SKILL GUIDE · WATER & FOOD

Food Preservation: Canning, Dehydrating & Smoking

The Water & Food chapter's Tier 3 names canning, dehydrating, smoking, and root cellaring in one line each. This guide is the real how-to, and just as important, the real safety line. Most of the skills on this site fail loudly: a bad water filter tastes off, a weak knot slips. Food preservation is different. Done wrong, it can produce food that looks, smells, and tastes completely normal while containing a toxin that's fatal in a taste. That's why this guide leads with what actually destroys the risk, not just what tradition says worked.

The core rule: acid decides the method

Clostridium botulinum, the bacteria behind botulism, forms hardy spores that survive ordinary boiling. In an acidic environment, pH below 4.6, those spores can't germinate or produce toxin, so a boiling-water bath (212°F) is genuinely sufficient. In a low-acid environment, pH above 4.6, boiling isn't enough: the spores survive, then germinate and produce toxin inside the sealed, oxygen-free jar while it sits on your shelf, with no visible sign anything is wrong.

Food category	Examples	Safe method
High-acid (pH below 4.6)	Most fruit, jam, jelly, and anything properly acidified with vinegar (pickles, salsa made to a tested recipe)	Water-bath canning (boiling water, 212°F) is sufficient
Low-acid (pH above 4.6)	Vegetables, meat, poultry, seafood, beans, soups and stews, and any mixed dish containing them	Pressure canning only (240°F+); a water-bath canner cannot reach a safe temperature for these

WARNING

This isn't a theoretical risk: a real outbreak from exactly this mistake

At a 2015 Ohio church potluck, potato salad made with home-canned potatoes, a low-acid food processed in a water-bath canner rather than a pressure canner, sickened 29 of the 77 attendees with botulism; one person died. The jars looked, smelled, and tasted normal. This is the specific, documented failure mode the acid/method table above exists to prevent, not a hypothetical.

Altitude changes the numbers

Water boils below 212°F above 1,000 feet of elevation, which means both canning methods need adjusting the higher you are, not just a mountain-specific concern. Most of the Wasatch Front sits well above that threshold.

Altitude	Water-bath: add to processing time	Pressure canning: increase pressure by
1,001–3,000 ft	+5 minutes	+2 lbs (dial gauge) or use 10 lb weight (weighted gauge)
3,001–6,000 ft	+10 minutes	+3 lbs (dial gauge) or use 15 lb weight (weighted gauge)
6,001–8,000 ft	+15 minutes	+4 lbs (dial gauge) or use 15 lb weight (weighted gauge)
8,001–10,000 ft	+20 minutes	+5 lbs (dial gauge) or use 15 lb weight (weighted gauge)

Pressure canning compensates with more pressure rather than more time, since a pressure canner can reach a higher temperature than boiling water can. A dial-gauge canner adjusts in small pound increments; a weighted-gauge canner jumps between fixed weights, so round up to the next available weight rather than under-adjusting. Look up your specific elevation, not just a rough guess, before your first canning session; a NOAA or county extension elevation lookup takes a minute.

The equipment itself, plainly identified

Equipment	What it actually is
Water-bath canner	A large pot, deep enough to submerge filled jars under at least 1–2 inches of boiling water, with a rack in the bottom so jars don't sit directly on the hot metal
Pressure canner	A heavy pot with a locking lid and a pressure gauge, built to reach higher-than-boiling temperatures under pressure. Not the same as a stovetop pressure cooker unless it's specifically rated large enough and approved for home canning
Dial gauge	A numbered pressure dial on the canner's lid; needs to be tested for accuracy once a year (free at most county extension offices, including USU county offices), and replaced if it reads more than 2 lbs off
Weighted gauge	A small weight that sits on a vent pipe and rocks or jiggles at set pressures (usually 5, 10, and 15 lbs); self-verifying by the way it moves, so it never needs separate accuracy testing
Food dehydrator	An electric appliance with stacked trays and a fan that circulates warm air; a home oven set to its lowest temperature with the door propped open is a real, if less efficient, substitute

Filling and processing a jar: the physical steps the tables above assume

Knowing the right acid category, time, and pressure doesn't help if the jar itself isn't filled correctly first.

- **Leave the headspace a tested recipe specifies**, typically ¼ inch for jams and jellies, ½ inch for most fruits and tomatoes, and 1 inch for low-acid vegetables and meats. Too little headspace can force food out and break the seal during processing; too much can leave too little vacuum to seal at all.
- **Remove trapped air bubbles** by sliding a non-metallic spatula or bubble-remover tool down between the food and the jar wall, working it around the full circumference. Trapped air that isn't released can cause liquid loss and a false or weak seal.
- **Wipe the jar rim clean** with a damp paper towel or cloth before adding the lid. A single bit of food residue, even one you can't easily see, on the sealing surface is enough to prevent a real seal from forming.
- **Center the lid and apply the band fingertip-tight**, not cranked down as hard as possible. Air needs a path to escape the jar during processing; a band tightened too hard traps it and can also prevent a proper seal.

Pressure canning: don't skip the venting step

Before starting the timer on a pressure-canning load, vent steam continuously for a full **10 minutes**, letting a steady column of steam escape before closing the petcock or adding the weight. This purges the air that's still trapped inside the canner alongside the steam. Skipping it is one of the most common, least visible mistakes in home pressure canning: a canner with trapped air can still show full pressure on the gauge, but the actual temperature inside runs lower than that pressure reading implies, which means low-acid food can come out under-processed with no way to tell just by looking at it.

Cooling and checking the seal

Once processing time is up, let a pressure canner depressurize and cool on its own; don't run water over it or force the vent open early; either one can cause liquid loss from the jars or damage the canner. Once jars come out (water-bath or pressure), set them undisturbed on a towel or cooling rack for 12 to 24 hours before touching the lids.

After that wait, check each seal: press the center of the lid. A sealed lid stays down and doesn't flex. A lid that pops back up when pressed, or a jar that sounds dull rather than ringing clearly when tapped with a spoon, didn't seal. An unsealed jar isn't a failure to panic over, just refrigerate it and eat the contents within a few days, or reprocess it within 24 hours using a new lid and the full original processing time.

A worked example, so you know what a real tested recipe looks like

Pressure-canned green beans process for 20 minutes (pints) or 25 minutes (quarts) at 10 lbs of pressure on a weighted gauge, before any altitude adjustment. A real, tested recipe always gives you a specific time *and* a specific pressure or method together, like that; if a recipe only gives you one of the two, or neither, it isn't a tested recipe and shouldn't be trusted for a low-acid food.

Safe dehydrating: the preheat step most instructions skip

Jerky is dehydrated meat, not a separate process: the same moisture-removal mechanism that preserves dried fruit or vegetables applies here, historically with salt or a marinade and sometimes light smoking added for flavor and shelf life. What's genuinely different is the risk profile, which is exactly why it gets its own callout below rather than folding silently into the general dehydrating steps.

A food dehydrator's typical drying temperature, 130–140°F, is fast enough to dry meat before it spoils but not hot enough on its own to reliably kill bacteria like *Salmonella* and *E. coli* O157:H7, the actual cause of most homemade-jerky illness outbreaks. The USDA's fix is a step most dehydrator manuals never mention: heat meat to **160°F** and poultry to **165°F** with moist heat (simmering the meat, or steaming/roasting it) before it goes into the dehydrator. That single step kills what the drying temperature alone won't, and the rest of the process, drying at 130–140°F until fully dry, proceeds the same way afterward.

Vegetables carry a lower risk profile but still benefit from a quick blanch (a brief boil or steam) before drying: it stops enzyme activity that would otherwise continue degrading flavor, color, and nutrients in storage, not primarily a pathogen-kill step the way meat preheating is.

"Dried enough" is a real endpoint, not a guess: fruit should be leathery and pliable with no pocket of moisture when torn open, most vegetables should be brittle enough to shatter rather than bend, and jerky should bend and crack without fully snapping in half. Once a batch looks done, condition it before final packaging: pack it loosely into a jar for 7 to 10 days, shaking it once a day. If condensation shows up on the inside of the glass, moisture is still redistributing from wetter to drier pieces, and the batch needs more drying time before it goes into long-term storage. Package fully conditioned, dried food out of light and air, canning jars or this site's own Mylar-and-oxygen-absorber method, not a loose bag that lets moisture back in.

Smoking and curing: real technique, real dose

Hot smoking, cooking meat through at a safe internal temperature while adding smoke flavor, carries roughly the same risk profile as any other cooking method: get the internal temperature right and it's safe.

That means checking with a calibrated digital probe thermometer inserted into the thickest part of the meat itself, not trusting a smoker's built-in lid gauge, which reads chamber air temperature, not the meat's. The real targets: poultry to 165°F, ground meats to 160°F, and whole-muscle cuts (a roast, steaks, a whole chicken breast) to at least 145°F held for a 3-minute rest before cutting or serving. Cold smoking is different and genuinely riskier: it holds meat in the 40–100°F range for extended periods, exactly the conditions *C. botulinum* favors, without ever cooking it through.

Curing salt (often labeled Cure #1, containing sodium nitrite) is what actually makes cold-smoked and cured meat safe, not the smoke itself: at roughly **0.25% of the meat's weight**, it doesn't kill spores, but it disables their ability to germinate and produce toxin for about 30 days under refrigeration-range cold-smoking conditions. This is a real dose, not a pinch-to-taste ingredient; measure it by weight against a tested recipe, never estimate it, since both too little (spores survive) and too much (nitrite toxicity) are real failure modes in the wrong direction.

What Works, What's Questionable, What Doesn't (Avoid)

Home food preservation carries more folklore than almost any other skill in this book, plenty of it from people who did it that way for years without incident. Surviving isn't the same as safe: *C. botulinum* contamination is rare per jar, which is exactly why an unsafe method can seem to "work" for years before it doesn't. Here's what the actual research and regulatory guidance (USDA, the National Center for Home Food Preservation, and state extension services) supports.

Works: methods backed by real research and testing

- **Water-bath canning** for genuinely high-acid foods, following a tested recipe's exact processing time, adjusted for your altitude.
- **Pressure canning** for low-acid foods, following a tested recipe's exact time and pressure, adjusted for your altitude, with a canner whose gauge has been checked for accuracy (most county extension offices test dial gauges for free).
- **Dehydrating**, meat and poultry preheated to 160–165°F before drying, vegetables blanched first, everything dried to a low enough moisture content to actually stop microbial growth.
- **Cold-smoking and curing with a properly measured nitrite cure**, following a tested recipe's exact dose and time, not a family tradition without a known dose.
- **Root cellaring** and **freezing**, both well-understood, low-risk methods when held at correct temperature and humidity for the specific food.

Questionable: real techniques, but with real caveats

- **Home freeze-drying.** A real, effective method, but the "25-year shelf life" claim you'll see marketed is validated for commercial, industrially packaged freeze-dried food, not necessarily a home unit's output. Realistic figures for home freeze-dried food in typical home packaging run closer to 1–15 years depending heavily on the packaging quality and storage conditions; treat the 25-year number as a commercial-product claim, not a guarantee for your own batches.
- **Cold smoking without a precisely measured cure.** The technique itself is real and long-established, but it's genuinely more dangerous than hot smoking or straightforward canning, and it's not the place to estimate rather than measure. If you're not confident in the exact dose and timing, hot-smoke instead, or cure first using a tested recipe before cold-smoking.

WARNING

Doesn't work / avoid entirely

- **Open-kettle canning** (cooking food in an open pot, then filling and sealing jars without a separate processing step). Filling the jar reintroduces spores from the air and equipment; only an actual timed processing step reliably kills them.
- **Oven canning.** Dry oven heat never reliably reaches the food's interior fast enough, doesn't destroy *C. botulinum* spores in either high- or low-acid foods, and can shatter jars not designed for dry heat.
- **"Dry canning"** of dry goods, flour, rice, sugar, dried beans, heated in jars in an oven. This isn't canning at all: residual moisture in the dry food migrates and condenses inside the jar, creating exactly the conditions mold and bacteria need, while the jar never achieves a genuine vacuum seal. For long-term dry storage, use this site's own Mylar-and-oxygen-absorber method instead.
- **Inversion (upside-down) cooling** as a substitute for real processing. Flipping a hot-filled jar upside down to cool can make the lid pop the way a real seal does, but the contents were never actually processed at a safe temperature; the seal is cosmetic, not sterilizing.
- **Paraffin (wax) sealing** for jams and jellies, once standard, discontinued for a real reason: wax develops microcracks as it cools, and testing found significantly higher mold contamination compared to a proper vacuum-sealed jar.
- **Reusing single-use canning lids.** The sealing compound is designed to compress once; a used lid's compound is already indented and won't reliably form an airtight seal a second time, and boiling a used lid doesn't restore it.
- **An untested family recipe, or a tested recipe with unlisted substitutions.** Processing times are calculated for a specific density, acidity, and jar size. Adding extra low-acid ingredients (onion, garlic, extra vegetables) to a recipe that wasn't tested with them, using a bigger jar than specified, or skipping a step "because Grandma always did" can silently invalidate a safe

processing time. Follow a current NCHFP or extension-tested recipe exactly, or don't assume the result is safe.

Sources

- National Center for Home Food Preservation (NCHFP), equipment and methods not recommended: NCHFP
- CDC, home-canned food and botulism prevention: CDC
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- Altitude adjustments for water-bath and pressure canning: SDSU Extension; Colorado State University
- USDA jerky preheating guidance (160°F meat / 165°F poultry before dehydrating): USDA FSIS
- Jar headspace, air-bubble removal, and rim-wiping technique: NCHFP
- Pressure canner venting/exhausting requirement: Iowa State Extension
- Cooling jars and testing jar seals: NCHFP
- Pressure canner dial-gauge testing, free at county extension offices: USU Extension
- Hot smoking safe internal temperatures by meat type: USDA FSIS
- Worked example processing time (pressure-canned green beans): SDSU Extension
- Conditioning and packaging dried food: NCHFP
- Cold smoking, botulism risk, and nitrite (Cure #1) dosing and function: AmazingRibs
- Dry canning of dried goods, why it's unsafe: UC Master Food Preservers; Penn State Extension
- Inversion canning, paraffin sealing, and reused-lid safety: Pick Your Own; NDSU Extension
- Home freeze-drying realistic shelf life versus commercial claims: Valley Food Storage