

## Note on Mechanism and Sources Involved in Prebiotics

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### DESCRIPTION

Prebiotics are defined as non-digestible food ingredients that were beneficial to the host through their selective stimulation of specific bacteria and fungi within the colon [1]. Prebiotics have the ability to alter the composition of the bacteria in the gut microbiome. Oat beta-glucan and chicory root inulin are two common prebiotics used in food production. Prebiotics may have an effect on bacteria outside of the colon.

Compounds that can be classified as prebiotics should have the following criteria.

- Non-digestible and resistance against stomach acids and enzymes in the human gastrointestinal tract.
- Fermented by microorganisms in the body.
- Stimulating the growth and activity of beneficial bacteria.

Thus, consumption of prebiotics may facilitate the health of the host [2]. Plant-derived carbohydrate compounds called oligosaccharides as well as resistant starch are the main source of prebiotics that have been identified. In particular, fructans and galactans are two oligosaccharide sources which have been found to stimulate the movement and development of beneficial bacterial colonies in the gut. Resistant starch has been shown to shift the intestinal bacteria, as well as improve biomarkers for numerous health conditions. Other dietary fibers of prebiotics are pectin, beta-glucans and xylooligosaccharides.

### Mechanism of action

Fermentation is the primary mechanism of action by which prebiotics are used by beneficial bacteria in the colon [3]. Both *Bifidobacterium* and *Lactobacillus* are those bacterial populations which use saccharolytic metabolism to break down substrates. The bifidobacterial genome contains numerous genes that encode for carbohydrate-modifying enzymes as well as genes that encode for carbohydrate uptake proteins. The presence of these genes indicates that Bifidobacteria contain specific metabolic pathways particularly for the fermentation and metabolism of plant-derived oligosaccharides, or prebiotics. These pathways in Bifidobacteria ultimately produce short chain fatty acids, which have diverse physiological role in body functions [4].

### Sources

Fermentable carbohydrates derived from fructans and xylans are the examples of prebiotics. In mixed diets, 4-10% of resistant starch from starchy foods will reach the large intestine. The sources of prebiotics are endogenous and exogenous.

**Endogenous:** An endogenous source of prebiotics in humans is human breast milk, which contains oligosaccharides which are structurally similar to galacto-oligosaccharides. These are referred to as human milk oligosaccharides. Human milk oligosaccharides were found to increase the Bifidobacteria bacterial population in breastfed infants and also strengthen the infant immune system. Moreover, human milk oligosaccharides help to establish a healthy intestinal microbiota composition in newborns [5].

**Exogenous:** Indigestible carbohydrate compounds classified as prebiotic fermentable fiber, hence can be classified as dietary fiber. However, not all dietary fiber can be classified as a prebiotic source. Raw oats, unrefined barley, yacon and whole grain breakfast cereals are some of those which are classified as prebiotic fiber sources. For example, oats and barley have high amounts of beta-glucans, fruit and berries contain pectins, seeds contain gums, onions are rich in inulin and oligofructose, and bananas and legumes contain resistant starch. Genetically modified plants have been created in research labs with upregulated inulin production.

### CONCLUSION

Prebiotics have the ability to alter the composition of the bacteria in the gut microbiome. Thus, it may facilitate the health of the host. Plant-derived carbohydrate compounds called oligosaccharides as well as resistant starch are the main source of prebiotics that have been identified. Fermentation is the primary mechanism of action by which prebiotics are used by beneficial bacteria in the colon. An endogenous source of prebiotics in humans is human breast milk, which contains oligosaccharides and referred to as human milk oligosaccharides. Indigestible carbohydrate compounds classified as prebiotic fermentable fiber are of exogenous source. Oats and barley have high amounts of beta-glucans, fruit and berries contain pectins, etc.

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