Hypocholesterolemic effect of blue-green alga, ishikurage (*Nostoc commune*) in rats fed atherogenic diet

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**Abstract.** Blue-green alga, *Nostoc commune* is rich in dietary fiber. To examine the hypocholesterolemic effect, the alga or the dietary fibers were given to the rats fed cholesterol diet. Serum cholesterol elevation was significantly depressed in those rats. Cholesterol increased in the liver of rats given the alga and the fiber. The content of fecal cholesterol and bile acid unchanged. Of the dietary fibers, oxalate – oxalic acid soluble substance (OOSS) found abundant in the alga was most effective in lowering cholesterol in the serum. It seems to depress the elevation of LDL-cholesterol. The mechanism of hypocholesterolemic effect by OOSS remains to be unclear. This study indicated that *Nostoc commune* is expected to be a new dietary fiber source of possible importance in human nutrition.

**Introduction**

Dietary fiber has various physiological and nutritional effects on humans and animals. Hypocholesterolemic activity of dietary fiber is one of the effects. Plant foods are good sources of dietary fiber, thus a variety of plant foods were to be studied to find out their cholesterol lowering effect. Of the dietary fibers from plant foods, soluble fiber has a high hypocholesterolemic effect (Anderson et al., 1991). Marine algae have been consumed since ancient times in Asia. Many of Oriental researchers studied the effect of different sorts of sea weed on the cholesterol metabolism, though there are some controversies on their effect (Cho, 1983). The algae used in the previous studies were restricted to marine products.

*Nostoc commune* is a blue-green alga species and numerous grown in parks and streets. It is called ishikurage in Japan. People in some districts of Japan have used this alga as one of the ingredients for soup and salad. It is rich in dietary fiber (Hori et al., 1990). The dietary fiber is expected to have a hypocholesterolemic effect.
This study attempts to find out the effectiveness of *Nostoc commune* and the dietary fibers from the alga in lowering cholesterol in blood of rats fed high cholesterol diet.

**Materials and methods**

**Materials**

*Nostoc commune* grown spontaneously on the university campus was harvested and washed with tap water to remove dirt, then rinsed with distilled water. Air dried alga was pulverized to pass through a 30-mesh sieve. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were prepared by the method described in previous paper (Hori et al., 1990, 1992). Ishikurage (10 g) was extracted with 500 ml of 0.25% ammonium oxalate-oxalic acid solution. The supernatant was collected and oxalate-oxalic acid soluble substance (OOSS) was obtained by adding alcohol to the supernatant. Re-precipitation with alcohol was done after dissolving the precipitate in water. OOSS was freeze-dried after dissolving in water.

**Animal and diets**

Male Wistar rats were obtained from Kyudo (Kumamoto, Japan) and divided randomly into 4 groups of 7 animals each. All rats were housed in an air conditioned room (at 20-22°C) with lights on at 6:00 AM and off at 6:00 PM and kept for 21 days (Experiment 1) and 18 days (Experiment 2). Food and tap water were provided ad libitum.

The composition of the basal diet for Experiment 1 was as follows; vitamin-free casein 18, soybean oil 4, lard 4, vitamin mixture 1, mineral mixture 4 (both mixtures were AIN-76), cellulose 1, choline chloride 0.15 and corn starch 67.85. The diets were supplemented with 0.5% cholesterol and 0.25% sodium cholate, and 5% *Nostoc commune* at the expense of corn starch. Although this blue-green alga contains about 30% crude protein and 10% ash (Hori et al., 1990), no consideration was given to the differences caused by them. The composition of the control diets for Experiment 2 was the same as the basal plus cholesterol diet used in Experiment 1 except for cellulose and corn starch. The control diet consisted of 63.1% corn starch and 5% cellulose. The diets were adjusted to 100 at the expense of cellulose when 1.65% OOSS, 0.93% NDF or 0.20% ADF was added to the control diet. These amounts of the dietary fibers correspond to 5% alga.