About Fermented Guava

The Fermented Guava was developed through the joint studies by the following research institutes, including Okinawa Industrial Technology Center, as part of the Okinawa R&D coordinating project on commercializing new products in 2001:

Ryukyu Bio-resource Development Co., Ltd. Okinawa Industrial Technology Center, National Food Research Institute, Graduate School of Bio-agricultural Sciences of Nagoya University, University of the Ryukyus, Faculty of Agriculture, University of the Ryukyus, Faculty of Medicine.

Ryukyu Bio-resource Development Co., Ltd.
January 25, 2005
Why can Guava have the effect of suppressing increase in blood glucose levels?

One in six Japanese have or will have diabetes
Announced by the Ministry of Health, Labor and Welfare in August 2003

- Typical lifestyle-related disease
- Abundant medical herbs in Okinawa
- Leaves of Guava have strong effect
- Development of delicious and functional food
A disease which elevates blood glucose levels

The Blood glucose level is the amount of glucose in the blood.

Glucose: A sugar that comes from the foods we eat, and is formed and stored inside the body.
- The main source of energy for the cells of our body.
- Carried to each cell through the bloodstream, and utilized in muscles and organs.

* When you get diabetes, glucose cannot be carried to cells that need energy, and as a result, too much glucose is kept in the blood.

<Cause>

The body doesn't make enough insulin or can't respond normally to the insulin that is made.
What's insulin?

Insulin is a hormone that lowers the level of glucose in the blood and controls it so that the level of glucose will not become too high after eating.

Insulin helps glucose enter the body's cells, where it can be used for energy, or converted into fat or glycogen and stored for future use.

When the body doesn't make enough insulin or can't respond normally to the insulin that is made, glucose can not be carried to cells and it remains in the blood.

The level of glucose in the blood goes up.

As energy can not be delivered to muscles and internal organs, the entire body becomes short of energy.
About Guava

Classification: Myrtaceae, Pusidium
Nomenclature: *Pusidium guajava* L.
Origin: Tropical America
Functionality: Anti-diabetes property
  Anti-obesity property
  (boost fat metabolism in the liver)
  Antiallergenic property
  Antioxidant property
  Whitening effect

In Okinawa

Called “Banshiru” and traditionally used in many ways.

Diuretic effect
Prevention of diabetes
Fermented Guava

Guava leaves characteristically have an astringent taste.

- Can not use so often
- Use our unique fermentation technology

Guava leaves + Syrup + lactobacilli = Fermented Guava

- Improve its taste = delicious
- Increase minerals (syrup derived)
- Increase quercetin

Our unique process = (PATENT NO.4031637)
The amount of quercetin in fermented Guava

Before

After

Amount of quercetine (mg/100g)

Increased 4.7 times through fermentation

* : p<0.01
What’s Quercetine?

A kind of polyphenol included in various vegetables and fruits
Vegetables including onions, asparagus, and broccolis, as well as apples and red wine contain quercetine.

Function and Efficacy
- Strong antioxidant property
  Prevent cells from “oxidizing”
- Prevent fat absorption through the gastrointestinal tract
- Prevent sugar absorption
- Allergy prevention
What kind of tests?

- **In vitro**
  Inhibitory activities of starch breakdown enzymes
  (α-amylase, maltase)
  
  Every substance can be absorbed when it is broken down and decomposed into low molecules (an easier form for absorption)

  - If substances which are easily absorbed are not made, unnecessary absorption can be inhibited

  Inhibiting activities of those enzymes will work

- **In vivo**
  Long-term administration test of fermented Guava powder by using spontaneous diabetic mice (KK-Ay),

  Glucose tolerance test by using human volunteers (administering 1.4g of Guava powder)
Inhibiting activities of \( \alpha \)-amylase in Fermented Guava

The activities of digestive enzymes are well suppressed when the value is smaller.

* : \( p < 0.01 \)
Inhibiting activities of maltase in Fermented Guava

The activities of digestive enzymes are well suppressed when the value is smaller.
In vivo test

Long-term administration test of fermented Guava powder by using spontaneous diabetic mice (KK-Ay),

Laboratory animal: KK-Ay mice (N=10)

Experimental diet group:

a. control: Normal diet
b. Fermented guava diet
   (Normal diet + Fermented guava)

Feeding duration: 52 days
Daily changes of the blood sugar level of spontaneous diabetic mice (KK-Ay)

Fermented Guava

Control

Fermented Guava

* : p<0.01

Normal value !!

49th Japanese Society for Food Science and Technology
Nagoya, Japan, August 29-31, 2002
Changes of insulin concentration of spontaneous diabetic mice (KK-Ay)

* : p<0.01

Insulin concentration in the blood (g/l)

Normal Value!!

Control  Fermented guava

49th Japanese Society for Food Science and Technology Nagoya, Japan, August 29-31, 2002
Efficacy of suppressing glycated hemoglobin of spontaneous diabetic mice (KK-Ay)

![Graph showing glycated hemoglobin concentration over breeding days for control and fermented guava groups.](image)

- Normal value!!
- Control
- Fermented Guava

* : p<0.01

49th Japanese Society for Food Science and Technology
Nagoya, Japan, August 29-31, 2002
Standard of human blood sugar level

WHO Standard (1999)

<table>
<thead>
<tr>
<th>Fasting blood sugar level</th>
<th>2 hours after testing glucose tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>110mg/dl or less : Normal</td>
<td>140 or less : Abnormal fasting blood sugar level</td>
</tr>
<tr>
<td>110〜125 : Borderline</td>
<td>140〜199 : Impaired glucose tolerance</td>
</tr>
<tr>
<td>126 or more : Diabetes</td>
<td>200 or more : Diabetes</td>
</tr>
</tbody>
</table>
Preliminary test of suppressing blood sugar level and Glucose tolerance test in human beings

(administering 1.4g of Fermented Guava)

Blood sugar level (mg/dl)

Not absorbed

* : p<0.05

49th Japanese Society for Food Science and Technology
Nagoya, Japan, August 29-31, 2002
Impact of Fermented Guava grains on after-meal blood sugar levels

The above graphs show the relative values when fasting level is set as 100.

Give 1.4g after meal for up to 12 weeks.

57th Japanese Society of Nutrition and Food Science
Fukuoka, Japan, May 17-19, 2003
Summary

Fermented Guava

- Contains increased amount of quercetin (4.7 times after fermentation)
- Has better taste (improved the bitter and harsh taste)
- Has effects on suppressing blood sugar levels:
  - Inhibiting activities of starch breakdown enzymes
  - Suppressing blood sugar levels in KK-Ay mice
  - Suppressing blood sugar levels in human beings
- Was proven safe for human consumption
Standard

- Quercetin: 58mg/100g or more
- General live microorganisms: 300/g or less
- E. coli: negative
- Arsenic: 2ppm or less
- Heavy metals: 20ppm or less
- Remained agricultural chemicals:
  - DDT: 0.5ppm or less
  - BHC: 0.002ppm or less
  - Endrin: Not detected
  - Dieldrin: 0.01ppm or less
  - Aldrin: 0.01ppm or less