Product introduction

Better quality, better food

YOUNG SOO FOOD

SWEET HAPPY Allulose

SWEET HAPPY Allulose

- A natural rare sugar ingredient
- Safe for everyone with low GR
- Easy to use with properties similar to liquid fructose
- Minimize the shortcomings of allulose products with rice syrup and Indigestible Maltodextrin
- A low-calorie product with 35 kcal per 100 g
- Contains 4 g Dietary Fiber per 100 g
- Can be produced in various packaging units
  - 10~20g stick product
  - 25~250g pouch, small package product
  - 700g, 1kg, 1.2kg pump type for home and store
  - 3~25kg large capacity product

SWEET HAPPY Allulose with Samyang corp.

Allulose raw material manufacturer	Raw material GMO status	Strength
Samyang corp.	Non-GMO	- Developed with Samyang Corp's own enzyme technology - Australia, New Zealand allowed to import, only among Korean product
Domestic Company D	GMO	
Chinese products	Unclear	

- In addition to allulose, Samyang Corp. handles a variety of functional ingredients such as dietary fiber (Indigestible maltodextrin), oligosaccharide, sugar alcohol, and high-intensity sweeteners
- 40 Years of Partnership with Samyang Corp. – Currently producing 1,000 tons of Samyang's products per month
- Receive excellent raw materials from Samyang Corp.
- Allulose-based vanilla syrup and maple syrup are under development
- Through cooperation with Samyang Food Research Institute, such as Cafe Syrup and Hazelnut Syrup, desired composition and functional products can be developed

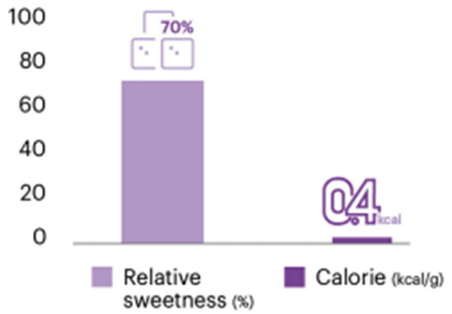
SWEET HAPPY Allulose - Allulose

Nexweet® Allulose

SAMYANG

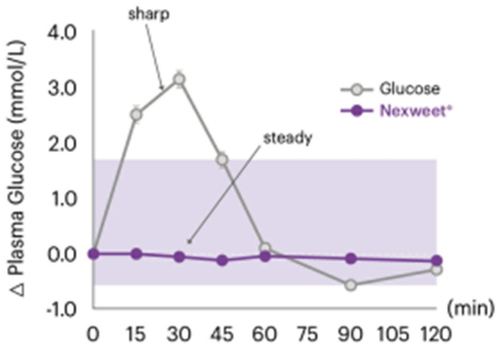
01 Characteristics

Almost zero calorie sweetener with 'No added sugar' claim



*Sucrose relative sweetness = 100

Lower blood glucose curve



* Glycemic response research report SUGiRS (2023)

The most sugar-like sweetener

- ✓ Activates 100% of sweetening sensation with its full agonist molecule
- ✓ Optimizes the sweet taste with its enhancing, masking, and modifying properties

Allulose raw material accounting for more than 90% of the product

- Natural rare sugar found in fruits such as figs and grapes
- Almost 0 kcal food material allulose
- Uses raw materials from Samyang Corporation, a leading domestic allulose developer
- Produced using Samyang Corporation's proprietary enzyme technology
- Safe for diabetes due to low blood sugar response

SWEET HAPPY Allulose - Allulose

03 Health functionalities

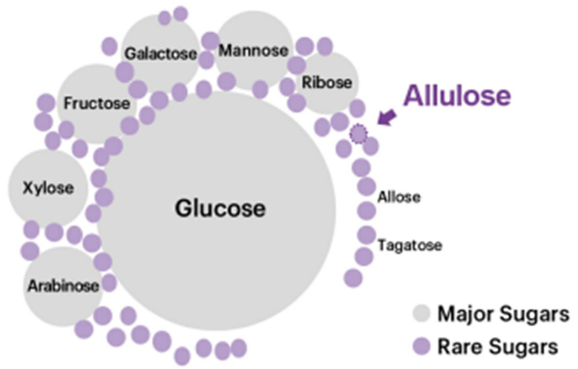
1. Improves glucose metabolism by alleviating insulin resistance
2. By regulating oxidative stress, maintains the function of beta cells and insulinemic function
3. Alleviates adiposity by improving adipokine levels and lipid profiles
4. Maintains intestinal barrier integrity by enhancing the tight junction proteins
5. Inhibits the growth of cavity-inducing bacteria and does not induce dental caries

04 Application

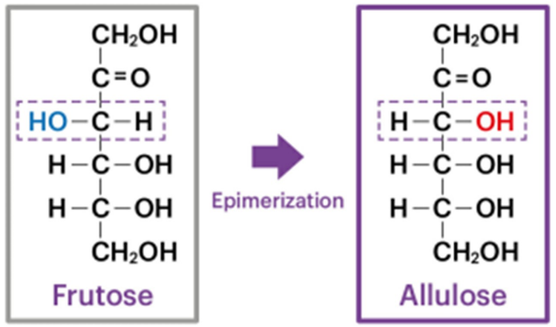
Certifications

SWEET HAPPY Allulose - Allulose

▲Figure 1. Composition in natural sweeteners



▲Figure 2. Allulose: C3 epimer of fructose



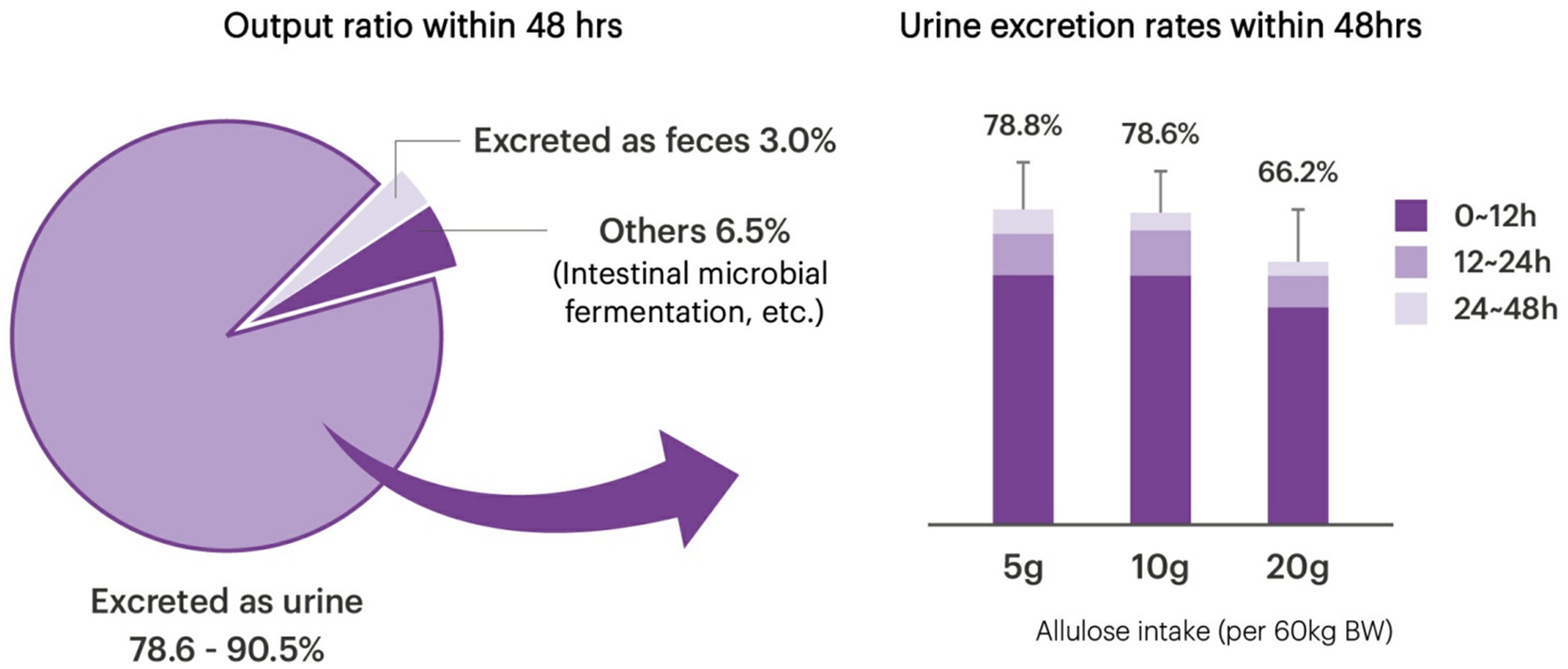
▲Table 1. Sweetener comparison chart

	Sweeteners approved as food additives		Plant, fruit based high intensity sweeteners		Natural sugars	Sugar alcohols		
Sweeteners	Sucralose	Aspartame	Steviol glycosides	Monk fruit	**Allulose**	Xylitol	Maltitol	Erythritol
Calories (kcal/g)	0	0	0	0	**0.4**	2.4	2.1	0
Sweetness Intensity (SI)*	600	200	200 ~ 400	100 ~ 250	**0.7**	~1	0.8 ~ 0.9	0.6 ~ 0.7

* SI of sucrose: 1

SWEET HAPPY Allulose - Allulose

▲Figure 3. Output after ingestion of Allulose

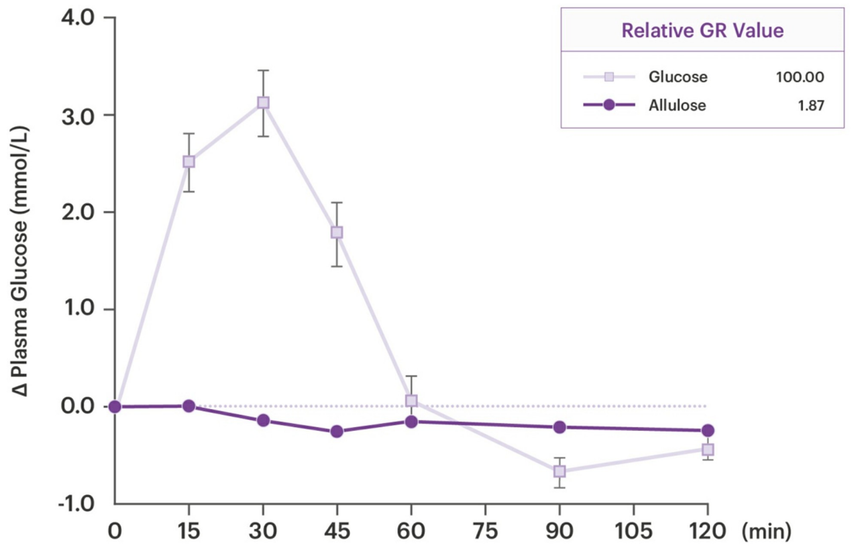


SWEET HAPPY Allulose - Allulose

Nexweet® Allulose shows a low level of glycemic response.

The relative postprandial glycemic response (GR) value was measured using the modified method of ISO 26642:2010. In human (n=10), the GR value is measured after consuming the aqueous solutions containing 25 g of Nexweet® Crystalline Allulose or glucose each. For Nexweet® Crystalline Allulose, the GR value is about 1.87, compared to 100 for reference food (glucose).

▲Figure 4. The average plasma glucose concentration curves after Allulose or glucose intake

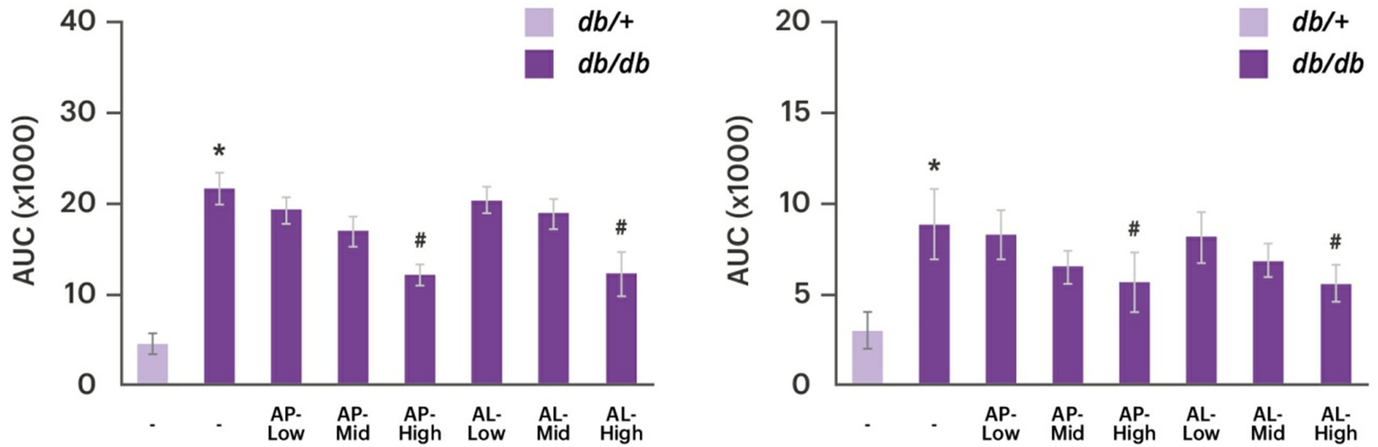


SWEET HAPPY Allulose - Allulose

Nexweet® Allulose has the effect of regulating glucose metabolism.

To determine the effect on changes in postprandial blood glucose levels, two types of Nexweet® Allulose samples, liquid (AL) and crystalline powder (AP) type, were orally administered at a daily dose of 1.02 g/kg (low), 3.07 g/kg (mid), and 5.16 g/kg (high) to mice. The oral glucose tolerance test (OGTT) and the insulin tolerance test (ITT) were conducted on diabetic (*db/db*) mice. For the OGTT, 1 g/kg of glucose was orally administered to mice after an overnight fast. Subsequently, blood samples were collected from the tail vein at 0, 15, 30, 45, 60, 90, and 120 minute(s) to measure glucose levels. As a result, there was an improvement in postprandial blood glucose levels in the *db/db* group treated with Nexweet® Allulose, compared to the vehicle-treated group.

▲Figure 5. Effects of Allulose on blood glucose levels (OGTT, ITT)

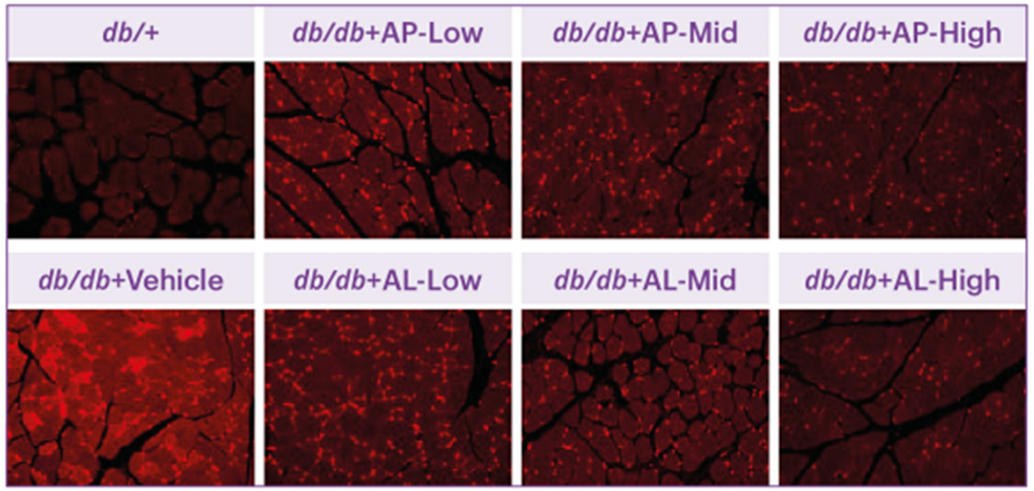


SWEET HAPPY Allulose - Allulose

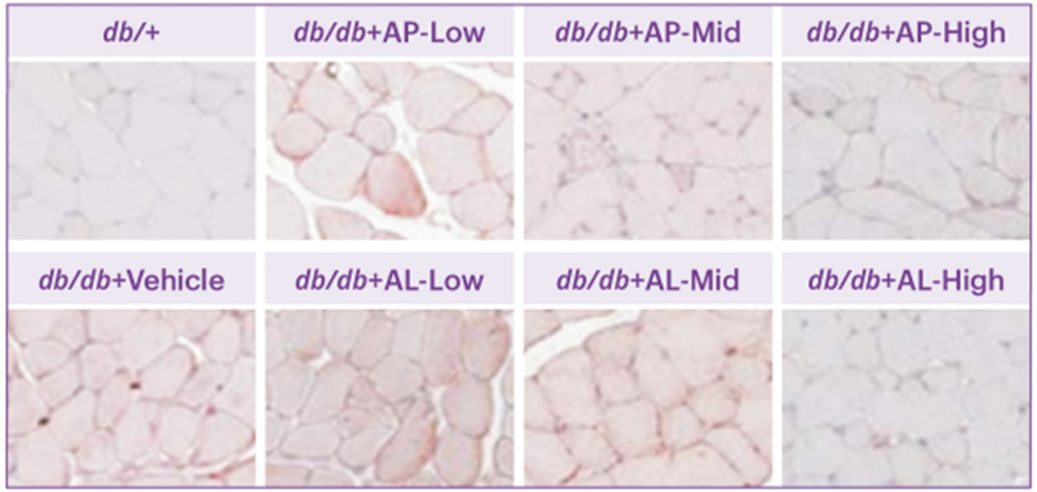
Nexweet® Allulose controls oxidative stress and ER redox balance in skeletal muscle cells under hyperglycemic conditions.

In diabetic patients, high glucose level is associated with increased reactive oxygen species (ROS) production. It causes oxidative stress, eventually leading to several cellular damages, such as the apoptosis of β-cells. The ROS level in the skeletal muscles of diabetic mice (diabetic *db/db* mice) was higher than that in non-diabetic mice. When Nexweet® Allulose (liquid [AL] or crystalline powder [AP]) was administered to diabetic mice, the ROS level is alleviated. ROS generation related to glucose metabolism is influenced by the conversion of NADPH to NADP+. The ratio of NADP+/NADPH decreased upon Nexweet® Allulose administration, leading to reduced NADPH oxidase (Nox) activity and decreased Nox4 expression.

▲Figure 7. Representative DHE-stained images depicting ROS production



▲Figure 8. Representative images of Nox4 staining in tibialis anterior muscle

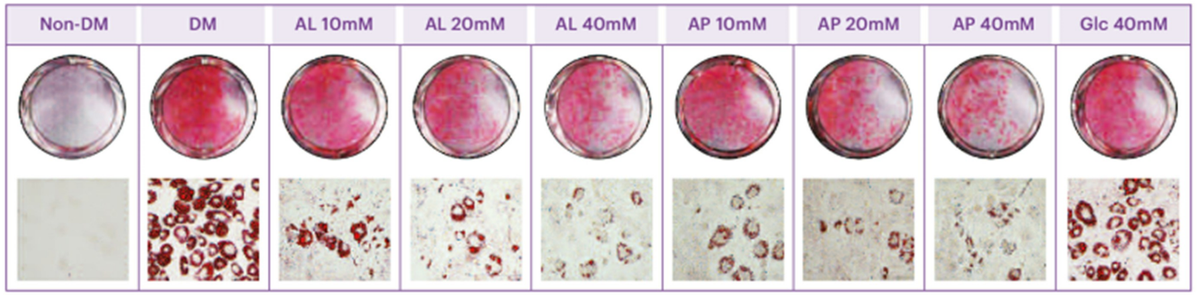


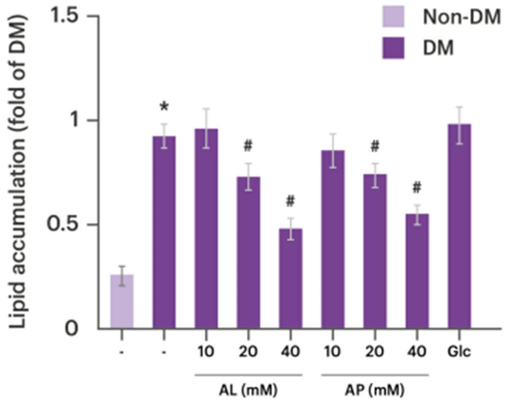
SWEET HAPPY Allulose - Allulose

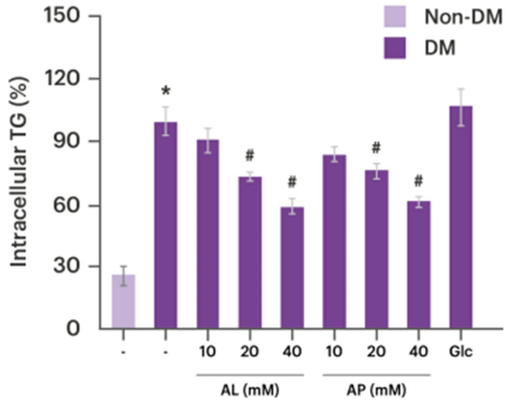
Nexweet® Allulose modulates the lipid accumulation and intracellular triglyceride levels in 3T3-L1 adipocytes.

To investigate the anti-adipogenic effect, *in vitro* Oil red O (ORO) staining was performed using 3T3-L1 preadipocytes. When Nexweet® Allulose (liquid [AL] or crystalline [AP]) was treated in a test group with the differentiated medium (DM), lipid accumulation was significantly reduced in a dose-dependent manner against the DM-only group. On the other hand, when glucose was treated instead of Nexweet® Allulose, there was no improvement in lipid accumulation. In addition, the high-concentration Nexweet® Allulose treatment group showed a significant reduction in intracellular triglyceride (TG) levels compared to the other groups.

▲Figure 9. Lipid accumulation and intracellular TG content in differentiated 3T3-L1 adipocytes







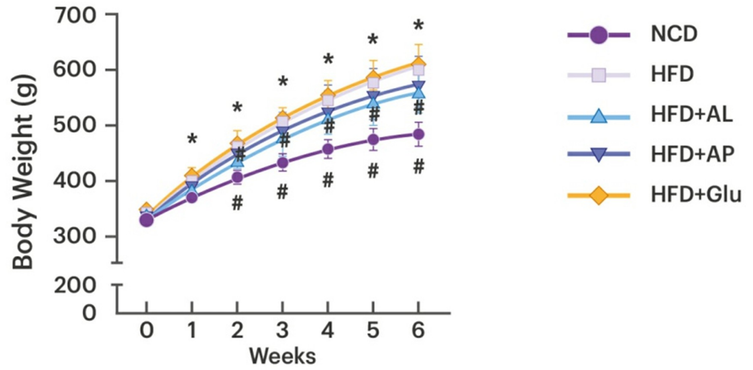
*$P < 0.05$ versus Non-DM, #$P < 0.05$ versus DM

SWEET HAPPY Allulose - Allulose

Nexweet® Allulose alleviates weight gain.

Nexweet® Allulose was administered to SD rats at a daily dose of 0.4 g/kg fed with a high-fat diet (HFD) to evaluate its efficacy in inhibiting fat accumulation. In the tests, Weight loss was observed in the Nexweet® Allulose-fed group compared to the group that only fed HFD. Since there was no difference in total food intake between each experimental group, it means that Nexweet® Allulose alleviates the rate of weight gain.

▲Figure 10. Effects of Allulose on changes in body weights



When biochemical parameters in serum were analyzed in each test group, Nexweet® Allulose showed a decrease in ALT and AST, which increased when HFD was supplied. In addition, the levels of triglyceride, total cholesterol, and LDL-cholesterol were alleviated. Hormones that secreted by adipocytes were also affected by HFD. Leptin is a hormone related to regulate energy balance, while adiponectin is a hormone that plays a role in improving insulin resistance. In general, leptin is known to help weight control homeostasis through regulating appetite, but in obesity, the level of leptin in plasma is high due to leptin resistance. Therefore, leptin levels are high and adiponectin levels are low in obesity. However, when Nexweet® Allulose was administered with HFD, it was confirmed that the levels of leptin and adiponectin were improved.

SWEET HAPPY Allulose - Allulose

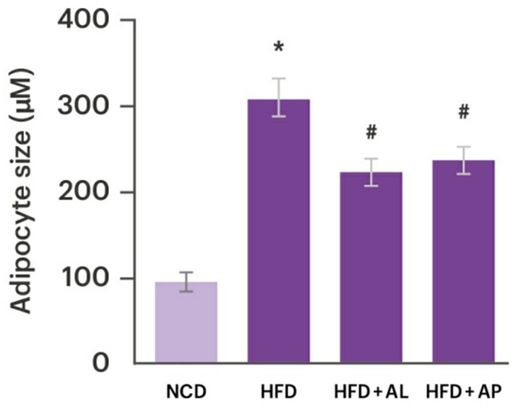
Nexweet® Allulose inhibits fat accumulation.

In addition, the amounts of white adipose tissue (WAT) in each adipose tissue were measured. WAT accumulates lipids, and the amount of WAT is associated with visceral adiposity. WAT increased significantly in each adipose tissue (abdominal, epididymal, and perirenal fat). On the other hand, it was shown to be significantly reduced in abdominal and epididymal fat in the group administered with Nexweet® Allulose, and decreased in perirenal fat, but there was no statistical significance. Epididymal fat is a typical visceral fat tissue and is a widely used indicator to analyze the relationship between adipose tissue and obesity. The size of the adipocytes increased in the HFD and the HFD + glucose intake group. On the other hand, it was shown that the size of adipocytes decreased in the group fed AL or AP.

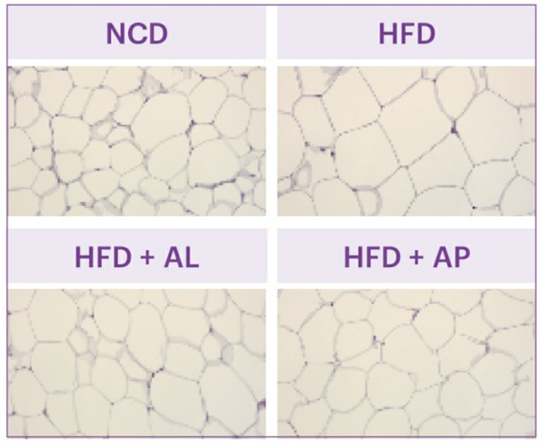
▲Table 3. Effects of Allulose on WAT weight distribution

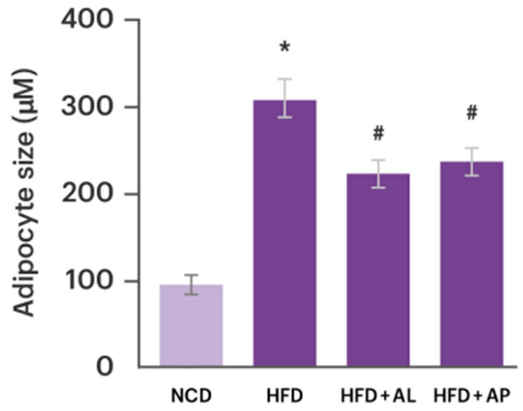
White adipose tissue	NCD	HFD	H
Abdominal fat (g)	11.56 ± 0.84	23.35 ± 0.95 *	17.4
Epididymal fat (g)	7.62 ± 0.65	17.90 ± 0.82 *	13.4
Perirenal fat (g)	3.57 ± 0.24	6.33 ± 0.45 *	5.4
Total fat (g)	22.75 ± 1.45	47.57 ± 2.00 *	36.2

Results are means ± SEM, $^{*}P < 0.05$ versus NCD-group, $^{\#}P < 0.05$ versus HFD-group. NCD, Normal chow diet; HFD, High fat diet.



$^{*}P<0.05$ versus NCD-group, $^{\#}P<0.05$ versus HFD-group





$^{*}P<0.05$ versus NCD-group, $^{\#}P<0.05$ versus HFD-group

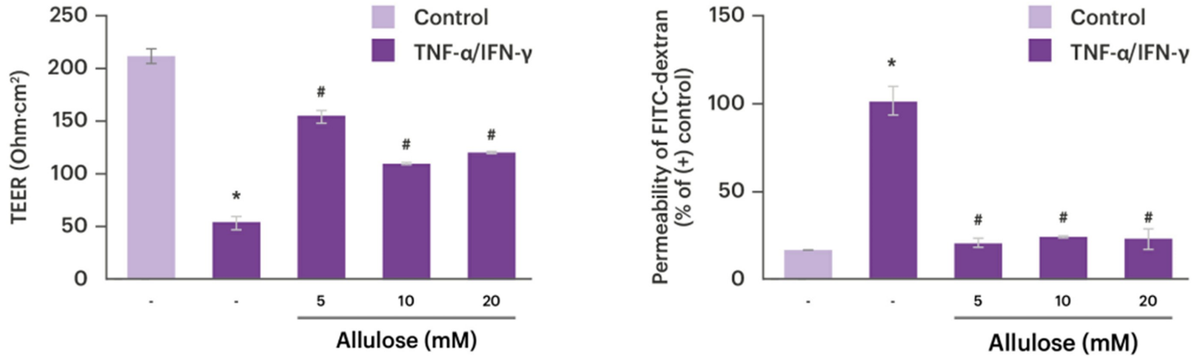
▲Figrure 11. The morphology of epididymal WAT and the average diameter of adipocytes

SWEET HAPPY Allulose - Allulose

Nexweet® Allulose enhances the tight junctions between intestinal epithelial cells.

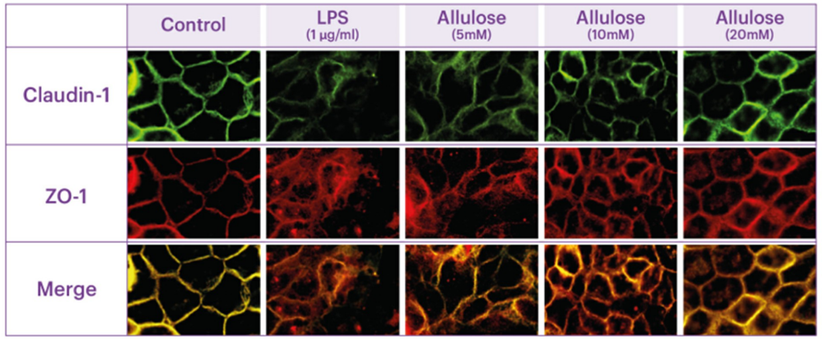
To confirm extracellular permeability, transepithelial electrical resistance (TEER) and fluorescein isothiocyanate (FITC) - dextran permeability assay were conducted. When Caco-2 cells were exposed to TNFα/IFN-γ, TEER decreased, and paracellular dextran flux increased. However, when Nexweet® Allulose was treated simultaneously, it was observed that TEER increased, and the permeability of FITC-dextran decreased. The reinforcement of the intercellular barrier entails the participation of tight junction (TJ) proteins (ZO-1, occludin, claudin-1) that establish connections between cells. Upon treatment of Caco-2 cells with LPS, there was a reduction in the levels of TJ proteins. On the other hand, Nexweet® Allulose treatment resulted in an observed increase in the mRNA expression levels of TJ proteins, which had been reduced by LPS. Consequently, it was confirmed that the intercellular TJ proteins in Caco-2 cells were restored through Nexweet® Allulose treatment, thereby reinforcing the epithelial barrier function.

▲Figure 12. Effects of Allulose on epithelial permeability (TEER and FITC-dextran fluorescence)



*$P < 0.05$ versus Control, #$P < 0.05$ versus TNF-α/IFN-γ-treated group.

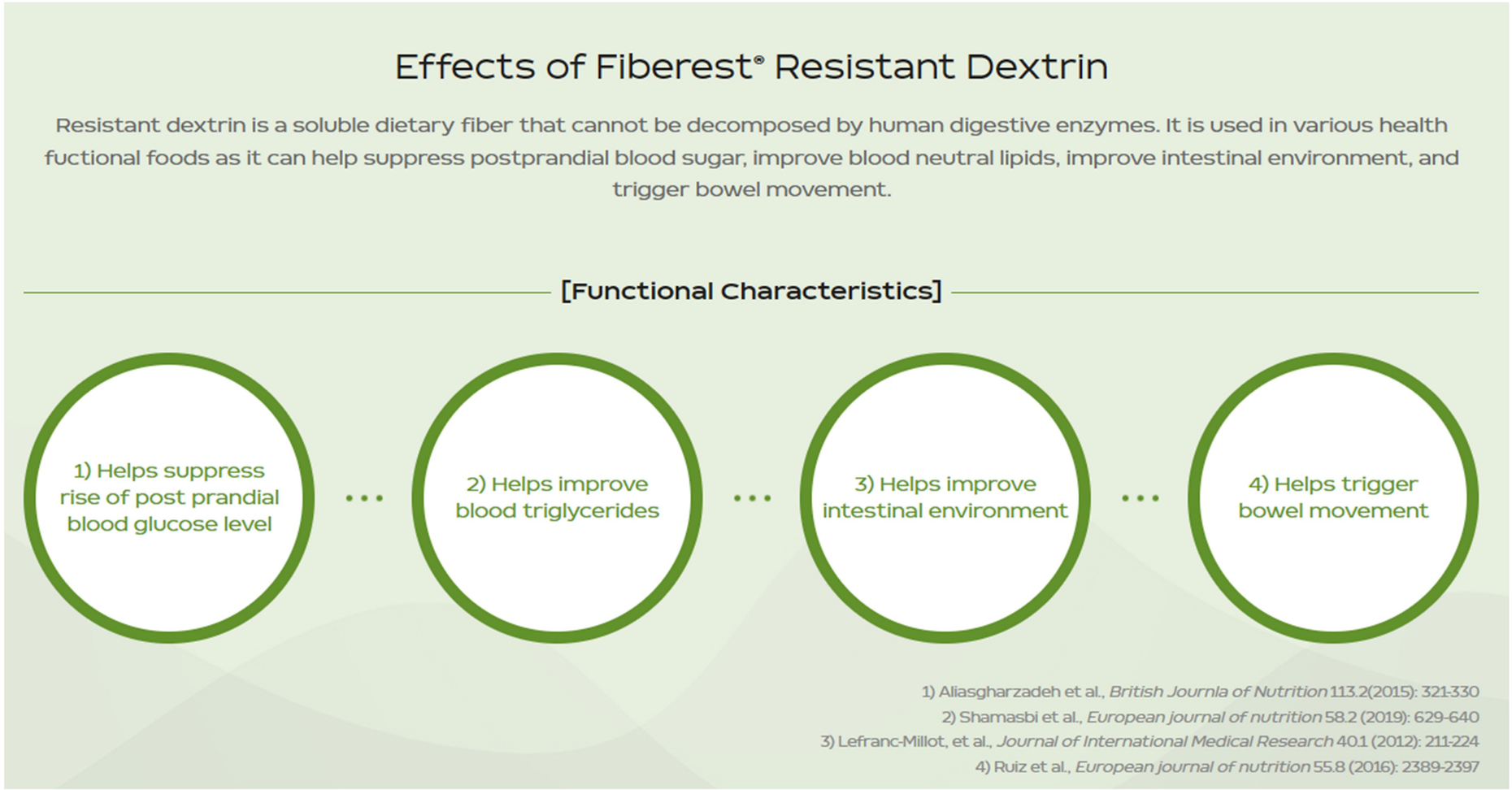
▲Figure 13. Effects of Allulose on claudin-1 and ZO-1 identification, and co-localization in Caco-2 cells



SWEET HAPPY Allulose – Dietary Fiber

Contains 4g Dietary Fiber per 100g (Indigestible Maltodextrin)

- Uses certified products from Samyang Corporation, a leading domestic food material developer



Rice bran oil

Rice bran oil

- Extracted from rice bran
- Contains gamma-oryzanol
- High heat stability, suitable for high-temperature cooking such as frying and stir-frying
- Its own scent is not strong, so it can be used in various dishes without damaging the original taste and scent of the dish
- Highly nutritious cooking oil

- Various packaging units such as 500ml, 520ml, 1.8L, and 18L