

DuOLIGO® is a functional oligosaccharide that can solve constipation and ingest safely. It is a Dual-Type, which is composed of lactulose and galactooligosaccharide, and it is an innovative food material applicable to various products conveniently.

Features of DuOLIGO®

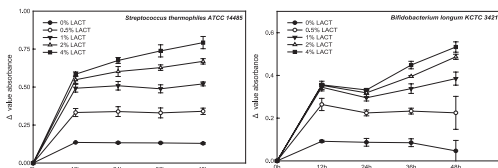
• Synergy Effect of Bowel Movement and Intestinal Function Improvement

- Lactulose Effect of Constipation Improvement : It helps make the bowel movement smooth by increasing intestinal osmolality.

- Effect of galactooligosaccharide to improve the intestinal environment: It is selectively used by beneficial bacteria in the body and it inhibits the growth of pathogenic germs to improve the intestinal environment.

Proliferation Effect of Lactic Acid Bacteria

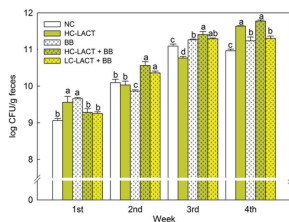
Determination system for glucose utilization is established by modified-Peptone-Yeast-Fields medium as a search medium for glucose utilization and the proliferation effect of lactic acid bacteria was analyzed by the system. The growth curve of lactic acid bacteria was confirmed according to the increase in the concentration of DuOLIGO® in Streptococcus thermophilus, Bifidobacterium-longum group.



Picture 1. Proliferation Effect of Lactic Acid Bacteria

Animal Testing – Viable Counts in Feces

After DuOLIGO® was orally administered to SD mice, the viable count of bifidobacteria among their feces has been observed by period (1st~4th: 30day).



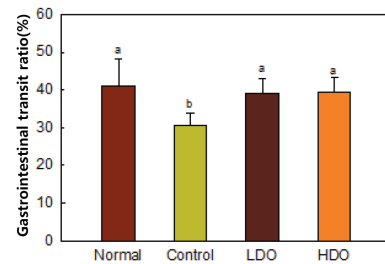
Picture 2. Viable Count of Feces

- NC (Normal control)
- HC-LACT (High content DuOLIGOTM)
- BB (bifidobacteria)
- HC-LACT+BB (High content DuOLIGOTM+bifidobacteria)
- LC-LACT+BB (Low content DuOLIGOTM+bifidobacteria)

It showed that the viable count and the growth and development duration of high content DuOLIGO® group are superior and also indicated that the viable count and the growth and development duration in the High content DuOLIGO® + bifidobacteria group that DuOLIGO® and bifidobacteria are ingested together are superior compared with a single intake group of bifidobacteria.

Animal Testing to Cause Constipation – Gastrointestinal Transit Ratio

Constipation was caused after the normal dietary intake period (0-28 day) with SD rats to carry out an experiment for a total of 35 days with a normal control group (Normal=NOR: drinking water), a control group (Control=CON= drinking water, inducement of constipation) and a DuOLIGO® intake group (LDO: 10% DuOLIGO®, drinking water, inducement of constipation, HDO: 15% DuOLIGO®, drinking water, inducement of constipation).

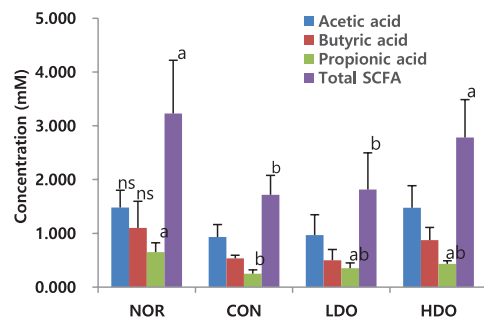


Normal : Normal Group with Water Intake / Control : Group to Cause Constipation with Water Intake
LDO: 10% Group with 10% DuOLIGO® Drinking Water Intake
HDO : Group with 15% DuOLIGO® Drinking Water Intake

Picture 3. Gastrointestinal Transit Ratio

As a result of measuring the gastrointestinal transit of an activated carbon diet to check out the improvement effect of intestinal functions, the gastrointestinal transit ratio of an activated carbon diet in the DuOLIGO® intake group has significantly increased compared with the control group that only drinking water was administered. It showed mobility similar to the normal group, verifying that it is effective to relieve constipation.

Animal Testing to Cause Constipation – Measurement of Monoenoic Fatty Acid

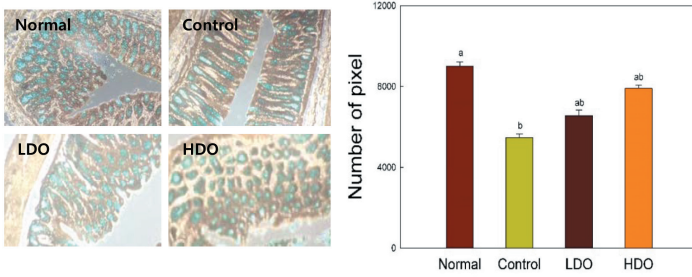


NOR: Normal Group with Water Intake CON: Group to Cause Constipation with Water Intake
LDO: Group with 10% DuOLIGO® Drinking Water Intake
HDO: Group with 15% DuOLIGO® Drinking Water Intake

Picture 4. Measurement of Monoenoic Fatty Acid (SCFA)

As a staple product of intestinal beneficial bacteria, monoenoic fatty acid inhibits harmful bacteria by lowering intestinal PH and helps promote intestinal health by the acceleration of water and electrolyte absorption, the blood increase of colonic mucous membrane, etc. It was verified that monoenoic fatty acid has risen depending on concentration in the LDO group (10% DuOLIGO®) and the HDO group (15% DuOLIGO®) with the intake of DuOLIGO® in comparison with the CON group (drinking water, inducement of constipation). An increase in the generation of intestinal monoenoic fatty acid means that beneficiary bacteria have been on the rise.

Animal Testing to Cause Constipation - Histological Examination of Intestinal Mucous Membrane



Normal: Normal Group with Water Intake / Control: Group to Cause Constipation with Water Intake
LDO: Group with 10% DuOLIGO Drinking Water Intake / HDO: Group with 15% DuOLIGO® Drinking Water Intake

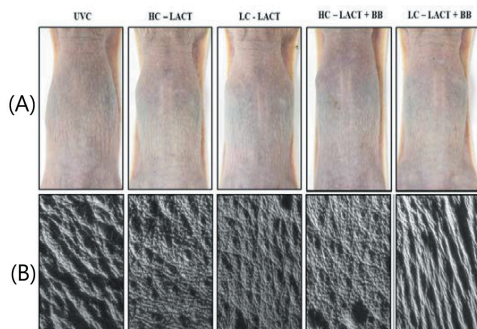
Picture 5. Comparison of Crypt Cell Staining in Intestinal Mucous Membrane

Constipation decreases the secretion of mucus in the large intestine while at the same time reducing the colonic movement, hindering the movement of colonic contents. As a cell which increases the mobility of colonic contents by secreting mucus, Cepinskas et al., 1993) crypt cell was stained alcian blue and observed, which confirmed that while the number of pixels of crypt cells stained in the Control group tends to decrease, the figure of pixels of crypt cells stained depending on concentration tends to increase in the DuOLIGO® intake group (LDO, HDO).

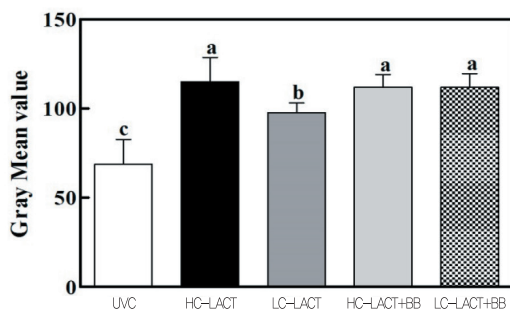
Animal Testing to Cause Constipation - Wrinkle Improvement (Hairless Mouse)

• Visual Analysis & Mold Analysis of Skin

With hairless mouse, skin has been observed with the naked eye after causing wrinkles first through UVB irradiation for 10 weeks to check out the effect of wrinkle improvement. It was filmed by using a digital camera in back, and gray mean value was measured in the mouse skin mold with a stereoscopic microscope of 7 magnifications by taking a skin mold with Replica. It was confirmed that wrinkles have been improved in the DuOLIGO® and Bifidobacterium intake group, considering that the smaller the gray mean value, the more shadows and wrinkles in Replica.



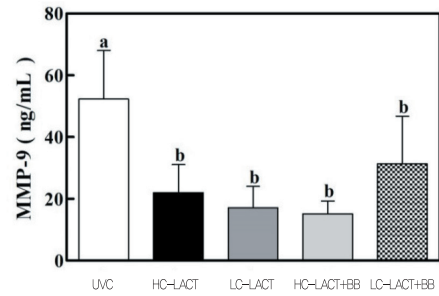
Picture 6. Photographs of skins (A) and replicas of the skins (B)



Picture 7. Gray mean value

• Protein Level of MMP-9

Collagen, protein composed of the dermis layer, is destroyed by MMP (Matrix metallo-proteinase) and wrinkled. Of that, MMP-9 is type IV collagenase, a main factor of wrinkles. UVB irradiation facilitates the expression of MMP-9 generating wrinkles by provoking oxidative stress. It was confirmed that the protein level of MMP-9 has significantly decreased in the DuOLIGO® and Bifidobacterium intake group by analyzing the serum protein level of hairless mouse with ELISA

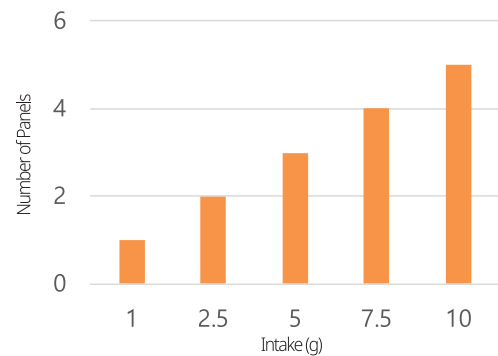


UVC: UVB control
HC-LACT: 1.0% DuOLIGO® Intake Group
LC-LACT: 0.2% DuOLIGO® Intake Group
HC-LACT+BB: 1.0% DuOLIGO® + 0.5% Bifidobacterium Intake Group
LC-LACT+BB: 0.2% DuOLIGO® + 0.5% Bifidobacterium Intake Group

Picture 8. Serum Protein Level of MMP-9

Human Experiment - Effective Intake

The experiment was carried out to check out the effective intake of DuOLIGO®. It was confirmed that the effect was more than 50% among 10 normal subjects when intake of 10g or more of DuOLIGO® as shown in Picture.



Picture 9. Effective Intake of DuOLIGO®

Product Information

Parameter	Specification
Appearance	Liquid
Solid Content (Brix)	More than 75.0
Lactulose (DB%)	More than 50.0
Galactooligosaccharide	More than 10.0
Total Plate Count	Less than 3,000 cfu/g
Packing Unit	24kg