MODIFIED RICE BRAN, MGN-3, IMPROVES GLUCOSE TORELANCE IN NIDDM ADULT RATS GIVEN STREPTOZOTOCIN AS NEONATES

Ohara I, Onai K, Maeda H*. Faculty of Economics, Kobe Women's University, Kobe, JAPAN and *Daiwa Pharmaceutical Co., Ltd., Tokyo, JAPAN

ABSTRUCT

The effect of modified rice bran (MGN-3) on glucose tolerance as studied in NIDDM adult rats and changes in taste preference were also examined.
NIDDM adult rats were made by intraperitoneal injection of 100mg streptozotocin at 1.5 days of age. Following weaning, the animals were divided into 3 groups, control, diabetic rats fed 1% cellulose diet and diabetic rats fed 1% MGN-3 diet. Rats were free access to experimental diets and water for 2 months. Oral glucose tolerance tests were performed at 8 weeks of age. Two-bottle-choice preference tests between aqueous solution, either of 5mM citric acid, 0.016mM quinine sulfate, 0.82mM sodium saccharin, 21mM sodium chiloride or 27 mM monosodium glutamate, and deionized water were conducted in the experimental period. Trunk blood were collected and plasma levels of insulin, glucose, triglyceride, total cholesterol, HDL-cholesterol, Total protein, albumin, urea nitorogen and zinc were measured.
Plasma glucose levels increased significantly faster and higher than that of the normal controls in oral glucose tolerance test. When the NIDDM rats administered MGN-3, the abrupt rise of plasma glucose levels slowed down. Although taste preferences in NIDDM rats were not significantly different as to the control, diabetic rats showed aversion to sourness as was observed in IDDM rats (Nutrition Research, in press). The plasma total cholesterol level only among various parameters lowered significantly by the administration of MGN-3.
MGN-3 can be useful as a dietary fiber supplement for the treatment of diabetes.

OBJECTIVES

Beneficial actions of diets high in fiber ameliorated diabetic symptoms. For example, certain dietary fiber, especially soluble ones, lower plasma cholesterol and maintain blood glucose concentrations within a suitable range, mechanisms underling these effects are not fully understood, the delay of gastric emptying, interferences with the intestinal absorption of cholesterol and glucose, and others are thought to be caused.

These studies were mostly conducted under the large amounts of fiber consumption, usually 20g/day. Then, it is thought to be difficult to achieve such intakes of fiber from foods alone and fiber supplements are needed. There are also questions whether it plays a significant role practically or not.
On the other hand, MGN-3, Arabinoxylan Compound, is used for general health promotion benefits, as a natural food supplement. This is also recognized to have an immunotherapeutic effect in the treatment of cancer patients.
Our previous study demonstrated the administration of MGN-3 of MGN-3 improves streptozocin (STZ)-induced diabetes. Plasma levels of triglycerides and total cholesterol lowered by the administration of MGN-3. Water intake also reduced which suggested that polyurea induce by STZ improves. The diabetic rats showed strong aversion to sourness and bitterness (Nutrition Research, in press).
The present study was designed first to examine the curative effect of MGN-3 on glucose tolerance in NIDDM adult rats given STZ as neonates and second to measure the changes in taste preference of NIDDM.

METHODS

Diabetic rats were made by intraperitional injection of 100 mg/kg streptozocin (STZ) at 1.5 days of age. Animals were weaned on days 28 and fed experimental diet and water freely throughout the experimental period (60 days).

Control Group : Fed 1% Cellulose Diet (C), n=5
Diabetic Group : Fed 1% Cellulose Diet (D), n=7 Fed 1% MGN-3 Diet(DM), n=8

Oral glucose tolerance test was done on day 58 days after feeding of experimental Diets.
Blood samples were taken from tail vein at 0, 30, 60 and 120 min following the administration of 2g/kg glucose by stomach tube.
Two-bottle-choice preference tests for 24 hours were performed.

5mM citric acid (Day 42)
0.82mM Saccharin (Day 43)
0.016mM quinine (Day 44) VS Deionized water
21mM NaCl (Day 45)
21mM monosodium glutamate (Day 46)

Trunk Blood was collected on Day 60.
Plasma levels of insulin, glucose, triglyceride, total cholesterol, HDL-cholesterol, zinc, urea nitrogen, total protein and albumin were measured.

RESULTS

1) Body, weight, Plasma Insulin and Glucose Levels

The NIDDM rats showed the depression of body mass gain during the experimental period. Insulin concentrations in the plasma of diabetic rats were lower than those in non-diabetic controls and these tended to ascend by the administration of MGN-3, although not significantly different. Plasma glucose levels in the state of hunger were not different between groups.

2) Oral Glucose Tolerance Test

At any time following the administration of glucose, plasma glucose levels in the NIDDM rats were significantly higher than those in the non-diabetic controls. When the NIDDM rats were continuously daily administered MGN-3, the abrupt rise of plasma glucose levels due to STZ decreased at 30 min.

3) Plasma Biochemical Analysis

Among various parameters, total cholesterol and urea nitrogen were significantly higher than in the NIDDM rats than those in the non-diabetic controls. The total cholesterol levels only lowered significantly by the administration of MGN-3.

4) Preference Test

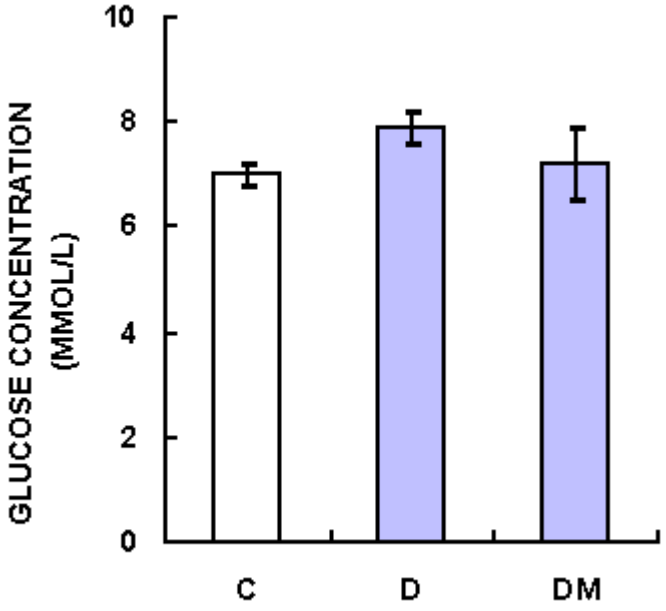
Although taste preferences in NIDDM rats were not significantly different as to the control, diabetic rats showed aversion to sourness as observed in IDDM rats.

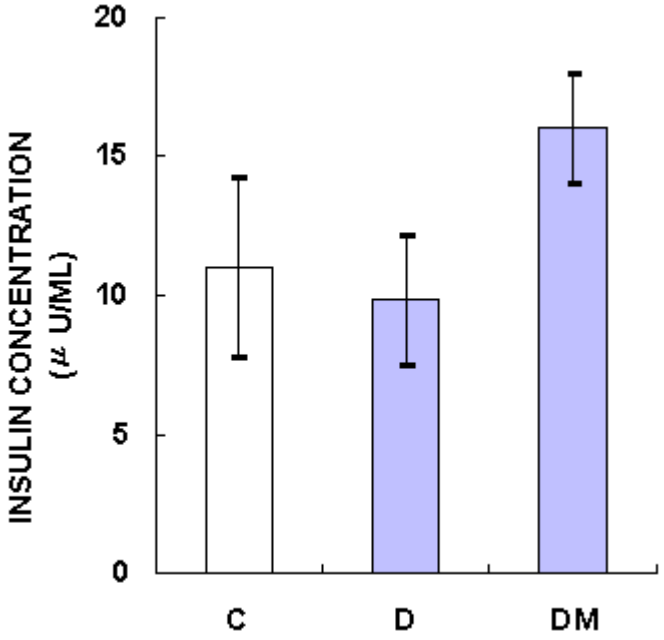
CONCLUSION

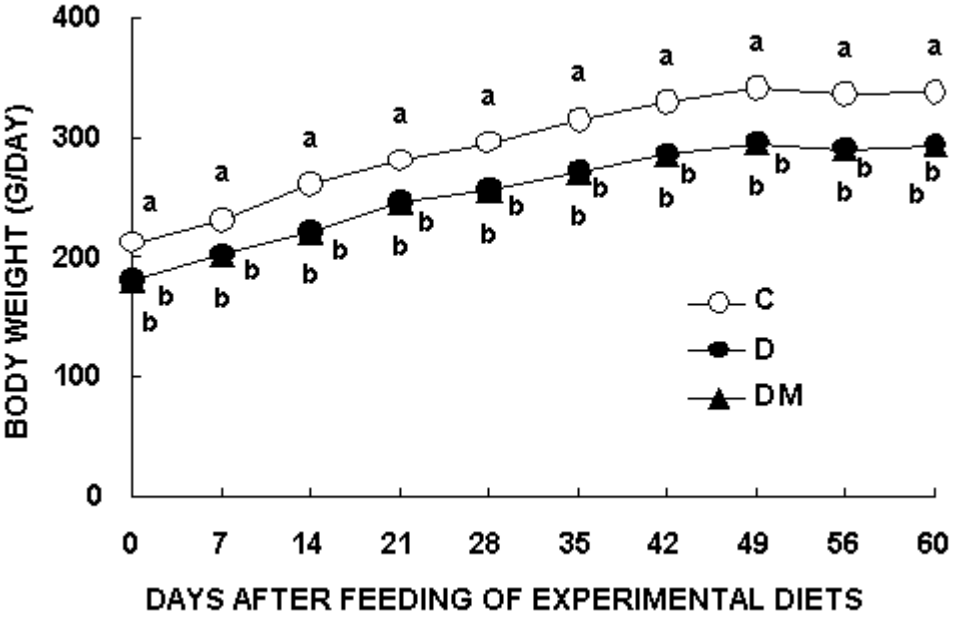
Continuous MGN-3 feeding led to lessen the sharp rise in plasma glucose level in response to oral glucose load and lowered total cholesterol in plasma in the NIDDM rats. Then, MGN-3 can be useful as a dietary fiber supplement for the treatment of

diabetes.

- **MGN-3:Diabetes(1)**





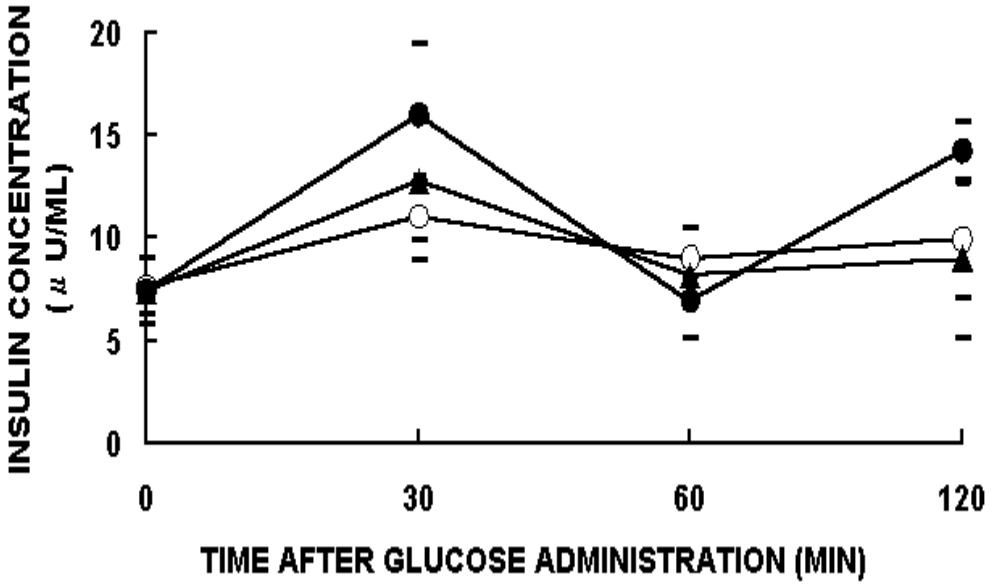


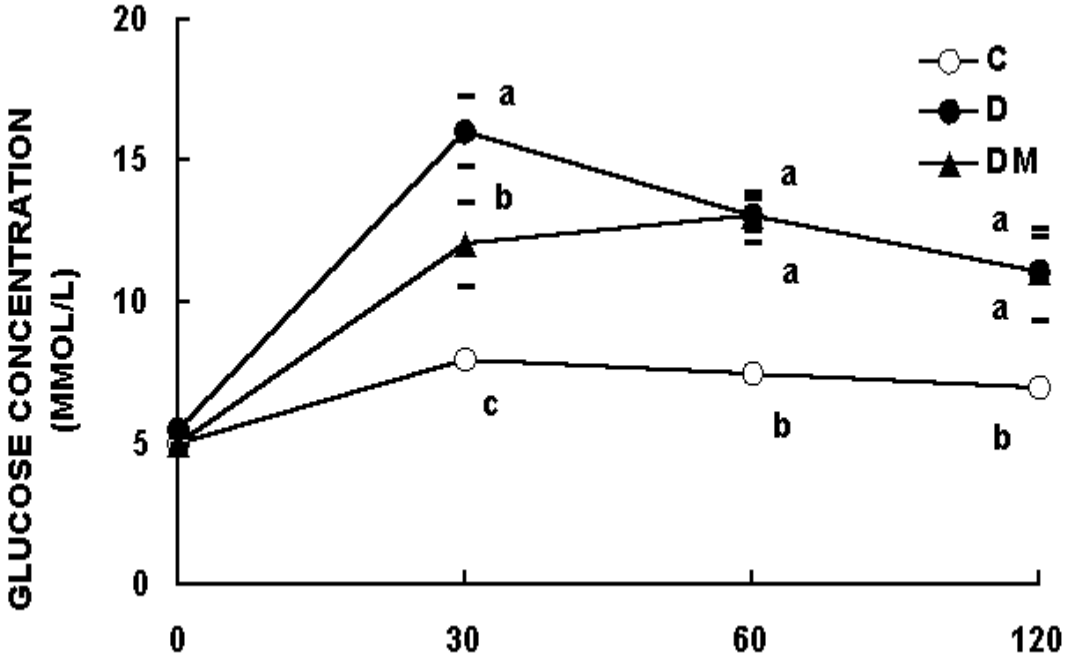
GROUP

Changes in body weight, plasma insulin and glucose concentrations of the control and

diabetic rats administrated MGN-3 for 60 days. Bars are means ± SEM. Within each parameter,bars with different letters are significantly different at p <0.05.
Abbreviations used : C = Control rats fed 1% cellulose diet,D = Diabetic rats, fed 1% cellulose diet, DM = Diabetic rats,fed 1% MGN-3 diet.

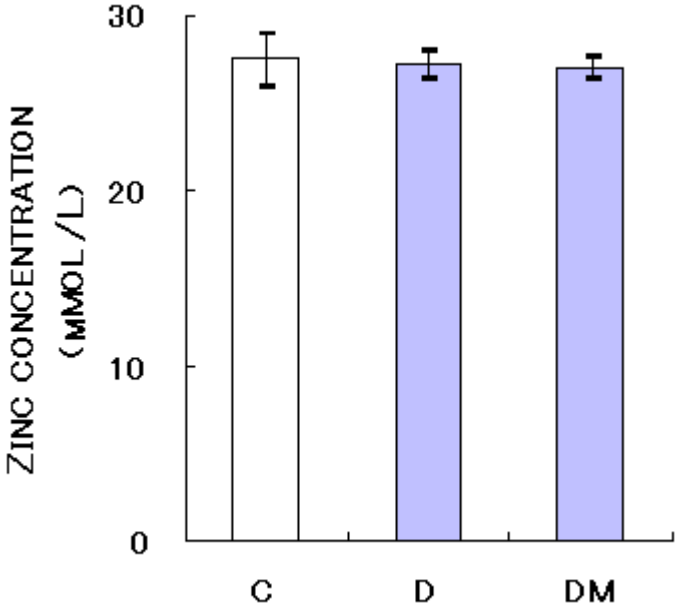
- **MGN-3:Diabetes(2)**

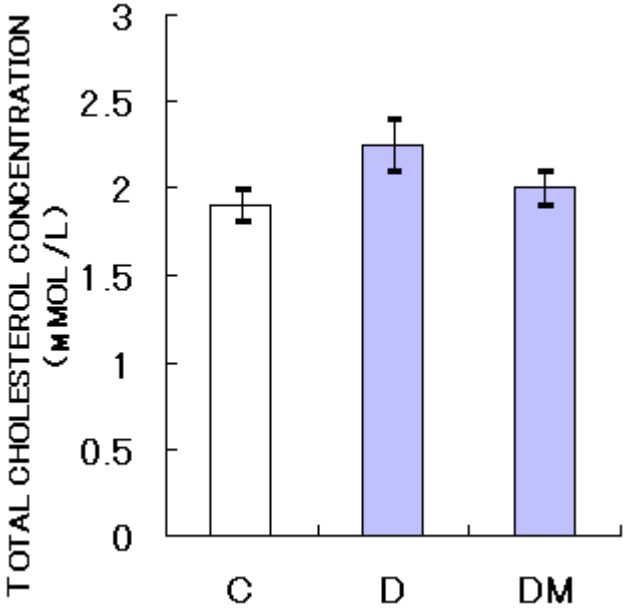


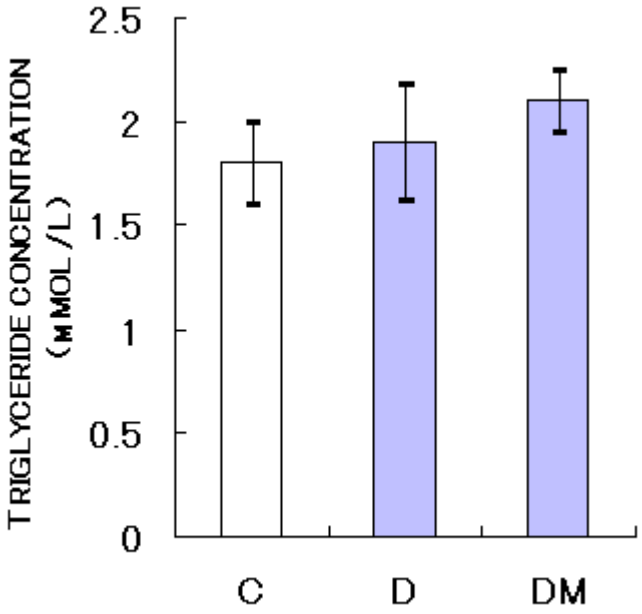


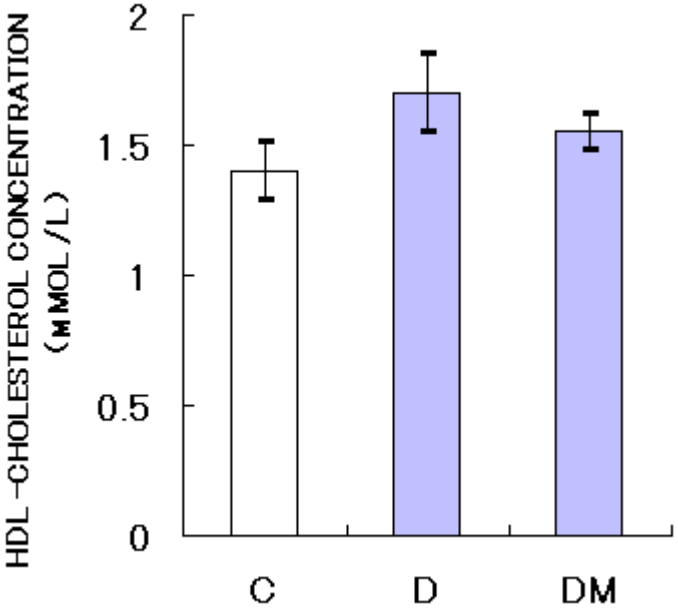
Effect of MGN-3 on plasma glucose response to oral glucose tolerance testing in rats. Each plotted point represents the mean for 5-8 rats and the vertical bars denote ± SEM. At each values with different at $p < 0.05$. Abbreviations used : C = Control rats fed 1% cellulose diet, D = Diabetic rats, fed 1% cellulose diet, DM = Diabetic rats, fed 1% MGN-3 diet.

- **MGN-3:Diabetes(3)**


ZINC CONCENTRATION
（MMOL/L）
30
20
10
0
C
D
DM


TOTAL CHOLESTEROL CONCENTRATION
（MMOL/L）
3
2.5
2
1.5
1
0.5
0
C
D
DM



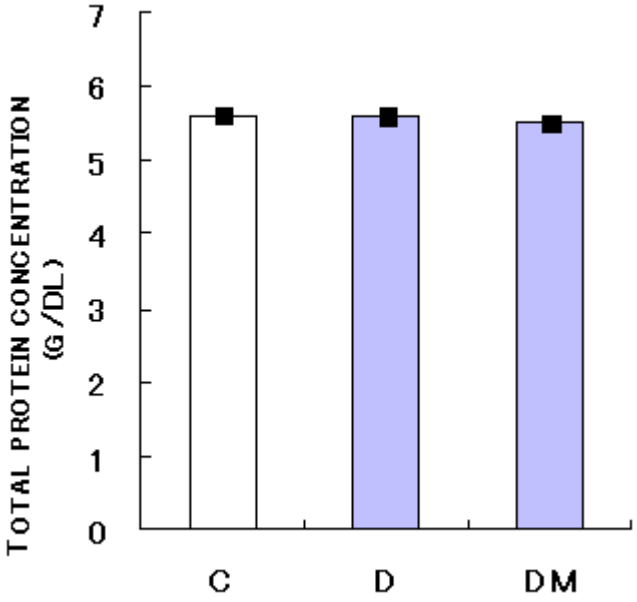


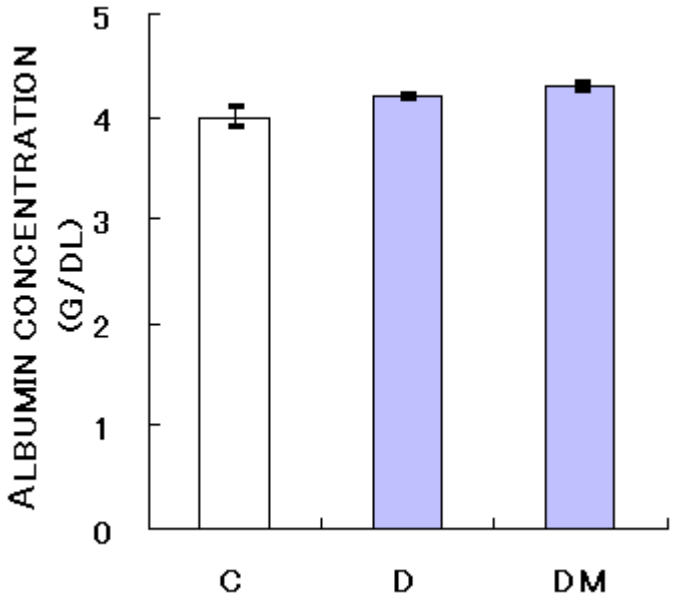
GROUP

Plasma triglyceraide, total cholesterol, HDL-cholesterol and zinc concentrations of the control and diabetic rats administrated MGN-3 for 60 days. Bars are means ±

SEM. Within each parameter, bars with different letters are significantly different at p <0.05. Abbreviations used : C = Control rats fed 1% cellulose diet, D = Diabetic rats, fed 1% cellulose diets, DN = Diabetic rats, fed 1% MGN-3 diet

- **MGN-3:Diabetes(4)**





GROUP

Plasma urea nitrogen, total protein and albumin concentrations of the control and diabetic rats administrated MGN-3 for 60 days. Bars are means ± SEM. Within each parameter, bars with different letters are significantly different at p <0.05. Abbreviations used : C = Control rats fed 1% cellulose diet, D = Diabetic rats, fed 1% cellulose diet, DM = Diabetic rats, fed 1% MGN-3 diet