A Consumer's Guide to Probiotics and Health

Objectives

- To outline current evidence on the effectiveness of probiotics for common conditions such as constipation, IBS, and type 2 diabetes
- To provide tips for choosing probiotics.

Definition of probiotics

- Probiotics are defined as "live microorganisms, which when administered in adequate amounts confer a health benefit on the host" (WHO).
- In the US, probiotics are considered dietary supplements, not food or drugs, and thus, are not specifically regulated by the Food and Drug Administration (FDA).
- FDA approval is needed for testing of probiotics (as drugs) to prevent or treat disease.

What is and what is not a probiotic?

- As dietary supplements, some products containing live microorganisms have been marketed as probiotics without the testing needed to confirm the health benefits.
- Only microbial species that have been shown to confer health benefits in well designed studies should be considered probiotics.
- Difficult to show benefit in healthy individuals! Restrictions on testing disease outcomes...

What makes a good probiotic?

- Alive when they reach the gut.
- Need to survive the acidic environment of the stomach, bile acids in small intestine, and resist other bacteria.
- Must be safe - accurately identified, free from contamination, and labeled properly.
- Probiotics are tested to make sure they do not cause stomach upset, diarrhea, or other side effects - tested further to make sure they have positive effects on human health.
What about the science behind probiotics?

- Microorganisms (e.g., bacteria, yeast) differ in their health effects and so each potential probiotic needs to be tested.
- Animal research cannot be used to support recommendations for humans. (good for hypotheses and mechanisms)
- Human research studies needed on all “potential” probiotics. Note: A single human research study is not sufficient to confirm the health benefits of a probiotic - well-designed studies provide the strongest evidence that a probiotic is effective.

More about the science...

- A high level of scientific evidence is considered to be a systematic review with meta-analysis – all the studies on a topic are evaluated.
- Positive findings of a systematic review with meta-analysis strongly suggests efficacy, i.e., the probiotic exerts a specific health benefit.

General Health Benefits of Probiotics

- Various species of Bifidobacterium (adolescentis, animalis, bifidum, breve and longum) and Lactobacillus (acidophilus, casei, fermentum, gasseri, johnsonii, paracasei, plantarum, rhamnosus) provide general health benefits.
- Dose taken, measured in “colony forming units” or CFU, is important for effectiveness. A minimum dose of $1 \times 10^9$ (1 billion) CFU per serving is thought to be needed to provide general health benefits. Or is it higher?

Mechanisms of Probiotics

- Most probiotics inhibit pathogens and produce beneficial fermentation products such as short chain fatty acids.
- Many probiotic species produce vitamins and useful enzymes, and help to maintain gut health (e.g., barrier & sensitivity).
- A few probiotic strains have immune, neurological and other body system effects.
- A few probiotic strains are considered drugs, shown to prevent or treat disease.

Constipation

- Infrequent, hard stools that are difficult to pass. Lack of dietary fiber, medical conditions, and certain medications are common causes.
- A function of the colon (large intestine) is removal of water - prevention of diarrhea – too much removal → constipation (usually not about water intake)
- The longer material remains in the colon, the more water that is removed. When transit time (time in the colon) is slow, lasting many days, the result is hard stools that are difficult to pass.

Constipation

- Probiotics are effective in speeding up transit time in adults and are most effective in people with constipation.
- Single-strain may be more effective than the multi-strain probiotics.
- This health benefit is strain-specific.
- Bifidobacterium lactis strains (specifically B. lactis HN019 and B. lactis DN-173 010) have been shown to be the most effective, but other strains also show a benefit.
Diarrhea Prevention

• Frequent, loose or watery stools and is often caused by pathogens.
• Probiotics reduce the risk of antibiotic-associated diarrhea and *Clostridium difficile*-associated diarrhea in hospitalized patients. Separating patients by age, found that probiotic administration did not reduce the risk of antibiotic-associated diarrhea in adults over 65 years of age.\(^7\)
• Probiotics are safe and effective in preventing *Clostridium difficile* infection.\(^9,10\)
• *Lactobacillus* spp., *Saccharomyces* spp., and combinations of probiotics show reduced risk.\(^9\)

Saccharomyces boulardii, *Lactobacillus casei* DN114001, a mixture of *L. acidophilus* and *Bifidobacterium bifidum*, and a mixture of *L. acidophilus*, *L. casei* and *L. rhamnosus* are effective in prevention of *C. difficile* infection.\(^11\)

• Probiotics decrease radiotherapy-induced diarrhea but not chemotherapy-induced diarrhea in patients with abdominal and pelvic cancer.\(^14\) More research is needed to determine if this a general or strain-specific effect.

Irritable Bowel Syndrome (IBS)

A condition of the intestinal tract that results in abdominal pain and/or discomfort with altered bowel habits (diarrhea and/or constipation).
• Probiotics improve overall symptom scores and quality of life in individuals with IBS.\(^15\)
• Probiotic doses <10^10 (10 billion) CFU and single strain probiotics may be more effective than multi-strain.
• *Lactobacillus acidophilus* SDC, *Lactobacillus plantarum* 299v, *Bacillus coagulans* and *Bifidobacterium bifidum* MIMBB7 improved overall symptom scores.
• *Bifidobacterium bifidum* MIMBB7 improved quality of life.

Peptic Ulcer Disease

• Infection with *Helicobacter pylori* (*H. pylori*), a bacterial pathogen, causes gastritis (inflammation of the stomach lining) and if left untreated leads to gastric ulcers and cancer.
• Current treatment for *H. pylori* is a combination of antibiotics with a proton-pump inhibitor - treatment may cause nausea, vomiting, diarrhea and constipation.
• Various probiotic mixtures have been evaluated for their efficacy in improving the treatment (eradication rate) of *H. pylori* and preventing side effects from treatment.\(^20,18\)
• *Saccharomyces boulardii* (*S. boulardii*) CNCM I-745 improves treatment, prevents adverse symptoms and antibiotic-associated diarrhea.\(^21\)
• *Lactobacillus rhamnosus* GG showed improvements in antibiotic-associated diarrhea.

Diverticular Disease

• Diverticulosis is common, especially in older adults. (olive oil, nuts, seeds diet)
  • Diverticulitis, colonic diverticula (pouching of the colon) without or with symptoms (abdominal pain, discomfort and changes in bowel habit).
  • Few develop diverticulitis, an acute inflammation of the diverticula.
  • Few quality studies of probiotics on diverticular disease.\(^22\) Probiotics may potentially be beneficial in the management of symptoms of diverticular disease - much more research is needed before recommendations can be made.

Body Weight

• Probiotics may reduce body weight and BMI (body mass index).\(^23\)
• Multi-strain probiotics taken for 8 weeks or longer seem to be most effective.
• A greater effect is seen in overweight individuals (BMI>25).
• Various combinations and single strains have been tested - >1 species seems to be effective vs single strains.
**Type 2 Diabetes**

- Successful management of type 2 diabetes is to achieve near normal fasting blood glucose and A1C (hemoglobin A1c), a blood test used to estimate average blood glucose levels over 3 months.
- Fasting blood glucose was lower with probiotic supplementation compared to placebo.\(^{24,26}\)
- No recommendations can yet be made regarding what strain of probiotic is most effective, as the studies included in the reviews used combinations of strains of Lactobacillus and Bifidobacterium. Only one study tested a single probiotic.

**Blood Cholesterol**

- Elevated serum total cholesterol and LDL cholesterol are risk factors for cardiovascular disease (heart attack and stroke).
- Probiotics result in a significant decrease in total and LDL cholesterol.\(^{27,28}\)
- No change in HDL cholesterol (good cholesterol) or triglycerides.
- Lactobacillus acidophilus, alone and in combination with Lactobacillus lactis and Lactobacillus plantarum showed independent beneficial effects.
- Participants with the highest cholesterol levels showed greatest benefits.

**Urinary Tract Infections**

- Studies of any strain, formulation, dose, or frequency of probiotics on the prevention of UTI in healthy individuals has been evaluated.\(^{29}\)
- No benefit was found - most studies were small and poor quality.
- More research is need to determine if there is a relationship between probiotic consumption and urinary tract infections.

**Respiratory Tract Infections**

- Upper respiratory tract infections (URTI) are often due to viruses e.g. common cold.
- Evidence supports the role of probiotics in decreasing incidence of acute URTI, duration of URTI, and related antibiotic use.\(^{30}\)
- Research studies with improved quality are needed.
  
  Note: Bifidobacterium spp. have shown positive effects.

**Periodontal Disease**

- Probiotics may be beneficial in the prevention and treatment of dental caries (caries) and periodontal disease.
- Insufficient evidence on probiotics and prevention of dental caries.\(^{31}\)
- *Bifidobacterium* spp., in particular, has been shown to reduce *Streptococcus mutans* (a bacteria linked to dental caries) periodontal disease and also may help manage gingivitis and periodontitis.

**Hot research in probiotics**

- Treatment of Type 2 Diabetes
- Prevention of Gestational Diabetes
- Reducing upper respiratory symptoms
- Gut-brain e.g. abdominal discomfort, headaches etc.
- Male fertility?? (animal trials only so far)
Buying Tips

- Probiotics should be described by genus, species and strain on label, e.g. Lactobacillus helveticus R0052
- Match at least the genus and species to the health effect you want – match to strain if health effect is strain-specific.
- Label should clearly indicate viable cells (CFUs) and should exceed at minimum 1 billion and perhaps 5 billion.

Common Questions on Probiotics

- Do probiotics need to be kept refrigerated? Depends… but best option
- Do the probiotics get killed by the antibiotic I am taking? Nope…
- How often do I need to take probiotics? Daily??
- What happens when I stop taking my probiotics? Should disappear as they don't tend to colonize - take up residence in the gut.
- Any issues with allergies? Yes – milk protein.


