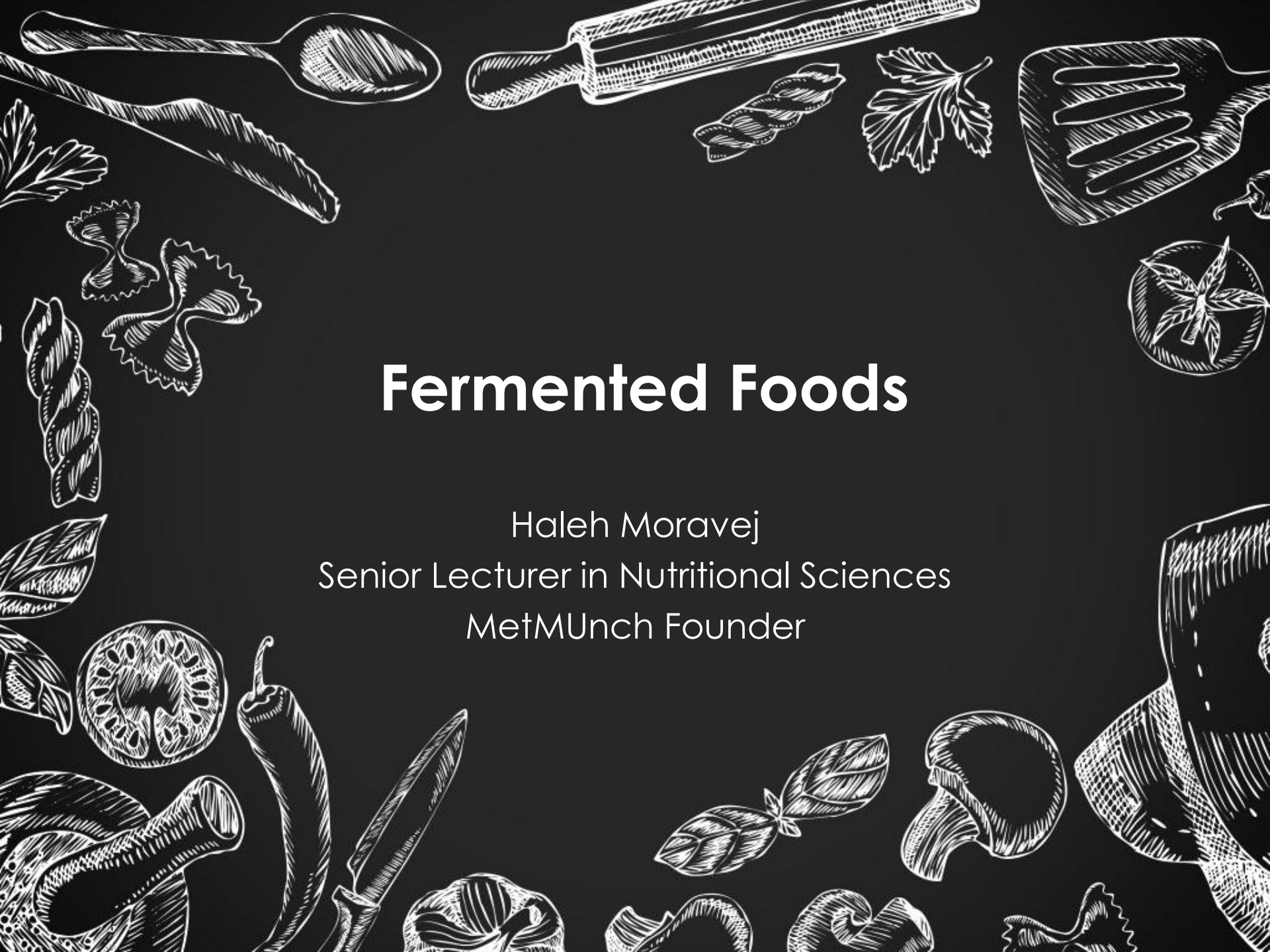


Fermented Foods

Haleh Moravej
Senior Lecturer in Nutritional Sciences
MetMUnch Founder

History

- **Persian version of the Old Testament (Genesis 18:8) states Abraham owed his longevity to the consumption of sour milk.”**
- **In 76 BC the Roman historian Plinius recommended the administration of fermented milk products for treating gastroenteritis**
- **Metchnikoff claimed that the intake of yogurt containing lactobacilli results in a reduction of toxin-producing bacteria in the gut and this increases the longevity of the host.**

Probiotic Concept

- **Probiotic (Greek Language) “ for life” .**
- **It was first used by Lilly and Stillwell in 1965 to describe “substances secreted by one microorganism which stimulates the growth of another”.**
- **Parker was the first to use the term *probiotic* in the sense that it is used today “organisms and substances which contribute to intestinal microbial balance”.**
- **In 1989, Fuller attempted to improve Parker’s definition of probiotic with the following distinction: “A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance.”**

Global Fermented Food

There are more than 3500 types of fermented foods worldwide, the following are the major groups:

Dairy products……Cheeses,Yogurt,Sour cream

Meat Products…Pepperoni,Salami,Pickled meat

Cereal products…….Breads, Pancake, Pizza

Fruits and vegetable products…….Pickled fruits, pickled vegetables, Olives

Legume products……Soy sauce, fermented soymilk

Fish products……Fish sauces, Pickled fish

Beverages……Coffee, tea, cocoa, Beer

Starch crop products……Fermented products from potato, sweet potato, Bananas

Miscellaneous products……Vinegar, fermented eggs

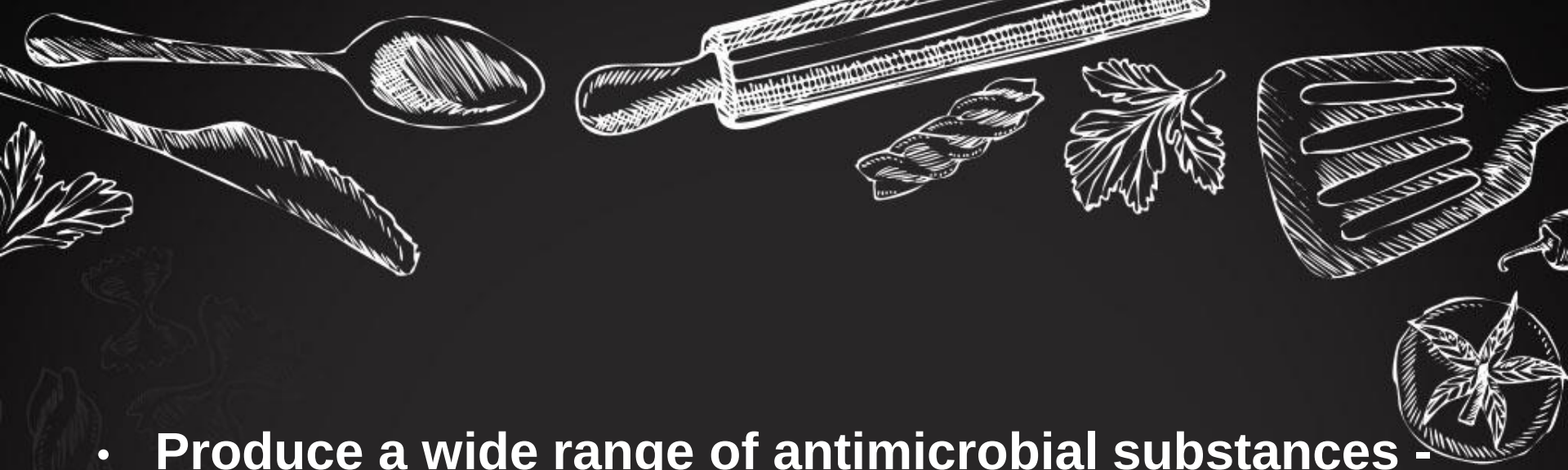
How do they work?

- **Adherence and colonization of the gut**
- **Suppression of growth or epithelial binding/invasion by pathogenic bacteria and production of antimicrobial substances**
- **Improvement of intestinal barrier function**
- **Controlled transfer of dietary antigens**
- **Stimulation of mucosal and systemic host immunity**

(Harish and Varghese, 2006)

Advantages

- **Produce lactic acid- lowers the pH of intestines and inhibiting bacterial villains such as *Clostridium, Salmonella, Shigella*, *E. coli,* etc.**
- **Decreases the production of a variety of toxic or carcinogenic metabolites.**
- **Aid absorption of minerals, especially calcium, due to increased intestinal acidity.**
- **Production of β- D- galactosidase enzymes that break down lactose .**



- **Produce a wide range of antimicrobial substances - acidophilin and bacteriocin etc. help to control pathogenic bacteria .**
- **Produce vitamins (especially Vitamin B and vitamin K)**
- **Act as barriers to prevent harmful bacteria from colonizing the intestines**

(Roberfroid, 2000

Microbiology of Fermented Foods

Partial breakdown of carbohydrates taking place in the absence of oxygen.

Major fermentations used are lactic, propionic & ethanolic fermentations

History of Fermentation

- Fermentation has been a major way of preserving foods. Microbial growth causes chemical and/or textural changes to form a product that can be stored for extended periods.

- Fermentation also creates new, pleasing food flavors and odors.

Fermented Foods

- Alcoholic Beverages
- Bread
- Dairy Products
- Kimchi (Traditional Korean fermented Vegetables)
- Kefir
- Lassi
- sauerkraut (preserved white cabbage),
- kimchi
- kombucha (a fermented tea-based drink)

Production of Breads

- involves growth of *Saccharomyces cerevisiae* (baker's yeast) under aerobic conditions
  - maximizes CO_2 production, which leavens bread
- other microbes used to make special breads (e.g., sourdough bread)
- Can be spoiled by *Bacillus* species that produce ropiness

Yoghurt

- Milk is fermented by a mixture of *Streptococcus salivarius* ssp *thermophilus* and *Lactobacillus bulgaricus* (official name *Lactobacillus delbrueckii* ssp. *bulgaricus*). Often these two are co-cultured with other lactic acid bacteria for taste or health effects (probiotics).
- Acid produced from the fermentation causes the protein in the milk (casein) to coagulate into a semisolid curd
- For flavored yogurt, fruit are added after the yogurt is made.

Cheese production

- Cheese is one of the oldest human foods and is thought to have developed approximately 8000 years ago.
- About 2000 varieties are produced throughout the world.
- All cheese results from a lactic acid fermentation of milk, which results in coagulation of milk proteins and formation of a curd. All the major cheeses produced by dairy fermentation are done by *Streptococcus lactis.*

Cheese

- Milk is treated with lactic acid bacteria and an enzyme called rennin that partially hydrolyses the protein and causes it to coagulate into “curds.” The liquid portion of the milk at this time is called “whey.”
- The whey is separated from the curds, and the curds are heated, pressed and then usually aged (ripened).
- Different microbes in the early and late stages of processing give rise to cheeses with different characteristics.

Fermented Milks

- Dairy products can be fermented to yield a wide variety of cultured milk products.
- Fermented milks have therapeutic effects.
- Acidophilus milk is produced by *Lactobacillus acidophilus*. *L. acidophilus* may exhibit anticancer activity.
- *Bifidobacterium*-amended fermented milk products may also promote antitumorigenic activity.

Yeast as a food supplement

- Yeast for nutritional purposes is cultivated in large aerated fermentors in a medium containing molasses as an ingredient.
- At the end of the growth period, yeast cells are recovered by centrifugation and washed.
- Nutritional yeast is heat-killed and usually dried.
- Yeast cells are rich in B vitamins and in protein.

Kefir

- Kefir is a cultured, fermented milk drink, originally from the mountainous region that divides Asia and Europe. It is similar to yogurt – but a drink, with a tart, sour taste and a slight ‘fizz’. This is due to carbon dioxide – the end product of the fermentation process. The length of the fermentation time will affect the taste. Kefir is a good source of calcium and is rich in probiotic bacteria.
- Traditional milk kefir uses kefir grains and whole cow’s milk – although now you can find it made from goat’s milk, sheep’s milk and *coconut milk* as well as from rice and soy milk alternatives.

Kefir

- Kefir grains are not actually grains at all but are small gelatinous beads that look like grains containing a variety of bacteria and yeasts.
- The grains are placed in a glass jar/bowl, soaked in milk, covered and left at room temperature for a minimum of 24 hours. This enables the bacteria and yeast to ferment the lactose (natural sugar in milk) into lactic acid, activating the bacteria to proliferate and grow.
- Milk is a good source of protein and calcium, and kefir is no different. However it has the added benefits of probiotics. Probiotics are known as ‘friendly bacteria’ that can ease IBS symptoms such as bloating and digestive distress in some people.

Kimchi

- Kimchi is a traditional Korean food manufactured by fermenting vegetables with probiotic lactic acid bacteria (LAB). Many bacteria are involved in the fermentation of kimchi, but LAB become dominant while the putrefactive bacteria are suppressed during salting of baechu cabbage and the fermentation.
- The addition of other subingredients and formation of fermentation byproducts of LAB promote the fermentation process of LAB to eventually lead to eradication of putrefactive- and pathogenic bacteria, and also increase the functionalities of kimchi.
- Kimchi can be considered a vegetable probiotic food that contributes health benefits in a similar manner as yogurt as a dairy probiotic food. Further, the major ingredients of kimchi are cruciferous vegetables; and other healthy functional foods such as garlic, ginger, red pepper powder

Kombucha

- Kombucha is a fermented drink made from sweetened tea and a specific culture known as a scoby. Scoby stands for ‘symbiotic culture of bacteria and yeasts’. The bacteria and yeasts convert the sugar into ethanol and acetic acid. The acetic acid is what gives kombucha its distinctive sour taste.

Production of alcoholic beverages

- Fermentation of fruit juice results in wine. Most wine is made from grapes.
- Beer and ale is produced by the fermentation of malted grains.
- Distilled beverages are produced by concentrating alcohol by distillation.

Beer

– “Produced by the fermentation of malted grain

- Malted grain: Grain that has been allowed to germinate, then dried in a kiln & perhaps roasted
- Germinating the grain causes the production of a number of enzymes, most notably α- and β-amylase
- Malted grains that may be used are barley, rye, or wheat
- Unmalted grains, such as rice or corn, may also be used

Wine

- “Produced from the fermentation of fruit juice, usually from grapes
- The grapes are crushed to form a “must”
  - For white wines, white grapes are usually used, and the skins are removed from the must (“pressing”) before fermentation
  - For red wines, red or black grapes are used, and the skin is allowed to remain during fermentation
  - For rosé wines, red grapes are used and the juice is allowed to remain in contact with the skins just long enough for a rose or pink color to develop

Wine production

- Grapes are harvested and crushed by machines and the juice called must, is squeezed out.
- Yeasts used can be of two types – wild yeasts and *Saccharomyces ellipsoideus*.
- Fermentation is carried out in vats of various sizes made of various materials.
- Wine is separated from the sediment and then stored at lower temperature for aging.

Other Fermented Food

- variety of bacteria, yeasts, and other fungi are used as animal and human food sources
- probiotics
  - microbes added to diet in order to provide health benefits beyond basic nutritive value


Thank You!