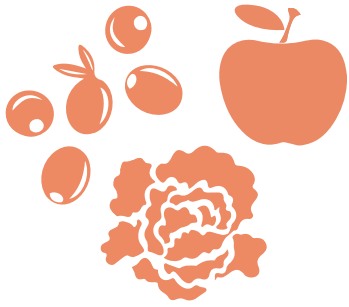
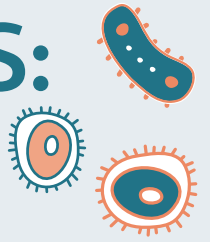




LIVE DIETARY MICROBES: A Role in Human Health



For millennia, humans ate raw fruits and vegetables and fermented foods that serve as rich and diverse sources of live dietary microbes. Today, our foods have often been processed in a manner that removes or kills most of these microbes. Is it possible that the high levels of some modern non-communicable diseases could be linked to our reduced exposure to live microbes in our diet?

What do we know about the value of consuming live dietary microbes?

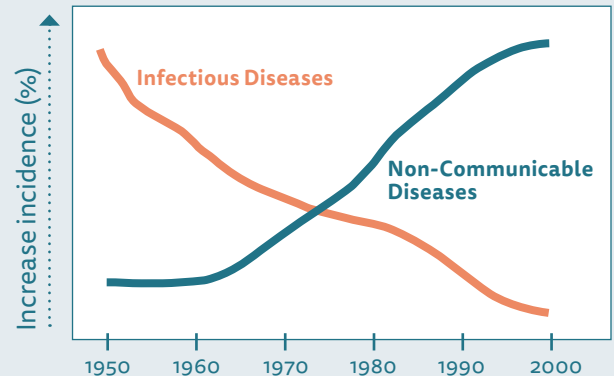
- Fermented foods are thought to support gut health
- Fermented foods are associated with improved cardiovascular and metabolic health
- Probiotics, which are live microbes of many different species, can improve some health parameters
- There remains much to learn:
 - How many live microbes should we consume for a health benefit?
 - Are some microbes better than others for our health?
 - What types of health benefits could we expect?



Fermented foods have been consumed by humans for over 14,000 years

As exposure to microbes has decreased, infectious diseases decreased. However, non-communicable diseases such as immune-mediated and metabolic diseases have become more common.

Graph adapted from Bach, 2002. NEJM: 347(12):911.



How many microbes do we eat?

NHANES is a nationally representative data set that contains information on what Americans eat. A recent study using this data showed:

- Approximately one in three adults only consume foods with low levels of live microbes
- Diets that include foods with medium (10^4 - 10^7 CFU/g) or high ($>10^7$ CFU/g) levels of live microbes as compared to those with lower levels of live microbes were linked with reduced systolic blood pressure and waistline size.
- What foods would provide a consumer with high levels of microbes? You could consume one 200g serving of yogurt, 75g of fresh fruit, and a 125g serving of fresh uncooked vegetables.



Is consuming live microbes safe?

- Many microbes are beneficial or simply pass through the consumer without an impact
- Some also cause food spoilage
- But some microbes can cause serious illness – such as *Salmonella* or *Campylobacter* – and these need to be avoided
- Keep in mind that eating certain undercooked or raw foods – such as milk, fish, meat – can pose a health risk



What are good sources of live dietary microbes (LDM)?

- Raw vegetables and fruit (unpeeled) and fermented milk and vegetables (untreated after fermentation) are foods that contain LDM. Examples include yogurt, kim chi, fresh and mature cheeses, lettuce, and fresh, uncooked broccoli, celery, green beans, apples, berries.
- Probiotics consumed orally are LDM, although LDM may not be necessarily probiotics
- Fermented foods are made with live microbes, but some processing steps may kill or remove the live microbes
- See the ISAPP infographic on fermented foods isappscience.org/for-consumers/infographics/

Understanding live dietary microbes (LDM)

- LDM do not need to be specifically characterized or taxonomically identified but could be naturally present in raw or fermented foods
- LDM do not need to have a defined 'dose', but would presumably have to be consumed in high numbers to generate a potential health benefit
- LDM are not required to have scientific evidence directly linking them to conferring specific health benefits

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