FIBER TYPES
The Definitive Guide
TYPE: CELLULOSE

Definition: INSOLUBLE

Food Category: Fruits, vegetables, legumes, grains, nuts, seeds

Examples:
- Apples, bananas, raspberries, carrots, beets, broccoli, collar greens, spinach, artichokes
- Black beans, navy beans, pinto beans, garbanzo beans
- Almonds, pumpkin seeds, flax seeds, walnuts
Metabolic by product:
Short-chain fatty acids (SCFA)

Effects on bowel flora:
Increase in Clostridiacea, Peptostreptococcaceae, decrease in Coriobacteriaceae

Clinical Benefits:
Increases the length of colon, associated "with protection against DSS

Dietary fibers have been observed to decrease colitis severity in acute and chronic rodent models

References:
1, 2
TYPE: HEMICELLULOSES
(Hexose, pentose)

Definition:
INSOLUBLE
– containing arabinoxylan, glucans, galantans, xylans, mannans, and pontosans

Food Category:
Whole grains

Examples:
Steel cut oats, oat bran, rice bran, wheat bran
**Metabolic by product:**

Hexose and pentose polymers

**Effects on bowel flora:**

Decreased beta glucuronidase, beta glucosidase

**Clinical Benefits:**

Increase bowel regularity and hydration, reduce cholesterol absorption

**References:**

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TYPE: LIGNIN

Definition: INSOLUBLE

Food Category: Root vegetables, berry seeds

Examples: Flaxseeds, sesame seeds
Metabolic by product:  
4-methylcatechol, dilignol, and ferulic acid

Effects on bowel flora:  
Reduces *E. coli* in broiler chickens

Clinical Benefits:  
May improve gut integrity, May reduce the risk of cancer, antioxidant properties

References:  
5, 6, 7, 8
TYPE: PECTIN

Definition: SOLUBLE

Food Category:
Apples, citrus fruits, legumes, nuts

Examples:
Citrus peels, navel oranges, braeburn apples, gaia apples, dried apricots
Metabolic by product:
Polyamines by gut microbes. Butyrate and other SCFAs

Effects on bowel flora:
Increase in Bacteroidetes in whole fecal communities in anaerobic cultures. Increase in Clostridium *coccoides*, Firmicutes and decrease in Bacteroidetes in rats

Clinical Benefits:
Apple pectin has cholesterol lowering properties in rats and decrease total cholesterol levels in humans. Contradictory studies report no effect on pectin on cholesterol levels

References:
9, 10, 11, 12, 13, 14, 15
TYPE: HYDROCOLLOIDS (gums)

Definition: HYDROPHILIC

Food Category: Thickening agents

Examples: Xanthan gum, guar gum, gum Arabic, acacia gum, carboxymethyl cellulose, Agar-agar, glucomannan – konjac root
**Metabolic by product:**
Short chain fatty acids with higher levels propionic acid, putrescine, spermidine and cadaverine

**Effects on bowel flora:**
Increased Bacteroidetes, reduced *Firmicutes* and *Proteobacteria*. Increased *Bifidobacteria*

**Clinical Benefits:**
Cholesterol lowering properties, reduced adiposity and hepatic steatosis, relief of abdominal pain in patients with irritable bowel syndrome

**References:**
16, 17, 18, 19, 20, 21
**TYPE:**

**OAT BETA GLUCAN**

**Definition:**

**SOLUBLE**

**Food Category:**

Oats, barley, rye

**Examples:**

Gluten free rolled oats, steel cut oats, whole oats, oat bran, pearled barley, while grain rye
Metabolic by product:
Short chain fatty acids

Effects on bowel flora:
Stimulate *Lactobacillus, Enterococcus, Bifidobacterium*

Clinical Benefits:
LDL reduction up to 16.5% lower postprandial blood glucose
improved wound healing

References:
22, 23, 24, 25, 26
TYPE:

MUSHROOM BETA GLUCAN

Definition:

SOLUBLE

Food Category:

Certain medicinal mushrooms

Examples:

Reishi, shiitake, chaga, maitake, cremini, mushroom sclerotia
**Metabolic by product:**
Short chain fatty acids

**Effects on bowel flora:**
Increase in Bacteroidetes and decrease in Firmicutes

**Clinical Benefits:**
Anti-carcinogenic, antiviral, immunomodulatory lower IL-4 and IL-5 cytokines, increased IL-12 decrease in post- surgical infections

**References:**
27, 28, 29
OLIGOSACCHARIDES
(short chain carbohydrates)
**TYPE:** INULIN

**Definition:**
NON-DIGESTIBLE’ OLIGOSACCHARIDE

**Food Category:**
Certain root vegetables

**Examples:**
Metabolic by product:
Lactate and acetate

Flora effects:
Increase in *Bifidobacteria Faecalibacterium praunitzii*, decrease in *Fusobacterium and Enterococci*

Clinical Benefits:
Reduced tumor incidence initiated by carcinogenic compounds such as azoxymethane (AOM) and dimethylhydrazine, Lowers plasma triacylglycerol

References:
30, 31, 32, 33, 34
TYPE:

FRUCTO-OLIGOSACCHARIDES (FOS, fructans)

Definition:

SOLUBLE

Food Category:

Certain vegetables and fruits

Examples:

Onion, chicory, garlic, asparagus, banana, artichoke, and other vegetables
Metabolic by product:
Short-chain fatty acids, acetate, propionate

FloraEffects:
Increase in Bifidobacteria and Lactobacilli, Enterococcus and Olsenella in mice, increased abundance of Clostridium leptum in rats and increased growth of Faecalibacterium prausnitzii in humans

Clinical Benefits:
May prevent colorectal cancer. Associated with reduced mucosal inflammation and lesion scores in a rat model of colitis, reduction in body weight in human subjects, promotes satiety, increases IL-10 production in intestinal dendritic cells in Crohn’s disease patients

References:
35, 36, 37, 38, 39, 40
TYPE: GALACTO-OLIGOSACCHARIDES (GOS, galactans)

Definition: SOLUBLE

Food Category:
Legumes

Examples
Lentils, garbanzo beans, green peas, lima beans, kidney beans
**Metabolic by product:**
SCFAs, lactate, acetate

**FloraEffects:**
Increase in Bifidobacteria and lactobacilli, decrease in family Bacteroidaceae

**Clinical Benefits:**
May play a role in prevent or progression of colorectal cancer. Increased calcium absorption, may improve IBS symptoms

**References:**
41, 42, 43
TYPE:

RAFFINOSE OLIGOSACCHARIDES
(ROS, raffinose, stachyose, verbascose)

Definition:

Food Category:
Legumes, cruciferous vegetables

Examples:
Black eyed peas, lima beans, kidney beans
Cabbage, Brussels sprouts, broccoli, asparagus
**Metabolic by product:**
Lactic acid, propionic acid, d-galactose

**FloraEffects:**
Bifidogenic, increase in *Lactobacilli* and *Bifidobacteria* [44]

**Clinical Benefits:**
Alleviation of constipation

**References:**
44, 45
RESISTANT STARCH
**TYPE:**

RS1

**Definition:**
Physically inaccessible or indigestible resistant starch

**Food Category:**
Seeds or legumes and unprocessed whole grains, coarsely milled grains, seeds or legumes

**Examples:**
Cracked wheat, red beans, raw steel cut oats, pinto beans, white beans
**Metabolic by product:**
SCFA, mainly acetate, propionate and butyrate

**FloraEffects:**
Increases in *Ruminococcus bromii* and *Eubacterium rectale*

**Clinical Benefits:**
Decreases risk of colorectal cancer by increasing SCFA, decrease in fecal pH and transit time. Increased insulin sensitivity

**References:**
46, 47, 48
TYPE:

RS2

Definition:
Resistant starch is inaccessible to enzymes due to starch conformation

Food Category:
High amylopectin pea starch, high amylose corn starch, raw potato, unripe banana

Examples:
RS2 Pea starch in Adrenal Reset Shake, Webo banana flour, unmodified potato starch
Metabolic by product:
SCFA, mainly acetate, propionate and butyrate

FloraEffects:
Increase in Bifidobacterium, Lactobacillus brevis, bifidobacterium subtilis
Decreases Candida, improves SIBO

Clinical Benefits:
Reduces hunger, improves weight loss, lowers glucose levels, increases metabolism of fat, increase GLP1

References:
49
TYPE: RS3

Definition: Resistant starch that is formed when starch-containing foods are cooked and cooled

Food Category: Cooled potato, rice, pasta

Examples: Boiled and refrigerated potatoes, chilled sushi rice
Metabolic by product:
Acetate and propionate

FloraEffects:
Increase in *Ruminococcus bromii* and *E. rectale*

Clinical Benefits:
Improve basal metabolic rate, improve bowel flora

References:
50, 51
**TYPE:** RS4

**Definition:** Resistant starch formed by chemical modification to create resistance to enzyme digestion

**Food Category:** Cross linked starch with sodium trimetaphosphate or tripolyphosphate

**Examples:** Fibersym RW, Midsol, Midsol 46, Pregel 40
Metabolic by product:
Unknown

FloraEffects:
Unknown

Clinical Benefits:
Decrease postprandial glucose and insulin
**TYPE:** RS5

**Definition:**
Resistant starch formed by heading starch with fats or lipids into starch-lipid or amylose lipid complexes

**Food Category:**
Non commercially available

**Examples:**
None
Metabolic by product:
Unknown

FloraEffects:
Unknown

Clinical Benefits:
Bread from 60% RS5 decreased postprandial plasma glucose and insulin to 55 and 43% of that of white bread.

References:
52
REFERENCES
(Endnotes)


