

Lesson Plan Overview for 2011 – 2012 NATURE Sunday Academy Program

Project Title

Food Safety and Food Science: Method to preserve fruit using traditional and modern jam/jelly making.

Project Objectives

1. To understand the cultural aspect of preserving prairie fruits using traditional Native American preservation methods.
2. To understand the scientific basis for preserving fruits using modern preservation methods such as jam and jelly production.
3. To make jam and jelly using various formulations and methods.
4. To explore how food is kept safe through preservation
5. To increase student knowledge of how to conduct research in the food safety field.

North Dakota Science Content and Achievement Standards Met

- 9-10.1.1 Explain how models can be used to illustrate scientific principles
- 9-10.2.2. Use appropriate safety equipment and precautions during investigations
- 9-10.2.3 Identify questions and concepts that guide scientific investigations
- 9-10.2.6. Design and conduct a guided investigation
- 9-10.2.8. Analyze data found in tables, charts, and graphs to formulate conclusions
- 9.10.7.2 Identify factors that affect populations (e.g. food webs, carrying capacity, overpopulation, disease, food supply, algal blooms, resources, conservation practices)
- 9-10.8.5. Explain how views and attitudes have influenced the development of science (e.g., religion, previous knowledge, cultural tradition, superstition, folklore, legends)

Introduction

Preservation is done during periods of abundance with the intent that the product will be available at a later date. Preservation is any method that converts useable commodity or product into a finished product. The raw material must be of high quality because preservation does not improve the quality of poor quality raw materials. The preserved food remains safe because harmful organisms are usually killed during processing or cannot grow in the preserved food.

Session Organization

- 11:00-11:30 General organization/Cultural connection
- 11:30-12:00 Background about preservation methods and jam and jelly production
- 12:00-12:45 Lunch
- 12:45-2:00 “Hands-on” activity: jam and jelly production
- 2:00-2:30 “Hands-on” activity: evaluation of molds on various jams and jellies
- 2:30-3:00 Wrap-up and Evaluation

Activity I

Students will work in groups to make jams and jellies using various fruit and fruit juices. If available, traditional Native American fruits or juices will be used. Student will prepare jams and jellies following typical high sugar formula, and a low sugar formula. The production of freezer/refrigerated jams and jellies will also be made.

Activity II

Student will be provided Petri dishes containing jellies spiked with mold. The students will view the Petri dishes and determine if the ingredient used in the formula affect the shelf stability of the prepared jellies.

Food Safety and Food Science: Method to preserve fruit using traditional and modern jam/jelly making.

Rotating Activity

Deland Myers Sr. and Clifford Hall (NDSU)

Mafany Mongoh (Sitting Bull College)

Jim Helphrey (New Town High School/FBCC)

Cultural Activity

Traditional Native American jam and jelly making

Note: This activity will be completed by the Cultural Leader at Each Academy Location

Food Safety and Food Science:

Method to preserve fruit using traditional and modern jam/jelly making.

Project Description

Preservation is done during periods of abundance with the intent that the product will be available at a later date. Preservation is any method that converts useable commodity or product into a finished product. The raw material must be of high quality because preservation does not improve the quality of poor quality raw materials. The preserved food remains safe because harmful organisms are usually killed during processing or cannot grow in the preserved food. Native Americans preserved foods using different methods such as drying and smoking. Fruits were preserved through a method that resulted in a dried fruit paste that was rehydrated prior to consumption. Great Plains Native American jelly and jam were called: 1. Canpa - Choke Cherry Jam, 2. Wicagnaska - Current Jelly, 3. Mastinska Tawoyute - Buffalo Berry Jelly and 4. Kanta - Wild Plum Jam. Wojapi (Lakota/Sioux) or Madsu Nakapa (Arikara) are a fruit pudding, Jam, or jelly made from various available fruits. Modern preservation of fruits resembling these traditional products are called jams and jellies. Today you will learn how to make jams and jellies and how ingredients and preparation method impact the safety of these products.

Objectives

1. To make jam and jelly using various formulations and methods.
2. To evaluate the role of chemicals, heat and osmotic inhibition in the preservations of fruits used in jam and jelly making
3. To explore how food is kept safe through preservation
4. To increase student knowledge of how to conduct research in the food safety field.

Outcome

1. To understand the cultural aspect of preserving prairie fruits using traditional Native American preservation methods.
2. To understand the scientific basis for preserving fruits using modern preservation methods such as jam and jelly production.
3. To understand how modern preservation methods of berries differ from the traditional methods used.
4. To be aware of local native plant species used in jam making.

Session Organization

11:00-11:30	General organization/Cultural connection
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12:45-2:00	“Hands-on” activity: jam and jelly production
2:00-2:30	“Hands-on” activity: evaluation of molds on various jams and jellies
2:30-3:00	Wrap-up and Evaluation

Introduction

The preservation of the food can be accomplished by using chemical and physical methods. All methods of preservation can be grouped into one of these two methods. Chemical preservation involves the addition of chemical additives in the form of gases, liquids or solids. Physical preservation involves altering the environment in and around the product to inactivate or inhibit the deteriorative concern. Temperature (heat or cold), available moisture content or water activity (a_w), and oxygen content are a few examples of physical properties of a food that can be manipulated.

Sulfur dioxide is a gas that can be used to preserve color of products but yet prevent the growth of microorganisms. Wines are often treated with sulfur dioxide to inhibit bacterial and yeast growth. High fructose corn syrup (liquid) or sugar (solid) at high concentrations can prevent the growth of pathogenic microorganism by reducing a_w . Other chemical activities include a direct effect on the microorganisms. Chemicals such as calcium propionate, which is used in bakery goods, alter cellular function that in turn will kill the microorganism. Some scientists also include a third method, biological, as a means to preserve foods. Although microorganisms can be used to preserve foods through a process defined as fermentation, the preservation action is primarily due to a change in the chemical or physical characteristic of the food. In the activity today, the function of acid, sugar, and heat will be used to preserve fruits (i.e. jams and jellies). The use of osmotic pressure and a_w are two physical parameters that play a significant role in preserving fruits. Furthermore, low oxygen and thermal treatments further enhance the preservative effect of the jam and jelly making process.

Jams and jellies are simply acid gelled fruit spreads made from fruit or fruit juice, pectin and sugar. Failure of a gel to form will occur if one of these components is eliminated. The high level of sugar in jams and jellies is the main reason why these products do not readily spoil. However, in low sugar jams and jellies for the diabetic consumers, chemical additives are typically added to prevent the growth of microorganisms. The acidity of jams and jellies and the thermal treatment used in the production of these products further enhances the preservation. Thus, in the production of traditional jams and jellies the three hurdles for microorganisms to overcome and grow include a_w , pH (acidity) and heat. Successful jam and jelly production does not allow for the growth of microorganisms. If mold is observed on these products, it is best to throw these out because molds can produce toxins that cause illness in people. Therefore, the presence of mold not only indicates spoilage but also a possible food safety risk.

References

Basics of Jam and Jelly making: http://www.uga.edu/nchfp/how/can_07/types_jellied_products.html

The role of ingredients: http://www.uga.edu/nchfp/how/can7_jam_jelly.html

Below, are links for the preparation of wojapi:

<http://www.aihd.ku.edu/recipes/wojapi.html>

<http://www.dlife.com/diabetes/diabetic-recipes/Wojapi/r1371.html>

Activity I

Students will work in groups to make jams and jellies using various fruit and fruit juices. If available, traditional Native American fruits or juices will be used. Students will prepare jams and jellies following a typical high sugar, and a low sugar formula. The production of freezer/refrigerated jams and jellies will also be completed.

Laboratory Exercises

Product 1. Grape Jelly – Typical Product

Materials

- 2 ½ cups prepared grape juice
- ¾ cup water
- ½ Box SURE GEL fruit pectin
- 3 ½ cups sugar, measured into separate bowl

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Measure exactly 2.5 cups prepared juice into 6-quart sauce pan.

Step 3. Stir sugar into juice in a sauce pan. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/4 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 2. Grape Jelly – Typical Product but adjust Ph

Materials

- 2 ½ cups prepared grape juice (pH 5.5 adjusted)
- ¾ cup water
- ½ Box SURE GEL fruit pectin
- 3 ½ cups sugar, measured into separate bowl

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Measure exactly 2.5 cups prepared juice into 6-quart sauce pan. Please note that the juice labeled with pH 5.5 should be used.

Step 3. Stir sugar into juice in a sauce pan. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/4 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 3. Grape Jelly – Low methoxy pectin

Materials

- 2 ½ cups prepared grape juice
- ¾ cup water
- ½ Box Low Methoxy pectin (provided in a premade solution)
- 3 ½ cups sugar, measured into separate bowl

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Measure exactly 2.5 cups prepared juice into 6-quart sauce pan.

Step 3. Stir sugar into juice in a sauce pan. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/4 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 4. Grape Jelly – Low methoxy pectin without sugar

Materials

- 2 ½ cups prepared grape juice
- ¾ cup water

½ Box Low Methoxy pectin (provided in a premade solution with calcium ascorbate added)
Please Note: No sugar in this formula

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Measure exactly 2.5 cups prepared juice into 6-quart sauce pan.

Step 3. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/4 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 5. Strawberry Jam – Typical method

Materials

3 cups prepared strawberries
¾ cup water
1 box SURE JELL
6 cups sugar

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Crush strawberries thoroughly, one layer at a time. Measure exactly 3 cups prepared fruit into 6- or 8-quart saucepot. Stir in water.

Step 3. Stir sugar into juice in sauce pan. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/8 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 6. Strawberry Jam – Splenda method

Materials

- 3 cups prepared strawberries
- ¾ cup water
- 1 box SURE JELL
- 1/2 cup SPLENDA® No Calorie Sweetener, Granular

Method

Step 1. Bring boiling-water canner, half full with water, to simmer (http://www.kraftfoods.com/surejell/sj_secrets_cooked.html). Pour boiling water over flat lids in a saucepan off the heat. Let stand in hot water until ready to use. Drain well before filling.

Step 2. Crush strawberries thoroughly, one layer at a time. Measure exactly 3 cups prepared fruit into 6- or 8-quart saucepot. Stir in water.

Step 3. Stir sugar into juice in sauce pan. Bring mixture to full rolling boil (a boil that doesn't stop bubbling when stirred) on high heat, stirring constantly. Stir in pectin. Return to full rolling boil and boil exactly 1 min., stirring constantly. Remove from heat. Skim off any foam with metal spoon.

Step 4. Ladle immediately into prepared jars, filling to within 1/8 inch of tops. Wipe jar rims and threads. Cover with 2-piece lids. Screw bands tightly. Place jars on elevated rack in canner. Lower rack into canner. (Water must cover jars by 1 to 2 inches. Add boiling water, if necessary.) Cover and bring water to gentle boil. Process 5 min. under boiling conditions.

Step 5. Remove jars and place upright on towel to cool completely. After jars cool, check seals by pressing middle of lid with finger. (If lid springs back, lid is not sealed and refrigeration is necessary.)

Product 7. Freezer of Refrigerator Strawberry Jam (Makes six half-pints) – Please note that you will be able to bring these samples home.

Materials:

- 2 (10-ounce) packages frozen strawberries
- 1 pouch liquid pectin
- 3 ½ cups sugar
- 2 teaspoons lemon juice

Method:

Step 1. Thaw berries completely in a bowl (this will be done prior to activity).

Step 2. Stir in sugar and lemon juice. Be sure the sugar is completely dissolved (warm the berries slightly, if needed).

Step 3. Stir in the pectin very thoroughly (3 minutes of stirring suggested).

Step 4. Pour into jars and cover tightly.

Step 5. Store in the refrigerator in tightly covered jars for a maximum of six weeks.

Activity II

Student will be provided Petri dishes containing jellies spiked with mold. The students will view the Petri dishes and determine if the ingredient used in the formula affect the shelf stability of the prepared jellies.

1. Please remain in your group. No more than 3 people.
2. You will be provided a series of Petri dishes containing jellies made using different methods.
3. Please DO NOT open the Petri dishes. Observe the level of spoilage that exists on the jellies.
4. Spoilage is indicated by the presence of mold (i.e. green, black, or white fuzzy looking material) or small white circular colonies (yeast).
5. Record your observation below and indicate by labeling the treatments with a number indicating the level of spoilage. The number 0 indicates no spoilage, 1 indicates minimal or little spoilage, and 2 indicates a high level of spoilage.

A. Treatment 1 (Product 1 above): _____

B. Treatment 2 (Product 3 above): _____

C. Treatment 3 (Product 4 above): _____

D. Treatment 4 (Product 5 above): _____

E. Treatment 5 (Product 6 above): _____

C. Clean Up

Please wash all utensils and pans with soapy water. Rinse with water. Return all materials to the instructors. Return the Petri dishes to instructors.

Evaluation and Wrap-up

Please answer the following questions:

1. How does modern processing of jams and jellies differ from traditional Native American products?
2. Are jams and jellies the same product? Explain
3. Do the viscosities and texture of the jams and jellies differ? How?
4. Did replacing the sugar with sucralose impact the gel formation?
5. Was there any mold growth on the products in the Petri dishes? If so, which products contained mold?