NACCHO
National Association of County & City Health Officials

Sharing Session Specialized Processes- Fermentation and Curing

April 9, 2019

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Overview

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- Boulder County Curing & Fermenting Review Process
- Fermentation Food Safety
- Q&A Session

Housekeeping Items

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Throughout the presentation and during the discussion and Q&A session, please use the chat box to share your experiences and questions. The facilitator will pose your questions to the presenters.

Housekeeping Items

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A link to the recorded webinar will be emailed to all participants. This recording and past food safety sharing sessions can also be found the NACCHO website:

http://www.naccho.org/programs/environmental-health/hazards/food-safety/

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Zack Lustgarten

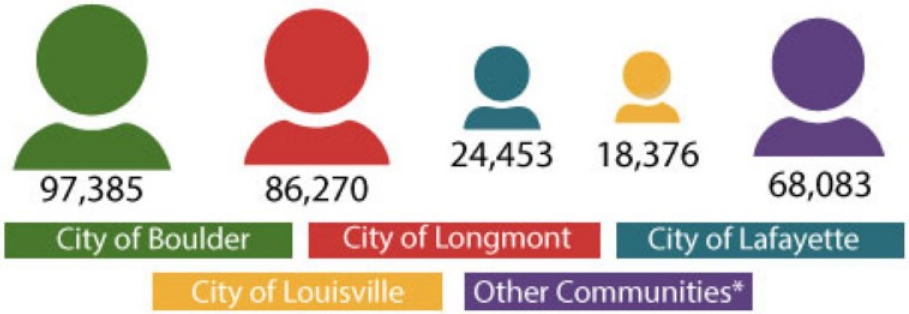
Curing and Fermenting Review Process

Zack Lustgarten, REHS, CP-FS, MS

BOULDER COUNTY
PUBLIC HEALTH
Opportunity for a healthy life.

Boulder County, Colorado

Cities Served



*Includes towns of Erie, Jamestown, Lyons, Nederland, Superior and Ward, and unincorporated areas such as the communities of Allenspark, Eldorado Springs, Gunbarrel and Niwot.

Food Safety Program

Vision

The BCPH Food Safety Program vision is a community free of foodborne illness that is responsible, informed, and partners with our Food Safety Program, a trusted and innovative leader.

Mission

The program mission and goal is to protect, promote, and enhance the health and well-being of the community by preventing foodborne illness.

Food Safety Program

- Plan Reviews
- Inspections
- Complaints and FBI investigations
- HACCP reviews

Specialized Processing

2013 FDA Food Code

- Adopted January 1st, 2019
  - HACCP with Variance now required for specialized processing methods

Steps to Conduct Review

1. Pre-submittal Consultation
2. Application Submission And Validation
3. Letter To State For Final Approval Review
4. On-site Verification

Pre-Submittal Consultation

Commonly Encountered Foods

- **Fermenting**
  - Lactic Acid:
    - Kimchi, Yogurt,, Crème Fraiche, Sauerkraut
  - Alcohol:
    - Kombucha, Kefir
- **Curing**
  - Bacon
- **Combination of Curing And Fermenting**
  - Charcuterie Such As Sausages And Salamis

Commonly Encountered Foods

Colorado-Specific Consideration

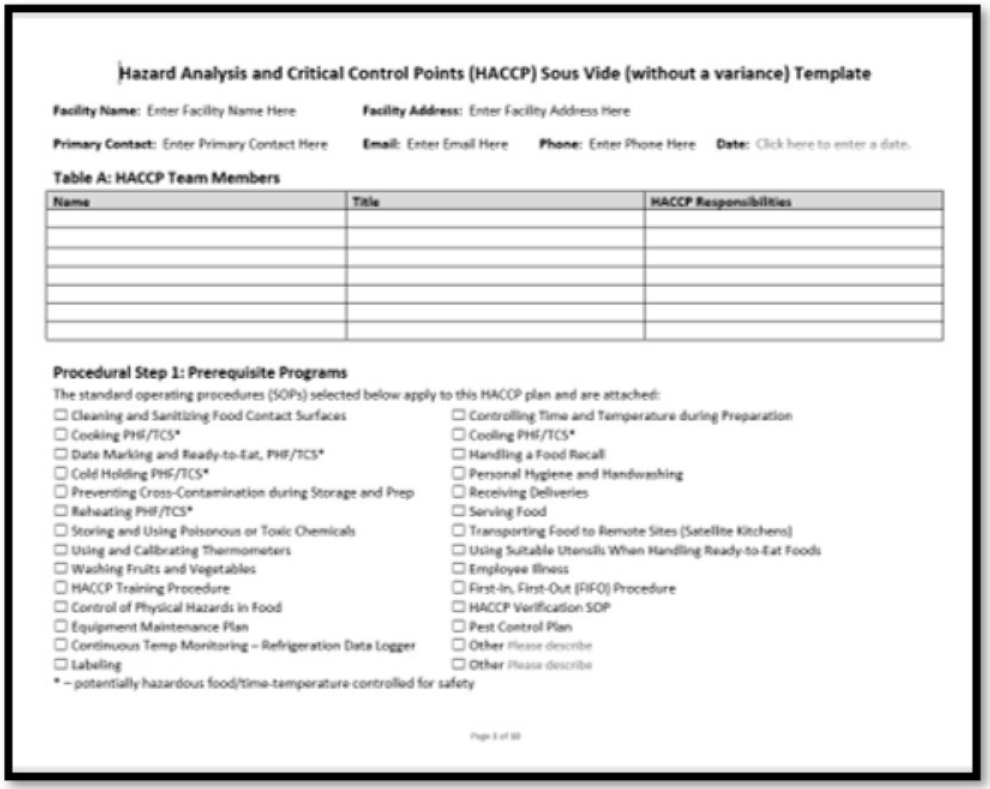
- Statewide Variance for Fermenting
  - Standard Recipe
  - Lab tested final pH >4.2
  - ≤41°F
  - Date marked 7 days

HACCP Application and Validation

Required Materials

- ☐ Hazard analysis description/process
- ☐ HACCP Team members/roles
- ☐ Food flows –critical control points(CCP), critical limits and corrective actions
- ☐ Labeling, shelf life information, date marking
- ☐ Monitoring devices and frequency, including information about continuous temperature monitoring devices
- ☐ Product testing (when required)
- ☐ Equipment information (must be commercial)
- ☐ Standard Recipes
- ☐ Recordkeeping/location
- ☐ Employee training procedures
- ☐ Supporting documents or standard operating procedures (SOPs):
  - ☐ Bare-hand contact on ready-to-eat (RTE) foods
  - ☐ Cross-contamination
  - ☐ Employee illness policy
  - ☐ Logs (cooling, reheat)
  - ☐ Cleaning and sanitizing
  - ☐ Thermometer calibration
  - ☐ pH calibration (when applicable)

Validation



Hazard Analysis and Critical Control Points (HACCP) Sous Vide (without a variance) Template

Facility Name: Enter Facility Name Here **Facility Address:** Enter Facility Address Here

Primary Contact: Enter Primary Contact Here **Email:** Enter Email Here **Phone:** Enter Phone Here **Date:** Click here to enter a date.

Table A: HACCP Team Members

Name	Title	HACCP Responsibilities

Procedural Step 1: Prerequisite Programs

The standard operating procedures (SOPs) selected below apply to this HACCP plan and are attached:

- ☐ Cleaning and Sanitizing Food Contact Surfaces
- ☐ Cooking PHF/TCS*
- ☐ Date Marking and Ready-to-Eat, PHF/TCS*
- ☐ Cold Holding PHF/TCS*
- ☐ Preventing Cross-Contamination during Storage and Prep
- ☐ Reheating PHF/TCS*
- ☐ Storing and Using Poisonous or Toxic Chemicals
- ☐ Using and Calibrating Thermometers
- ☐ Washing Fruits and Vegetables
- ☐ HACCP Training Procedure
- ☐ Control of Physical Hazards in Food
- ☐ Equipment Maintenance Plan
- ☐ Continuous Temp Monitoring – Refrigeration Data Logger
- ☐ Labeling
- ☐ Controlling Time and Temperature during Preparation
- ☐ Cooling PHF/TCS*
- ☐ Handling a Food Recall
- ☐ Personal Hygiene and Handwashing
- ☐ Receiving Deliveries
- ☐ Serving Food
- ☐ Transporting Food to Remote Sites (Satellite Kitchens)
- ☐ Using Suitable Utensils When Handling Ready-to-Eat Foods
- ☐ Employee Illness
- ☐ First-In, First-Out (FIFO) Procedure
- ☐ HACCP Verification SOP
- ☐ Pest Control Plan
- ☐ Other Please describe
- ☐ Other Please describe

* – potentially hazardous food/time-temperature-controlled for safety

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Validation Elements Required (cont'd)

- Introduction
- Flow Chart
- Hazard Analysis
- HACCP Plan
- SOP's
- Training Program
- Records

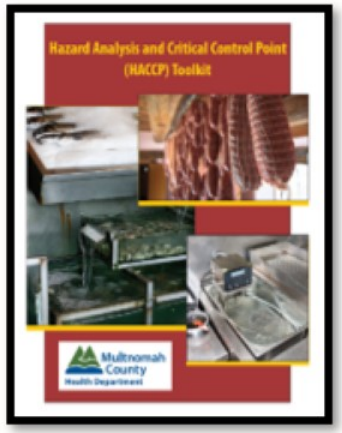
Common Deficiencies

Position Letter

Onsite Verification

Resources

- AFDO HACCP Guide
- FDA Regulator's Manual for HACCP
- BCPH Guides and Templates
- NEHA Courses https://nehahaccp.org/RetailHACCP.php
- Dr. Nummer www.food-safety.guru
- Multnomah County Toolkit https://multco.us/file/39943/download



Thank You

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Dr. Brian Nummer

"From Rot to Religion"

FERMENTATION FOOD SAFETY

GMPs | GFPs | HACCP

Fermented foods (the good)

probiotics

Vitamin and nutrient byproducts
Safe "spoilage"

Intestinal fortitude

Leaky gut concept, biota byproduct concept, antimicrobial concept, fecal transfers (yum), antioxidant concept, more

A "culture" gap

"I know that's how its done, but I am going to do it *my* way"

"It's too acidic, I am changing the recipe"

"Of course the probiotics are alive, why wouldn't they be?"

"I get my culture from my neighbor"

"My _____ cures everything!"

"I am an expert. Foods have spoiled in my restaurant for 20 years"

A “culture” gap

FAIL

Bigger FAIL

EPIC FAIL

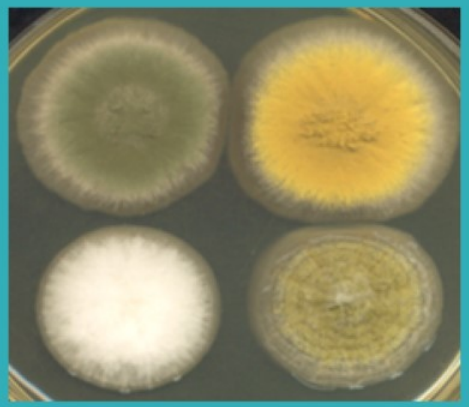
FERMENTATIONS

Lactic Acid
Lactic Acid (+)

Nut cheese
Sauerkraut
(kimchi), meats

Alcohol
Alcohol to acetic acid

Kombucha
(kefir)
(vinegar)



Mold involved

Sake, Tempeh
Blue Cheese

Others

Natto
Fish sauces

FERMENTATION IN RETAIL-FOODSERVICE

Fermentation is a “Special Process”

All special processes require HACCP

GMP = Good manufacturing practices are guidelines for manufacturers

The US FDA model Food Code **prescribes** the required GMPs for retail-foodservice operators

The food code is prescriptive, while GMPs are flexible.

GOOD MANUFACTURING FERMENTATION PRACTICES

HACCP Preliminaries

HACCP Preliminaries

5 Steps to get started  *after GMP/GFPs are met*

01 **Create a HACCP team**

02 **Describe the *fermented* food product and consumer**

03 **List ingredients, packaging, and equipment**

04 **Create/verify a flow diagram**

05 **Consult Regulatory Agency**

DAIRY

- Yogurt
- Cultured milk and butter
  - *Acidophilus milk*
- Kefir (dairy)
- Cheese

YOGURT

Ingredients: 1-gal milk (cream, whole, low fat, or skim)—In general the higher the milk fat level in the yogurt the creamier and smother it will taste. High fat yogurt will not "set".

Nonfat dry milk powder—Use 1 and 1/3-cups when using whole or low fat milk, or use 2 and 2/3-cups powder when using skim milk. The higher the milk solids the firmer the yogurt will be.

Commercial, unflavored, cultured yogurt—Use 1-2 cups. Be sure the product label indicates that it contains a **live** culture. Also note the content of the culture. *L. bulgaricus* and *S. thermophilus* are required in yogurt, but some manufacturers may in addition add *L. acidophilus* and/or *B. bifidum*. The latter two are used for health reasons attributed to these organisms.

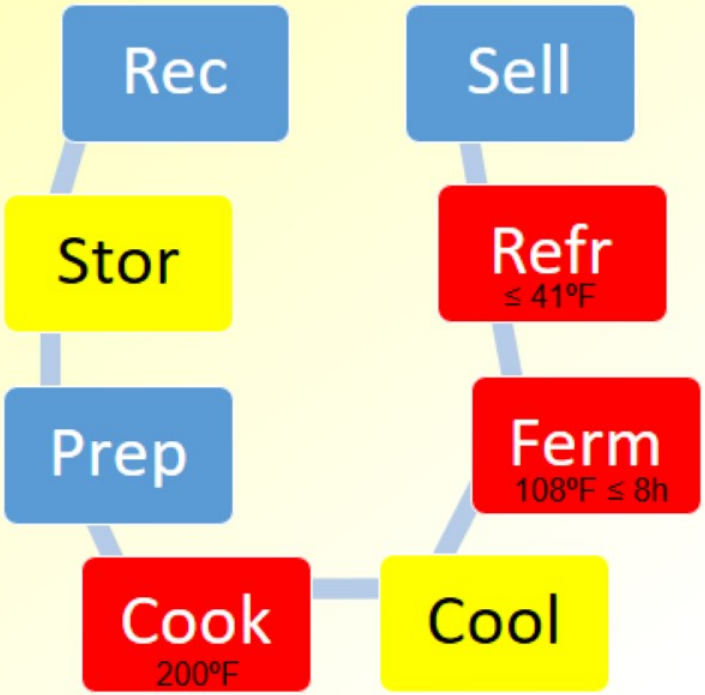
(*Optional*) 2 to 4 tablespoons sugar or honey. (*Optional*) For a thick, firm yogurt swell 1 teaspoon unflavored gelatin in a little milk for 5 minutes. Add this to the milk mixture before cooking.

Process: **Combine ingredients except culture and heat.** Heating the milk is a necessary step to change the milk proteins so that they set together rather than to form curds and whey. ***This heating step will also serve as pasteurization.*** Place cold, pasteurized milk in top of a double boiler and stir in nonfat dry milk powder. Adding non-fat dry milk to heated milk will cause some milk proteins to coagulate and form strings. Add sugar or honey if a sweeter, less tart yogurt is desired. Heat everything to 200°F, stirring gently and (a) hold for 10 minutes for thinner yogurt or (b) hold 20 minutes for thicker yogurt. ***Do not boil.*** Be careful and stir constantly to ***avoid scorching*** if not using a double boiler.

Cool milk rapidly to 112-115°F. Remove one cup of the warm milk and blend it with the yogurt starter culture. Add this to the rest of the warm milk. The temperature of the mixture should now be 108-112°F.

Incubate. Pour immediately into clean and sanitary container(s); cover and place in prepared incubator. Close the incubator and incubate about 4-8 hours at 110°F +/-5°F. Yogurt should set firm when the proper acid level is achieved (~pH 4.6). Incubating yogurt for several hours past the time after the yogurt has set will produce more acidity. This will result in a more tart or acidic flavor and eventually cause the whey to separate. Pour off the whey to obtain "greek style" yogurt.

Refrigerate. Rapid cooling stops the development of acid. Yogurt will keep for about 10-21 days if held in the refrigerator at 41°F or lower.



FRUITS

- *shrubs* Vinegars
- Kombucha (tea)
- Water (fruit) kefir
- Alcoholic

Vinegars

Ingredients:

- Fruit or a starch/sugar source (starches have to be converted to sugars), water, (optional fruit juice and sugar for shrubs)
- Yeast culture (anaerobic alcohol fermentation)
- Acetic acid culture (aerobic oxidation)

Process:

All ingredients are received and stored as needed. Prep will include preparing the sugar source for fermentation. Sometimes the sugar syrup is pasteurized to remove competitive microbes.

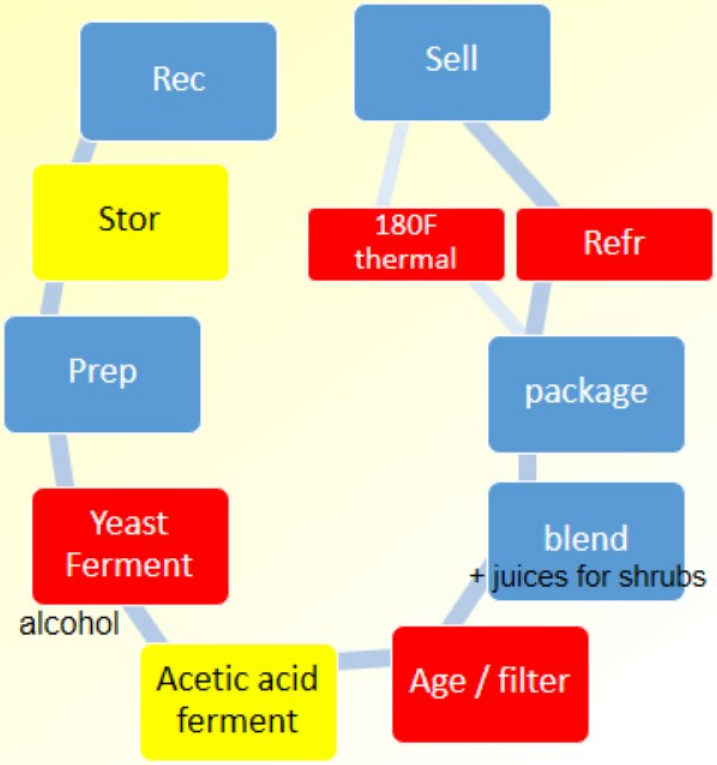
A standard yeast (*Saccharomyces cerevisiae*) fermentation is allowed to work producing alcohol and CO2 from the sugars.

A secondary aerobic oxidation (fermentation) with *Acetobacter aceti* or similar converts the alcohol into gluconic and acetic acids (vinegar).

The vinegar is aged. It can then be filtered before use (optional). Raw vinegar can be blended with flavors (e.g. fruit, sugar, or honey) and water to make a drinkable product.

The product is then packaged. Smaller processors typically use glass jars or bottles.

As an acidified condiment or beverage, this product can be hot filled into bottles for shelf stable sale. Alternatively, it can be left as is and sold as a refrigerated food item.



VEGIES

- Sauerkraut
- Kimchi
- Pickles

fermented versus "fresh pack" brine acidification

- Drinks

the fermented juice of any of the above

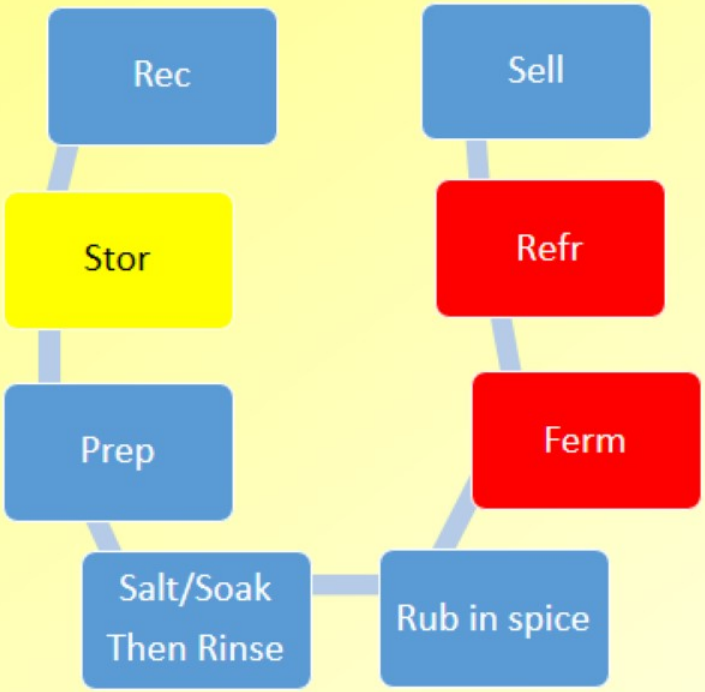
Food Safety GMPs

kimchi

Kimchi in jars

Korea

Kimchi



Ingredients:

Chinese (Napa) cabbage, salt and water. Kimchee may contain radish, green onion, red pepper powder, garlic, and ginger.

Process:

The vegetable ingredients are all received cold and stored cold (refrigerated).

Preparation involves rinsing soils off vegetables and trimming them to desired cuts. A red pepper and salt paste is made.

A short 2-3 h salt soak is used to soften the cabbage leaves in preparation for fermentation. That salt is rinsed off with clean water.

The red pepper paste is then rubbed into the Napa cabbage leaves. Generally, the natural lactic acid bacteria will provide the fermentation.

Ferment. Kimchi is fermented at three different temperatures.

2-5ºC 10-14 days | 5-15ºC 7 days | 15-25ºC 3 days

Refrigerate. Rapid cooling slows the development of acid/fermentation when using the 5-25ºC fermentation temperatures. Because psychrotrophic lactic acid bacteria are present, fermentation will continue under refrigeration. This makes the kimchee shelf life short.

The typical ending pH is 4.3 to 4.5. Highly acidic kimchee is not desired.

STARCHES

- **Miso** — paste (*solids*); soy sauce tamari (*juice extract*)
- **Tofu/Tempeh**
- **Natto**
- **Alcoholic** — beer, sake

Breads

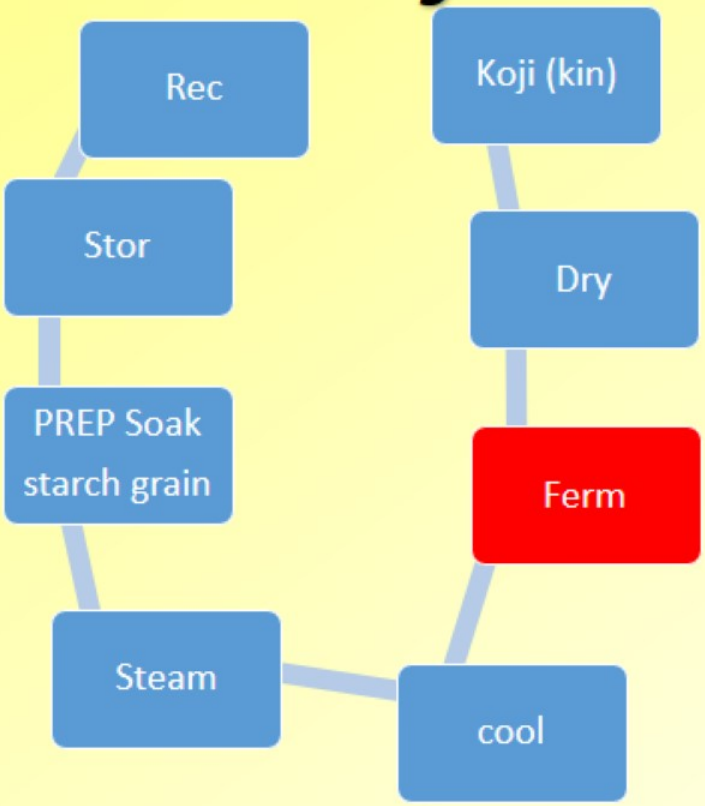
Food Safety GMPs

Koji

Miso

barrel

Koji



Ingredients: A starch source (soybean, barley, rice, wheat, etc) + *Aspergillus oryzae (spores)*

Process: The ingredients are all received dry and stored dry.

Preparation involves soaking the grain(s) to begin softening them.

Steam is used to cook the grains resulting in gelatinization. This is needed to swell the starch grains and release the smaller chains of starch (pectin and amylopectin).

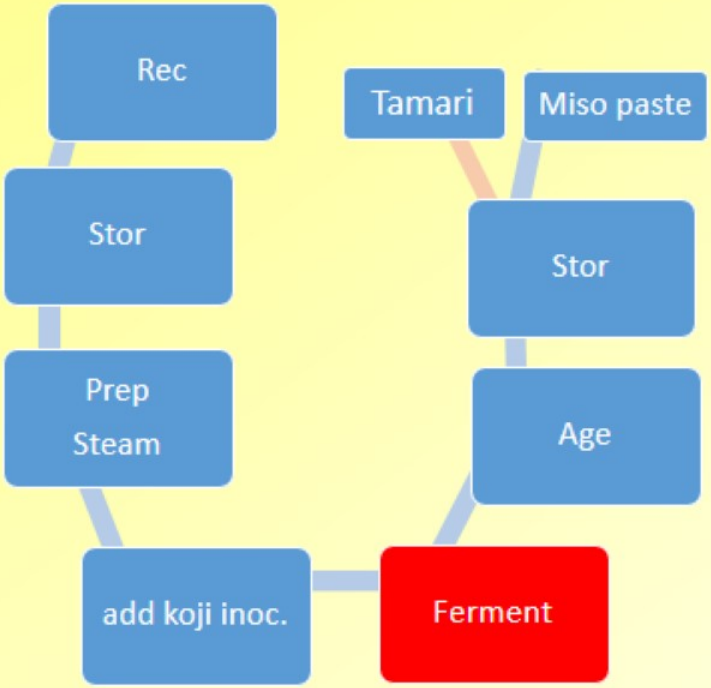
The steamed starch is cooled just to the point not to kill the mold spores.

Ferment. Spores of *Aspergillus oryzae* or koji-kin are sprinkled onto the gelatinized starch. The spores grow to produce a bed of mold usually under high humidity. As the mold grows it produces high levels of amylases and proteinases (the enzymes needed to convert starch into sugars and break down proteins into amino acids).

Protein → amino acids (glutamate)
Glutamate is the umami flavor!

Dry. The mold is allowed to dry out (reduced humidity) on the dried grains. The result is koji, the source of starch and protein degrading enzymes. *When koji is used in product fermentations the enzymes are already present. It is not expected that the koji needs to grow.*

Miso



Ingredients:

Cooked soybeans, salt, water, and koji.

Process:

The dry ingredients are all received dry and stored dry.

Preparation involves cooking soybeans to gelatinize the soybean starches. Salt is added to favor the correct natural fermentations. Koji is added and the paste is held at warm temperatures to encourage enzymatic actions.

Ferment/Age. Koji enzymes break down the soybean proteins, starches, and fats into amino acids, sugars, and fatty acids. Sugars are degraded by bacteria such as *Pediococcus halophilus* and *Lactobacillus delbrueckii*, to form lactic acids (flavor and acidity). Yeasts turn sugars into alcohols for aroma. The proteinases from koji break down amino acids into glutamate (umami). *The longer the aging process the greater the flavor development*.

As fermentation proceeds, liquids can be drained from the miso paste. This is known as *traditional* tamari. Modern tamari and soy sauce are processed derivatives of the natural tamari from miso.

cured, fermented …

MEATS

Dry sausage

USDA: dried to MPR 1.9:1 = shelf stable
Food Code: ≤ 0.85 aW

Semi-dry sausage

USDA: pH ≤ 4.5 & aW ≤ 0.91 = shelf stable
Food Code: ≤ 0.85 aW

- **Italian-type**
- Salami
- Genoa salmi
- Coppa
- Soppreseta
- Toscana
- Pancetta
- Prosciutto
- Pepperoni
- Breseola
- **S. European type**
- Saucisson
- Fuet
- Chorizo
- Soujoul (Turkish)

- **Germanic type**
- Summer sausage
- Thuringer
- Hard salmi
- Cervelat
- Landjager
- Lebanon bologna
- Baquette salami
- Westphalia salami
- Teewurst
- Schlackwurst
- +300-400 more of various recipes

Cured, fermented, Sausage

Ingredients:

Pork, beef, other meats, spices, casings; cure mix (nitrites)

Process:

The ingredients are all received cold and stored cold (refrigerated). Note trichinae concerns for pork and correct nitrite usage concerns.

Preparation involves grinding and blending. Each variety will have a preferred grind coarseness. Metzger's typically add ice during grinding to keep the meat cool. After grinding spices, etc are mixed in. Should have meat out ≤ 2 h until inoculated. Generally, a purchased lactic acid bacterial starter is added to provide the fermentation.

Stuffing sausage into casings follows the grinding and mixing steps.

Ferment. The meat is fermented at approx. 110F (varies) to pH 5.3 to inhibit *S. aureus* (toxin), then to its target product level. Degree hours are used here.

Optionally, some sausages are smoke flavored.

Dry. After fermentation, the cured, fermented sausage is aged until it dries to the desired finished water activity. Many will develop a white mold on the casing (not a concern).

Packaging. Note that the USDA permits (and encourages) vacuum packaging of semi dry fermented sausages, especially those sliced.

USDA performance standards (log reductions of *E. coli* O157, *Salmonella*, and *L. monocytogenes*).

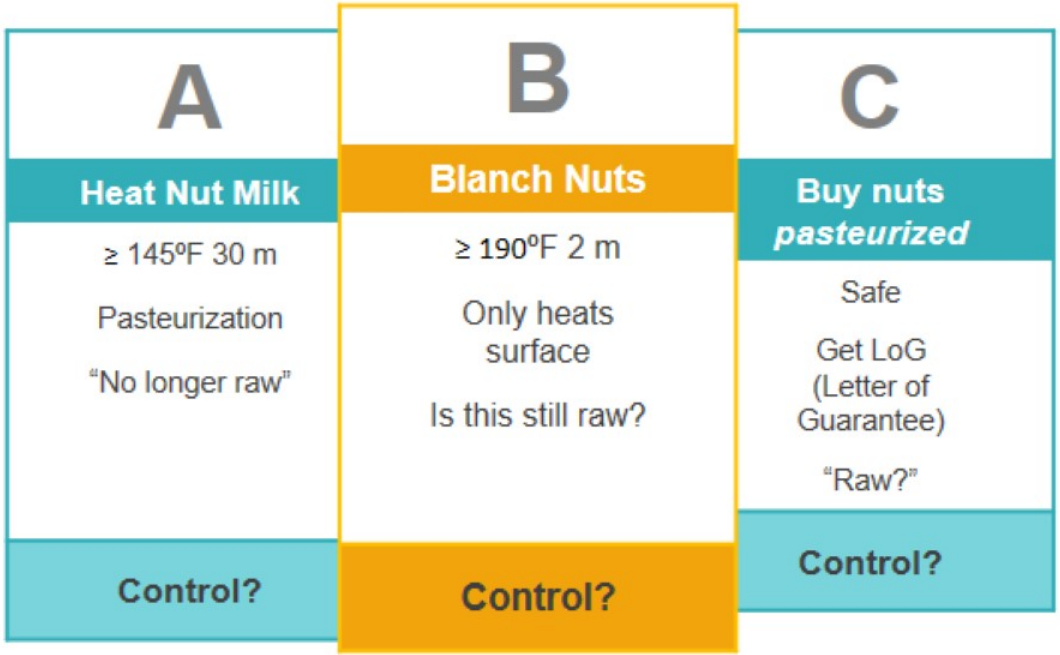
MISC.

- Nut cheeses
- Fish sauces
  - *> 10% salt required ↓ pathogens*
- Black garlic*
  - *not a true fermentation*
- Alcoholic

Food Safety GMPs

Hazards and controls

Salmonella is associated with nuts!



Nut cheese HACCP

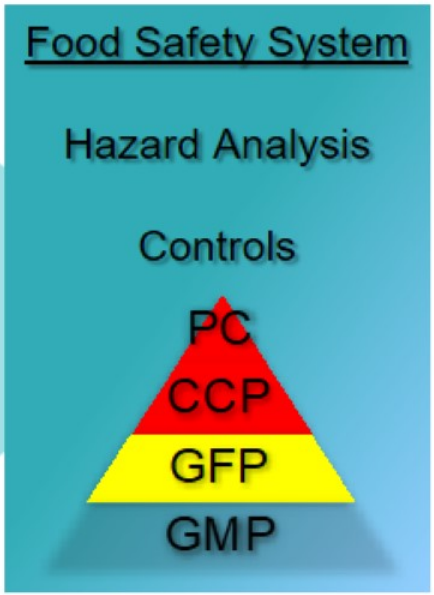
D. Or, wash nuts carefully to **minimize** presence of *Salmonella*. Ferment nut milk to cheese and risk foodborne illness in the same manner as any "fresh" product.

E. Determine if pH and acids reduce *Salmonella* during fermentation or aging (*not researched yet*).


FERMENTATION
HACCP

HA+CCP

7 STEPS (Principles)

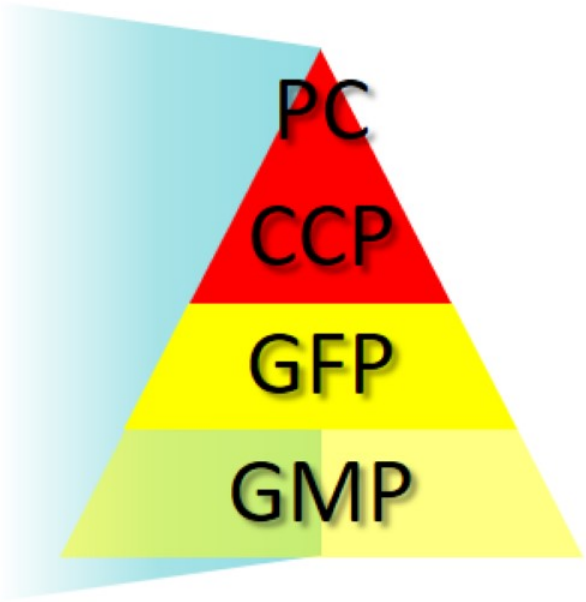


PC = supplier, allergen, or sanitation control

HACCP

7 STEPS (Principles)

02 IDENTIFY CONTROLS



Preventive Controls
Critical Control Points
Good Fermentation Practices
Good Manufacturing Practices (21 CFR 117)

Significance

If a significant hazard requires control –*at this step*-- (otherwise foodborne illness is possible) a CCP or PC control is required.

Micro Hazards

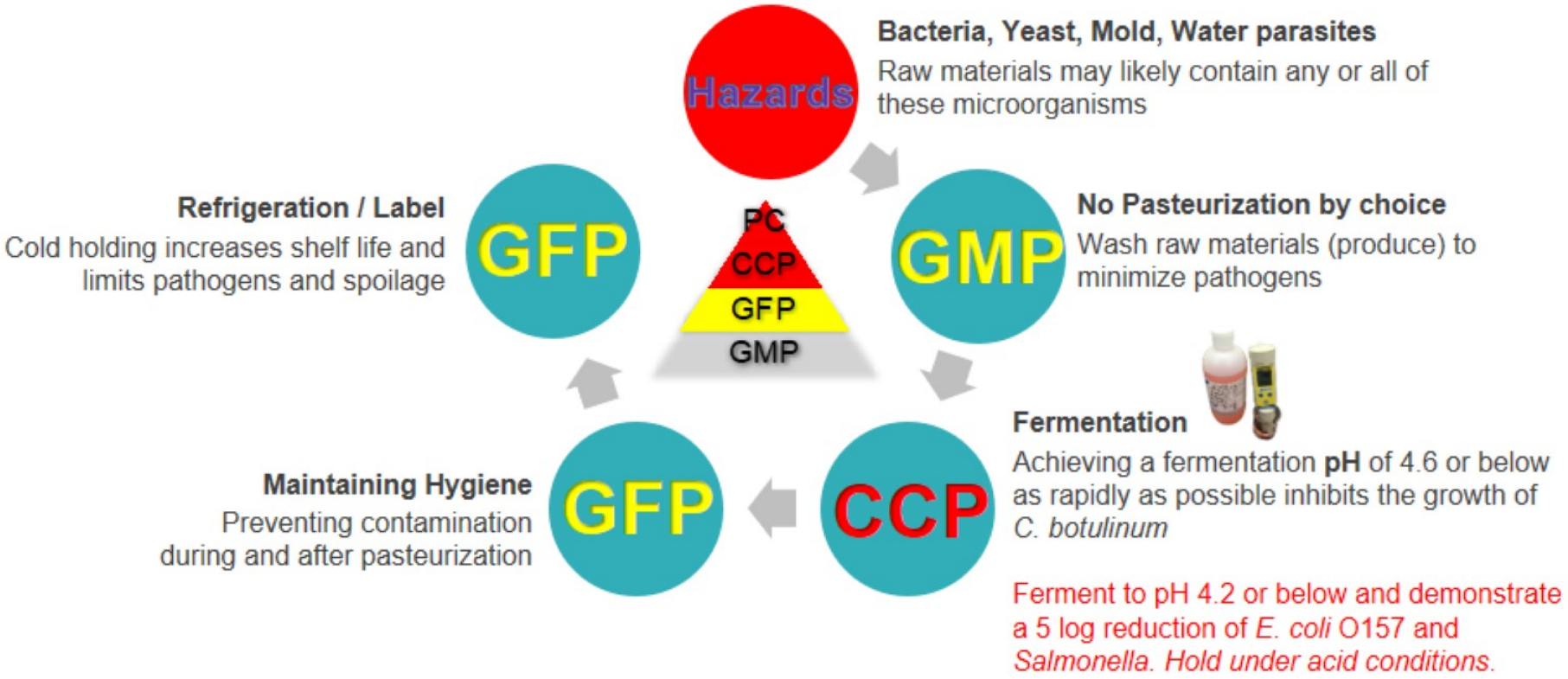
	Dirty water	Pasteurization	pH ≤ 4.6	pH ≤ 4.2	≤ 41ºF
E. coli O157	⚠	⊘	⚠	⊘ S	⊘ S
Salmonella	⚠	⊘	⚠	⊘ S	⊘ S
C. botulinum spores	⚠	⚠	⊘ S	⊘ S	⊘ S
L. monocytogenes	⚠	⊘	⚠	⊘	⚠
Yeast/mold*	⚠	⊘	⚠	⚠	⚠
Parasites	⚠	⊘	⚠ S	⚠ S	⊘ S

S=survival *=spoilage ⚠= hazard

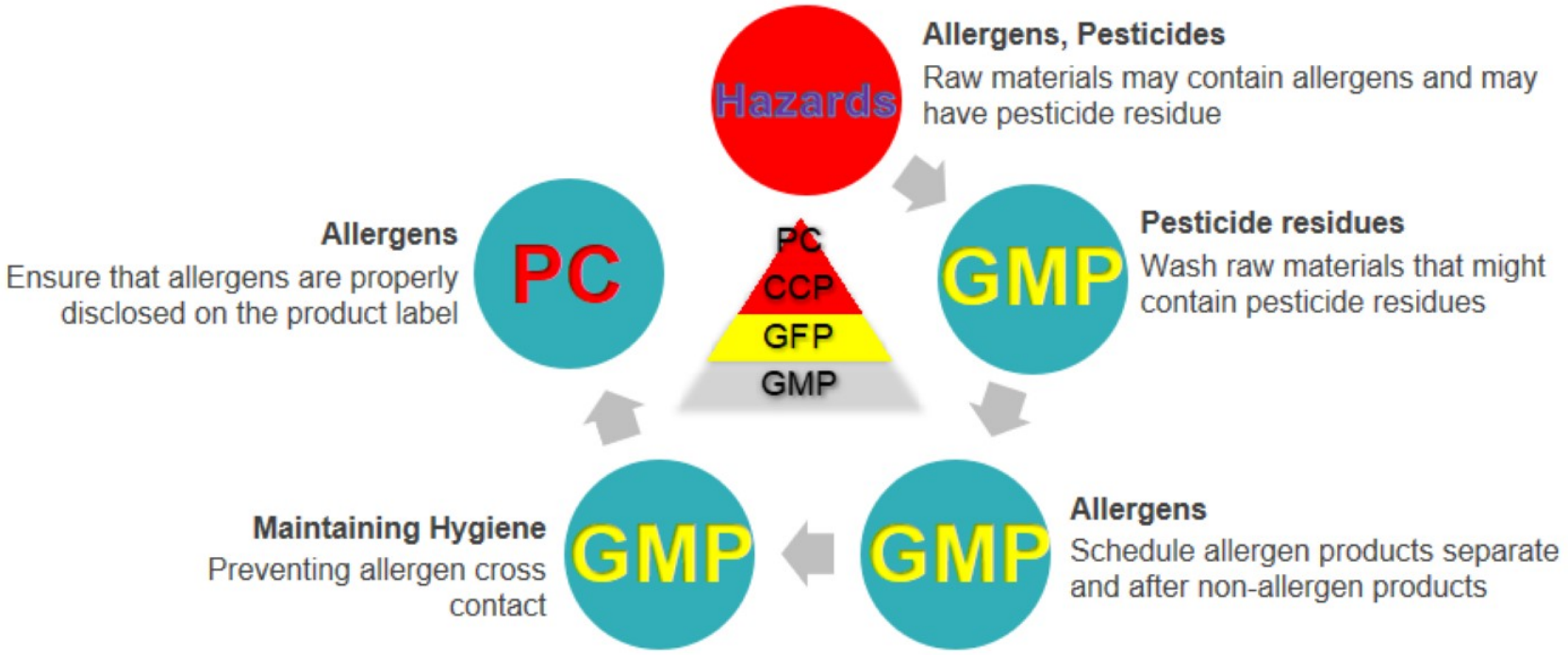
These hazards are found in unclean water and on many raw materials.

Raw produce frequently has pathogens related to animal fecal material in soils or water.

Microbiological Hazards



Chemical Hazards



Q&A Session

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National Association of County & City Health Officials

Thank you for your participation in today's sharing session!

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For more information about NACCHO's Food Safety Program, contact:

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- Amy Chang(achang@naccho.org; 202-507-4221)

http://www.naccho.org/programs/environmental-health/hazards/food-safety