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Preparing Food at High Altitudes

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Preparing foods in the high altitude areas of Oregon can create problems for newcomers, who discover that cakes tend to fall and food takes longer to cook at high elevations. This publication provides guidelines for preparing food at altitudes above 2,000 feet.

What Happens at High Altitudes?

Atmospheric pressure decreases as the altitude increases, with these results:

- Water and other liquids evaporate faster and boil at lower temperatures.
- Leavening gases in breads and cakes expand more.

Cooking Foods in Liquids

Because water boils at a lower temperature, you need to cook foods longer (see table 1).

Vegetables

You need more liquid and a longer cooking time to cook vegetables by boiling.

Thinly slice the vegetables or cut into small pieces to reduce the cooking time.

Frozen vegetables such as whole carrots and beans may require as much as 5 to 12 minutes of additional cooking. For other frozen vegetables, add only 1 to 2 minutes to the cooking time.

For pressure-cooking vegetables, increase the liquid in your cooker by ¼ to ½ cup for every 2 cups of vegetables, depending on the length of cooking time. Small or thinly sliced vegetables may cook almost as rapidly as they would at sea level using 15 pounds pressure. With asparagus, celery, turnips, cauliflower, and some leafy greens, you'll get better results using 10 pounds pressure and a slightly longer cooking time. Whole potatoes, beets, yams, and beans need considerably more cooking time than at sea level.

Table 1. Boiling temperatures of water

Altitude (ft)	*Boiling point (°F)*
0 (Sea Level)	212.0
1,000	210.0
2,000	208.2
3,000	206.2
4,000	204.4
5,000	202.6

Soups

Since liquids boil at a lower temperature, soups need longer cooking periods above 2,500 feet.

Eggs

Cooks must do their own testing with soft- or hard-cooked eggs to obtain the desired results. "Three-minute" eggs may take up to 5 or 6 minutes. Use a saucepan with a tight-fitting lid and enough water for the longer cooking time.

Meats

To simmer or braise meats at higher altitudes, add up to one-fourth of the usual cooking time. Roasted and baked meats require no adjustments. Meats pressure-cooked at 10 pounds pressure have less shrinkage than those cooked at 15 pounds pressure.

Deep-Fat Frying

At high altitude, the lower boiling point of the water in foods requires lowering the temperature of the fat. This adjustment will prevent overbrowning the surface of the food and undercooking the inside.

The decrease in temperature varies according to the food fried, but a general guideline is to lower the frying temperature about 3 degrees Fahrenheit for each elevation increase of 1,000 feet.

Sea level temperatures for deep-fat frying are:

Chicken.....350°F
Doughnuts, fish, seafood.....350°F to 375°F
Cauliflower, eggplant, onions.....375°F
French-fried potatoes.....385°F to 395°F

For example, at 3,000 feet chicken should be fried at 341°F instead of 350°F (350°F - 9°F [3°F for each 1,000 feet]).

Surface Cooking

At high altitudes, you need to lower the temperature setting for surface unit cooking. For example, use medium-low heat instead of medium or medium-high when you fry meat to prevent it from burning.

With electric skillets, you may need to use a lower temperature than that given in the instruction book.

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Baked Foods

Cakes

In commercial cake mixes the amount of leavening cannot be reduced, so adjustments usually include adding all-purpose flour, liquid, and possibly an egg yolk. Most cake mix boxes provide suggestions for high-altitude adjustments.

At elevations up to 3,000 feet, you will not need to modify your recipes for homemade cake. Above 3,000 feet the decrease in atmospheric pressure can cause excessive rising, which results in a coarse texture caused by a stretched cell structure. Cakes may also fall because of broken cells. Increasing the baking temperature by 15 to 25 degrees Fahrenheit will help "set" the batter before cells formed by the leavening gas expand too much.

Often it is necessary to adjust the amounts of certain ingredients. Experiment with each recipe to discover the most successful proportion to use.

Decreasing the amount of leavening, reducing sugar, and increasing liquids in the recipe help compensate for the weakened cell structure. Try the smaller adjustment first—it may be all that is needed (see table 2 below).

For very rich cakes, reduce the fat by 1 to 2 tablespoons per cup, since fat weakens the cell structure. Eggs, in contrast, strengthen cell structure, and the addition of an egg may prevent a rich cake from falling.

For angel food and sponge cakes, egg whites should be beaten just until soft peaks are formed. The cell structure of foam-type cakes can also be strengthened by using less sugar and more flour, and by baking at a higher temperature.

Table 2. Cake recipe adjustments

	Elevation (ft)	
Adjustment	3,000	5,000
Baking powder		
For each teaspoon, decrease	1/8 tsp	1/8 - 1/4 tsp
Sugar		
For each cup, decrease	0-1 tbsp	0-2 tbsp
Liquid		
For each cup, add	1-2 tbsp	2-4 tbsp

Cookies

You can often improve recipes by making the following slight adjustments:

- Increase baking temperature
- Decrease baking powder or soda
- Decrease fat and sugar
- Increase liquid ingredients and flour

Many cookie recipes already contain a higher proportion of sugar and fat than is necessary.

Quick Breads

The cell structure of quick breads can vary from muffin-like to cake-like. The structure of many quick breads is firm enough to withstand the increase in internal pressure at high altitudes. However, a slight decrease (up to one-fourth the required amount) in the baking soda or baking powder usually will improve the results. You may need slightly more liquid if the bread seems to dry excessively in baking.

For cake-like quick breads, follow the recommended adjustments for cakes.

Biscuits

Add 1 tablespoon of milk for each cup of flour to improve the quality of biscuits.

Doughnuts

No adjustment is needed for yeast-based doughnuts. For doughnut recipes with baking powder or soda, reduce the amount of leavening by one-fourth.

Pies

Because of the greater evaporation at high altitudes, the addition of a small amount of liquid to the dough may give better results.

Yeast Breads

Yeast doughs rise in a shorter time at high altitudes. Dough reaches its maximum height and stops for a short period before reaching its breaking point and falling. Since good flavor in bread partially depends on the length of the rising period, it is a good idea to punch the dough down twice to give the flavor time to develop. The dough should be punched down as soon as it remains dented when pressed with a finger.

Candy and Frostings

The end-point temperature for all frostings and candies must be lowered from sea level requirements. The rapid loss of water at high altitudes causes these mixtures to become too concentrated. Depending on the type of sugar mixture being cooked, the results may be sugary or hard.

Use the thermometer test to determine temperature adjustments. Measure the boiling temperature of water. Subtract this number from 212°F. The difference should be subtracted from the required sea-level temperature. For example: 212°F - 206°F = 6°F. See table 3 at the top of the next page.

Table 3. Adjustments for candy and frosting preparation

Product	Cold water test*	Altitude (ft) 0 (sea level)	2,000	3,000	4,000	5,000
Creamy candies and filling	Soft ball	234-240°F	230-236°F	228-234°F	226-232°F	224-230°F
Chewy candies (caramels)	Firm ball	242-248°F	238-244°F	236-242°F	234-240°F	232-238°F
Pulled candies, divinity, fillings and frostings with egg whites	Hard ball	250-268°F	246-264°F	244-262°F	242-260°F	240-258°F
Taffies, butterscotch	Soft crack	270-290°F	266-286°F	264-284°F	262-282°F	260-280°F
Brittles	Hard crack	300-310°F	296-306°F	294-304°F	292-302°F	290-300°F

* Drop about 1/2 teaspoon of boiling syrup into 1 cup of cold water and test firmness of mass with fingers. Soft crack separates into hard but not brittle threads. Hard crack separates into hard and brittle threads.

Table 4. Boiling-water canner processing time adjustments

At these altitudes	If 20 minutes or less, add	If over 20 minutes, add
1,000 ft	1 minute	2 minutes
2,000 ft	2 minutes	4 minutes
3,000 ft	3 minutes	6 minutes
4,000 ft	4 minutes	8 minutes
5,000 ft	5 minutes	10 minutes

Food Preservation

Be sure to make adjustments for altitude when you are canning to ensure the safety of your product.

Boiling-Water Canner

High-acid foods such as fruits, pickled vegetables, and tomatoes may be canned safely in a boiling water canner. Increase the processing time 1 minute for each 1,000 feet above sea level if the processing time is 20 minutes or less; increase the time by 2 minutes per 1,000 feet if the processing time is more than 20 minutes (see table 4).

Canning in a Pressure Canner

At altitudes above sea level, it takes more than 11 pounds pressure to reach 240 degrees F. If you live at an altitude of 2,000 feet and have a pressure canner with a dial gauge, process low-acid foods (vegetables, meat, poultry, fish) at 12 pounds pressure. At 4,000 feet, use 13 pounds pressure; and at 6,000 feet, use 14 pounds pressure. Do not adjust the processing time.

If your pressure canner has a weighted gauge, use 15 pounds pressure rather than 10.

Pressure saucepans are no longer recommended for use in canning. Be sure to have the dial gauge of your pressure canner checked for accuracy each year. This is especially critical when using the canner at high altitudes.

Blanching Before Freezing or Drying

For steam-blanching above 2,000 feet, add 1 minute to the specified time for each 1,000 feet. When blanching by boiling, add 30 seconds per 1,000 feet.

Jelly Making

A jelly, candy, or deep fat thermometer is helpful for making good jelly. Lower the final end point temperature by about 2 degrees Fahrenheit for each 1,000 feet in elevation. Or determine the boiling point of water at your altitude and cook the jelly mixture to a temperature 8 degrees Fahrenheit higher than the boiling point of the water. If you live at an altitude over 3,500 feet, use the sheet test to determine that the jelly has reached an appropriate end point.

For the sheet test, dip a cold metal spoon in the boiling jelly mixture. Then raise it at least a foot above the kettle, out of the steam, and turn the spoon so the syrup runs off the side. If the syrup forms two drops that flow together and fall off the spoon as one sheet, the jelly should be done.

Table 5. Selected Oregon cities and towns with elevations over 2,000 feet

Location	Elevation (ft)	Location	Elevation (ft)
Adrian	2,220	Lakeview	4,800
Antelope	2,631	LaPine	4,233
Baker City	3,449	Long Creek	3,754
Bend	3,623	Lostine	3,200
Bonanza	4,200	Madras	2,242
Burns	4,148	Malin	4,058
Butte Falls	2,535	Merrill	4,064
Canyon City	3,194	Metolius	2,530
Chiloquin	4,200	Mitchell	2,777
Condon	2,844	Monument	2,000
Cove	2,893	Mt. Vernon	2,871
Culver	2,633	North Powder	3,256
Dayville	2,348	Nyssa	2,178
Elgin	2,670	Ontario	2,154
Enterprise	3,757	Paisley	4,369
Fossil	2,654	Prairie City	3,539
Grass Valley	2,269	Prineville	2,868
Haines	3,333	Redmond	2,996
Halfway	2,663	Richland	2,213
Hines	4,155	Seneca	4,666
Huntington	2,113	Sisters	3,182
Imbler	2,732	Summerville	2,705
Island City	2,743	Sumpter	4,388
John Day	3,083	Ukiah	3,347
Jordan Valley	4,389	Union	2,789
Joseph	4,191	Unity	4,029
Klamath Falls	4,105	Vale	2,243
La Grande	2,788	Wallowa	2,923

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