



ORYZA OIL & FAT CHEMICAL CO., LTD.

ORYZA TOCOTRIENOL

Cholesterol-Lowering Effect
Anti-Atherosclerosis Effect
Biological Antioxidant

- ORYZA TOCOTRIENOL
- ORYZA TOCOTRIENOL-30G
- ORYZA TOCOTRIENOL-70
- ORYZA TOCOTRIENOL-90
- ORYZA TOCOMIX-P15
- ORYZA TOCOMIX-P27
- ORYZA TOCOTRIENOL-L



ORYZA OIL & FAT CHEMICAL CO., LTD.

ver. 4.0MS

ORYZA TOCOTRIENOL

Super Vitamin E from Rice

Rice bran oil is one of vegetable oils and has been widely used as a traditional cooking oil in the Southeast Asia. This oil contains large amount of unsaturated fatty acids which are essential for life and health, as well as other constituents such as gamma-oryzanol, sterols, tocopherols and tocotrienols. Therefore, rice bran oil is heat-stable and effective in lowering serum cholesterol. Especially, gamma-oryzanol and tocopherols are believed to be beneficial compounds for health by growing research and have been used as medicines, cosmetics, health foods and food additives.

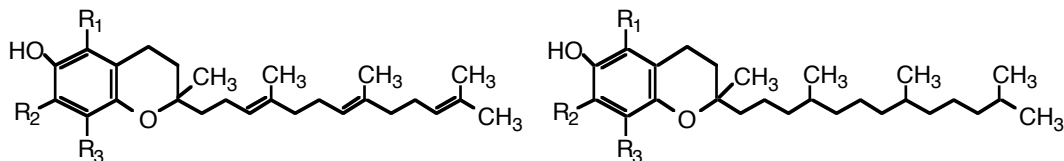
Recently, tocotrienols were extracted and produced from rice bran oil by ORYZA OIL & FAT CHEMICAL CO., LTD.

1. ORYZA TOCOTRIENOL

ORYZA TOCOTRIENOL, an amber, viscous, odorless liquid which extracted and refined from rice bran oil or rice germ oil, it contains a large amount of tocotrienols and tocopherols. Tocotrienol whose chemical structure is similar to that of tocopherols, but with three double bonds in the side chain and also there are four homologues *viz.* alpha-, beta-, gamma- and delta-tocotrienols. Especially, gamma-tocotrienol, a major constituent in the product was found to have potent biological activity.

In recent years, several studies have shown that tocotrienols may reduce cholesterol levels in people with hypercholesterolemia, play important roles in human as biological antioxidants, have growth inhibition efficacy on some human cancer cells and have recuperation efficacy from defatigation.

2. Structures of Tocotrienols



| | R ₁ | R ₂ | R ₃ | | R ₁ | R ₂ | R ₃ |
|-----------------------|-----------------|-----------------|-----------------|----------------------|-----------------|-----------------|-----------------|
| α -tocotrienol | CH ₃ | CH ₃ | CH ₃ | α -tocopherol | CH ₃ | CH ₃ | CH ₃ |
| β -tocotrienol | CH ₃ | H | CH ₃ | β -tocopherol | CH ₃ | H | CH ₃ |
| γ -tocotrienol | H | CH ₃ | CH ₃ | γ -tocopherol | H | CH ₃ | CH ₃ |
| δ -tocotrienol | H | H | CH ₃ | δ -tocopherol | H | H | CH ₃ |

Structures of Tocotrienols and Tocopherols

3. Absorption and distribution of Tocotrienols

Tocotrienols were reported that there were absorbed into skin on animal studies.

Ikeda *et al.* reported the tissue distribution of dietary tocotrienols and tocopherols were examined in rats and mice, using a vitamin E mixture. According to the study, α -tocopherol was abundantly retained in the skin, liver, kidney and plasma of rats and mice. In contrast, α -tocotrienol and γ -tocotrienol were detected slightly in the liver, kidney and plasma, while substantial amounts of these tocotrienols were detected in the skin of both rats and mice (Fig. 1).⁽¹⁾

Packer *et al.* also observed that tocotrienols penetrate rapidly through skin and efficiently combat oxidative stress induced by UV or ozone.⁽²⁾

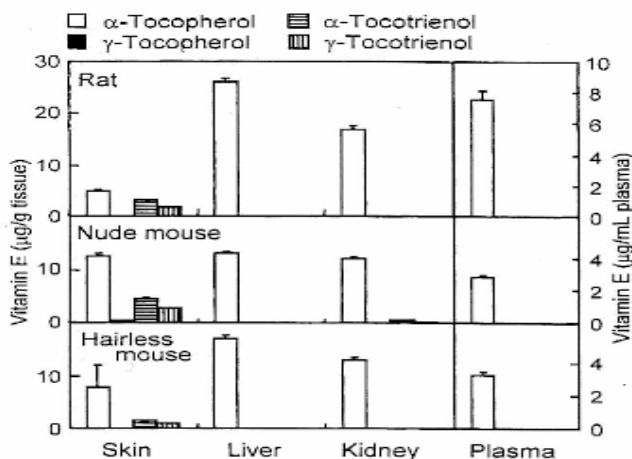


Fig. 1. Concentrations of α -tocopherol, γ -tocopherol, α -tocotrienol and γ -tocotrienol in the skin, liver, kidney and plasma of rats, nude mice and hairless mice. Values are means \pm SE, $n=6$. Rats were fed the diet for 8 wk, and both nude mice and hairless mice were fed the diet for 4 wk. The animals were killed after fasting for 24 h.

4. Functions of Tocotrienols

4-1 Hypercholesterolemia

Hypercholesterolemia is known to be a signal of cardiovascular disease. If your cholesterol levels are too high, you may try to eat ORYZA TOCOTRIENOL as new nutritional supplements. In some studies, tocotrienols have been found to effected a significant decrease in serum cholesterol of 15% and LDL cholesterol of 8%. Recent reseach reports that novel tocotrienols isolated from rice bran lower serum total LDL cholesterol levels than α -, β -, γ -, δ -tocotrienol.⁽¹²⁾ Tocotrienols are proved to reduce cholesterol levels by suppressing the activity of an enzyme, HMG-CoA reductase, involved in cholesterol biosynthesis in the liver.^(3,4) In addition, Watkins *et al.* report that rice bran non-saponifiables reduce serum total cholesterol and LDL cholesterol (Table 1).⁽¹⁴⁾

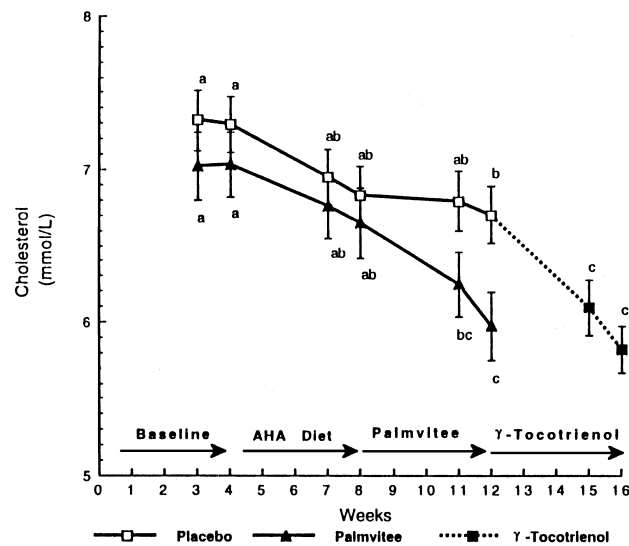


Fig. 2. Time-dependent impacts of American Heart Association Step 1 Diet (AHA) dietary regimen, Palmvitee and γ -Tocotrienol on serum cholesterol levels of hypercholesterolemic adult subjects. Differences between values on each plotted line which do not share a letter are significant ($P < 0.05$).⁽³⁾

Table 1. Effect of daily addendum of Palm Tocotrienols or Rice Bran Non-saponifiables (RBN) upon serum lipids in hypercholesterolemic subjects (mmol/L)

| | Palm tocotrienols (n=25) | | | RBN | | |
|--------------------------------|--------------------------|-------------|----------|-------------|-------------|----------|
| | Baseline | 3yr | <i>p</i> | Start | 12mo | <i>p</i> |
| Cholesterol | 6.05 ± 0.03 | 6.18 ± 0.33 | n. s. | 6.18 ± 0.33 | 5.31 ± 0.20 | <0.05 |
| LDL cholesterol | 4.24 ± 0.03 | 4.28 ± 0.37 | n. s. | 4.28 ± 0.37 | 3.40 ± 0.18 | <0.05 |
| HDL/cholesterol | 0.17 ± 0.01 | 0.17 ± 0.02 | n. s. | 0.17 ± 0.02 | 0.24 ± 0.02 | <0.05 |
| Triglyceride ^a /HDL | 2.70 ± 0.58 | 2.16 ± 0.35 | n. s. | 2.16 ± 0.35 | 1.21 ± 0.21 | <0.05 |
| | Palm placebo (n=25) | | | RBN placebo | | |
| | Baseline | 3yr | <i>p</i> | Start | 12mo | <i>p</i> |
| Cholesterol | 5.90 ± 0.16 | 5.70 ± 0.21 | n. s. | 5.70 ± 0.21 | 6.06 ± 0.32 | n. s. |
| LDL cholesterol | 4.19 ± 0.14 | 3.95 ± 0.18 | n. s. | 3.95 ± 0.18 | 4.05 ± 0.31 | n. s. |
| HDL/cholesterol | 0.20 ± 0.14 | 0.21 ± 0.06 | n. s. | 0.21 ± 0.06 | 0.22 ± 0.01 | n. s. |
| Triglyceride ^a /HDL | 1.80 ± 0.35 | 1.54 ± 0.31 | n. s. | 1.54 ± 0.31 | 1.55 ± 0.20 | n. s. |

4-2 Atherosclerosis

Studies in animals and humans have shown that tocotrienols could slow the progression of atherosclerosis by reducing serum indicators of platelet aggergation and vasoconstriction. In 1995 Tomeo *et al.* reported the effect of tocotrienols in 50 patients with proven atherosclerotic lesions in the carotid artery. In the group received tocotrienols, 28% of the patients improved degree of stenosis, only 8% got worse. Whereas in the control group, 48% of the patients deteriorated and none improved (Table 2). This result suggests tocotrienols may influence the course of atherosclerosis.⁽⁵⁾

Table 2. Comparison of change in carotid stenosis in groups receiving tocotrienols or placebo for six and twelve months^a

| | Antioxidant | Placebo |
|--------------------|-------------|---------|
| Six months | | |
| Marked regression | 1 | 0 |
| Regression | 5 | 0 |
| No change | 18 | 20 |
| Progression | 1 | 2 |
| Marked progression | 0 | 3 |
| Total number | 25 | 25 |
| Twelve months | | |
| Marked regression | 1 | 0 |
| Regression | 6 | 0 |
| No change | 16 | 15 |
| Progression | 2 | 6 |
| Marked progression | 0 | 4 |
| Total number | 25 | 25 |

^aData expressed as number of subjects per category.

4-3 Anticarcinogen

Cell culture and animal studies have shown that tocotrienols have inhibitory effect on the growth and proliferation of several types of human cancer cell. In 1995 Nesaretnam *et al.* reported that tocotrienol-rich blends completely inhibited the growth and proliferation of MDA-MB-435 human breast cancer cells by 50% at 180 $\mu\text{g/ml}$, whereas α -tocopherol have no effect at concentration up to 1000 $\mu\text{g/ml}$.⁽⁶⁾ Guthrie *et al.* observed that a combination of tocotrienols with Tamoxifen, a widely used synthetic antiestrogen inhibitor in breast cancer cells, produced a synergistic effect (Table 3).⁽⁷⁾ In addition, we observed that ORYZA TOCOTRIENOL inhibited AOM-induced colorectal carcinogenesis in rats by joint research with Gifu University School of Medicine (Table 4). Thus tocotrienols may be used as health foods for cancer prevention and/or treatment.

Table 3. Inhibition of proliferation MDA-MB-435 cells by TRF and its components, with and without tamoxifen^a

| Inhibitor | IC ₅₀ (μg/ml) |
|---------------------------|--------------------------|
| α-Tocopherol | > 1000 |
| TRF | 180 ± 3 |
| α-Tocotrienol | 90 ± 3 |
| γ-Tocotrienol | 30 ± 2 |
| δ-Tocotrienol | 90 ± 3 |
| Tamoxifen | 90 ± 4 |
| TRF + Tamoxifen | 3.9 ± 0.2 |
| α-Tocotrienol + Tamoxifen | 1.5 ± 0.05 |
| γ-Tocotrienol + Tamoxifen | 1.9 ± 0.02 |
| δ-Tocotrienol + Tamoxifen | 5.9 ± 0.1 |

^a Estrogen receptor-negative MDA-MB-435 human breast cancer cells were cultured with or without various concentrations of the test compounds. The concentration required to inhibit cell proliferation by 50% was determined, as measured by the incorporation of [³H]thymidine into DNA. The experiments were done in triplicate, and the results are averages of three experiments. Values are given as average ± SEM.

Table 4. Incidence of ACF in each group

| Group (treatment) | No. of rats | ACF/colon | Large ACF/colon (over 4 crypts) |
|----------------------------------|-------------|--------------|---------------------------------|
| 1(AOM alone) | 8 | 62.7 ± 14.9 | 8.5 ± 3.6 |
| 2(AOM + 0.038% α-tocopherol) | 6 | 33.9 ± 6.9# | 1.8 ± 1.7# |
| 3(AOM + 0.005%ORYZA TOCOTRIENOL) | 4 | 50.3 ± 13.9# | 3.4 ± 1.3# |
| 4(AOM + 0.025%ORYZA TOCOTRIENOL) | 9 | 48.4 ± 13.9# | 2.5 ± 1.5# |
| 5(AOM + 0.1%ORYZA TOCOTRIENOL) | 8 | 41.3 ± 12.2# | 1.5 ± 1.4# |
| 6(0.1%ORYZA TOCOTRIENOL) | 4 | 0 | 0 |
| 7(basal diet) | 4 | 0 | 0 |

Significantly different from group 1 by Student's or Welch's t-test

4-4 Antioxidant

Tocotrienols are members of the vitamin E family, but recently much attention has been focused on it, because some biological activities of tocotrienols are stronger than that of tocopherols. In 1993 Suarna *et al.* reported that tocotrienols effectively inhibited lipid peroxidation in rat and human liproteins.⁽⁸⁾ Studies by Suzuki *et al.* and Kamat *et al.* even showed that tocotrienols are more potent in protecting against free radical-induced oxidating damage in lipid cell membranes and in brain cell mitochondria (Fig. 3-6).^(9,10) A study by Serbinova *et al.* α-tocotrienol possesses 40-60 times higher antioxidant activity against (Fe²⁺+ascorbate) and (Fe²⁺+NADPH) induced lipid peroxidation in rat liver microsomal membranes than α-tocopherol (Fig. 7).⁽¹¹⁾ In addition, novel tocotrienols isolated from rice bran have much greater in vitro antioxidant activity and greater suppression of B16 melanoma cell proliferation than α-, β-, γ-, δ-tocotrienols.⁽¹²⁾ Weber *et al.*⁽¹³⁾ and Traber *et al.*⁽¹⁵⁾ indicate that topical application of tocotrienols both prevents skin against UV-light-induced oxidative damage and preserves levels of vitamin E and ubiquinol in skin cell(Fig. 8). Thus tocotrienols may be used as cosmetics.

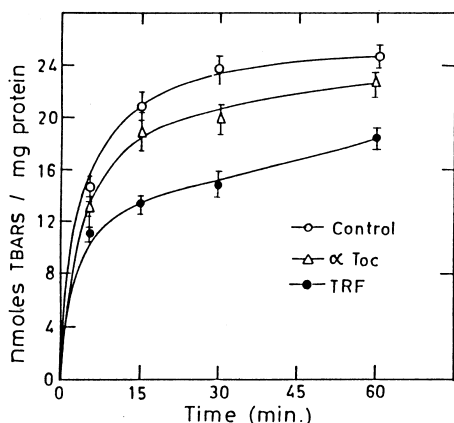


Fig. 3. Ascorbate-Fe²⁺-induced lipid peroxidation in rat brain mitochondria as a function of time with and without TRF, as assessed by TBARS. The concentration used was 5 μM and values are mean ± SE from 5 experiments.

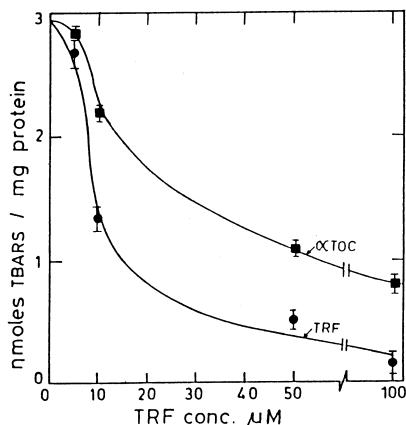


Fig. 4. AAPH-induced lipid peroxidation in rat brain mitochondria as a function of concentration of TRF and α-tocopherol. Peroxidation was assessed by TBARS and incubation was carried out for 5 min.

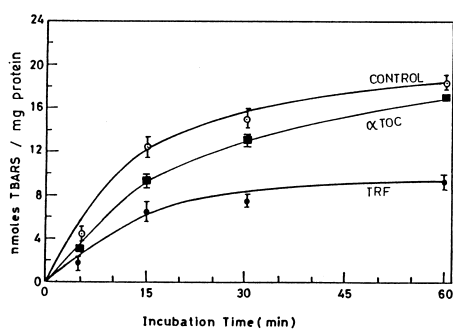


Fig. 5. The photosensitisation-induced lipid peroxidation in rat brain mitochondria and its prevention by TRF as a function of time. TRF was used at a concentration of 50 μM.

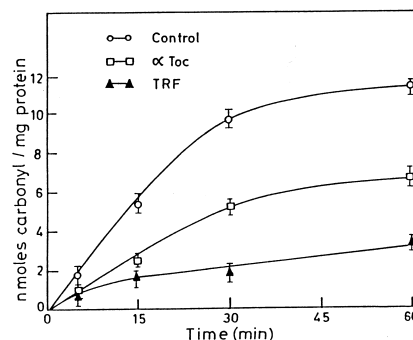


Fig. 6. Protein oxidation of brain mitochondria and inhibition by a-tocopherol and TRF as a function of time. Oxidative damage was induced by the ascorbate-Fe²⁺ system. The concentration of TRF was 5 μM.

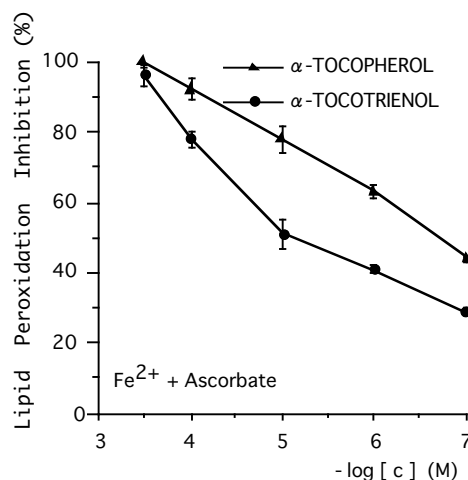
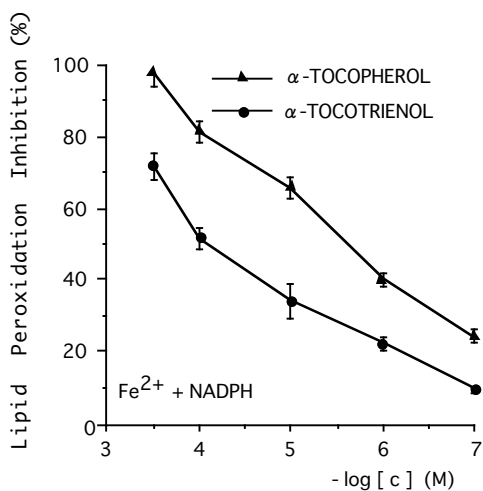


Fig. 7. Inhibition of lipid peroxidation in rat liver microsomes by alpha-tocopherol and alpha-tocotrienol. Microsomal suspensions were preincubated with chromanols for 15 min at 25°C after which lipid peroxidation-inducing system was added. The reaction was stopped after 5 min. Other conditions as in Methods.

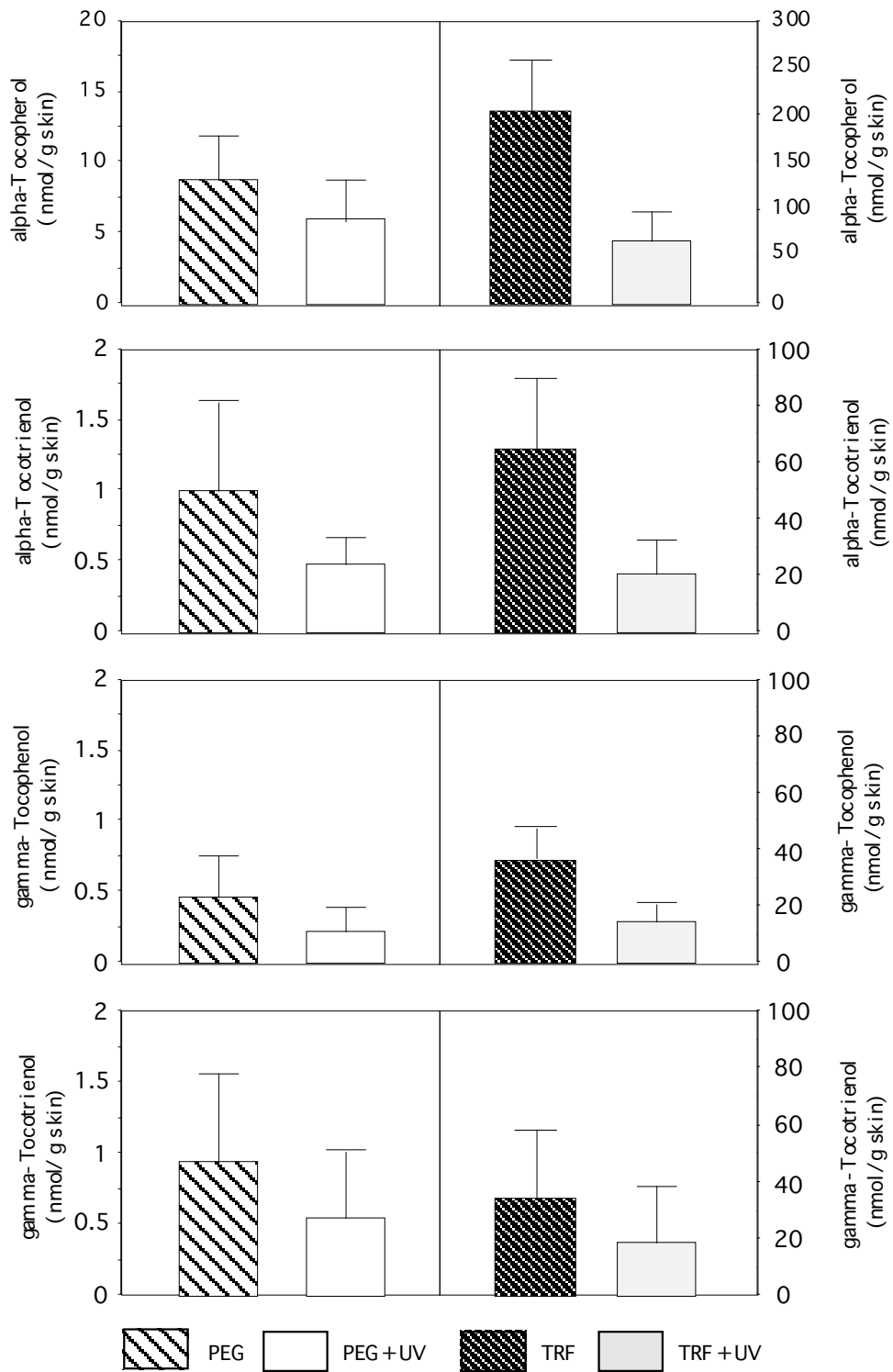


Fig. 8. α -tocopherol, α -tocotrienol, γ -tocopherol and γ -tocotrienol contents of murine skin.

4-5 Recuperation Efficacy from Defatigation

In recent report, Hirahara *et al.* burden exercise for 30 minutes on 1 st, and compares lactic acid value between serum levels just after exercise load to tocotrienol or the rat which let you take in α -tocopherol. As a result report that the dosage group of tocotrienol shows low serum lactic acid value compared with the α -tocopherol dosage group.

4-6 Protective action against cell damage

ORYZA TOCOTRIENOL inhibited oxidative damage-related cell death on keratinocyte (HaCaT) induced by H₂O₂ and t-BHP (Fig.9).

<Method> Preparation of cells and sample : HaCaT cells were washed twice with buffer. The concentration of ORYZA TOCOTRIENOL solution was adjusted to 200 μ g/mL, and added to 50 μ L of buffer.

Oxidative damage inducers : H₂O₂ (20 mmol/L) ; 50 μ L, t-BHP (1.8 mmol/L) ; 50 μ L

Treatment : After incubation of HaCaT cells with H₂O₂ (2 h) or t-BHP (4 h), cells were washed twice with buffer.

Detection : Cell viability was evaluated by NR assay.

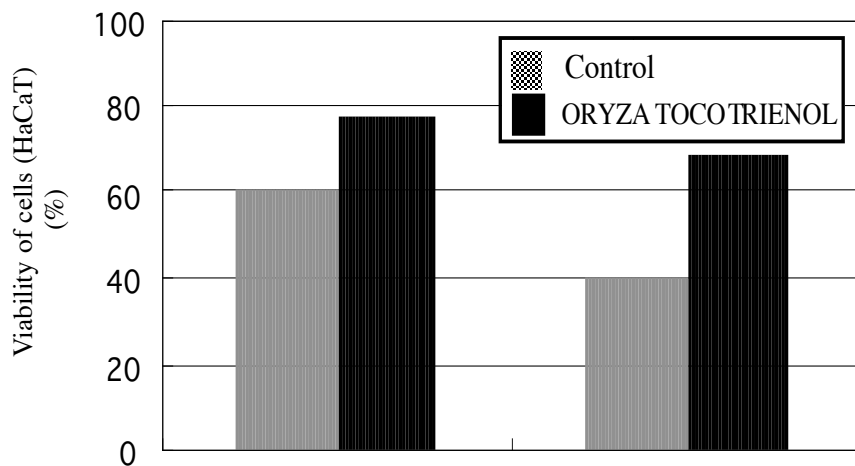


Fig.9. Protective action of ORYZA TOCOTRIENOL for cell damage

4. Cell activating action

Cell activating action of ORYZA TOCOTRIENOL was evaluated by MTT assay on inseedinated human dermal fibroblasts (NHDF) proliferation. The rate of the maximum proliferation (123% : compared with placebo) was observed at 0.025% ORYZA TOCOTRIENOL (final concentration) (Fig.10).

<Method> NHDF cells (2×10^4 cells/well) suspended in 1% FBS-DMEM medium were seeded in a 96-well plate. After 24 h incubation, the medium was replaced to new 1% FBS-DMEM containing sample. Cells were further cultured for 48 h, cell activating action was evaluated by MTT assay. The test was carried out 3 times, and cell activating action was estimated that its proliferation index was more than 105% with reproducibility.

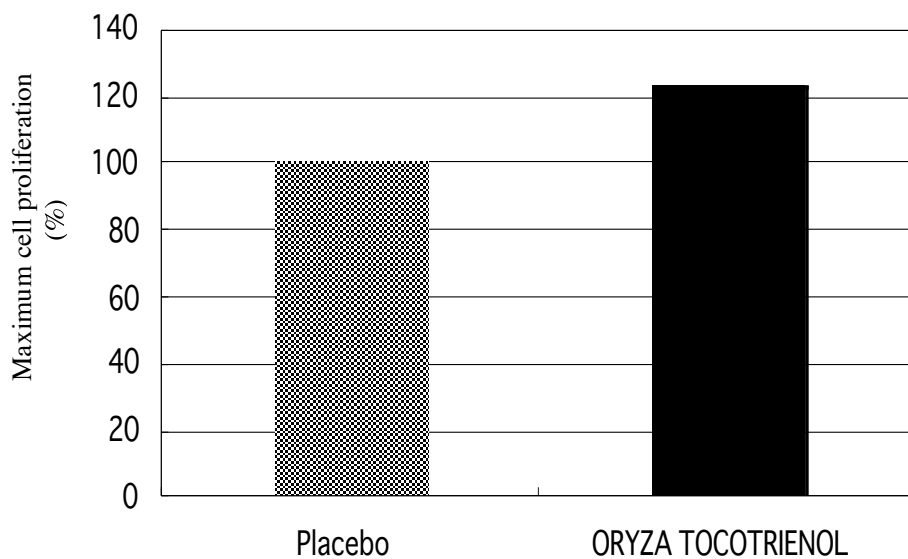


Fig.10. Cell activating action of ORYZA TOCOTRIENOL

4-8 Hyaluronic acid production by ORYZA TOCOTRIENOL

ORYZA TOCOTRIENOL promoted hyaluronic acid production at all concentrations evaluated in this study (0.00039-0.05%). At a concentration of 0.0031% or more, ORYZA TOCOTRIENOL promoted not only hyaluronic acid production but also dermal fibroblast proliferation (Fig.11).

Even at a concentration of 0.0015% or less showing no cell-proliferating effects, ORYZA TOCOTRIENOL promoted hyaluronic acid production, suggesting its marked promoting effects on hyaluronic acid production.

These results suggest the promotion of hyaluronic acid production and fibroblast proliferation by ORYZA TOCOTRIENOL. ORYZA TOCOTRIENOL may be a cosmetically and also cosmeceutically useful substance.

<Method> ORYZA TOCOTRIENOL (50%) was diluted 1/10 with 99.5% ethanol, further diluted with medium to each concentration, and used in the experiment.

Normal human dermal fibroblasts were used. After cell culture, the medium was replaced by DMEM containing 0.5% fetal bovine serum (FBS) and TOCOTRIENOL, and the cells were further cultured for 48 h. The supernatant was obtained, and hyaluronic acid was measured by routine ELISA. Anti-keratan sulfate (mouse) was used as the primary antibody, and peroxidase-labeled anti-mouse IgG1 as the secondary antibody. After color development with ABTS solution, absorbance at 405 nm was measured. Protein in the cells was measured by Lowry's method. The amount of hyaluronic acid per unit of protein was calculated as hyaluronic acid production. As the positive control for hyaluronic acid, DMEM supplemented with 5% FBS was used.

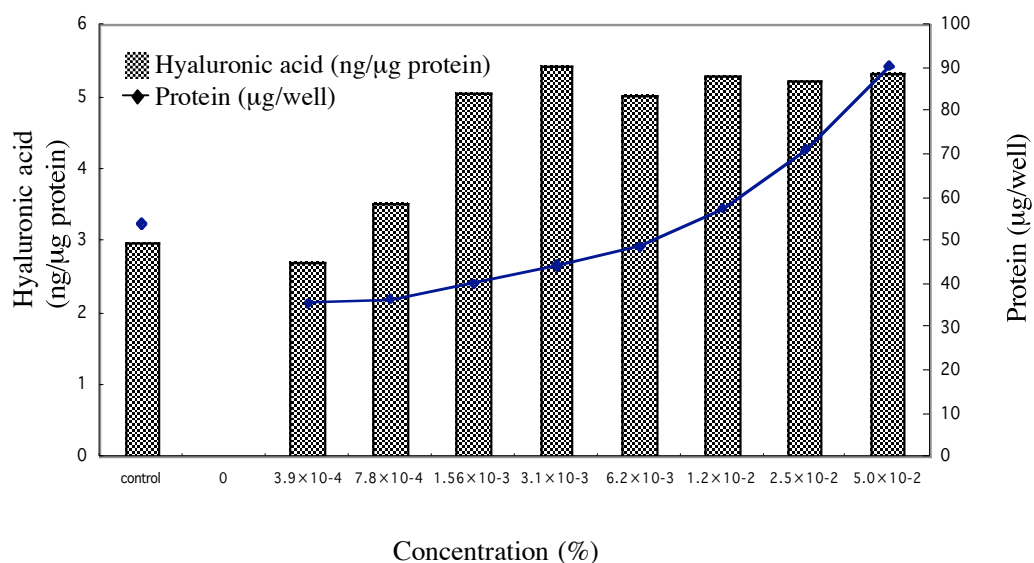
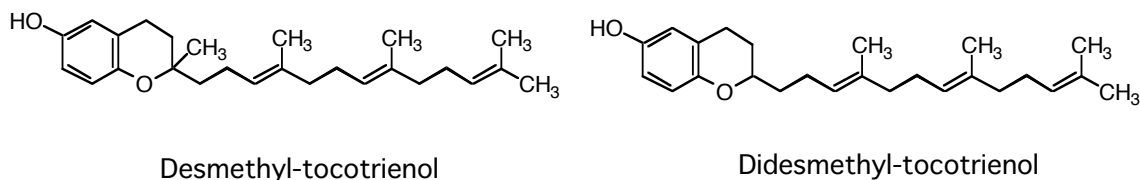


Fig. 11. Hyaluronic acid production on normal human dermal fibroblasts of ORYZA TOCOTRIENOL

4-9 Novel Tocotrienols from Rice Bran

In 2000 Qureshi *et al.* reported that two novel tocotrienols were isolated from rice bran. Their structures were established as desmethyl tocotrienol and didesmethyl tocotrienol. These tocotrienols significantly lowered serum total and LDL cholesterol levels and inhibited HMG-CoA reductase activity in chickens. They had much greater in vitro antioxidant activities and greater suppression of B16 melanoma cell proliferation than α -tocopherol and known tocotrienols. Results indicated that the number and position of methyl substituents in tocotrienols affect their hypocholesterolemic, antioxidant, and antitumor properties.⁽¹⁶⁾

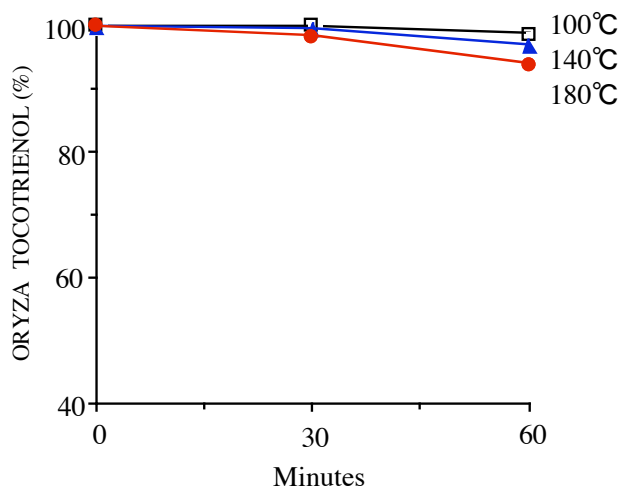


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5. Thermal Stability of ORYZA TOCOTRIENOL

The pyrolysis of ORYZA TOCOTRIENOL does not occur at a normal food processing temperature for 60 min.



6. Daily Dosage of Tocotrienols

It is recommended to take 25-60 mg of total tocotrienols per day as nutritional supplements. So it offers daily supplements ranging, 160-380 mg of ORYZA TOCOTRIENOL, 120-280 mg of ORYZA TOCOTRIENOL-30G, 63-150 mg of ORYZA TOCOTRIENOL-70, 42-100 mg of ORYZA TOCOTRIENOL-90, 320-750 mg of ORYZA TOCOMIX-P15, 140-330 mg of ORYZA TOCOTRIENOL-P27, 2300-5500 mg of ORYZA TOCOTRIENOL-L for healthy adults.

7. Acute Toxicity and Safety

After administering 240 mg/day for two weeks, no toxic effects were observed.^(5,13) LD₅₀ (mouse) is more than 5000 mg/kg.

8. Practical Applications of ORYZA TOCOTRIENOL

| Applications | Examples |
|--------------|--|
| Health foods | Soft-capsule, Tablet, Hard-capsule, and so on. |
| Foods | Candy, Gum, Cake, Cooky, Wafer, Drink, Nutritional oil, Margarine, and so on. |
| Cosmetics | Base cosmetics(Lotion, Milk, Cream, and so on) Body cosmetics(Body lotion, Body cream, and so on) Cleansing(Soap, and so on) Make up cosmetics(Lipstick, Foundation, and so on), and so on. |

9. Packaging

- ORYZA TOCOTRIENOL
- ORYZA TOCOTRIENOL-30G
- ORYZA TOCOTRIENOL-70
- ORYZA TOCOTRIENOL-90
 - 5 kg × 4 cans = one case (Filling nitrogen)
 - 15kg (Filling nitrogen)
 - Exterior packaging : Cardboard box, Interior packaging: Can
- ORYZA TOCOMIX-P15
- ORYZA TOCOMIX-P27
 - 5kg
 - Exterior packaging : Cardboard box
 - Interior packaging : Polyvinylidene coating bag
- ORYZA TOCOTRIENOL-L
 - 5kg
 - Exterior packaging: Cardboard box
 - Interior packaging: A double layered plastic bag

10. Storing Method

ORYZA TOCOTRIENOL is unstable when exposed to air, heat, alkali, acid or metal ions, store in a cool and dark place. Avoid humidity. ORYZA TOCOMIX-P15 has some absorbency, and therefore use quickly, when take off the seal.

11. Expression of ORYZA TOCOTRIENOL

Food

Rice oil extract, Tocotrienols, Rice Tocotrienols

Cosmetic

- | | | | |
|--|---|---|---|
| <ul style="list-style-type: none"> • ORYZA TOCOTRIENOL • ORYZA TOCOTRIENOL-30G | } | ⇒ | Oryza Sativa (rice) Bran Oil Tocotrienols Tocopherol |
| <ul style="list-style-type: none"> • ORYZA TOCOTRIENOL-70 • ORYZA TOCOTRIENOL-90 | } | ⇒ | Tocotrienols Tocopherol Oryza Sativa (rice) Bran Oil |
| <ul style="list-style-type: none"> • ORYZA TOCOTRIENOL-L | } | ⇒ | Glycerin Water Polyglyceryl-10 Oleate Oryza Sativa (rice) Bran Oil Lecithin Tocotrienols Tocopherol |

*please refer to your nation's standard

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOTRIENOL

This product is mixture of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols ($\alpha, \beta, \gamma, \delta$) is more than 16.0 %.

Appearance This product is slightly yellow or red-brown colored sticky liquid.
It has slightly unique smell.

Certification Test 0.01 g of this product is dissolved in 10 ml of ethanol, then 2 ml of nitric acid is added to the mixture. After incubation at 75 °C for 15 minutes, the solution shows red-orange color.

Content(HPLC)

| | |
|------------------------------------|-------------|
| Total tocopherols and tocotrienols | Min. 30.0 % |
| Total tocotrienols | Min. 16.0 % |
| α -tocopherol | Min. 9.0 % |
| α -tocotrienol | Min. 7.0 % |
| γ -tocotrienol | Min. 9.0 % |

Peroxide Value Max. 10.0 meq/kg (Japan Oil Chemists' Society)

Purity Test

- (1) Solubility Dissolve 2.0g of this product in 20ml of ethanol, the solution should be clear.
- (2) Heavy Metals Max. 10 ppm (The Japanese Standard for Food Additives)
- (3) Arsenic Max. 1 ppm (Standard Methods of Analysis in Food Safety Regulation)

Standard Plate Counts Max. 1×10^3 cfu/g (Analysis for Hygienic Chemists)

Moulds and Yeasts Max. 1×10^2 cfu/g (Analysis for Hygienic Chemists)

Coliforms Negative (Analysis for Hygienic Chemists)

Composition

| Ingredients | Contents |
|------------------------------|----------|
| Rice oil extract concentrate | 100 % |
| Tocopherol | 14 % |
| Tocotrienol | 16 % |
| Triglyceride | 30 % |
| Hydrocarbon | 23 % |
| Sterol | 9 % |
| Higher alcohol | 6 % |
| Fatty acid | 2 % |

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOTRIENOL-30G

This product is mixture of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols ($\alpha, \beta, \gamma, \delta$) is more than 22.0 %.

Appearance This product is slightly yellow or red-brown colored sticky liquid.
It has slightly unique smell.

Certification Test 0.01g of this product is dissolved in 10ml of ethanol, then 2ml of nitric acid is added to the mixture. After incubation at 75°C for 15 minutes, the solution shows red-orange color.

Content(HPLC)

| | |
|------------------------------------|-------------|
| γ -tocotrienol | Min. 20.0 % |
| Total tocotrienols | Min. 22.0 % |
| Total tocopherols and tocotrienols | Min. 30.0 % |

Peroxide Value Max. 10.0 meq/kg (Japan Oil Chemists' Society)

Purity Test

(1) Solubility Dissolve 2.0g of this product in 20ml of ethanol, the solution should be clear.

(2) Heavy Metals Max. 10ppm (The Japanese Standard for Food Additives)

(3) Arsenic Max. 1ppm (Standard Methods of Analysis in Food Safety Regulation)

Standard Plate Counts Max. 1×10^3 cfu/g (Analysis for Hygienic Chemists)

Moulds and Yeasts Max. 1×10^2 cfu/g (Analysis for Hygienic Chemists)

Coliforms Negative (Analysis for Hygienic Chemists)

Composition

| Ingredients | Contents |
|------------------------------|----------|
| Rice oil extract concentrate | 100 % |
| Tocopherol | 8 % |
| Tocotrienol | 22 % |
| Triglyceride | 30 % |
| Hydrocarbon | 23 % |
| Sterol | 9 % |
| Higher alcohol | 6 % |
| Fatty acid | 2 % |

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOTRIENOL-70

This product is mixture of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols (α , β , γ , δ) is more than 40.0 %.

Appearance This product is red-brown colored sticky liquid. It has slightly unique smell.

Certification Test 0.01g of this product is dissolved in 10ml of ethanol, then 2 ml of nitric acid is added to the mixture. After incubation at 75 °C for 15 minutes, the solution shows red-orange color.

Content(HPLC)

| | |
|------------------------------------|-------------|
| Total tocopherols and tocotrienols | Min. 70.0 % |
| Total tocotrienols | Min. 40.0 % |
| α -tocotrienol | Min. 14.0 % |
| γ -tocotrienol | Min. 24.0 % |
| Other tocotrienols | Min. 2.0 % |

Peroxide Value Max. 10.0 meq/kg (Japan Oil Chemists' Society)

Purity Test

(1) Solubility Dissolve 2.0g of this product in 20ml of ethanol, the solution should be clear.

(2) Heavy Metals Max. 10 ppm (The Japanese Standard for Food Additives)

(3) Arsenic Max. 1 ppm (Standard Methods of Analysis in Food Safety Regulation)

Standard Plate Counts Max. 1×10^3 cfu/g (Analysis for Hygienic Chemists)

Moulds and Yeasts Max. 1×10^2 cfu/g (Analysis for Hygienic Chemists)

Coliforms Negative (Analysis for Hygienic Chemists)

Composition

| Ingredients | Contents |
|------------------------------|----------|
| Rice oil extract concentrate | 100 % |
| Tocopherol | 30 % |
| Tocotrienol | 40 % |
| Triglyceride | 13 % |
| Hydrocarbon | 10 % |
| Sterol | 4 % |
| Higher alcohol | 3 % |

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOMIX-P15

This product is mixture powder of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols ($\alpha, \beta, \gamma, \delta$) is more than 8.0 %.

| | | |
|----------------------------|---|--|
| <u>Appearance</u> | This product is slightly yellow colored powder. It has slightly unique smell. | |
| <u>Certification Test</u> | 0.01 g of this product is dissolved in 10 ml of ethanol, then 2 ml of nitric acid is added to the mixture. After incubation at 75 °C for 15 minutes, the solution shows red-orange color. | |
| <u>Content(HPLC)</u> | Total tocopherols and tocotrienols | Min. 15.0 % |
| | Total tocotrienols | Min. 8.0 % |
| <u>Loss On Drying</u> | Max. 5.0 % | (Analysis for Hygienic Chemists, 1g, 105°C, 2h) |
| <u>Purity Test</u> | | |
| (1) Heavy Metals | Max. 10 ppm | (The Japanese Standard for Food Additives) |
| (2) Arsenic | Max. 1 ppm | (Standard Methods of Analysis in Food Safety Regulation) |
| <u>Standard Plate Coun</u> | Max. 1×10^3 cfu/g | (Analysis for Hygienic Chemists) |
| <u>Moulds and Yeasts</u> | Max. 1×10^2 cfu/g | (Analysis for Hygienic Chemists) |
| <u>Coliforms</u> | Negative | (Analysis for Hygienic Chemists) |

Composition

| Ingredients | Contents |
|---|----------|
| Rice oil extract (contains tocotrienol) | 30 % |
| Calcium carbonate | 60 % |
| Dextrin | 6 % |
| Lecithin | 1 % |
| Purified water | 3 % |
| Total | 100 % |

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOMIX-P27

This product is mixture powder of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols ($\alpha, \beta, \gamma, \delta$) is more than 18.0 %.

Appearance This product is slightly yellow colored powder. It has slightly unique smell.

Certification Test 0.01 g of this product is dissolved in 10 ml of ethanol, then 2 ml of nitric acid is added to the mixture. After incubation at 75 °C for 15 minutes, the solution shows red-orange color.

| | | |
|----------------------|------------------------------------|-------------|
| <u>Content(HPLC)</u> | Total tocopherols and tocotrienols | Min. 27.0 % |
| | Total tocotrienols | Min. 18.0 % |
| | γ -Tocotrienol | Min. 16.0 % |
| | α -Tocopherol | Min. 4.0 % |

Loss On Drying Max. 5.0 % (Analysis for Hygienic Chemists, 1g, 105°C, 2h)

Purity Test

(1) Heavy Metals Max. 10 ppm (The Japanese Standard for Food Additives)

(2) Arsenic Max. 1 ppm (Standard Methods of Analysis in Food Safety Regulation)

Standard Plate Coun Max. 1×10^3 cfu/g (Analysis for Hygienic Chemists)

Moulds and Yeasts Max. 1×10^2 cfu/g (Analysis for Hygienic Chemists)

Coliforms Negative (Analysis for Hygienic Chemists)

Composition

| Ingredients | Contents |
|---|----------|
| Rice oil extract (contains tocotrienol) | 30 % |
| Calcium carbonate | 60 % |
| Dextrin | 6 % |
| Lecithin | 1 % |
| Purified water | 3 % |
| Total | 100 % |

PRODUCT STANDARD

PRODUCT NAME

ORYZA TOCOTRIENOL-L

This product is water-soluble mixture of tocotrienols extracted and concentrated from rice bran or rice germ. The quantity of total tocotrienols ($\alpha, \beta, \gamma, \delta$) is more than 1.1 %.

| | | |
|------------------------------|---|--|
| <u>Appearance</u> | This product is slightly yellow colored liquid. It has slightly unique smell. | |
| <u>Certification Test</u> | 0.15 g of this product is dissolved in 10 ml of ethanol, then 2 ml of nitric acid is added to the mixture. After incubation at 75 °C for 15 minutes, the solution shows red-orange color. | |
| <u>Content(HPLC)</u> | Total tocopherols and tocotrienols | Min. 2.0 % |
| | Total tocotrienols | Min. 1.1 % |
| <u>Purity Test</u> | | |
| (1) Heavy Metals | Max. 10 ppm | (The Japanese Standard for Food Additives) |
| (2) Arsenic | Max. 1 ppm | (Standard Methods of Analysis in Food Safety Regulation) |
| <u>Standard Plate Counts</u> | Max. 1×10^3 cfu/g | (Analysis for Hygienic Chemists) |
| <u>Moulds and Yeasts</u> | Max. 1×10^2 cfu/g | (Analysis for Hygienic Chemists) |
| <u>Coliforms</u> | Negative | (Analysis for Hygienic Chemists) |

Composition

| Ingredients | Contents |
|-----------------------------------|----------------|
| Rice oil extract | 7.0 % |
| Caprylic/capric acid triglyceride | 13.5 % |
| Glycerin esters of fatty acids | 46.0 % |
| Lecithin | 3.5 % |
| Purified water | 30.0 % |
| Total | 100.0 % |

ORYZA OIL & FAT CHEMICAL CO., LTD., striving for the development of the new functional food materials to promote your health.

- **From product planning to OEM** - For any additional information or assistance, please contact :

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