Instacure #1 or "pink salt" #1)
- 226.7 grams (1/2 pound) of salt (not iodized)
- 2/3 cup powdered dextrose

Make the brine by adding the Cure #1 and the salt to the icewater and stirring it until the salt becomes dissolved. Many people have attempted to cure a ham by simply soaking it in salt brine before it spoils.

The truth is that in using brine soaking only, the cure will not penetrate the innermost flesh, bone, and marrow of the leg, by the time it begins to spoil. - the very reason we must render a little assistance with a brining needle and give the piggy a shot in several places. You may find a large hypodermic called a "brining needle" in your kitchen supply store or at your favorite sausage supply store. We are going to inject 10% of the meat's weight in brine so the next step is to weigh out 1 pound of brine. That's 453.5 grams (16 ounces) of solution. Pour it into a plastic cup and weigh it. Next, inject it in several places throughout the entire ham, but only into meaty muscle. Don't worry about injecting the fat as it cannot be cured using sodium nitrite. Having injected the ham, submerge it in the remaining brine, (called a "pickle"), for 4 to 5 days at near as 38° F. as possible. Longer brining will produce a more salty product. This step removes the threat of some notoriously dreadful bugs including such micro-organisms as clostridium botulinum, campylobacter jejuni, escherichia coli O157:H7, listeria, cyclospora cayetanensis, staphylococcus aureus, clostridium perfringens, and three pathogens in particular responsible for 1,500 deaths annually - salmonella, listeria monocytogenes, and toxoplasma. Following a week's brining, the ham should be ready to cook. Generally, this type of ham is not smoked. However, it is your choice and may be done at this point. DO NOT soak the ham in fresh water before smoking or cooking it. Simply rinse it off, pat it dry, and begin smoking it (if desired) by preheating your smoker to 140° F. and introducing smoke for several hours.

Immediately following this step, place the ham into a suitable cooking utensil whereby it may be covered with 170° water and maintained at that temperature until the internal meat temperature reaches 150°F. Again, most hams of this type are never smoked. Lots of people mistakenly believe that smoking a ham cures it. Smoking meat absolutely does NOT cure it. This "preparatory" cooking is part of the curing process, and may take some time. Be patient and don't try to rush the cooking. Use a probe type thermometer with a timing alarm to alert you when the meat has cooked. Note that as the temperature surpasses 138°F. (59°C.), any possibly existing trichinella spiralis are destroyed. At 150°F. (66°C.), the ham becomes fully "prep cooked" and the threat of "crypto" has been removed. Next, cool the ham with cold running water, pat it dry, and then refrigerate it until it is finally cooked by any number of means to a finishing-serving temperature of 160° F.

Most people would be astonished if they realized how easy it is to actually re-introduce staphyloccous aureus at this point, having destroyed any trace of it previously by the cooking-curing step. Unfortunately, when re-introduced, staph may develop toxins which are not destroyed by further cooking! Ouch! So, if you smoke the ham, please get it into a refrigerator as soon afterward as possible until you reheat it for serving. Use sterile plastic gloves to handle it, and make sure the shelves in your smoker are clean too, or simply hang it while smoking. Remember, in order to smoke the ham, it must be dry to the touch. Use your smokehouse to maintain the ham's IMT at 140°F., the upper edge of the bacterial "danger zone".

When preparing the ham for dinner, please note that the FSIS suggests using a minimum 325°F. oven and serving it when the IMT reaches 160°F. For a moister ham, some folks even re-introduce it into boiling water before serving it. Of course microwaves or countertop appliances may be used as well. This ham is actually best having rested a couple of days. Be sure to wrap the ham tightly in butcher paper and keep it refrigerated. As this is a fully-cooked and cured product, it is perfectly safe to slice cold for sandwiches.

What about sweetener? In ham, it's just like my banjo pickin' - a little goes a long way! Powdered dextrose is only 70% as sweet as sugar but it forces itself into meat cells more readily. If you don't have it on hand, dissolve regular sugar into the brine. Technically, adding sugar will increase the strength of

the brine. Many people say that it “counteracts” the harshness of salt, but I disagree. I believe it simply “balances” flavors. Please make your first ham simply as possible, using a minimum of added sweetener, without additional flavorings or seasonings. Don’t expect it to be as strongly-flavored as “country ham”. The pros simply do not add a variety of other flavoring ingredients to “boiled ham”. The taste of properly cured ham is exquisite. The two most common mistakes by beginners are over-spicing and overcooking good ham.

Salinity Tables Posted Separately