

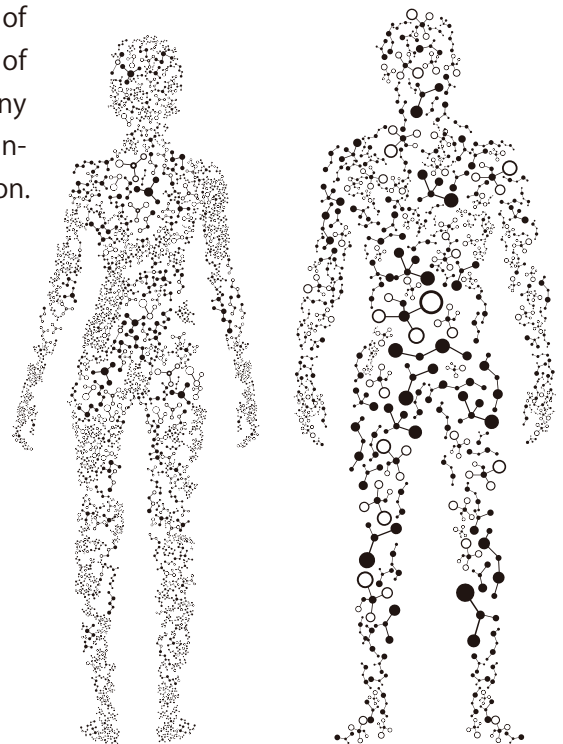
## Studies on Fermented Vegetables Extract (OM-X)

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# Human Clinical Studies

## ON Fermented Vegetable Extract OM-X

“OM-X” is a fermented vegetable extract that combines dozens of different kinds of plants fermented with a mixture of 12 kinds of probiotic strains including *E. faecalis* TH10. We performed many human clinical studies not only in Japan, but also in foreign countries. The data from the studies have gained worldwide recognition.



# Improvement of the Balance of Bacteria Responsible for Gaining or Losing Weight

Collaborative research with Hokkaido University of Science (2018)

The intake of OM-X capsules improved the balance of bacteria responsible for gaining or losing weight in the intestines of healthy people.

## Objective

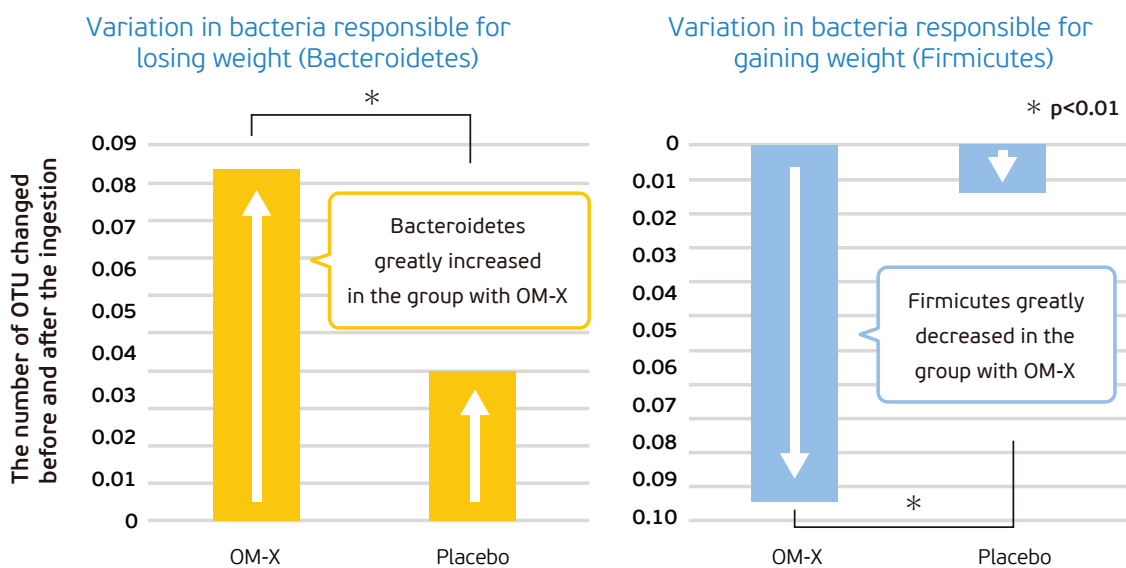
We examined whether the capsules filled with OM-X extract (OM-X capsules) can improve the balance of gut microbiota in healthy people who tend to be constipated.

## Methods

The test subjects were twenty healthy male and female who tend to be constipated and were divided into two groups: taking placebo or OM-X capsules three times a day. After 10 days of ingestion, one month of non-administration period was set. Then, a complete cross-over of OM-X or placebo materials were provided to the subjects. Their fecal matter was collected before and after the test material ingestion. The analysis of their gut microbiota was conducted on the fecal matter.

## Results

Many research papers have suggested that there are increased bacteria from the phylum Firmicutes and decreased numbers from the phylum Bacteroidetes in the intestines of obese people. The phylum Firmicutes is often considered as the bacteria responsible for weight gain. Through this experiment, the number of phylum Bacteroidetes was significantly increased and the phylum Firmicutes was significantly reduced after ingesting OM-X. Based on these results, OM-X can improve the balance of gut microbiota.



OM-X capsules increased the number of phylum Bacteroidetes (responsible for losing weight) and decreased the number of phylum Firmicutes (responsible for gaining weight).

# Increase of VO<sub>2</sub> max

Journal of Applied Nutrition 53, 1-6 (2003)

The OM-X capsule is effective in increasing the level of maximal oxygen consumption (VO<sub>2</sub> max).

## Objective

We examined the influence of the maximal oxygen consumption (VO<sub>2</sub> max: an index which shows the maximum oxygen consumption capacity per minute of a person) after taking the OM-X capsules.

## Methods

The study subjects were six adult male athletes. We measured their VO<sub>2</sub> max before taking the OM-X capsules. The subjects took the OM-X capsules every day for two weeks. After the ingestion periods were concluded, we measured their VO<sub>2</sub> max, hemoglobin levels in blood and blood lactate levels. Subsequently, we evaluated the effect of the OM-X capsules toward VO<sub>2</sub> max by comparing it with the levels that were measured before starting the ingestion.

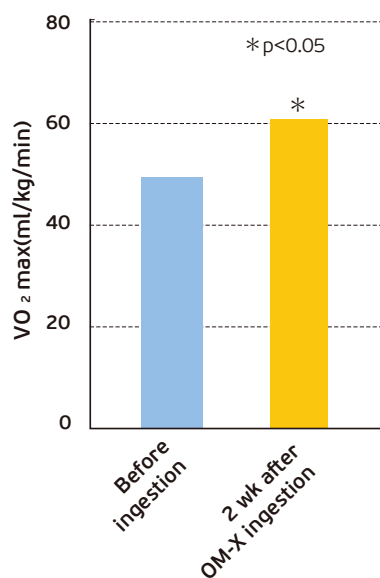
## Results

The intake of the OM-X capsules for 2 weeks increased the VO<sub>2</sub> max of the six adult male subjects being tested. The increment of VO<sub>2</sub> max was by an average of 30% per weight.

There was not much change in the blood lactate levels and the hemoglobin levels in blood increased approximately 8.4% after the intake of the OM-X capsules.

This study has revealed that the OM-X capsules can increase the VO<sub>2</sub> max of athletes.

### Changes in maximal oxygen consumption (VO<sub>2</sub> max)



### Measurement of hemoglobin levels in blood

Before ingestion → 2 wk after OM-X ingestion

Increased by an average of 8.4%

### Measurement of blood lactate levels

Before ingestion → 2 wk after OM-X ingestion

Not much change

The OM-X capsules increased the maximal oxygen consumption (VO<sub>2</sub> max) of athletes.

# Constipation Improvement

The 69th Annual Meeting of Japan Society of Nutrition and Food Science (2015)

The OM-X capsule is effective in reducing constipation and improving the stool condition among female college students having a tendency toward constipation.

## Objective

We evaluated the influence on bowel movement and the properties of stools by the intake of an encapsulated OM-X extract (OM-X capsule) among female college students having a tendency to be constipated.

## Methods

The subjects for the study were selected from 54 female college students with either a normal bowel movement or a tendency toward constipation. We examined the habits of bowel movement of each subject for 2 weeks before, during and after taking the OM-X capsules. The statistics on both groups were reviewed along the test items of defecation frequency, stool output, color, form, smell, and relief the subjects feel.

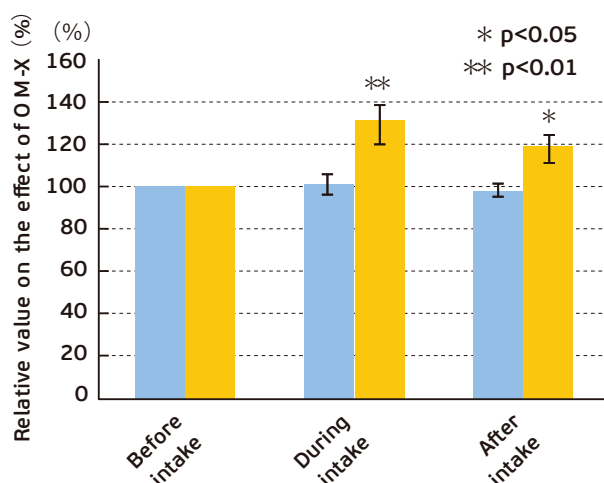
## Results

The female college students having a tendency to be constipated showed a significant increase in defecation frequency and stool output in comparison with their conditions before taking the OM-X capsules.

According to the other index of stool including color, form, smell, and relief the subjects feel, the frequency of stools with the ideal conditions also increased during the intake periods.

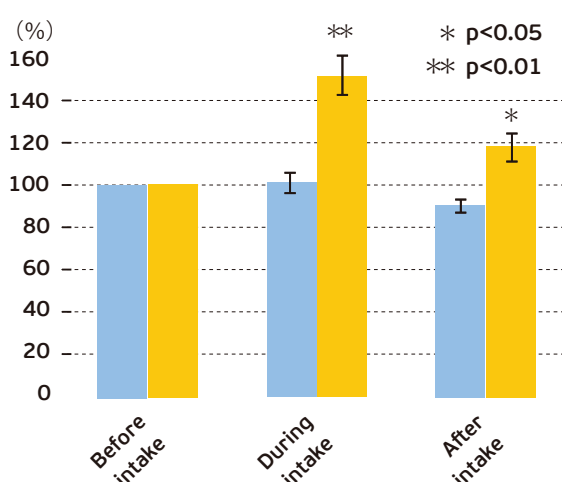
These results suggested that an intake of the OM-X capsules help to relieve constipation for people who tend to experience hard bowel movements.

Effects of OM-X on defecation frequency



Subjects without constipation  
Subjects tend to be constipated

Effects of OM-X on stool output



The OM-X capsules help to relieve constipation and improve the stool condition in people having a tendency to be constipated.

# Alleviation of Pneumonia

3rd Asian Congress of Pediatric Infectious Diseases and  
13th Pediatric Infectious Disease Society of The Philippines Annual Convention(2006)

The OM-X capsule is effective in reducing the length of hospital stay of infants with pneumonia.

## Objective

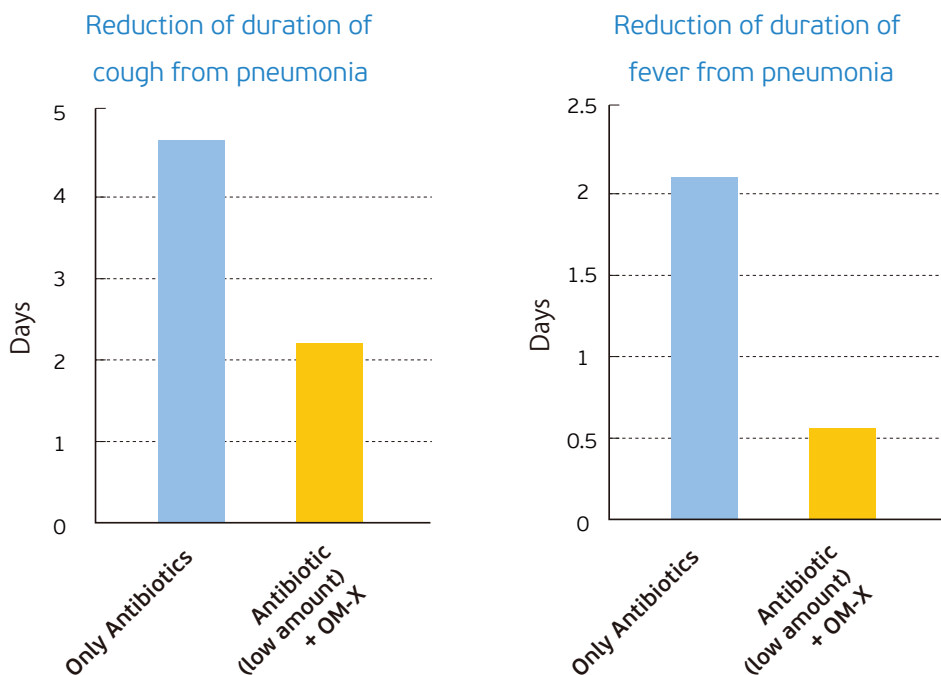
We examined the improvements of pneumonia symptoms by ingestion of OM-X capsules among infants with severe pneumonia.

## Methods

The test subjects were 76 infants between 6-24 months old with severe pneumonia at the hospital in the Philippines. We divided the infants into a group that was administrated only antibiotics and a group with OM-X + antibiotic (low amount). Then, we compared the subject groups with respect to the average number of days taken until the alleviation of coughing and fever, which are an index of the pneumonia symptoms. We cut a capsule and gave its contents to the infants who could not swallow the OM-X capsule.

## Results

In the OM-X + antibiotic (low amount) group, the average number of days taken until alleviation of coughing was remarkably reduced compared to the other group. The average number of days taken until alleviation of fever also became shorter in the OM-X + antibiotic (low amount) group. These results showed that the OM-X capsule is effective in reducing and improving pneumonia symptoms, and possibly contributing to diminish the use of antibiotics.



An intake of the OM-X capsules during an episode of pneumonia among infants contributed to reduce coughing and fever.

# Improvement in Diarrhea

1st Congress of Asian Society for Pediatric Research (2005)

The OM-X capsule is effective in reducing diarrheal symptoms among infants.

## Objective

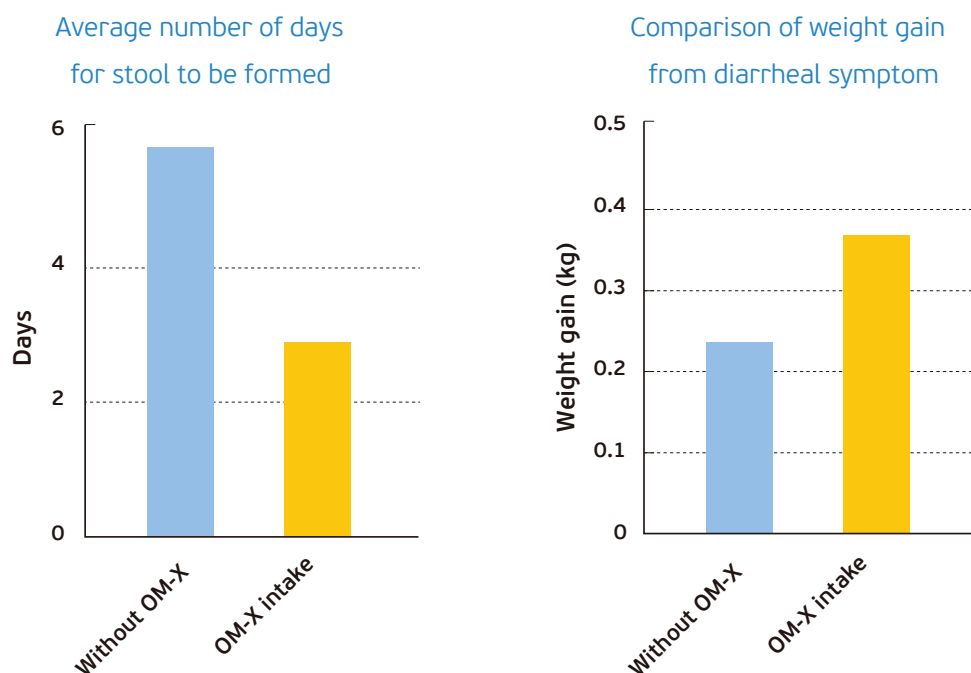
We examined about improvement in diarrheal symptoms by ingestion of the OM-X capsules among infants with acute non-bloody diarrhea.

## Methods

The test subjects were 70 infants between 3-24 months of age with acute non-bloody diarrhea at the hospital in the Philippines. We divided infants into the OM-X administered group and the OM-X non-administration group. Then, we compared subject groups with respect to the following range of items: the number of days with diarrhea, the frequency of defecation per day and the degree of weight restoration during episodes of diarrhea. We cut a capsule and gave its contents to the infants who could not swallow the OM-X capsule.

## Results

The infants in the OM-X administered group showed a shortened duration of diarrhea (the average number of days for stool to be formed). The frequency of daily defecation of the infants in the OM-X administered group decreased in comparison with the group without the OM-X capsules. Furthermore, the group that was administered the OM-X capsules recovered significantly from the weight loss caused by diarrhea. These results showed that the OM-X capsules are effective for improving diarrheal symptoms.



The OM-X capsules contributed to shortening the duration of diarrhea as well as the reduction of the defecation frequency among infants with acute diarrhea.

# Increase in Bone Density

Kurashiki University of Science and the Arts. 3, 131-144 (1998)

The OM-X capsule is effective in an increment of bone density among adult males and females.

## Objective

We examined an increment of bone density by ingestion of the OM-X capsules in healthy adult males and females.

## Methods

We divided test subjects into two groups: a group with an intake of the OM-X capsules and the other without the OM-X capsules. After a certain period of time, we measured the bone densities of subjects in each group. The bone density measurements were analyzed based on the volume of bone mineral content in the humerus and ulna at the test subjects non-dominant hand, bone mass, and the ratio of bone areas and bone mass.

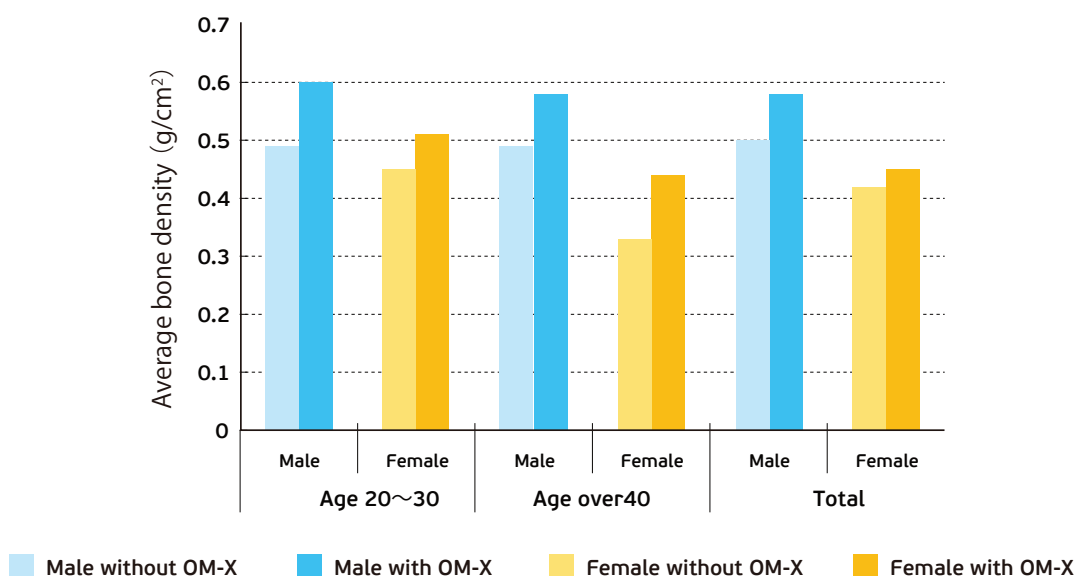
## Results

Overall, male subjects in the group given the OM-X capsules showed about 20% higher scores in bone density compared to those without the OM-X capsules. Female subjects with the OM-X capsules showed 12% higher scores than those without the OM-X capsules. The same tendency was observed in every aging group.

In the aspect of bone areas, the group with the OM-X capsule also showed higher values.

These results suggested that an intake of the OM-X capsules is effective in an increment of bone density and bone area regardless of age or gender.

Average bone density in different age groups after OM-X ingestion



After an intake of the OM-X capsule, increments in bone density and bone area were recognized.

# Alleviation of Dengue Fever

Asian Conference on Diarrhoeal Diseases and Nutrition (2006)

## The OM-X capsule is effective in reducing symptoms of dengue hemorrhagic fever.

### Objective

We examined the improvements of dengue hemorrhagic fever symptoms among child patients ingesting OM-X capsules.

### Methods

The test subjects were 36 patients between 4-18 years old with symptoms of dengue hemorrhagic fever (grade I and II) at the hospital in the Philippines. We divided the patients into the OM-X administered group and the placebo group. Then, we compared the subject groups with following index: recovery from the fever, restoration of appetite, abdominal pain, bleeding, blood cell count and platelet count.

### Results

The number of days taken until fever abatement was significantly shortened in the group with OM-X capsule compared to the placebo group. The number of days taken until restoration of appetite was also significantly shortened. These results showed that an intake of the OM-X capsule during an infectious episode of dengue hemorrhagic fever hastened recovery from the febrile symptoms and loss of appetite.

The blood cell counts tended to increase at an early point in the group with OM-X capsule compared to the placebo group.

### Reduction of symptoms of dengue hemorrhagic fever

|  | OM-X capsule     |       | Placebo          |       | p-value |
|--|------------------|-------|------------------|-------|---------|
|  | Number of people | Ratio | Number of people | Ratio |         |
| Number of days taken until fever abatement         | Day 1            | 6     | 25.00%           | 0     | 0.00%   |
|  | Day 2            | 18    | 75.00%           | 3     | 25.00%  |
|  | Day 3            | 0     | 0.00%            | 5     | 41.70%  |
|  | Day 4            | 0     | 0.00%            | 4     | 33.30%  |
|  | Total            | 24    | 100.00%          | 12    | 100.00% |
| Number of days taken until restoration of appetite | Day 2            | 16    | 88.90%           | 0     | 0.00%   |
|  | Day 3            | 0     | 0.00%            | 6     | 54.50%  |
|  | Day 4            | 1     | 5.55%            | 5     | 45.50%  |
|  | Day 5            | 1     | 5.55%            | 0     | 0.00%   |
|  | Total            | 18    | 100.00%          | 11    | 100.00% |

An intake of the OM-X capsules during an infectious episode of dengue hemorrhagic fever contributed to shorten the periods of recovery from the febrile symptoms and loss of appetite.

## Improvement in Urinary Tract Infection

The OM-X capsule showed a preventive effect against urinary tract infection.

### Objective

We compared the effect of the OM-X capsules and an antibiotic (nitrofurantoin) against recurrent urinary tract infection among children with urinary tract abnormalities.

### Methods

The test subjects were 56 patients with urinary tract infection at the hospital in the Philippines. We divided the patients into a group that was administrated OM-X capsules and a group that was administrated antibiotic (nitrofurantoin). Then, we compared the subject groups regarding their potential level of to prevent a relapse of urinary tract infection.

### Results

Regarding the potential to prevent a relapse of urinary tract infection among children with urinary tract abnormalities, the group that was administrated OM-X capsules showed a similar high defense rate against infection as the group that was administrated with the antibiotic. In late years, we are amid growing concerns over the emergence of drug-resistant strains of bacteria from overuse of antibiotics. The fact that the OM-X capsules showed the same effectiveness as antibiotics allow us to expect them to be an alternative to antibiotics.

The OM-X capsules contributed to prevent a relapse of urinary tract infection.

## Malnutrition Improvement

The OM-X capsule is effective in increasing the weight of malnourished children.

### Objective

We examined the improvements in immune markers and symptoms of malnutrition by ingestion of the OM-X capsules among malnourished children.

### Methods

The test subjects were 29 children with malnutrition at the hospital in the Philippines. We observed the OM-X capsules adinistrated malnourished children group with following index: immune markers, weights, incidence rate and duration of infection, and measured the effect of the OM-X capsules.

### Results

The weight of malnourished children significantly increased in the group that was administrated OM-X capsules compared with the other group. The incidence rates of infection were the same level in both groups. However, the duration of infection was significantly shortened in the group with the OM-X capsules. This result suggested that an intake of the OM-X capsules contributed to improve the nutritional status of malnourished children.

The OM-X capsules contributed to improve symptoms among malnourished children.

## Human Safety Test

The product safety at human level has been demonstrated through a collaborative research with Harvard University.

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### Objective

We conducted a collaborative research with Harvard University in the United States in order to demonstrate that the ingestion of OM-X capsules has no adverse effect on the human body.

### Methods

At a hospital affiliated with Harvard University, 46 test subjects were divided into two groups: taking placebo or OM-X capsules. We confirmed whether there were abnormalities two weeks after the start of this test and when the test was completed (30 days later).

### Results

No adverse effects were observed in blood biochemistry data or medical diagnoses in the group who ingested OM-X capsules. Based on these results, we demonstrated that the OM-X capsules do not adversely affect the human body and are a safe food when people take them on a daily basis.

Ingestion of normal amount of OM-X capsules is safe to the human body.

## Human Test For Overdose

A high level of safety was confirmed under the condition of ingesting an amount 5 times greater than the normal dosage.

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### Objective

We conducted a collaborative clinical study in order to demonstrate that there is no adverse effect on the human body even when people ingest a dosage five times greater (15 capsules) of OM-X capsules than the ordinary dosage (3 capsules) on a daily basis.

### Methods

Ten test subjects ingested 15 OM-X capsules daily for one month. Their blood samples were collected before and after the ingestion period and blood biochemistry data was investigated.

### Results

No adverse effects were observed in blood biochemistry data even in cases of an intake of 15 capsules. Based on this result, we confirmed that there was no adverse effect on the human body even when people ingest more OM-X capsules than the recommended dosage of 3 capsules per day.

There is no adverse effect on the human body under the condition of an unusually high intake of OM-X capsules.

## Animal Studies Related to Fermented Vegetable Extract OM-X

We performed not only human clinical studies, but also many laboratory animal studies with the fermented vegetable extract OM-X (OM-X extract) and keep accumulating more data every year. The obtained study results are presented to the academy and published in academic journals. OM-X is a functional fermented extract that receives scholarly attention from foreign countries.



# Anti-Allergy Action

*Natural Product Communications*. 10, 1597-1601 (2015)

## The fermented vegetable extract OM-X (OM-X extract) showed an inhibitory effect on model cells and mice with type I allergy.

### Objective

We conducted a study to evaluate the anti-allergic property of the OM-X extract by using cell and mouse models which is an index of the type I allergy, including asthma and hay fever.

### Methods

In order to evaluate the anti-allergic effect of the OM-X extract, we examined the action of the OM-X extract on the degranulation on rat basophilic leukemia cells (RBL-2H3) which is a model of mast cell and on passive cutaneous anaphylaxis reaction (PCA) by using mouse models of the type I allergy.

### Results

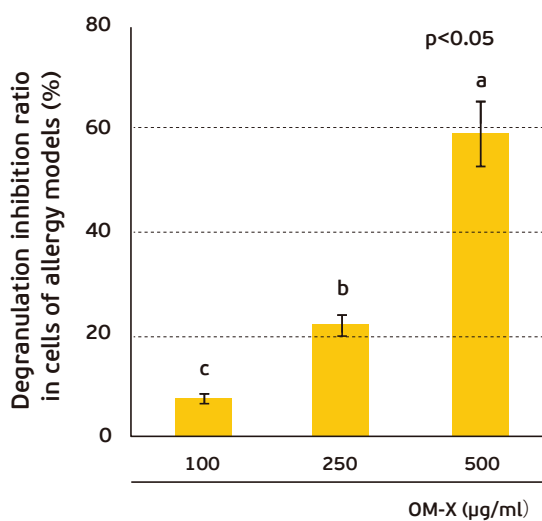
<The inhibitory effect against the degranulation of RBL-2H3 cells>

The degranulation that provokes allergic reactions was inhibited in a dose-dependent manner of the OM-X extract.

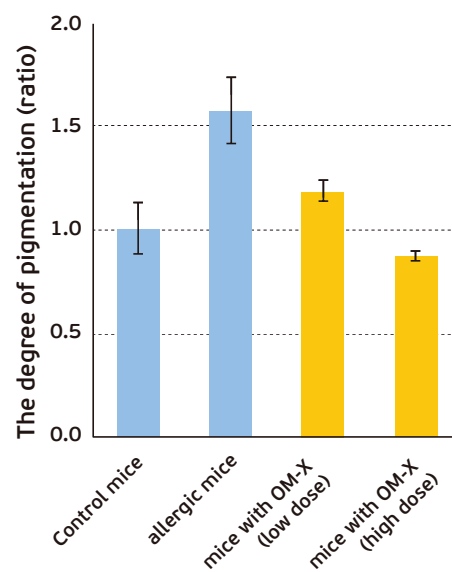
<The inhibitory effect against the type I allergy (mice)>

In the aspect of PCA reaction in mouse models of the type I allergy, the degree of pigmentation decreased and the allergic reactions were suppressed by an ingestion of the OM-X extract.

The inhibitory effect of OM-X on the degranulation (RBL-2H3 cells)



The inhibitory effect of OM-X on PCA reaction (mice)



The fermented extract OM-X is helpful for the type I allergy, including asthma, hay fever, and atopic dermatitis.

# Muscular Endurance Improvement

Annual Conference of the Japan Society for Bioscience, Biotechnology and Agrochemistry (2015)

The fermented vegetable extract OM-X (OM-X extract) is effective in prolonging swimming duration and enhancing the muscle endurance of mice.

## Objective

We examined mice to see if they can extend their swimming duration, which is an index of their athletic ability (muscle endurance), by giving them the OM-X extract.

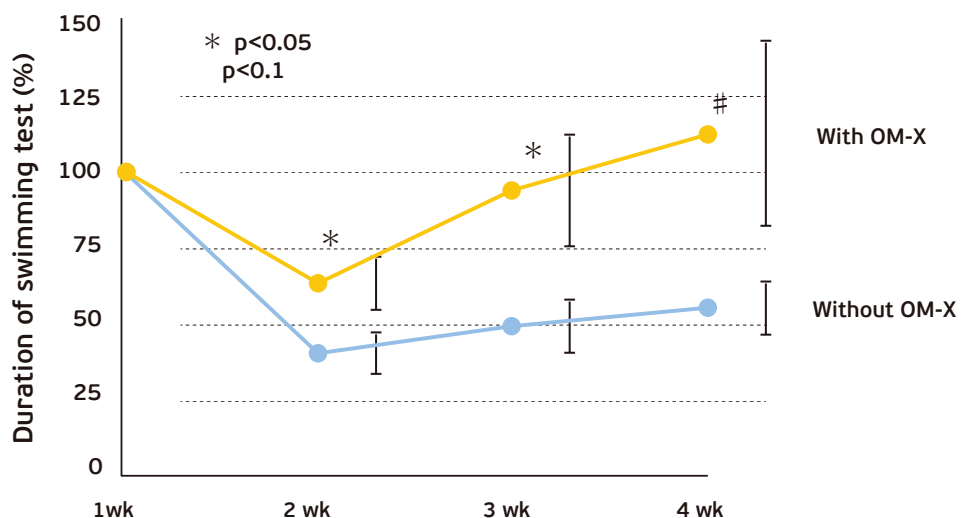
## Methods

We divided the test mice into 2 groups: with and without the administration of the OM-X extract, and recorded their swimming duration. The mice in the administered group received the OM-X extract for four consecutive weeks. Both groups underwent the swimming test once a week for four weeks. We set their swimming duration recorded at the first week as 100% and evaluated results of each test.

## Results

The group without the OM-X extract decreased their swimming duration to approx 40% at the second week and the duration became around 50% at the fourth week. In contrast, the swimming duration of the group with the OM-X extract became about 65% at the second week which was significantly extended compared with the group without the OM-X extract. At the fourth week, the swimming duration of the group with the OM-X extract extended 2 times longer than the other group. This record showed a longer swimming duration than their records measured at the first week. On the basis of these results, the OM-X extract contributed to enhance the muscle endurance of mice.

The evaluation of swimming duration in mice with the OM-X extract



The fermented extract OM-X is effective to enhance muscle endurance.

# Anti-Fatigue Action

Annual Conference of the Japan Society for Bioscience, Biotechnology and Agrochemistry (2015)

The fermented vegetable extract OM-X (OM-X extract) is effective in the reduction of substances causing fatigue among mouse models for fatigue test.

## Objective

We measured the levels of the substances causing fatigue and the gene expression that is involved in the metabolism of ammonia by ingestion of the OM-X extract among mouse models for fatigue test.

## Methods

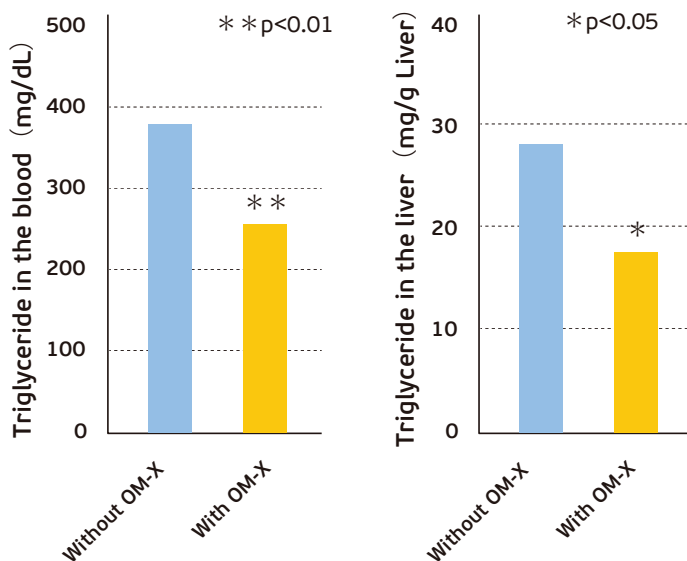
We divided test mice into 2 groups: with and without the OM-X extract, and both groups were given a forced swimming in order to make them be a model for fatigue test. Then, we examined the capacity of lipid metabolism in their blood and liver, and the gene expression of ammonia metabolism in their ornithine cycle.

## Results

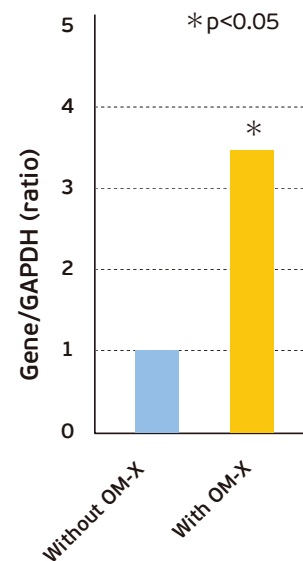
The results from the examination on the capacity of lipid metabolism in the liver of both groups showed that the level of triglycerides in the blood and the liver of the OM-X group has significantly decreased. There was no change in the level of glucose in the blood and glycogen in the muscles and the liver.

In the ornithine cycle, the gene expression (*Cps1*, *Arg1*) that is involved in metabolism of ammonia, which is known as a fatigue-causing substance, was significantly increased in the OM-X group. These results suggested that the OM-X extract is effective against the fatigue factors.

The level of triglyceride in the blood and liver



The level of the gene expression involving in the metabolism of ammonia (*Cps 1*)



The fermented extract OM-X is effective to reduce the accumulation of fatigue-causing substances and to alleviate fatigue.

# Prevention of the Deterioration of Liver Functions

The 138th Annual Meeting of the Pharmaceutical Society of Japan (2018)

The deterioration of the liver function of the mice incapable of synthesizing vitamin C within their body was prevented by the administration of the fermented vegetable extract OM-X.

## Objective

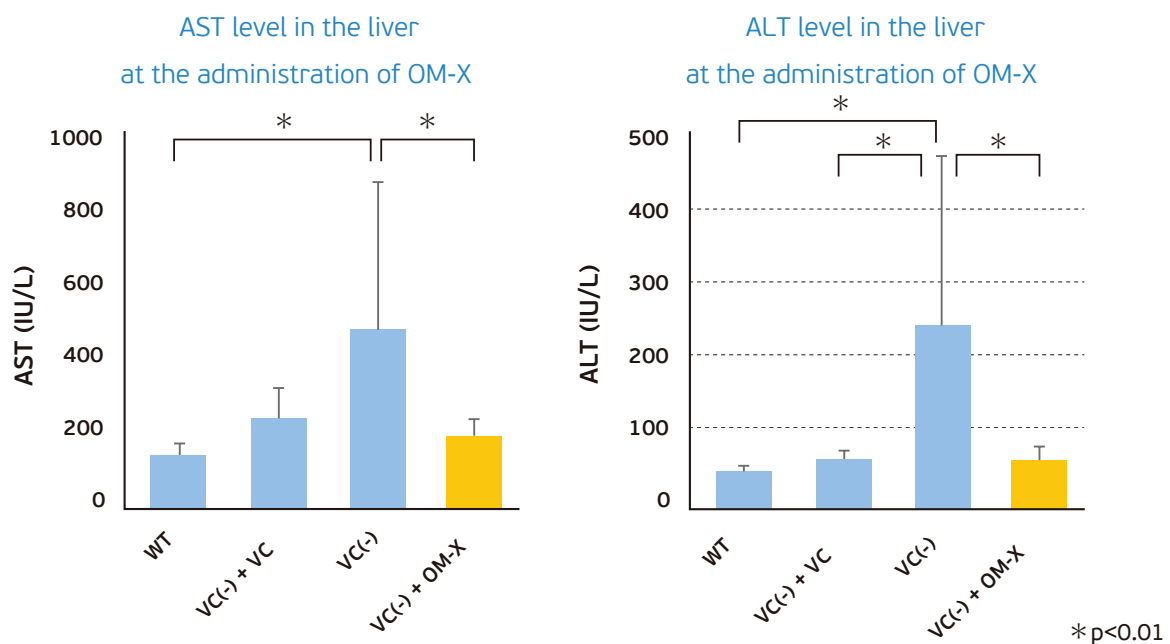
We examined the protective effect of OM-X extract on liver function by using mice incapable of synthesizing vitamin C within their bodies (SMP 30/GNL knockout mice), which are known to have functional liver deterioration.

## Methods

The antioxidant activity in the body of the mice incapable of synthesizing vitamin C was reduced and the level of their liver function worsened. The liver function markers in the blood were measured in the group with OM-X. A metabolome analysis for the liver was also performed and an encompassing analysis was performed on the genes related to liver function.

## Results

The mice incapable of synthesizing vitamin C internally showed a significant increase in transaminases (AST, ALT), which are indicators of the deterioration of liver function. On the other hand, the rise of both levels of AST and ALT were significantly suppressed among the mice administrated with OM-X. Although, it is not shown in this graph, the result of the metabolome analysis of the liver proved that the administration of OM-X can prevent the reduction of antioxidant capacity and the ATP production in the body of the mice.



The fermented vegetable extract OM-X can prevent the functional deterioration in the liver of the mice incapable of synthesizing vitamin C within their bodies.

# Prevention of the Reduction of Collagen Levels

Collaborative research with Hokkaido University of Science (2018)

Functional decline in the synthesis of type 1 and 17 collagens was prevented as a result of administering the fermented vegetable extract OM-X to the test mice.

## Objective

When collagen is synthesized in the body, vitamin C takes an essential role. Therefore, this study used mice incapable of synthesizing vitamin C within their bodies and examined the influence of the administration of OM-X on the synthesis of collagen.

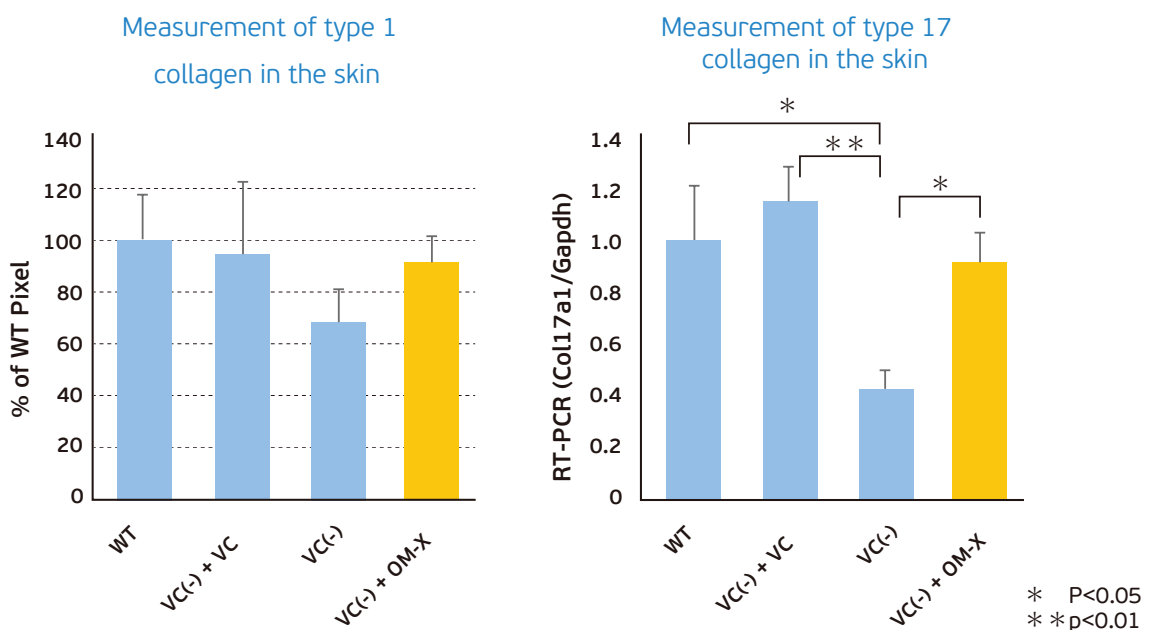
## Methods

We used the mice incapable of synthesizing vitamin C within their bodies. Vitamin C was removed from their feed and OM-X was given to them for 8 weeks. Thereafter, the levels of type 1 and 17 collagen were measured and verified how the administration of OM-X influences the production of collagen in the mice.

## Results

Type 1 collagen is mainly related to the elasticity of the skin. Type 17 collagen becomes a core of roots of hair and its insufficiency makes hairs thin or gray. Production of both type 1 and type 17 collagen decreased among the mice incapable of synthesizing vitamin C.

On the other hand, the decrease of type 1 collagen tended to be suppressed and the reduction of type 17 collagen was significantly prevented among the mice administered with OM-X.



The ingestion of the fermented vegetable extract OM-X can prevent reduction in the synthesis of type 1 and 17 collagens.

# Improvement of Candidiasis

Joint research with The University of Lille, France (2014)

The fermented vegetable extract OM-X (OM-X extract) showed the capability to defend against *Candida albicans* in a mouse model.

## Objective

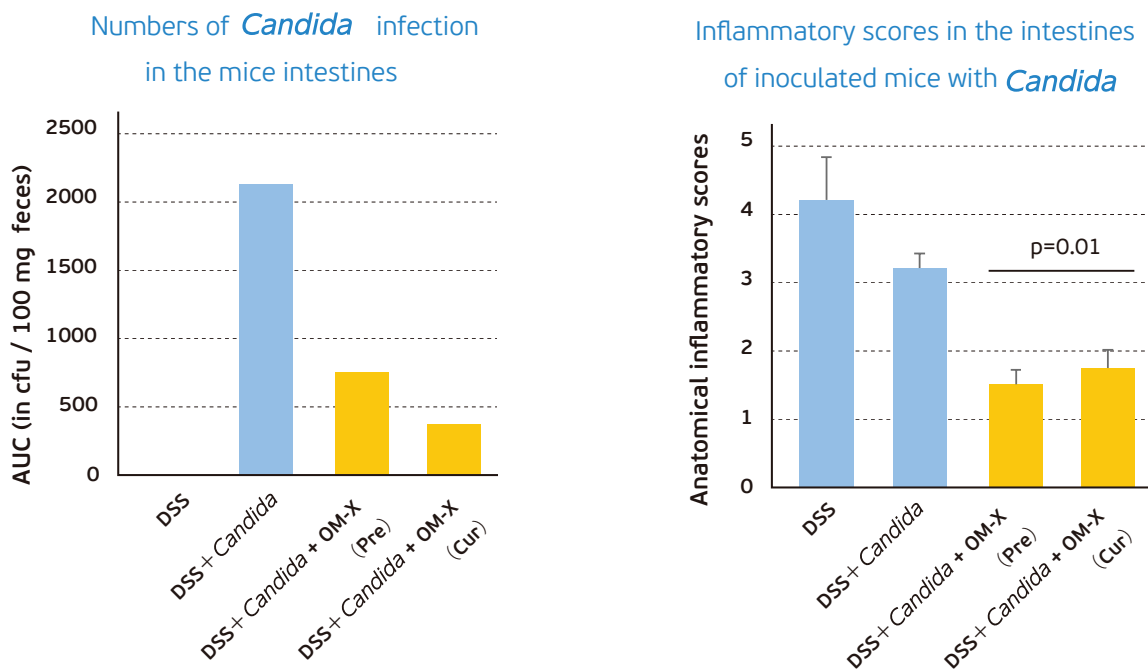
We examined the property of the OM-X extract to defend against candidiasis by using mouse models which are inoculated with *Candida albicans*, a type of fungus causes an intestinal infection.

## Methods

*Candida albicans* was orally administered in order to prepare the mouse models with candidiasis. Then, we set a group which was given the OM-X extract continuously before and after the inoculation with *Candida* (preventive treatment model) and a group which was given OM-X only after the inoculation with *Candida* (curative treatment model). We confirmed that the number of *Candida* infection and inflammatory scores in the mice intestines.

## Results

The inoculated group which did not receive the OM-X extract showed an increment of the number of *Candida*, but the inoculated groups that were given the OM-X extract for both preventive and curative treatments showed a reduction of the number of *Candida*. According to the result from the measurement of inflammatory scores in the intestines, the inoculated group with no administration of the OM-X extract showed high scores. On the other hand, both inoculated groups with the administration of OM-X extract showed significantly low scores. These results suggested that the levels of inflammation in the intestines of mice from the inoculated group with the administration of OM-X extract have been improved.



The fermented extract OM-X reduced the number of *Candida* infection and the inflammatory scores in the intestines of mice inoculated with *Candida*

# Improvement in Balance of Gut Microbiota

Joint research with Kinki University (2012)

The fermented vegetable extract OM-X (OM-X extract) is effective for the increase of the bifidobacteria and Butyrate-producing Clostridium ratio in feces of mice.

## Objective

The study was conducted to see how the administration of the OM-X extract would alter the microbiota of mice by T-RFLP analysis which assesses microbial community.

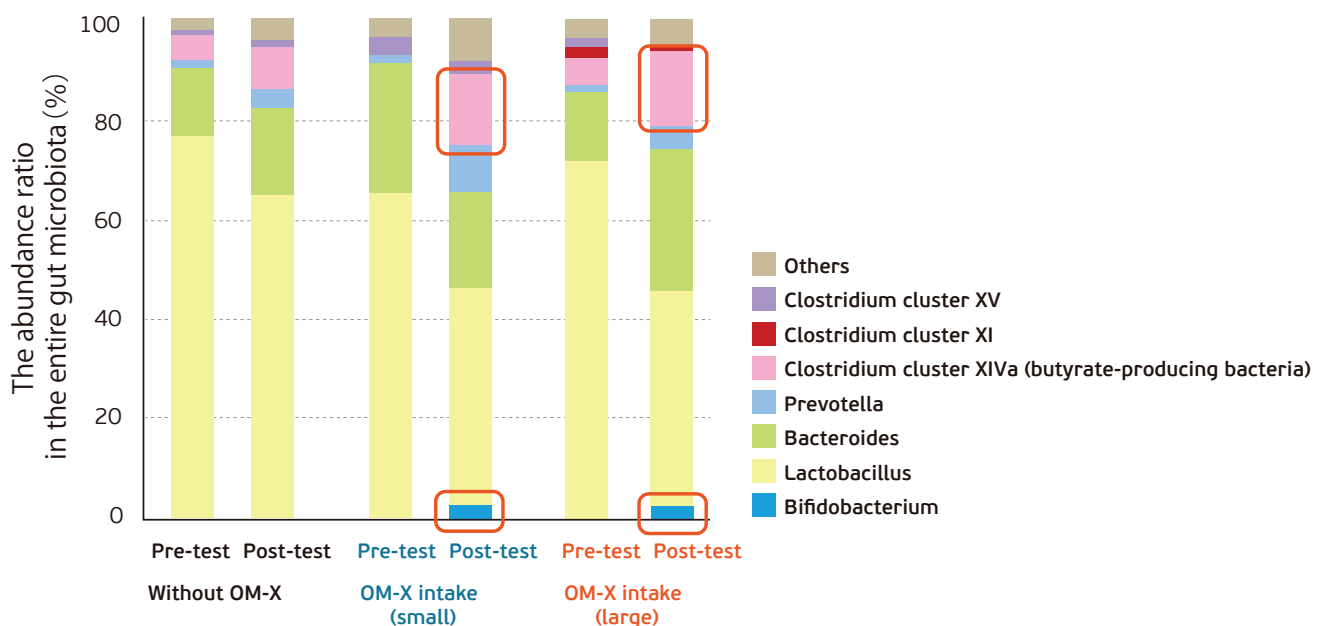
## Methods

DNA was extracted from mice feces for T-RFLP analysis to see the changes in their microbiota. We assessed the effect of the OM-X extract by the comparison of microbiota before and after the administration.

## Results

Compared with the data prior to the administration of the OM-X extract, the increase of *Clostridium* cluster XIVa was observed after the administration. *Clostridium* cluster XIVa is known as a butyrate-producing species, and it is predicted that the bacteria are involved in butyrate production which is one of important organic acids and responsible for cell proliferation, the anti-inflammatory action in the intestine etc. The study also showed an increase with bifidobacterium, which is known as good bacteria in the gut, after the OM-X administration. The result indicates that the administration of the OM-X extract altered the balance of gut microbiota.

The effect of the OM-X administration on the balance of gut microbiota



The fermented vegetable extract OM-X altered the balance of gut microbiota and may have induced butyrate production in the gut.

# *In vitro* Studies Related to Fermented Vegetable Extract OM-X

We perform *in vitro* studies (test tube experiments) with the fermented vegetable extract OM-X (OM-X extract). These studies are absolutely imperative to understand the potential functions that the OM-X extract may contain. Continuing these ordinary studies holds the potential to make a major discovery.



# Metabolome Analysis

In-house study data

We discovered that the fermented vegetable extract OM-X contains over 400 kinds of various nutrients.

We predicted that a large number of fermented metabolic compounds, which were produced by fermenting dozens of vegetable materials with lactic acid bacteria, are contained in OM-X extract. We performed metabolome analysis in order to find these compounds exhaustively.

## Methods

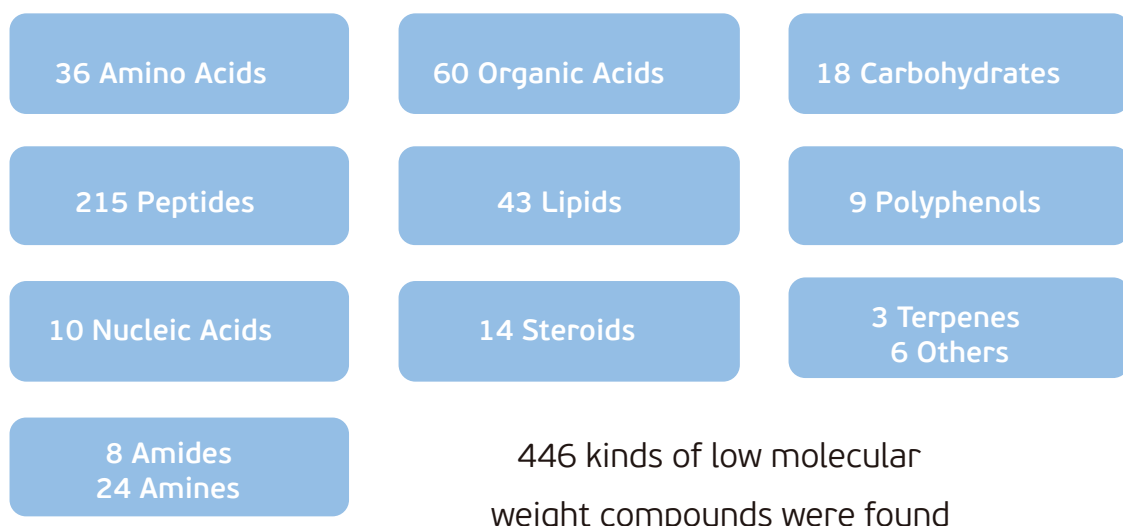
Metabolome analysis is a method to analyze in-depth water-soluble and fat-soluble low molecular weight compounds with the combination of different methods. This method conclusively detects various nutritional components present in OM-X extract.

## Results

Beyond our expectation, the study revealed that OM-X extract contains more than 400 types of nutrients, including compounds that are similar to neurotransmitters and hormones, as well as DHA and EPA. 60 kinds of organic acids which are important for the intestinal environment were also found.

These compounds are produced by going through a repetition of fermentation and maturation processes over a long period of time, and will work effectively when they are absorbed in the human body.

The list of nutrients found with the new method



Over 400 nutrients were found in the fermented vegetable extract OM-X by performing metabolome analysis.

# Prebiotic Effect

In-house study data

The fermented vegetable extract OM-X (OM-X extract) promotes the proliferation of various lactic acid bacteria which in turn plays a role of prebiotics.

## Objective

We examined the OM-X extract to see if it stimulates the proliferation of lactic acid bacteria which are typical good bacteria (prebiotics effect).

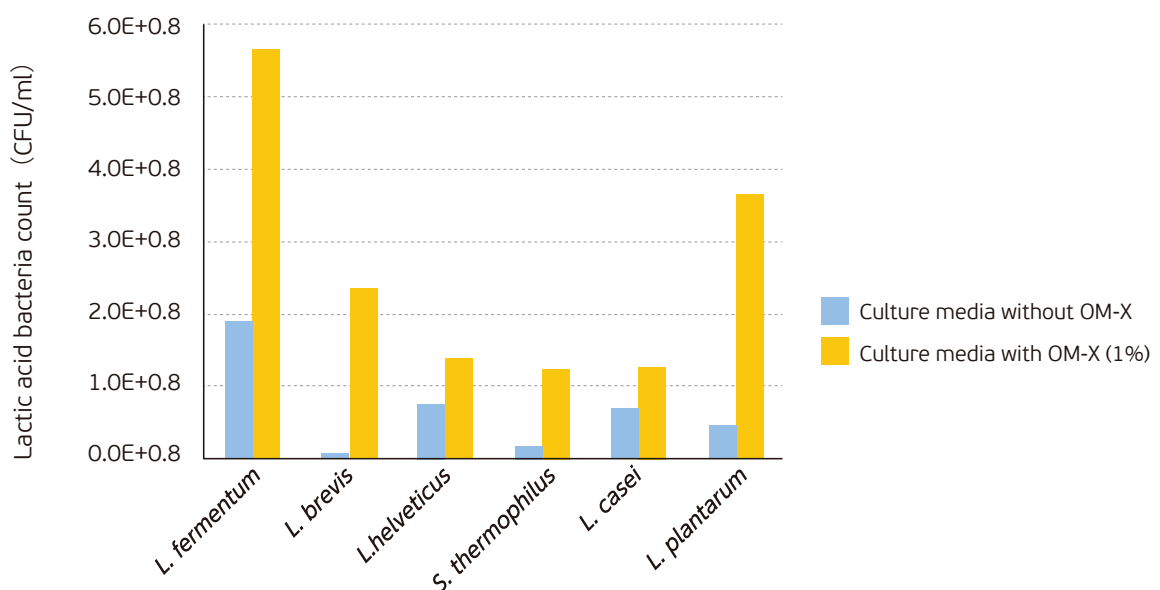
## Methods

We conducted this study on 6 different strains of lactic acid bacteria. We prepared 2 types of culture media for the proliferation of lactic acid bacteria: a medium with the application of 1% of the OM-X extract and a medium without OM-X. Then, we observed the proliferating potential of each strain.

## Results

Genus lactobacillus (*Lactobacillus fermentum*, *L. brevis*, *L. helveticus*, *L. casei* and *L. plantarum*) and genus streptococcus (*Streptococcus thermophilus*) showed greater proliferation potencies in the culture medium where the OM-X extract was applied than the other medium without OM-X. In the previous study, we observed greater proliferation potencies in the culture medium where the OM-X extract was applied than other media with applying dietary fiber or oligosaccharides. These results suggested that the OM-X extract plays a role of prebiotics for good bacteria.

The proliferation of lactic acid bacteria with application of OM-X



The fermented extract OM-X plays an excellent role of prebiotics

# Accumulation of Active Ingredients

Annual Conference of the Japan Society for Bioscience, Biotechnology and Agrochemistry (2010)

The fermented vegetable extract OM-X (OM-X extract) showed an increment of levels of contained polyphenols and melanoidins proportionally with the prolongation of its fermentation and maturation periods.

## Objective

The OM-X extract gains more food functionalities by undergoing fermentation and maturation processes. We examined the level of polyphenols which are known to be a functional ingredient from plants and melanoidins which are known to be a functional ingredient from fermented foods including Miso and Soy sauce.

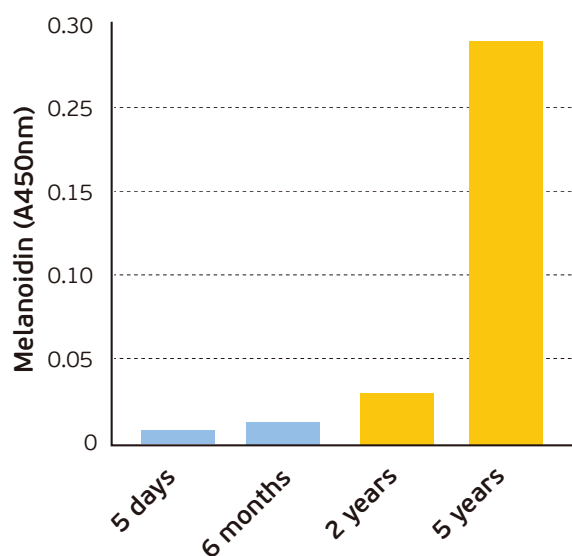
## Methods

Melanoidins are a functional ingredient that is formed when sugars and amino acids combine through the Maillard reaction. We refined the OM-X extract in order to remain the absorption wavelength in A450nm and measured it with a spectrophotometer. We measured polyphenols with Folin-Denis assay.

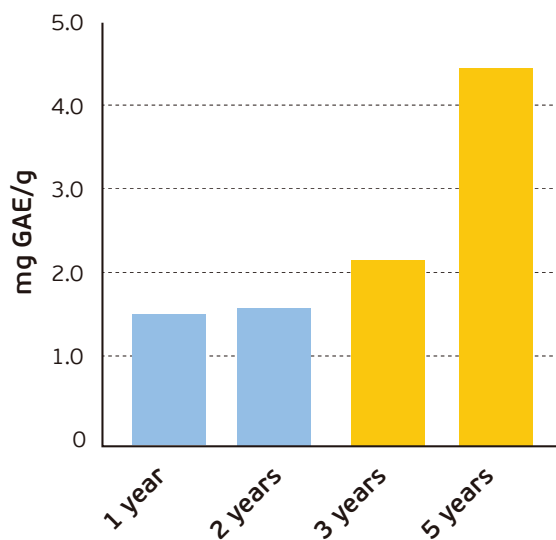
## Results

The contained amount of melanoidins in the OM-X extract increased drastically over time, especially an increment level after the second year was prominent. The contained amount of polyphenols also increased drastically over time. These results suggested that the OM-X extract gains more functional ingredients like melanoidins and polyphenols by undergoing a prolonged unheated fermentation process.

Changes in the level of melanoidins over the fermentation time



Changes in the level of polyphenols over the fermentation time



The fermented extract OM-X which underwent a prolonged unheated fermentation process gained more contained amount of melanoidins and polyphenols.

# Antioxidant Property, ACE-Inhibiting Activity

Annual Conference of the Japan Society for Bioscience, Biotechnology and Agrochemistry (2010)

The fermented vegetable extract OM-X (OM-X extract) showed an increment of its antioxidant activity and inhibitory activity of blood pressure elevation that is proportional to its fermentation and maturation periods.

## Objective

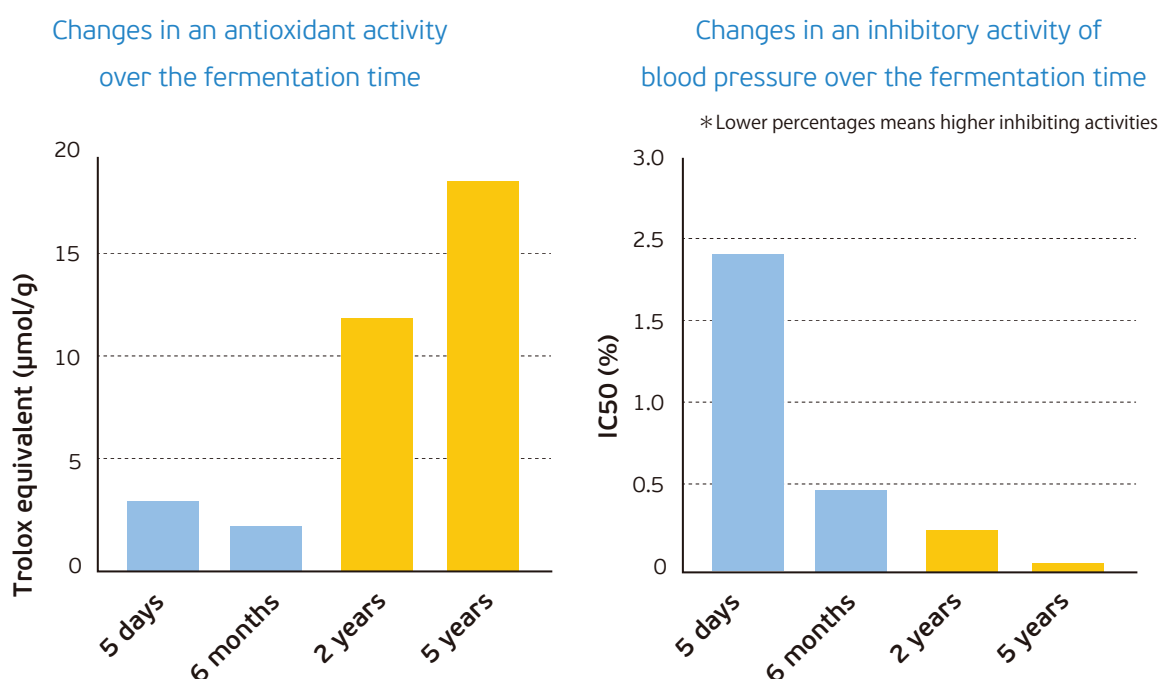
The OM-X extract undergoes fermentation and maturation processes for a maximum of 5 years. We examined a shift of its antioxidant activity and inhibitory activity of blood pressure through its fermentation and maturation periods.

## Methods

We measured the level of DPPH radical-scavenging activity in order to examine the potential level of the antioxidant activity of the OM-X extract. Subsequently, we measured the level of angiotensin converting enzyme-inhibiting activity (ACE-inhibiting activity) as an index of inhibitory activity of blood pressure elevation.

## Results

The OM-X extract undergoes unheated processes for fermentation and maturation for a long time. The extract was sampled immediately after the start of fermentation, after 6 months, 2 years and 5 years to see its food functionality. The level of DPPH radical-scavenging activity, the index of the antioxidant activity, was increased in process of time. The ACE-inhibiting activity which is the index of inhibitory activity of blood pressure elevation also increased over time. These results suggested that the OM-X extract gains more food functionalities by undergoing prolonged unheated fermentation processes.



The fermented extract OM-X which underwent a prolonged unheated fermentation process acquired higher potential levels of antioxidant activity and inhibitory activity of blood pressure.

# Antibacterial Activity (*Pseudomonas aeruginosa*)

In-house study data

The fermented vegetable extract OM-X showed an antibacterial activity against *Pseudomonas aeruginosa* that causes green nails.

## Objective

When nails turn green, one of the reasons is a type of bacterial infection that causes this condition. The green discoloration occurs when *Pseudomonas aeruginosa* infects the nails. We examined the antimicrobial activity of OM-X extract against *Pseudomonas aeruginosa*.

## Methods

*Pseudomonas aeruginosa* was grown on a petri dish. A paper disk soaked with OM-X extract was placed in the center of the petri dish and cultured. If an antibacterial reaction occurs, an inhibition ring against bacteria is formed. We examined the antibacterial activity by measuring the size of the inhibition ring.

## Results

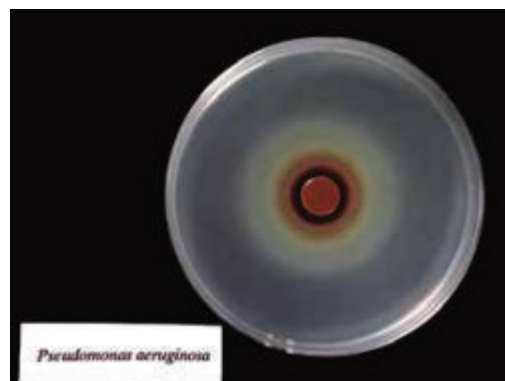
OM-X extract formed a large inhibition ring against *Pseudomonas aeruginosa*. This means that it showed an antibacterial activity against *Pseudomonas aeruginosa*.

OM-X also showed a high antibacterial activity against various other bacteria causing food poisoning and in-hospital infection such as *Clostridium difficile* during similar examinations.

Antibacterial test results  
against *Pseudomonas aeruginosa*



The average size of  
the inhibition ring is 18.9 mm



*Pseudomonas aeruginosa* ATCC 17653

OM-X extract showed a high antibacterial activity against *Pseudomonas aeruginosa* causing green nails.

# Analysis of D-amino Acids

In-house study data

The fermented vegetable extract OM-X contains a special D-amino acid indispensable for keeping the skin beautiful.

## Objective

Besides amino acids that form proteins in the body (L-amino acids), D-amino acids are present in nature and in fermented foods. Lately, D-amino acids are being recognized as essential compounds for keeping the skin beautiful. The level of D-amino acids naturally declines as a result of aging. We performed an analysis to detect D-amino acids present in OM-X extract.

## Methods

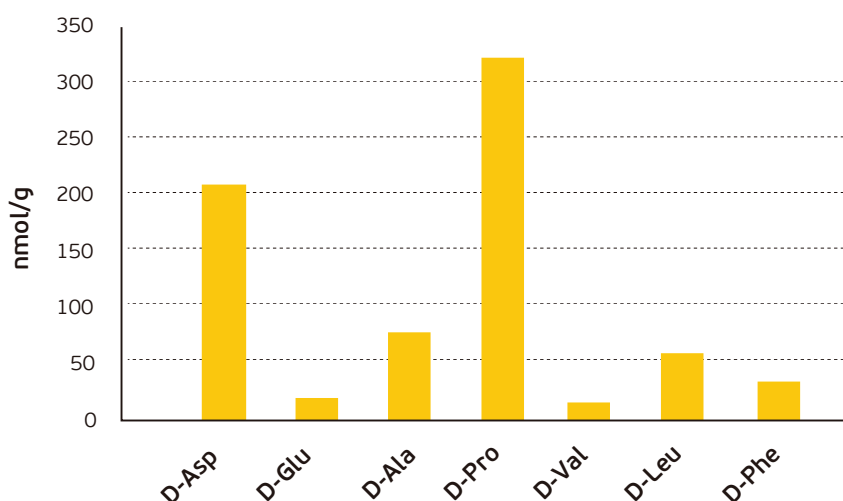
OM-X extract was analyzed by high performance liquid chromatography. D-amino acids were isolated under special conditions, and their types and quantities were measured.

## Results

Based on this examination, we found that a total of seven kinds of D-amino acids exist in OM-X extract, especially a large amount of D-proline, D-aspartic acid, D-alanine, and D-leucine were detected.

According to other studies, intestinal bacteria produce D-amino acids through intestinal fermentation. The result from our examination suggested that during the fermentation process that takes place in production of OM-X, the same synthesis of D-amino acids occurs.

The amount and types of D-amino acids present in OM-X



D-amino acids, which are indispensable for keeping the skin beautiful, were found in the fermentation vegetable extract OM-X.

# GLP-1 Stimulating Action

*Integrative Molecular Medicine. 4, 1-5 (2017)*

The fermented vegetable extract OM-X stimulates digestive tract cells that have been extracted from rats and promotes the production of a gastrointestinal hormone GLP-1.

## Objective

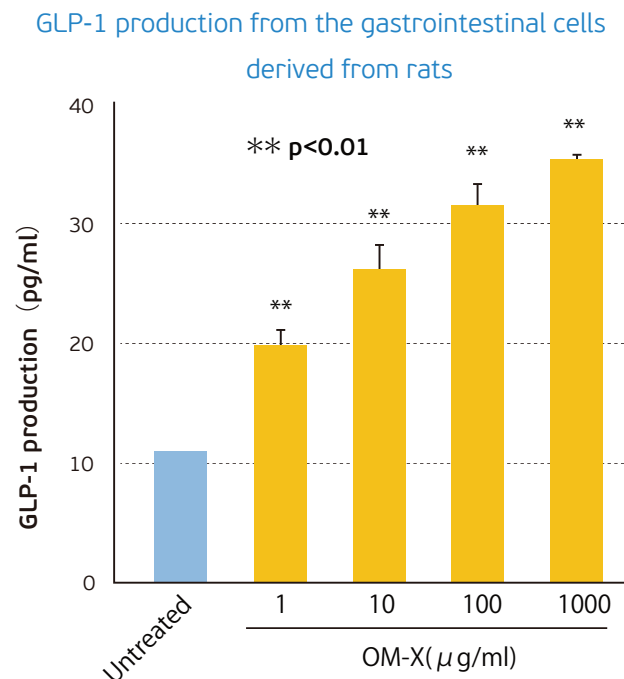
GLP-1 secreted from the gastrointestinal tract is one kind of gastrointestinal hormone that promotes the secretion of insulin to lower the blood glucose level. We examined the relationship between OM-X extract and secretory capacity of GLP-1.

## Methods

We added OM-X extract to gastrointestinal cells extracted from rats and measured the change in the production of GLP-1, a hormone promoting insulin secretion.

## Results

Once we added OM-X extract to the gastrointestinal cells derived from rats, the production of GLP-1 increased. This action was enhanced with the increase in the concentration of the added OM-X extract. Although the data is not displayed here, in the same research paper, we showed the activation of the immune system by adding OM-X extract to macrophage-like cells. And further, an examination of genes in the liver of OM-X mice confirmed the anti-inflammatory effect and the cell protective effect.



OM-X extract stimulated the gastrointestinal cells derived from rats and enhanced the GLP-1 production which promotes the secretion of insulin.