

## **Effects of Dietary Fiber Enriched Liquid Formula on Postprandial Glycemic Parameters**

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### **< Summary >**

DIMS<sup>®</sup> is a nutritionally balanced liquid formula that is designed to meet the specific nutritional requirements of persons with diabetes and metabolic syndrome. Unlike other liquid formulas for diabetes, less than 25% of the total energy is derived from fat and DIMS<sup>®</sup> contains 24 g of dietary fiber and 420 mg of EPA/DHA per 1,000 kilocalories to prevent the development of diabetic macroangiopathy as well as microangiopathy.

As 60% of the diabetic patients in Japan are over 60 years old, the number of bed-ridden elderly patients with diabetes mellitus is expected to increase in the future. Because of this, provision must be made for the nutritional management of diabetic patients with an insufficient caloric intake. In diabetes, the postprandial glucose peak leads to a rapid and marked increase of the blood glucose level that may give rise to diabetic complications. Hence, to prevent postprandial hyperglycemia, some diabetes-specific liquid formulas currently marketed in Japan have a low carbohydrate and high fat composition. On the other hand, some Japanese nutritional guidelines have pointed out the importance of regulating the fat intake to decrease the risk of cardiovascular disease.

This review explains the clinical and experimental usefulness of our high fiber and EPA/DHA-containing liquid formula, DIMS<sup>®</sup>.

#### **(1) Effect of a high-fiber liquid formula on postprandial hyperglycemia.**

To assess the effect of a high-fiber liquid formula on postprandial glycemia, we carried out a bolus administration test in 11 healthy volunteers and 8 subjects with impaired glucose tolerance (IGT). After an overnight fast, DIMS<sup>®</sup> liquid formula (4.4 g of fiber and 28.6 g of dextrin in 200 ml) or a standard formula (28.6 g of dextrin in 200 ml) or the reference solution (28.6 g of glucose in 200 ml) was administered to each volunteer in a cross-over manner. The postprandial glucose response (the area under the curve for 2 hours after administration) and the blood glucose level at 30 min after administration were significantly lower with the high-fiber formula compared with the standard formula. In the IGT subjects, the high-fiber formula resulted in significantly lower blood glucose levels at 30 minutes after intake compared with the standard formula. In contrast, the subjects with normal glucose tolerance showed no significant differences of postprandial blood glucose levels between these two formulas.

#### **(2) Comparison of a high fiber EPA/DHA-containing liquid formula with other diabetes-specific**

liquid formulas regarding insulin sensitivity and fat accumulation in diabetic mice.

To evaluate the long-term effect of the DIMS<sup>®</sup> high-fiber EPA/DHA-containing liquid formula on the treatment and prevention of diabetes-related complications, we investigated the effects DIMS<sup>®</sup> and several other diabetes-specific low-carbohydrate high-fat formulas on glucose tolerance (based on an oral glucose tolerance test: OGTT), insulin levels, and the increase of white adipose tissue in B6.V-Lepob/J mice. The mice were fed *ad libitum* a powdered diet in which liquid formula prepared by freeze-drying was mixed with the standard AIN-93G diet for 21 days. The fasting blood glucose and hemoglobin A<sub>1c</sub> levels of mice receiving DIMS<sup>®</sup> were comparable to those of animals fed the other liquid formulas, but serum insulin and HOMA-IR values were significantly lower in the mice fed DIMS<sup>®</sup> compared with the other groups. In addition, the area under the curve for OGTT (the dose of glucose was 1 g/kg body weight) was the smallest in the DIMS<sup>®</sup> group. Furthermore, mice fed the DIMS<sup>®</sup> high-fiber EPA/DHA-containing liquid formula showed less epididymal fat accumulation than mice fed the other liquid formulas for diabetes (low-carbohydrate high-fat formulas).

In summary, these data demonstrate that the high-fiber EPA/DHA-containing liquid formula “DIMS<sup>®</sup>” may be more appropriate for use in long-term care of diabetic patients than other formulas designed for diabetes, which are usually low-carbohydrate high-fat formulas.