# POLYDEXTROSE AND WEIGHT MANAGEMENT

Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. Globally, in 2016, more than 1.9 billion adults aged 18 years and older were overweight and of these, over 650 million were obese (BMI >30 kg/$m^2$).[1]

Increase of westernization, urbanization and mechanization occurring in most countries around the world with changes in dietary intake towards high fat, energy-dense foods and a sedentary lifestyle, has driven the increase in obesity rate.[2]

A comprehensive program of lifestyle modification is considered the first option for weight management, which includes diet, exercise, and behavior therapy.[3] A lower energy intake or higher energy expenditure leading to negative energy homeostasis can help reduce the risk of obesity.

Dietary fibres can help lower energy intake due to satiation and satiety mechanisms that help in the regulation of appetite control,[4,5] favouring weight management and contributing to a healthy lifestyle.

## DIETARY FIBRE AND WEIGHT MANAGEMENT

Dietary fibres are an important tool to modify the quality of the diet and also to reduce total caloric load of foods and beverages. An intake of 25 – 29 g/day is associated with lower body weight, compared to lower fibre intake.[6]

According to the U.S. Food and Drug Administration (FDA), dietary fibre is defined as (Fed Reg. 2016. 81:33979):[7]

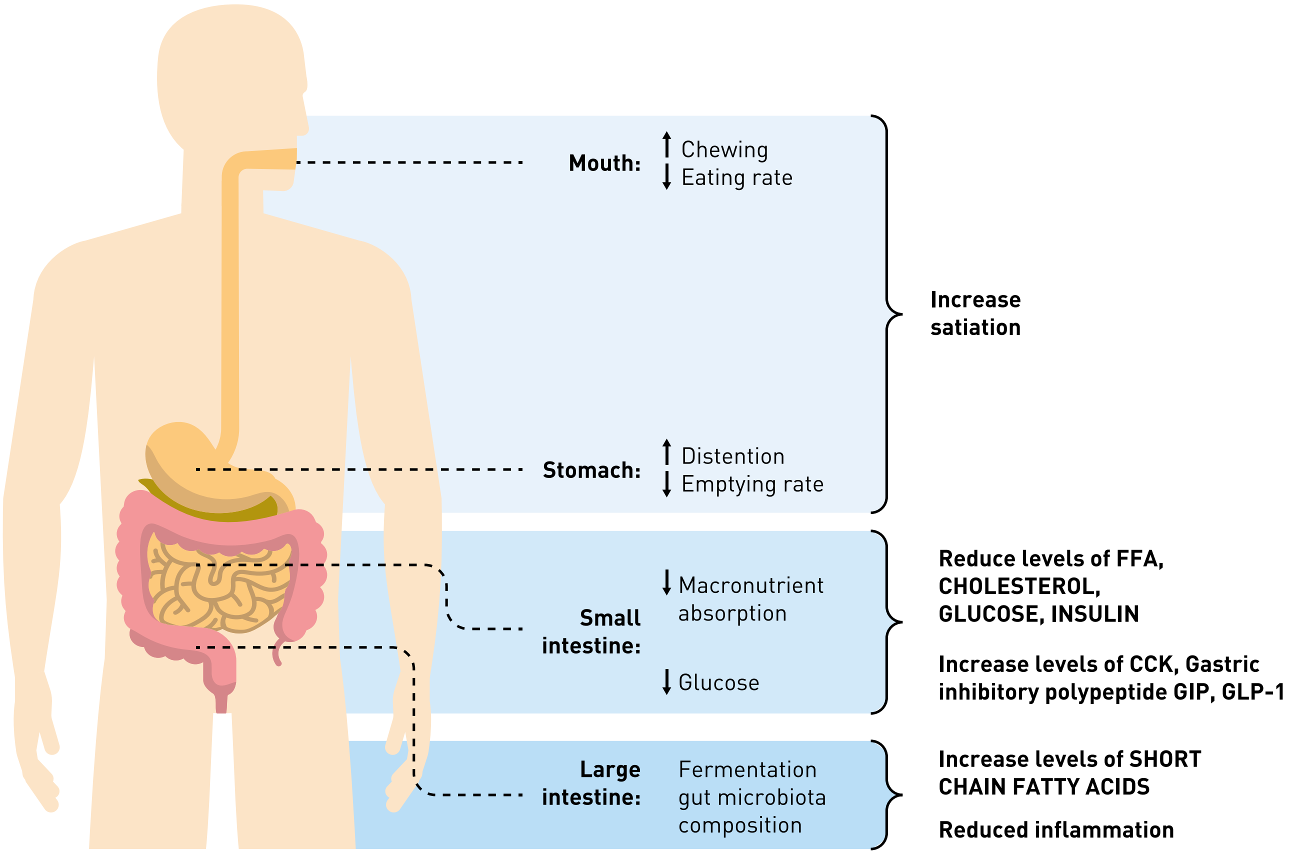
(1) Non-digestible soluble and insoluble carbohydrates (with 3 or more monomeric units) and lignin that are intrinsic and intact in plants;

(2) Isolated or synthetic non-digestible carbohydrates (with 3 or more monomeric units) determined by FDA to have physiological effects that are beneficial to human health.

Dietary fibres can delay intestinal transit and reduce glucose and free fatty acid (FFA) absorption (Figure 1).[8] Furthermore, the reduction in glucose absorption lowers insulin response and reduces the risk of reactive hypoglycemia during the post-absorption period, and thus decreases hunger.[9]

The role of dietary fibres in modulating secretion of gastrointestinal hormones in the small intestine has also been reported. A fibre-rich meal can help with the release of cholecystokinin (CCK), a peptide involved in gastric emptying regulation and hypothalamic satiety nucleus stimulation.[10] In addition, dietary fibres also increase glucagon-like peptide-1 (GLP-1), a gut hormone involved in satiety control and gastric emptying as well as influencing microbiota composition associated with lean individuals.[11,12]

Figure 1. Plausible mechanisms of dietary fibres and satiety[8]




## POLYDEXTROSE ROLE IN WEIGHT MANAGEMENT

Polydextrose is a highly branched, randomly bonded glucose polymer.[13] Its low viscosity, high solubility in water, bulking and texturing properties, and bland taste lends itself to a wide-variety of food and beverage formulations.[14] Polydextrose resists digestion and absorption and has the physiological effects of dietary fibre, and depending on local regulatory guidelines, it provides a caloric content of ~1 kcal/g*.

In several human studies, polydextrose was found to have a beneficial effect on body weight and glucose homeostasis. Hull et al found a decreased feeling of hunger and a reduced energy intake when yoghurt-based drinks containing 12.5 g of polydextrose were consumed 90 minutes before an *ad libitum* lunch and dinner.[15] Another acute study by Ranawana et al showed that the consumption of a smoothie containing 12 g of polydextrose 60 minutes prior to a meal significantly reduced energy intake during lunch.[16]

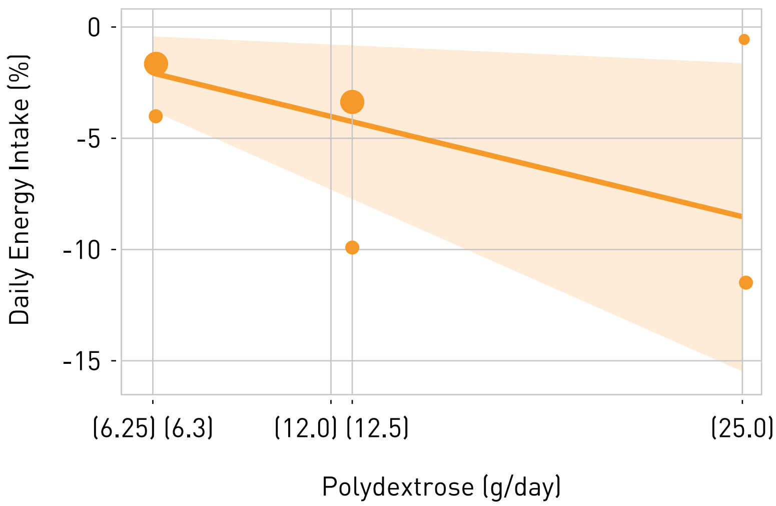
Furthermore, a dose dependent effect of polydextrose on decreasing energy intake was reported by Astbury et al.[17] In this study, 6.25 g, 12.5 g and 25 g of polydextrose was consumed 90 min before an *ad-libitum* lunch. Polydextrose effectively reduced subsequent energy intake in a dose-dependent manner. Konings et al found a pronounced decrease in feelings of hunger and an increase in whole-body fat oxidation, as well as a reduced postprandial peak glucose and insulin response when 30% of the daily carbohydrate intake was replaced by polydextrose at breakfast and lunch.[18] Olli et al showed that the supplementation of 15 g polydextrose to a high-fat meal reduced feelings of hunger, which was accompanied by increased plasma concentrations of the satiety-stimulating incretin glucagon-like peptide-1 (GLP-1), a hormone that could lead to appetite reduction.[19]

Longer-term studies have shown a reduced total daily energy intake with the addition of polydextrose in the diet.[20] In one study, the polydextrose group showed reduced glucose and ghrelin concentrations and increased GLP-1 and peptide tyrosine–tyrosine (PYY) responses, compared to the control group.

*Energy value of polydextrose for nutrition panel will vary according to different countries depending on local regulatory guideline.

In a study by Costabile et al, participants who consumed 8 g of polydextrose for 21 days showed a reduction in consumption of snacks and an increase in intestinal butyrate producing microbes, e.g. *Ruminococcus intestinalis* and bacteria of the *Clostridium* clusters I, II and IV.[21] A systematic review and meta-analysis to examine the effects of polydextrose on different levels of energy intake,[22] which included six studies and a total of 120 human volunteers, concluded that the consumption of polydextrose reduces voluntary energy intake levels in a dose-dependent manner (Figure 2).

Figure 2. Linear regression for reduction in energy intake (%) vs polydextrose intake[22]




## POSSIBLE MECHANISMS OF POLYDEXTROSE IN BODY WEIGHT REDUCTION

**A) Increased gastrointestinal transit time**

Polydextrose has been shown to have an impact on gastrointestinal transit time in human volunteers.[23,24] Increased gastrointestinal transit time might lead to a more gradual nutrient absorption in the proximal intestine and prolong the feeling of satiety. Satiety and post-prandial fullness were observed in more than 50% of those who experienced delayed in gastric emptying.[25]

**B) Effects on intestinal microbiota**

Gut microbiota may have an important role in modulating glucose homeostasis, obesity and metabolic syndrome. A human trial showed the number of a well-known producer of butyrate, *Faecalibacterium*, was increased after consumption of polydextrose for 21 days.[26] The concentration of this bacteria was found to be lower in individuals with diabetes compared to those without.[27] In a human crossover study by Costabile et al, an increase in the concentration of the *Eubacterium rectale–C. coccoides* group, which includes important butyrate-producing microbes, such as *Faecalibacterium prausnitzii* and *Ruminococcus intestinalis*, was found after polydextrose consumption for 3 weeks.[21]

Overall, available evidence suggests that polydextrose can induce changes in microbial composition, and favours an increase in production of short-chain fatty acids (SCFAs), which may lead to an improvement in metabolic profile.

**C) Increased short chain fatty acids (SCFA) production**

Several clinical studies have evaluated fecal SCFA following polydextrose feeding and found an increase in these fatty acids.[28,29] In one study, the production of acetate and butyrate in the faeces of the human volunteers who ingested 8 g or 12 g polydextrose increased significantly.[29] A polydextrose intake of ≥8 g/day has been shown to result in substantial production of butyrate and subsequent desirable effects on the human colon. An increase in SCFA may play a role in appetite regulation via the secretion of the gut-derived satiety-stimulating hormones peptide tyrosine tyrosine (PYY) and GLP-1 from enteroendocrine cells (L-cells) in the ileum and colon.

PYY is not only an appetite and satiety-regulating hormone, but is also known to stimulate glucose-induced insulin secretion and insulin sensitivity.[30,31] GLP-1 may help to increase insulin secretion, inhibit glucagon production and increase pancreatic B-cell proliferation and function.[32]

## Conclusion

Obesity is a global epidemic. With a staggering increase in the prevalence of obesity worldwide and its close association to chronic disease, a balanced dietary approach is one important measure that can help to address this public health challenge. Research indicates that diets containing an adequate amount of dietary fibre are linked to lower body weight due to an increase in satiety.[33] STA-LITE® Polydextrose has been shown to favourably impact satiety and reduce food intake. Reformulation of foods and beverages to include STA-LITE® Polydextrose to reduce sugar and caloric content can be an effective strategy for overall weight management.

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