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RAPID COMMUNICATION

The Mushroom Pleurotus Ostreatus Accelerates Plasma Very-Low-Density Lipoprotein Clearance in Hypercholesterolemic Rat

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Summary

The administration of a diet containing 5 % of dried oyster mushroom to male Wistar rats fed a cholesterol diet (0.3 %) shortly after weaning for 8 weeks reduced cholesterol levels in the serum and liver by 27 and 33 %, respectively and increased the fractional turnover rate of ^{125}I-very-low-density lipoproteins (VLDL) by more than 30 %.

Key words

Cholesterol – Very-low-density lipoproteins – Dietary *Pleurotus ostreatus*

Attempts to achieve more efficient dietetic therapy of hypercholesterolaemias stimulated the interest in surveying and characterizing natural substances with hypocholesterolaemic activity. Studies on model hyperlipoproteinaemias [induced nutritionally (Bobek *et al.* 1991c), by streptozotocin diabetes (Bobek *et al.* 1991a) or hereditary (Bobek *et al.* 1991b)] revealed that the addition of dried ground fruiting bodies of the oyster mushroom to the diet of experimental animals efficiently reduced the accumulation of cholesterol in the serum and liver and the production of cholesterol-enriched VLDL (VLDLC). The aim of the present study was to verify the hypothesis that stimulation of VLDLC removal from the plasma pool is involved in the mechanism of hypocholesterolaemic effect of the oyster mushroom.

Male rats of the Wistar strain with initial body weight of about 70 g (n=24) were fed a semisynthetic diet *ad libitum* for 8 weeks (Yamashita *et al.* 1980) of the following composition (g/100 g): starch 60, casein 18, pork fat 10, cellulose 6, mixtures of minerals and vitamins (4 and 1, respectively), Fel tauri 0.55, cholesterol 0.3, choline chloride 0.15 (control diet). One half of the animals was fed a diet where 5 % of dried ground fruiting bodies of the oyster mushroom were substituted for cellulose (mushroom diet). VLDLC was isolated using a preparative ultracentrifuge from pooled serum of rats fed the control diet and were labelled with ^{125}I (Fidge and Polis 1974). Radioiodinated VLDLC was administered into the tail vein of animals after 18 h of fasting. The treated animals were decapitated at intervals of 5, 10, 15 and 20 min (3 animals per interval). Lipoproteins [very-low-density (VLDL), low-density (LDL), and high-density (HDL)] were isolated from the serum by sequential flotation using a preparative ultracentrifuge at d=1.006, 1.063 and 1.21 g/ml, respectively. Radioactivity in VLDL was estimated after precipitation in 20 % trichloroacetic acid. Half-time ($t_{1/2}$) and fractional turnover rate (FTR) of labelled VLDL was calculated from the relation of ln counts per minute and time using linear regression analysis (Gregg *et al.* 1977). The concentration of cholesterol in the serum, in lipoproteins and in the liver was estimated.

The final body weight of animals was not affected by feeding them oyster mushroom. The reduction of cholesterol content was highly significant in the serum and liver (by 27 and 33 %, respectively). The most pronounced decrease of cholesterol was observed in VLDL (by 30 %). Feeding the oyster mushroom diet reduced $t_{1/2}$ by 30 % and enhanced FTR of VLDLC reciprocally.

Table 1
The effect of oyster mushroom on cholesterol content in serum, liver and of lipoproteins and on kinetic parameters of ^{125}I-VLDLC

	Diet	
Parameter	Control	Mushroom
n	12	12
Body weight (g)	363 ± 13	357 ± 13
Cholesterol		
Serum (mmol.l^{-1})	4.06 ± 0.10	2.96 ± 0.11^{c}
Liver (mmol.kg^{-1})	318 ± 11	212 ± 13^{c}
VLDL (mmol.l^{-1})	2.28 ± 0.09	1.44 ± 0.06^{c}
LDL (mmol.l^{-1})	0.72 ± 0.04	0.57 ± 0.04^{a}
HDL (mmol.l^{-1})	1.02 ± 0.06	0.82 ± 0.06^{a}
$t_{1/2}$ (min)	10.5 ± 0.8	7.2 ± 0.6^{b}
FTR (min^{-1})	−0.0661 ± 0.0064	−0.0964 ± 0.0075^{b}

Values are means ± S.E.M., a,b,c Statistical significance (Student's t-test) of differences compared with the control diet: ^{a} P<0.05, ^{b} P<0.01, ^{c} P<0.001

The decreased cholesterol content in VLDLC contributed most significantly to the reduced cholesterolaemia. A significant increase in FTR of VLDLC indicates that some unidentified substances from the oyster mushroom are able to stimulate the metabolic cascade from VLDL to LDL. We can assume that the significant reduction of intracellular content of cholesterol in the liver evoked by the oyster mushroom may release the blockade of Apo B/E receptors (induced by the cholesterol-diet) (Grundy 1984). This in turn may enhance the capacity of receptor-mediated catabolism of VLDL remnants as well as of their metabolic products – LDL. The oyster mushroom contains several substances (especially low-polymerized beta-1,3- D-glucan, pectin, undigested protein residues, etc.) which can interact with bile acids, thus reducing the absorption of cholesterol and enterohepatic circulation of bile acids. This effect can stimulate the catabolism of cholesterol in the liver by a feedback mechanism (Havel 1988). This is in agreement with the increased FTR of ^{14}C-cholesterol which was observed in hamsters treated with the ethanol extract of oyster mushrooms (Bobek *et al.* 1993). From the viewpoint of atherogenesis, enhanced catabolism of potentially atherogenic VLDLC is a highly positive effect of the oyster mushroom diet.

References

BOBEK P., CHORVÁTHOVÁ V., GINTER E.: Hypocholesterolemic effect of oyster mushroom (*Pleurotus ostreatus*) in rats with streptozotocine diabetes (in Slovak), *Biológia* **46:** 1025–1030, 1991a.

BOBEK P., GINTER E., JURČOVIČOVÁ M., KUNIAK L.: Cholesterol-lowering effect of the mushroom *Pleurotus ostreatus* in hereditary hypercholesterolemic rats. *Ann. Nutr. Metab.* **35:** 191–196, 1991b.

BOBEK P., GINTER E., KUNIAK L., BABALA J., JURČOVIČOVÁ M., OZDÍN Ľ, ČERVEŇ J.: Effect of mushroom *Pleurotus ostreatus* and isolated fungal polysaccharide on serum and liver lipids in syrian hamsters with hyperlipoproteinemia. *Nutrition* **7:** 105–108, 1991c.

BOBEK P., KUNIAK L., OZDÍN L.: Study on the mechanism of hypolipemic effect of oyster mushroom (*Pleurotus ostreatus*) in syrian hamster (in Slovak), *Biológia* **48:** 305–308, 1993.

FIDGE N.H., POLIS P.: Studies on the radioiodination of very low density lipoprotein obtained from different mammalian species. *Clin. Chim. Acta* **52:** 5–13, 1974.

GREGG R.C., DIAMOND A., MONDON C.E., REAVEN G.M.: The effects of chronic uremia and dexamethasone on triglyceride kinetics in the rat. *Metabolism* **26:** 875–882, 1977.

GRUNDY S.M.: Absorption and metabolism of dietary cholesterol. *Ann. Rev. Nutr.* **1:** 71–96, 1984.

HAVEL R.J.: Lowering cholesterol 1988. Rationale, mechanism and means. *J. Clin. Invest.* **81:** 1653–1660, 1988.

YAMASHITA S., YAMASHITA K., YASUDA H.: High-fiber diet in the control of diabetes in rats. *Endocrinol. Jpn.* **27:** 169–173, 1980.

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