

NHS Fiber Summary

Fiber Definition:

The definition of fiber differs slightly among various organizations and regulatory authorities. The most common definition used:

* Dietary Fiber is non-digestible carbohydrates and lignin which are neither digested nor absorbed in the human small intestine
* Functional Fiber is isolated, non-digestible carbohydrates which exert beneficial physiological effects in humans
* Total Fiber is the sum of dietary and functional fiber

Soluble vs. insoluble fibers.

* Soluble fibers, dissolve in water and form a gel. They are generally fermented by bacteria in the lower intestine forming short-chain fatty acids (SCFAs) including acetate, propionate and butyrate. SCFAs generate energy from the ingested fiber that can be used by other body cells or transported in circulation. Soluble fibers, like PHGG, also can have a prebiotic effect, by stimulating the growth of beneficial bacteria such as Bifidobacteria and Lactobacilli.
* Insoluble fibers, do not dissolve in water and are generally less fermentable by colonic microflora, so they pass through the intestinal tract intact. Insoluble fibers have water-attracting properties and pull water into the stool, therefore making stool easier to pass.

Public Health Recommendations;

Recommendations for dietary fiber intake in adults:

* The Dietary Guidelines for Americans 2015-2020 recommend a dietary fiber intake of 14 g per 1000 kcal consumed [51]. For adults, this level of fiber intake typically equates to approximately 30 g/day for men and 25 g/day for women [51]
* The European Food Safety Authority (EFSA) set 25 g/d as the Dietary Reference Value for fiber to support normal bowel function. They note that higher intakes of fiber are associated with additional health benefits such as reduced risk of heart disease and type 2 diabetes
* In Japan, the DRI for dietary fiber for adults aged 18+ is >20 g/d for males and >18 g/d for females [53]

Recommendations for dietary fiber intake in children:

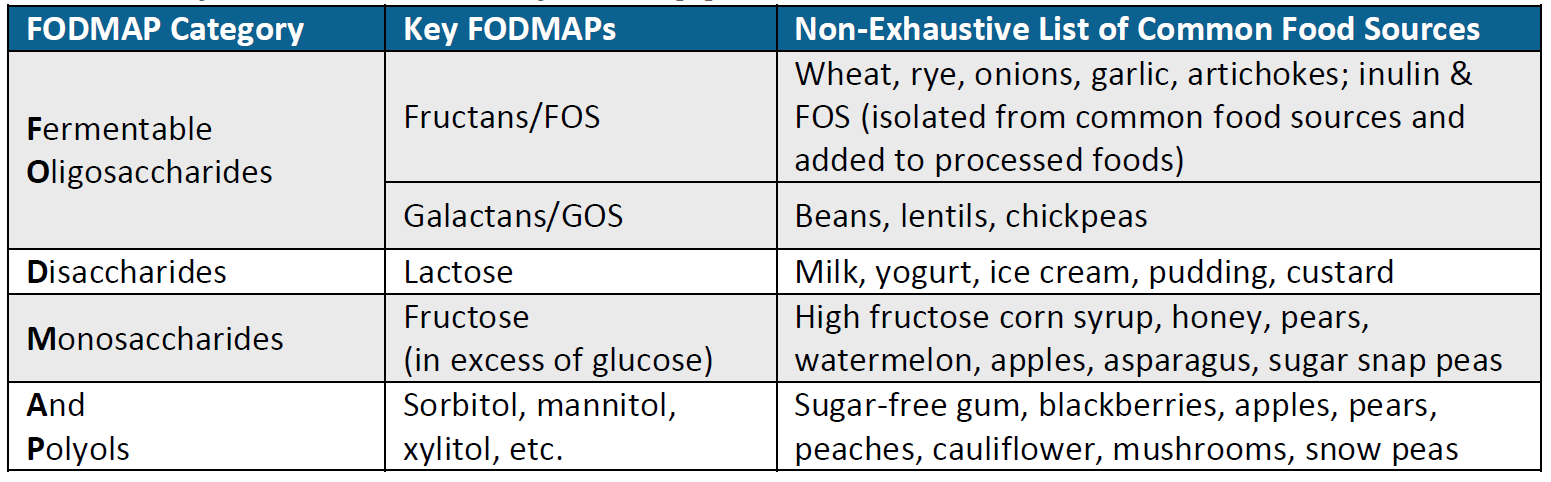
* The US Institute of Medicine uses the same Adequate Intake for adults as for children (i.e. 14 g fiber/1000 kcal)
* EFSA acknowledges there is limited evidence to set an adequate intake and suggests 2 g fiber per MJ (8.4 g/1000 kcal) is adequate for normal laxation in children aged 1 year and older
* The “age plus 5” rule (i.e. age + 5 g fiber) and 0.5 g/kg body weight are also commonly used as a basis for fiber recommendations in children



Fermentable, Oligosaccharides, Disaccharides, Monosaccharides, And Polyols (FODMAP)

FODMAPs share a number of characteristics:

* Poorly or slowly absorbed
* Osmotically active molecules
* Rapidly fermented by gut bacteria



Recommendations:

* There is good evidence to support elimination of FODMAPs and FODMAP fibers in products positioned for individuals with IBS. There may also be a benefit for individuals with other GI disorders. Providing prebiotics to support the gut microbiota is needed in these patients.
* There is no evidence to support eliminating FODMAPs in products not positioned for these populations. In most NHSc products, the amount of FODMAPs contributed by fiber is below that shown to induce GI symptoms. Additionally, these fibers provide important benefits related to SCFA production and preservation of gut microbiota.
* Additional education for HCPs on the science for FODMAPs in IBS vs. other populations, and the amounts of FOS and inulin in NHSc products is required. These recommendations are reflected in the updated

Clinical Nutrition Guidelines



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| Organisation | Recommendation |
| ESPEN 2006 | * A fiber intake of 15-30 g/d is considered advisable for patients on EN * In acute illness, fermentable fiber is effective in reducing diarrhea in patients after surgery and in critically ill patients (PHGG and pectin are superior to soy polysaccharides) * In non-ICU patients or in patients requiring long-term EN, the use of a mixture of bulking and fermentable fiber would appear to be the best approach * Although it is known that fermentable and viscous fiber (e.g. oat beta-glucan) are effective for glycemic control, there are no short or long-term studies available using these fibers in enteral formulae |
| ASPEN/SCCM 2016 | **For fiber-containing enteral formulas:**  **E4a.** We suggest that a commercial mixed fiber formula **not** be used routinely in the adult critically ill patient prophylactically to promote bowel regularity or prevent diarrhea.  [Quality of Evidence: Low]   * Routine provision of a commercially available mixed fiber formulation in a non-ICU patient may be useful in promoting bowel regularity. In a critical care setting, however, there is concern for use of mixed fiber formulas in patients at high risk for bowel ischemia or severe dysmotility due to reports of bowel obstruction in surgical and trauma patients receiving such formulations containing insoluble fiber.   **E4b.** Based on expert consensus, we suggest considering use of a commercial  mixed fiber-containing formulation if there is evidence of persistent diarrhea.  **E4b.** We suggest avoiding both soluble and insoluble fiber in patients at high risk for bowel ischemia or severe dysmotility.  **For providing adjunctive therapy:**  **F1.** Based on expert consensus, we suggest a fermentable soluble fiber additive  be considered for routine use in all hemodynamically stable MICU/SICU patients on a standard enteral formulation.  **F1.** We suggest that 10-20 g of a fermentable soluble fiber supplement be given in divided doses over 24 hours as adjunctive therapy if there is evidence of diarrhea.  Routine use of a soluble fiber additive should be considered in all ICU  patients as a prophylactic measure to help maintain commensal microbiota  and promote bowel health. |
| ESPEN 2018 | **Recommendation 3**   * For EN, fiber-containing products should be used. (BM)   Grade of recommendation B - strong consensus (91% agreement)  Commentary  Since dietary fiber may contribute to the normalization of bowel functions, and intake is usually low in geriatric patients, the importance of an adequate intake of dietary fiber is emphasized.  Daily amounts of 25 g are considered adequate for normal laxation in adults of ages and can be regarded as guiding value also for older patients.  Also for EN, there is no reason to omit dietary fiber as long as bowel function is not compromised. Conversely, fiber containing products for EN have been shown to contribute to normal bowel function and are, thus, generally recommended. In addition, enterally nourished patients should not be deprived of the well-known beneficial metabolic effects of dietary fiber. |

NHS Fibers



**Acacia Gum (AG)**

Acacia gum (AG) is a non-viscous, soluble fiber obtained as an exudate from the branches and stems of Acacia senegal and Acacia seyal. AG arrives to the colon undigested, and is slowly and completely fermented by colonic bacteria to yield SCFAs, namely propionate and butyrate.

AG is well tolerated up to high doses (50 g/d) and produces fewer GI symptoms than other fermentable fibers. AG has been shown to act as a prebiotic at a dose of 10 g/d in healthy adults and may act synergistically with other fermentable fibers at lower doses.

**Fructooligosaccharides (FOS) & Inulin**

FOS/oligofructose (OF) and inulin are non-viscous, soluble fibers obtained from a number of foods (primarily chicory root). Low doses of these fibers are generally well tolerated and can easily be incorporated into foods and beverages, making FOS and inulin useful sources of added fiber. FOS and inulin have been shown to selectively promote the growth of beneficial microbes such as bifidobacteria and lactobacilli and inhibit potential pathogens. This prebiotic effect has been established in a number of populations (infants, adults, elderly, hospitalized patients).

Low doses of these fibers are generally well tolerated . The effect is observed at doses as low as 5 g/d in adults, but in general a daily intake of 8 g/d is recommended to achieve these results.

**Partially Hydrolyzed Guar Gum (PHGG)**

PHGG is a soluble, vegetable white fiber composed of a linear backbone chain of β-1,4-linked mannose with side chain of α-1,6-linked galactose units. PHGG is commonly described as galactomannan and is formed by hydrolysis of Guar Gum, the ground endosperm of the guar plant *Cyamopsis tetragonoloba*. Fermentation of PHGG by colonic bacteria results in high levels of SCFAs (namely butyrate and propionate), which is useful for colonic health.

PHGG is well tolerated and doses up to 40 g/d have been used with no major side effects. 20-22 g/L of PHGG has been shown to reduce diarrhea in the clinical setting, and is an appropriate choice for this benefit. These qualities make PHGG a desirable choice for an added fiber source.

Recommendations:

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| Organisation | Recommendation |
| ESPEN 2004  *Consensus recommendations* | To prevent EN-induced diarrhea in post-surgical and in critically ill patients, supplementing EN with PHGG is effective (recommendation A) |
| ESPEN 2006 | In acute illness, fermentable fiber is effective in reducing diarrhea in patients after surgery and in critically ill patients. It was shown that guar gum (e.g. partially hydrolyzed guar gum) and pectin are superior to soy polysaccharides |



**Outer pea fiber**

Outer pea fiber is an insoluble fiber obtained from the hulls, or testa, of the field pea.

The primary benefit of pea fiber is its effects on increasing stool frequency in individuals with infrequent bowel movements, suggesting a normalizing effect on bowel function.

This has been observed at doses of 4 g/d in children and the elderly. There is some evidence of a stool bulking effect.

Pea fiber has been shown to be well tolerated and have a high acceptability at doses of 15-30 g/d.



**NHS Fiber blends**

**Prebio1**

Prebio1 is a blend of 100% soluble, fermentable, prebiotic fibers consisting of 70% FOS and 30% inulin.

**Prebio1+**

Prebio1+ is a blend of 100% soluble, fermentable, prebiotic fibers consisting of 41% FOS, 41% AG, and 18% inulin.

The combination of these fibers provides a range of short (FOS), medium (inulin), and long chain (AG) prebiotic fibers which are fermented at different rates, thus suggesting benefits along the entire length of the colon. The use of a 1:1 ratio of AG and FOS has been shown to promote a synergistic beneficial effect as well as enhanced GI tolerance, thus making this combination of soluble fibers ideal for addition to enteral formulas.

**IS50™**

This blend is a 50:50 mix of soluble and insoluble fibers. The soluble component of the fiber blend includes Prebio1+ (FOS, AG and Inulin), while the insoluble portion is composed of outer pea fiber.

This blend is suitable for the non-disease specific tube feeding formulas. It is specifically designed to maximize health benefits while optimizing GI tolerance and ensuring excellent flow rates during tube feeding. All fibers are included at levels shown to be well tolerated in human trials.

The amount of fiber offered by the blend in a complete feeding meets the recommendations for the target population, as set by several professional associations:

* ESPEN (2006): Patients with normal gut function, including postsurgical patients, may benefit from added fiber; 10-15 g fiber/L is an appropriate minimal amount
* Institute of Medicine (IOM) and American Dietetic Association (2008): 14 g fiber/1000 kcal
* American Diabetes Association (2004): 15-25 g/1000 kcal

**Acacia gum/PHGG (2:1)**

Emerging data supports that FODMAPs (including the fibers FOS and inulin) may lead to intolerance in

individuals with IBS. Other populations of concern include individuals with gastroparesis and small

intestinal bacterial overgrowth (SIBO).

Both acacia gum and PHGG are non-FODMAP fibers which are known to be well tolerated at high levels.

Increasing doses of acacia gum up to 70 g/d caused no major side effects in healthy adult subjects, and

a dose of 46 g acacia gum was required to cause symptoms similar to those experienced with 17 g FOS. PHGG is reported to be well tolerated at levels up to 40 g/d [101].

The AG/PHGG blend is recommended as a non-FODMAP fiber blend for individuals with digestive sensitivities, malabsorption and/or GI intolerance.