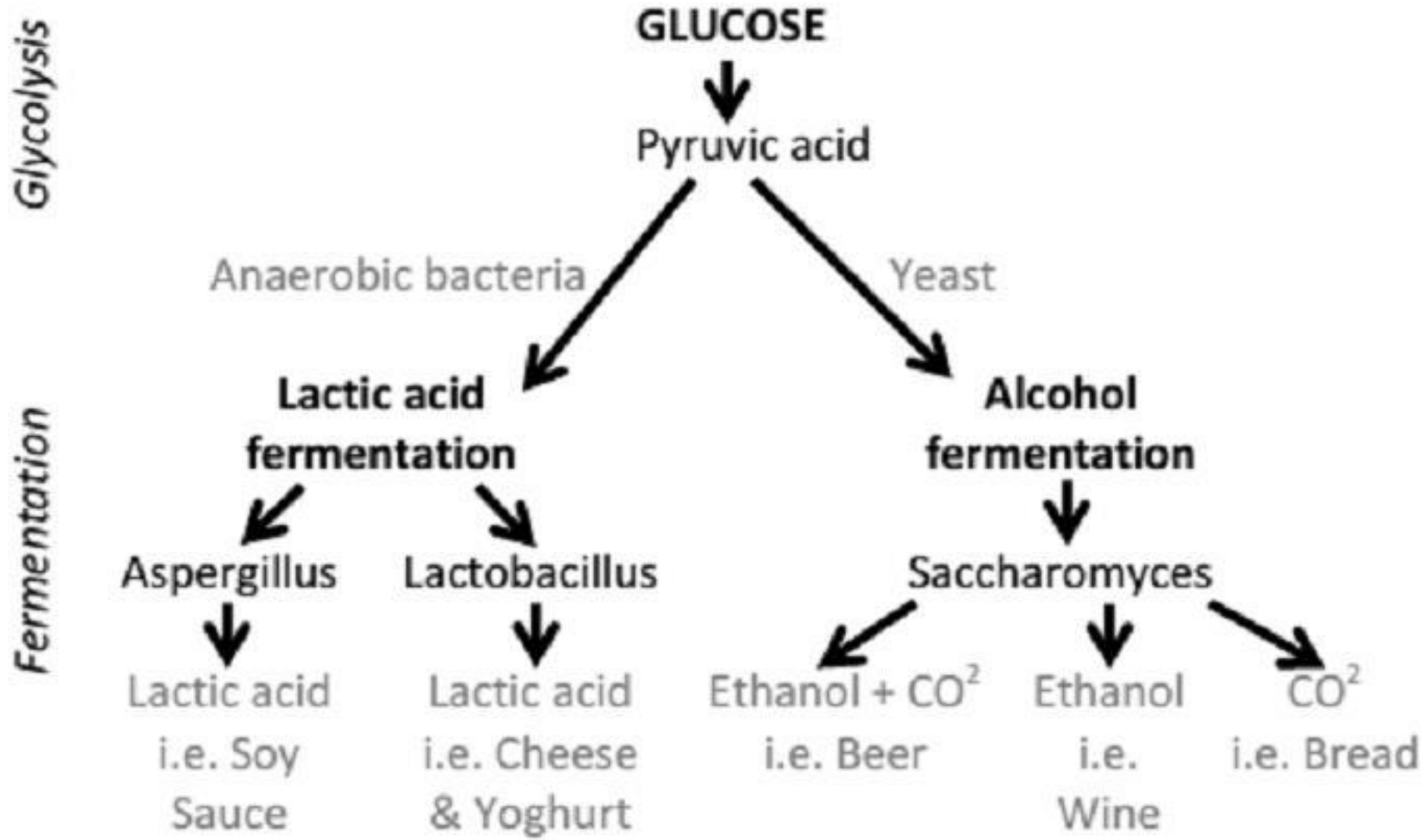
Food production involving microorganisms and their products

Introduction

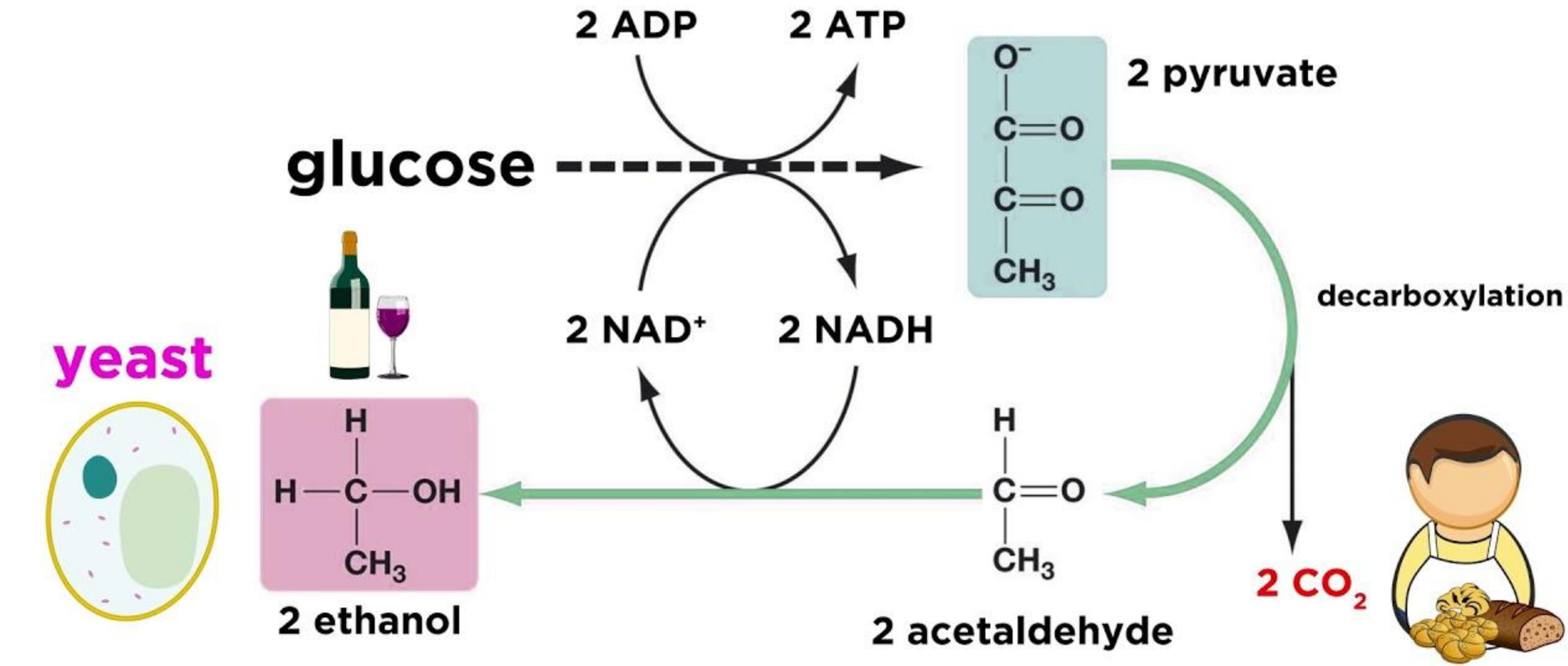
- **Fermentation** is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. In biochemistry, it is narrowly defined as the extraction of energy from carbohydrates in the absence of oxygen.
- **What Are the 3 Different Types of Fermentation?**
- **Lactic acid fermentation**. **Yeast** strains and bacteria convert starches or **sugars** into **lactic acid**, requiring no heat in preparation. ...
- **Ethanol fermentation/alcohol fermentation**. ...
- **Acetic acid** fermentation.

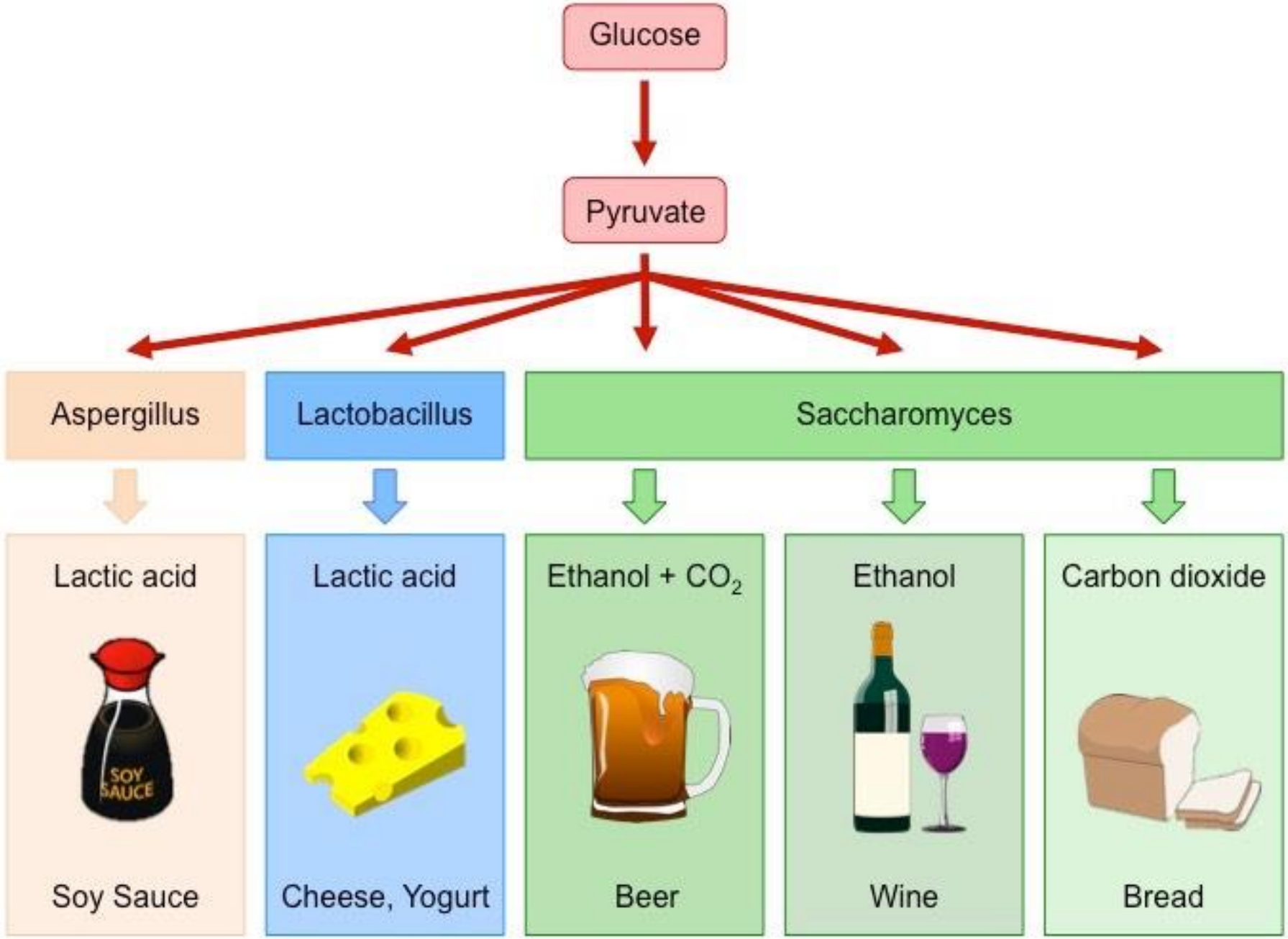
Introduction

- **Fermented foods** are defined as "**foods** or beverages produced through controlled microbial growth, and the conversion of **food** components through enzymatic action".
- Many **foods** have historically undergone **fermentation**, including meat and fish, dairy, vegetables, soybeans, other legumes, cereals and fruits.
- The **main function of fermentation** is to convert NADH, a chemical compound found in all living cells, back into the coenzyme NAD+ so that it can be used again. This process, known as glycolysis, breaks down glucose from enzymes, releasing energy.


Glycolysis
Fermentation
GLUCOSE
Pyruvic acid
Anaerobic bacteria
Yeast
Lactic acid fermentation
Alcohol fermentation
Aspergillus
Lactobacillus
Saccharomyces
Lactic acid i.e. Soy Sauce
Lactic acid i.e. Cheese & Yoghurt
Ethanol + CO2 i.e. Beer
Ethanol i.e. Wine
CO2 i.e. Bread

Alcohol Fermentation




Glucose
Pyruvate
Aspergillus
Lactobacillus
Saccharomyces
Lactic acid
Lactic acid
Ethanol + CO_2
Ethanol
Carbon dioxide
SOY SAUCE
Soy Sauce
Cheese, Yogurt
Beer
Wine
Bread

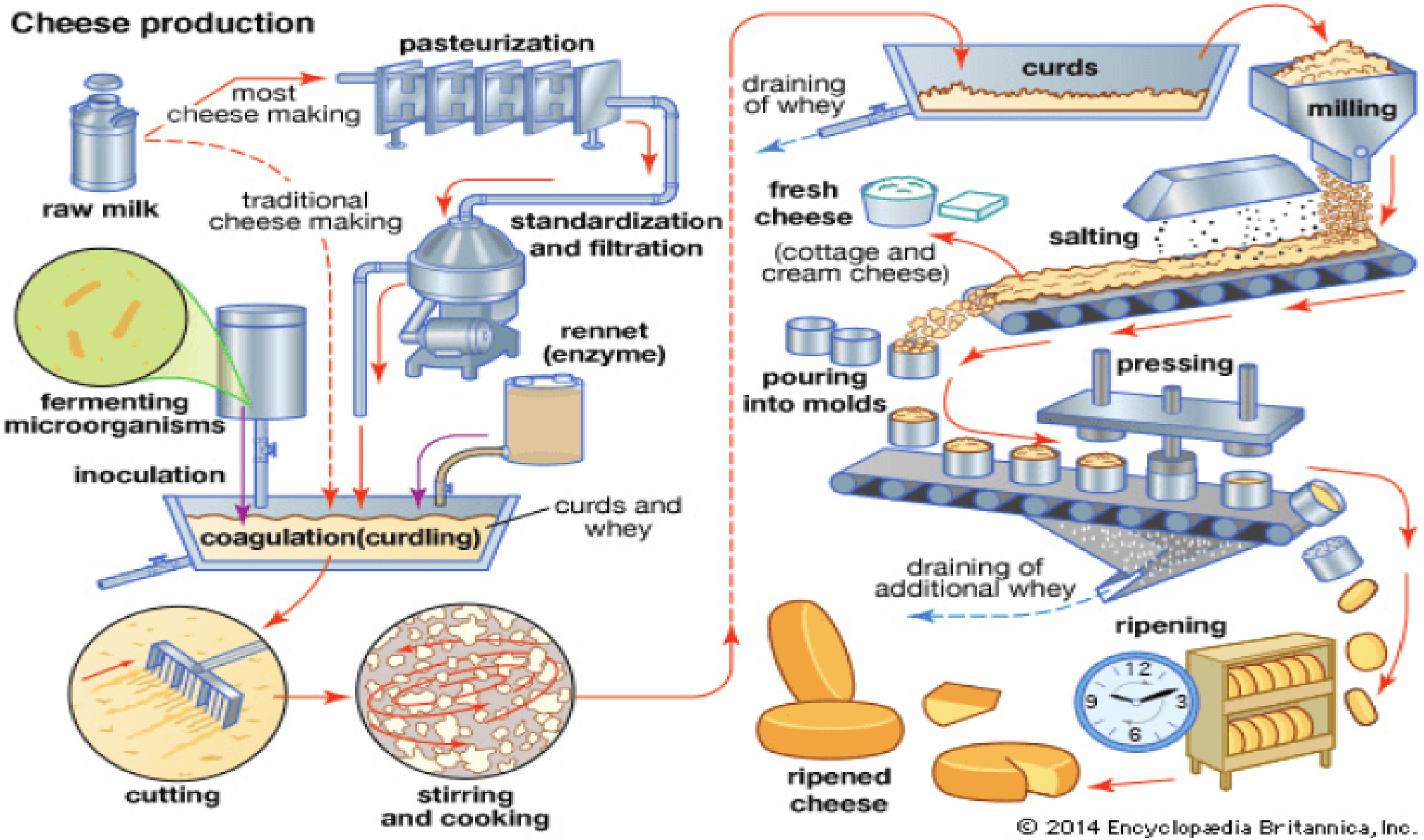
Dairy Products: Cheese

GENERAL CHEESE PROCESSING STEPS

- Standardize Milk/Collection
- Pasteurization
- Cooling of Milk
- Culturing
- Coagulation
- Draining
- Scalding
- Cheddaring
- Addition of Salt or Brine
- Form Cheese into Blocks
- Store and Age(maturation)
- Packaging

Renin

- Rennin, also called chymosin, protein-digesting enzyme that curdles milk by transforming caseinogen into insoluble casein; it is found only in the fourth stomach of cud-chewing animals, such as cows. ...
- A commercial form of rennin, rennet, is used in manufacturing cheese and preparing junket.
- To define rennet, it is an enzyme responsible for curdling milk to separate the curds and whey and the beginning of the process to make cheese. ... This means it repels the other casein micelles, causing milk to stay in its liquid form (a bit like putting two magnets of the same pole together).
- Earlier it was isolated from calfs, With genetic engineering it became possible to isolate rennet genes from animals and introduce them into certain bacteria, fungi, or yeasts to make them produce recombinant chymosin during fermentation.
- **Nonrennet coagulation by** citric acid or vinegar, or the lactic acid produced by soured milk.


Cheese production
pasteurization
most cheese making
raw milk
traditional cheese making
standardization and filtration
rennet (enzyme)
fermenting microorganisms
inoculation
coagulation(curdling)
curds and whey
cutting
stirring and cooking
draining of whey
curds
milling
fresh cheese
(cottage and cream cheese)
salting
pouring into molds
pressing
draining of additional whey
ripening
ripened cheese
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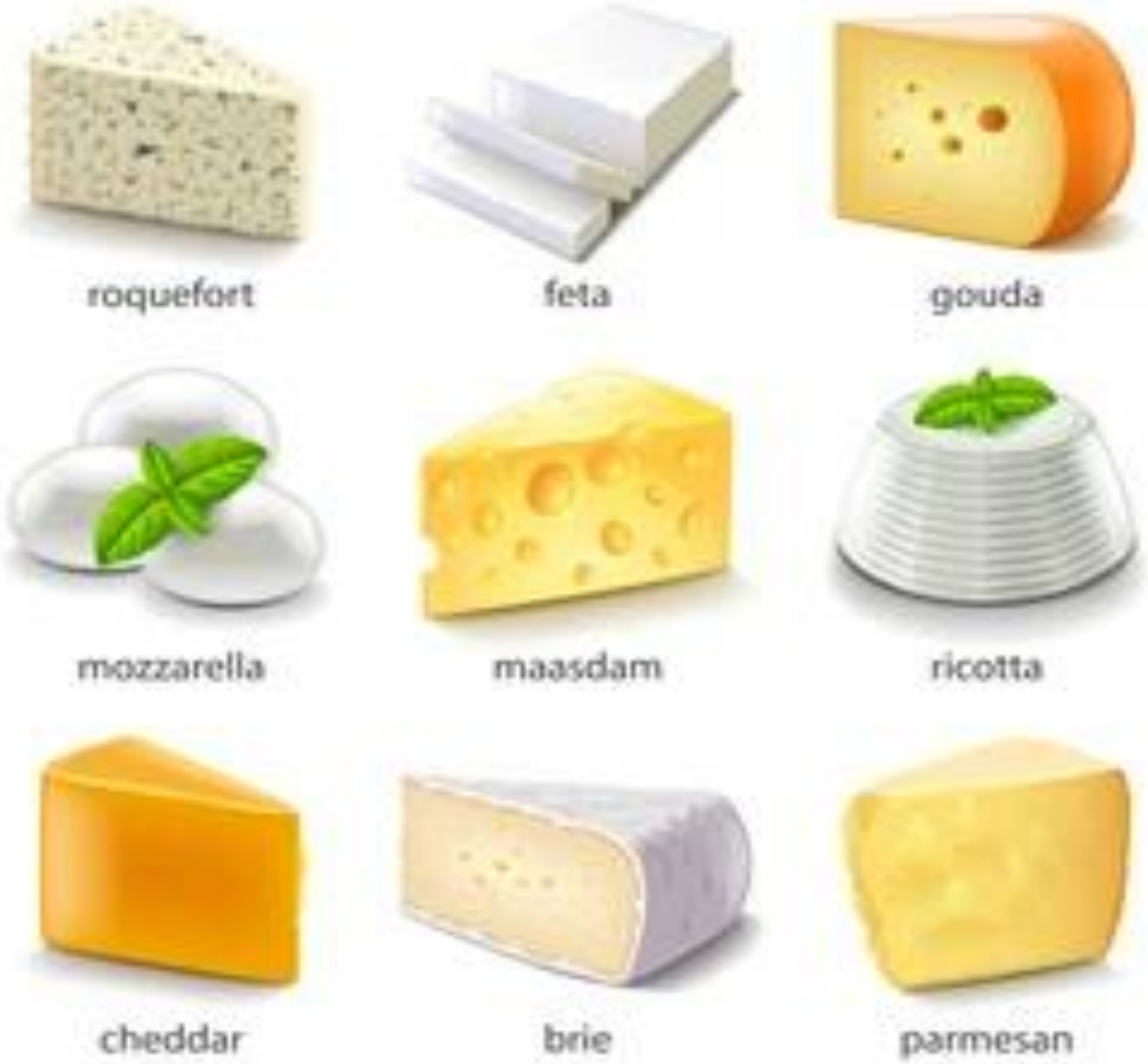


Cheese Classifications

Style	Characteristics	Examples
Fresh Cheese 	Moist fresh creamy flavor made from cow, goat or sheep milk	Chevre, Mascarpone, feta, cream, farmers, boursin, Ricotta, Spanish Mató, Cottage Cheese, Mexican Queso Fresco
Soft/Rind-Ripened Cheeses 	Edible surface mold cheese that ripens from the inside out and made with single, double or triple cream	Brie, Camembert, Tallegio, Reblochon
Semi-Soft Cheese 	Washed rind, dry rind, or wax-rind	Fontina, Monterey Jack, Muenster, Edam, Brick, Mozzarella, Mexican Oaxaca
Hard-Ripened Cheese 	Dryer texture cheese that is aged longer and is good for slicing or grating	Cheddar, Gouda, Manchego, Provolone, Colby, Emmentaler, Gruyere, Mexican Asadera, Mexican Manchego
Blue Veined Cheese 	Mold injected bacteria give the cheese a blue or green effect. Creamy to crumbly texture	Gorgonzola, Roquefort
Hard Grating Cheeses 	Hard texture that makes it suitable for grating and shaving over pasta or gratin	Parmigiana, Asiago, Romano, Grana Padano, Spanish Manchego, Mexican Cotija
Processed Cheese 	A pasteurized, processed cheese food that usually contains emulsifiers and a variety of types of cheeses	American, cheese spreads, cold pack cheese

Hard cheese

Hard cheese has a moisture content of less than 50% due to the cheese being the cheese to lose some of its moisture content and have a stronger flavour. Example: Romano

Blue cheese

Cow, sheep or goats milk with a blue or green-blue mold. The mold is derived from spores from Penicillium roqueforti, Penicillium glaucum or other being injected into the cheese curds. People who are allergic to penicillin are not advised to eat blue cheese. Example: Roquefort

Fresh, un ripened or infant cheese

Fresh cheese is not ripened, aged or fermented during the manufacturing process or at any point during the lifespan of the cheese. Fresh cheese has a very short shelf life. Example: Cottage cheese, Cream cheese.

light or lite cheese

Light cheese is made by reducing the amount of butterfat which makes the cheese rubbery in texture and much less flavourful than full fat versions of cheese. Light cheese has a high moisture content which makes it have a shorter shelf life. Example: Cheese with 7% Milk Fat, Cheddar which 19% Milk fat.

Processed cheese

This cheese is created by melting together blend of grated cheese, milk, milk solids or water, food colouring and seasonings. Example: Processed cheese shies, cheese spreads "swokies".

Types of Cheese


Brie


Camembert


Ricotta


Neufchatel


Feta


Cheddar


Gorgonzola


Quark


Danish Blue


Mozzarella


Parmesan


Cottage Cheese


Asiago


Queso Blanco


Grana Padano


Stilton


Cream Cheese


Appenzeller


Raclette


Roquefort

Yoghurt

- Modern **yogurt production** involves culturing milk with live bacteria. The bacteria **produce** lactic acid which coagulates the milk proteins, making **yogurt** thick and slightly sour in flavor. The bacterial cultures required for **producing yogurt** are *Streptococcus thermophilus* and *Lactobacillus bulgaricus.*
- To make **yogurt**, milk is firstly heated to around 80°C. ... Fermentation involves the harmless bacteria converting the milk sugar (called lactose) into lactic acid which helps to coagulate and set the milk, producing **yogurt**. When the **yogurt** is fermented, it is packed into containers and chilled to be sold to consumers.

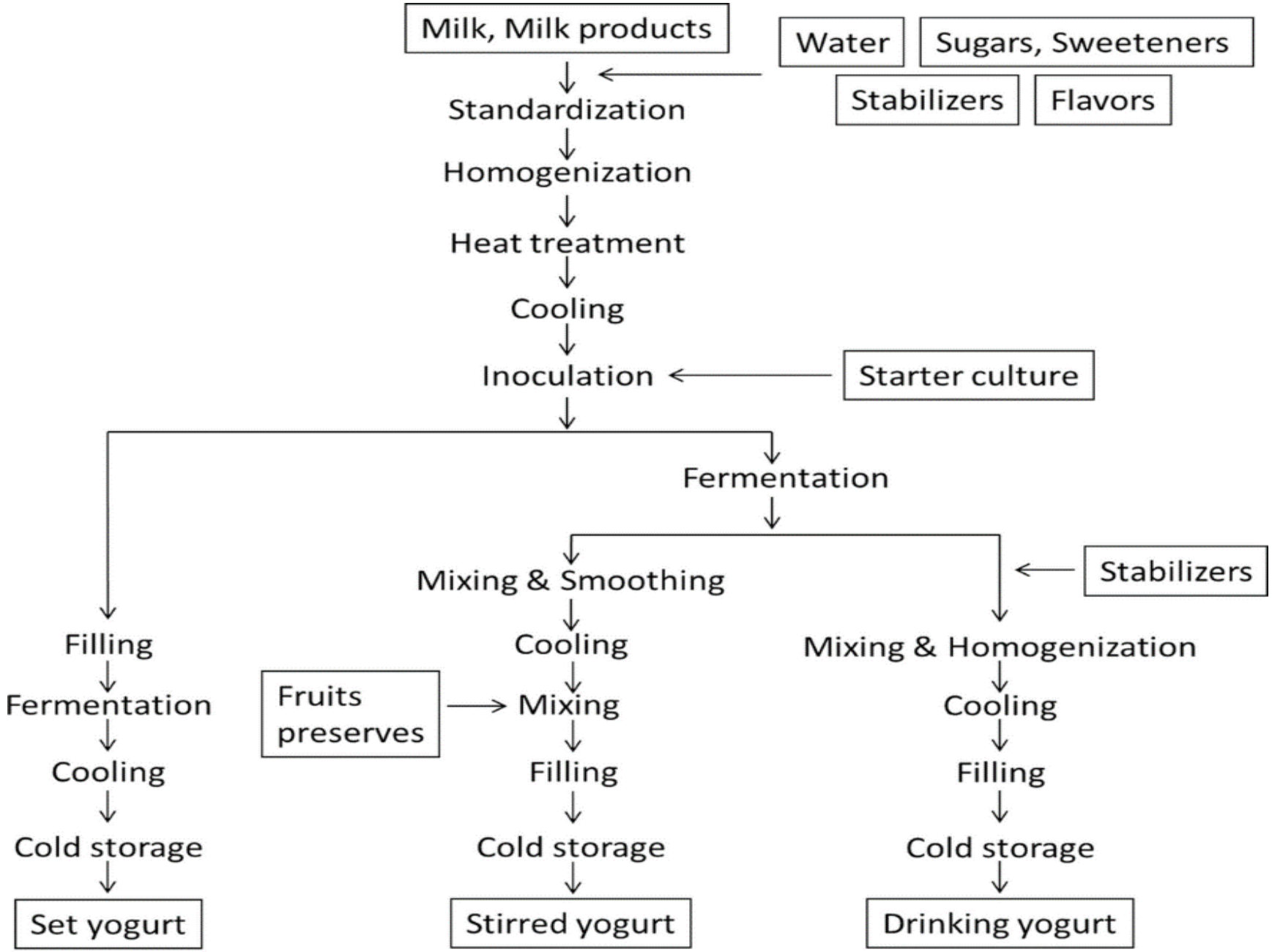


Fig. Manufacturing process of yogurt

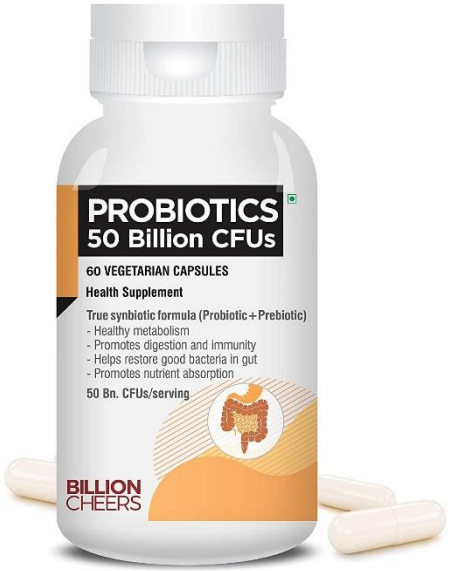

MilkyMist
FRUIT
YOGURT
MilkyMist
FRUIT
YOGURT
BLUEBERRY

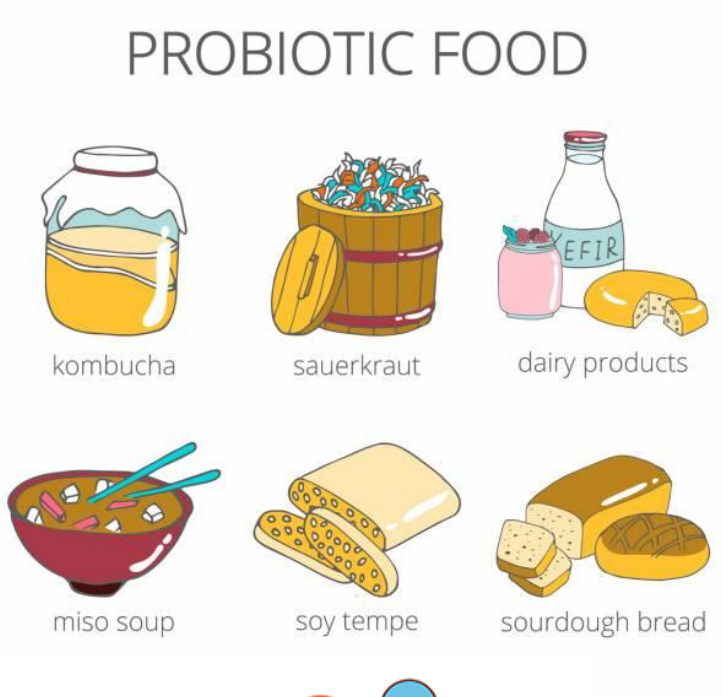

MilkyMist
FRUIT
YOGURT
MilkyMist
FRUIT
YOGURT
STRAWBERRY

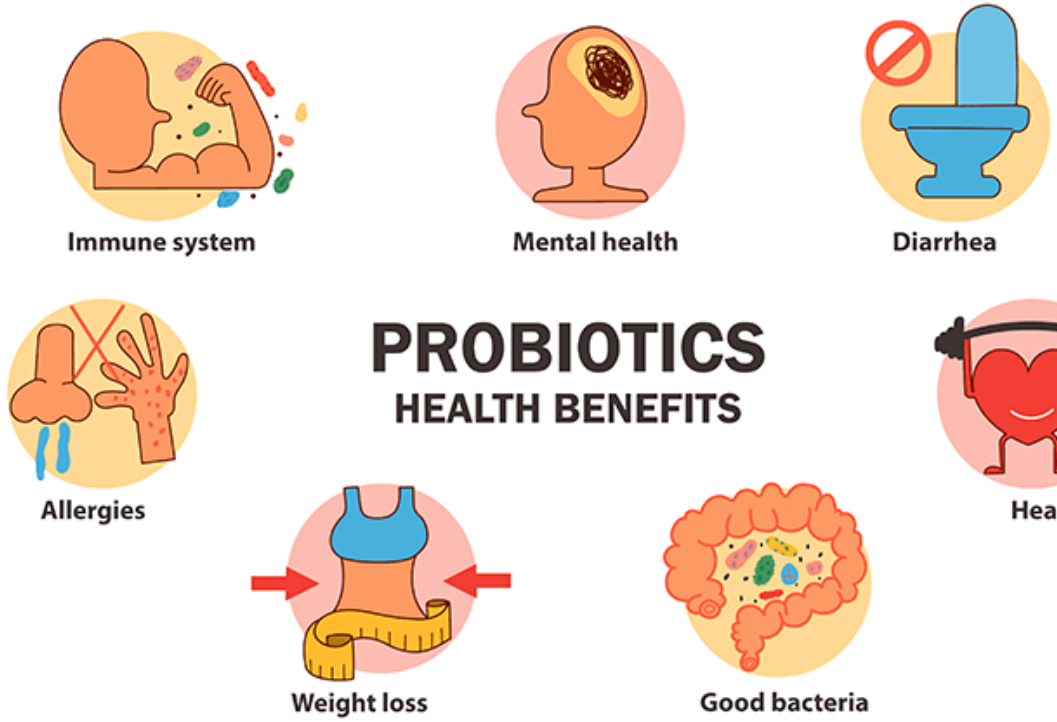

Amul
FROZEN
Yoghurt
Wild Berry
Amul
FROZEN
Yoghurt
Wild Berry

Probiotics

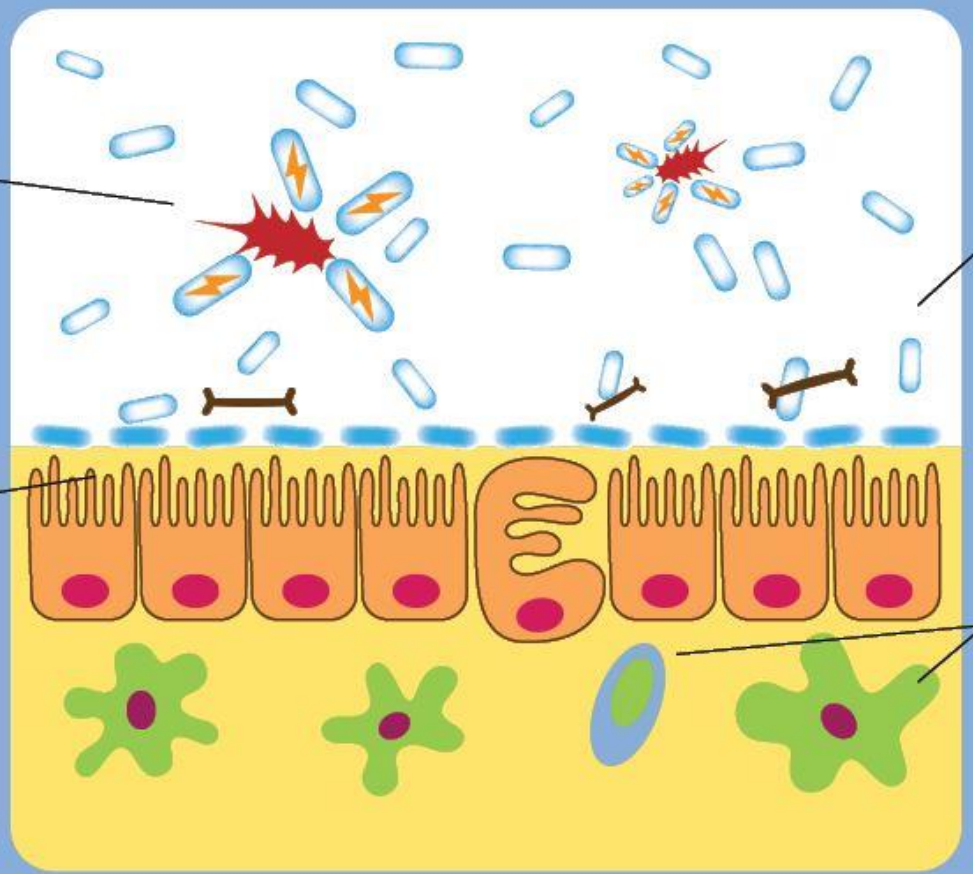
- **Probiotics** are live bacteria and yeasts that are good for you, especially your digestive system.
- We usually think of these as germs that cause diseases. But your body is full of bacteria, both good and bad.
- **Probiotics** are often called "good" or "helpful" bacteria because they help keep your gut healthy
- The most common **fermented foods** that naturally contain probiotics, or have probiotics added to them, include **yogurt**, **kefir**, **kombucha**, **sauerkraut**, pickles, **miso**, **tempeh**, **kimchi**, sourdough bread and some cheeses


PROBIOTICS
50 Billion CFUs
60 VEGETARIAN CAPSULES
Health Supplement
True synbiotic formula (Probiotic+Prebiotic)
- Healthy metabolism
- Promotes digestion and immunity
- Helps restore good bacteria in gut
- Promotes nutrient absorption
50 Bn. CFUs/serving
BILLION
CHEERS


PROBIOTIC FOOD
kombucha
sauerkraut
dairy products
miso soup
soy tempe
sourdough bread


Immune system
Mental health
Diarrhea
PROBIOTICS
HEALTH BENEFITS
Allergies
Heart
Weight loss
Good bacteria

Probiotics in Action



Kefir

- Kefir Is a Fantastic Source of Many Nutrients
- Kefir is a fermented drink, traditionally made using cow's milk or goat's milk. It is made by adding kefir grains to milk.
- These are not cereal grains, but grain-like colonies of yeast and lactic acid bacteria that resemble a cauliflower in appearance.
- **Kefir is** a healthy, fermented food with a consistency comparable to drinkable yogurt. This product **is** traditionally made from dairy milk, but plenty of non-dairy options are available. Studies suggest that it boosts your immune system, aids in digestive problems, improves bone health and may even combat cancer.

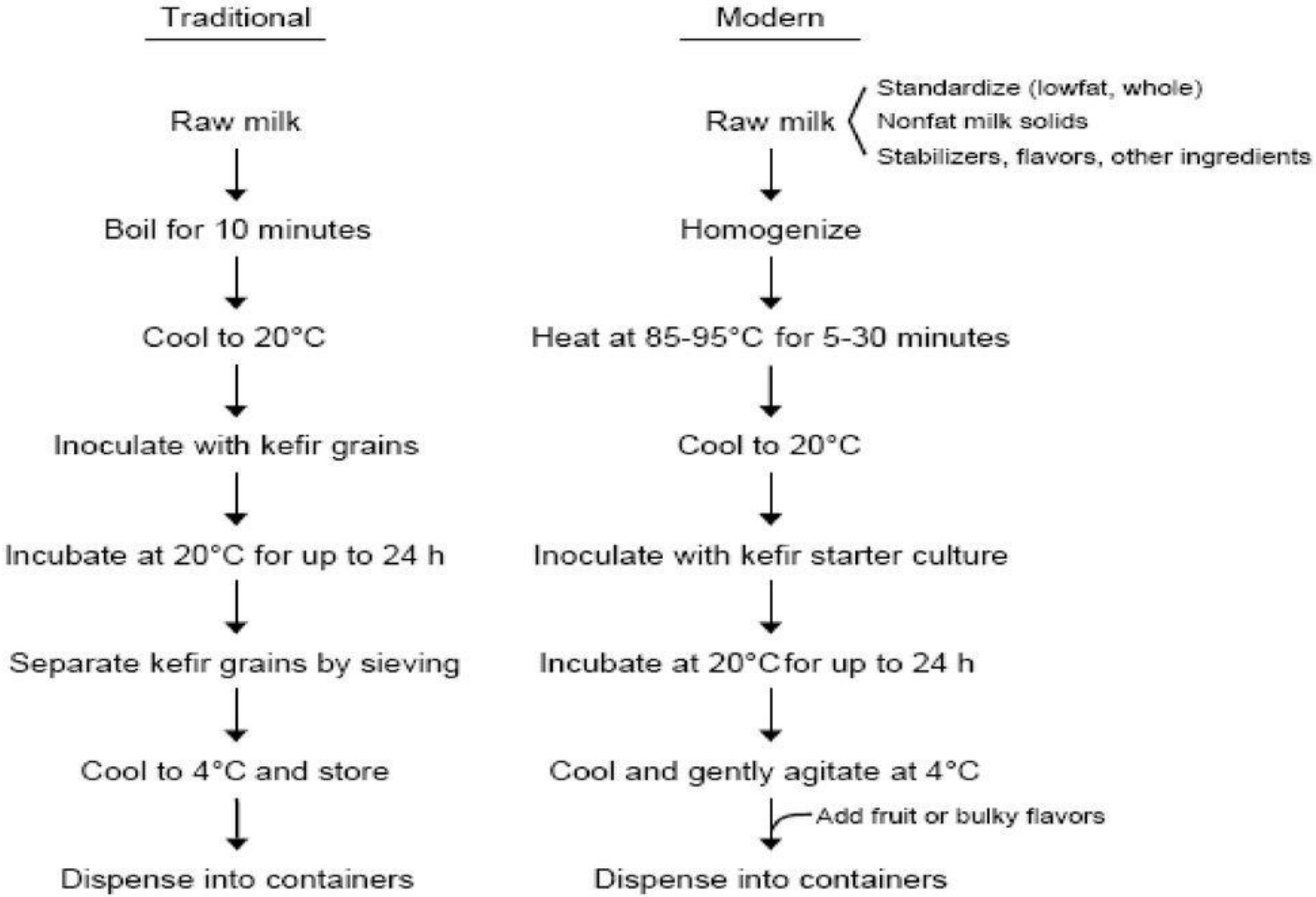


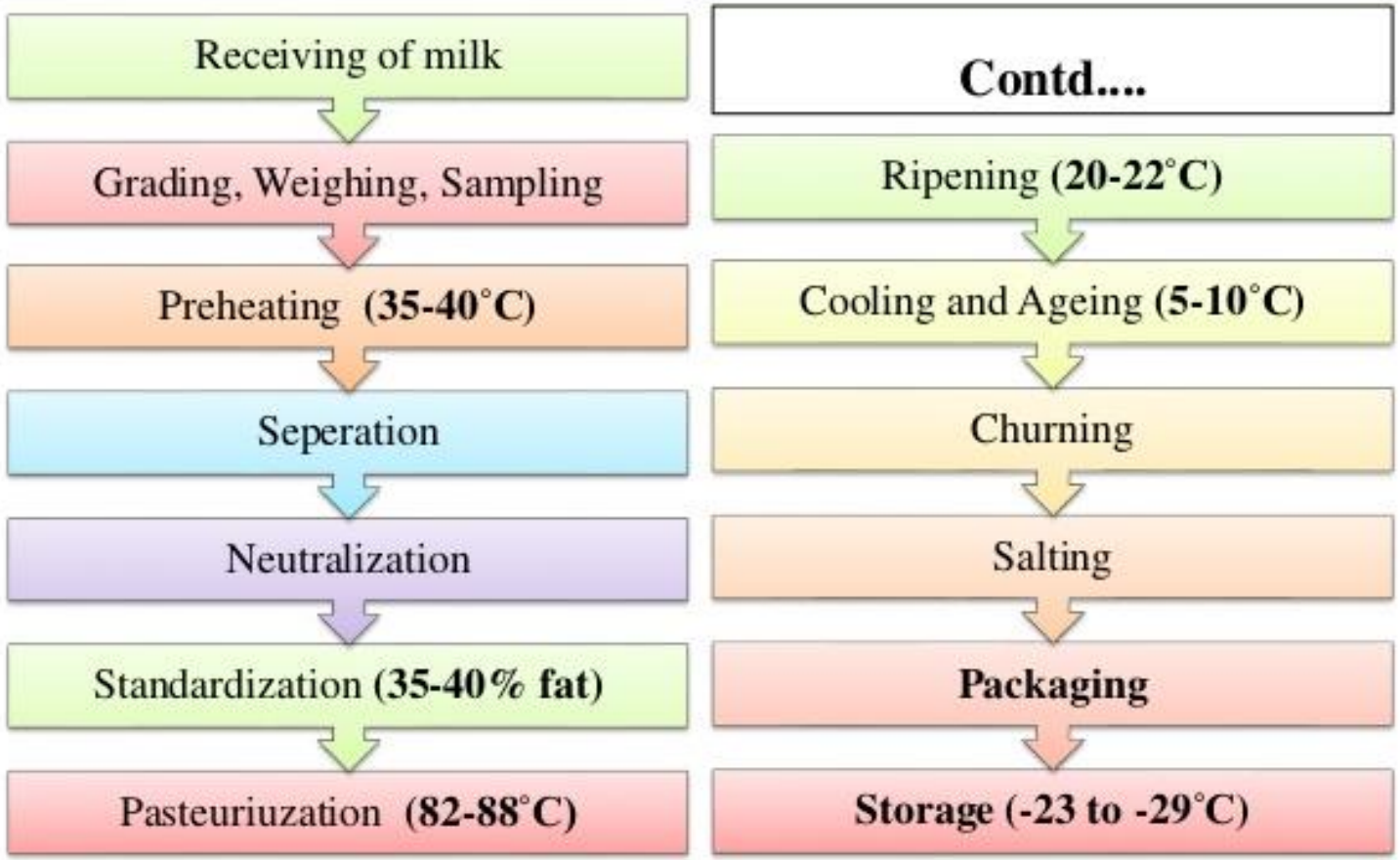
Figure 4–8. Traditional and modern manufacturing process for kefir. Otles and Cagindi. 2003.


Valio
Kefir
Juotava välipala
MAUSTA-MATON
Valio
Kefir
Juotava välipala
Maku vähemmällä sokerilla
PERSIKKA
Valio
Kefir
Juotava välipala
Maku vähemmällä sokerilla
VADELMA

Butter

- One traditional **butter**-making **process** begins with making cream. When whole **milk** sits out, tiny fat molecules float to the top, forming a layer of cream that can be skimmed and collected.
- To make **butter**, the cream is agitated (stirred up) so that the fat molecules get shaken out of position and clump together.

Butter Manufacturing Process




Amul
PASTEURISED
BUTTER
utterly butterly delicious

Buttermilk

- *Buttermilk* is a fermented dairy drink. Traditionally, it was the liquid left behind after churning *butter* out of cultured cream; however, as most modern *butter* is made not with cultured cream, but with sweet cream, most modern *buttermilk* is cultured.
- It is common in warm climates where unrefrigerated fresh milk sours quickly.
- Buttermilk can be drunk straight, and it can also be used in cooking. In making soda bread, the acid in buttermilk reacts with the raising agent, sodium bicarbonate, to produce carbon dioxide which acts as the leavening agent.
- Buttermilk is also used in marination, especially of chicken and pork, which the lactic acid helps to tenderize, retain moisture and allows added flavors to permeate the meat.

Spiced Buttermilk

200 ml

THE BENEFITS OF FERMENTED FOODS

BY APAGE

WHY EAT FERMENTED FOODS?

ENZYMES

Increased enzyme content helps you absorb nutrients, reducing the need for vitamins and supplements.

PROBIOTICS

These good bacteria help restore balance in the gut and aid digestion and immune health.

SAFETY

The lactic acid created during the fermentation process kills E. coli, making it safer to consume than raw vegetables.

PRESERVATION

The lacto-fermentation process stores food longer than canning without depleting nutrients.

NUTRITION

The fermentation process increases the nutritional value by enriching certain nutrients.

FERMENTING

Traditional & Gut Healing

- Traditional
- Easy to do
- Increases nutrition
- Increases digestibility of foods
- Source of probiotics in diet
- Marvelous, complex flavors
- All foods can be fermented, from fruits to vegetables, to dairy, to meats, to grains

BE AWARE

- Use tried-and-true recipes to get started
- Use air-tight containers for best results
- Store ferments in cool or cold storage
- Store fermented foods for months, but most are not suited for very long term
- Glass or ceramic containers can break

DrJockers.com
SUPERCHARGE YOUR HEALTH

Dehulled full-fat soybean grits

↓ ← Tap water

Soaked 30 min. at 25 C

↓

Drained

↓ ← Tap water

Cooked (30 min.)

↓

Drained and cooled

↓

Inoculated ← Spore suspension of *Rhizopus oligosporus* Saito NRRL 2710

↓

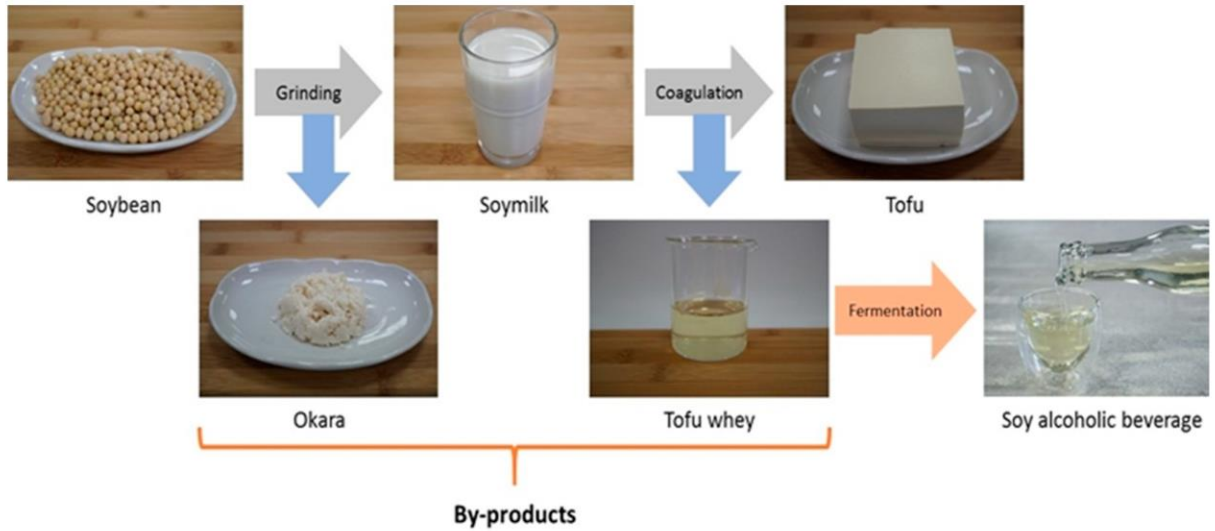
Tightly packed in petri dishes

↓

Incubated 31 C for 20-24 hr

↓

Tempeh cake



HOW TO MAKE SAUERKRAUT

WITH STEP-BY-STEP INSTRUCTIONS

Sauerkraut:

- Finely cut cabbage that has been fermented various lactic acid bacteria
- Sour in taste and has long shelf life
- Is recommended for treatment against over-weight, metabolic disorders and detoxification

List of contents:

Vitamins, minerals (iron, calcium), trace elements, roughage, lactic acid

Lactic Acid bacteria involved in Sauerkraut fermentation:

1. *Leuconostoc mesenteroides* (acid and gas producing coccus)
2. *Lactobacillus plantarum* and bacilli that produce acid and a small amount of gas (*L. Cucumeris)*
3. *Lactobacillus pentoaceticus* (acid and gas producing bacilli) *(Lactobacillus brevis)*

Fermented Meats

- A delicacy in some middle-east countries.
- Fermentation of meat is carried out during curing by lactic bacteria and *Pedicoccus cerevisiae*.
- Several types of salamis and sausages are produced by fermentation
  - Gives flavour
  - Preserves food