Effects of Saltwort Plants on Blood Plasma Lipids in Rats during Chronic Alcohol Intoxication and after Ethanol Withdrawal

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Saltwort plants (salsocollin) ameliorated plasma contents of total lipids, triacylglycerols, and phosphatidylcholine in rats with alcohol intoxication, but had no effect on cholesterol and total phospholipid levels. Salsocollin did not prevent the increase in the levels of total lipids and triacylglycerols 3 days after ethanol withdrawal. During abstinence, salsocollin potentiated symptoms of ethanol withdrawal (7 days later) in relation to the content of total phospholipids, but normalized the levels of phosphatidylcholine, phosphatidylethanolamine, and total lipids.

Key Words: *salsocollin; alcohol; plasma; lipids; withdrawal*

The pathogenic role of lipids in alcoholism is now extensively discussed [7,8]. Various substances are used for the correction of lipid metabolism during alcohol intoxication (for example, essentiale, lipostabil, S-adenosyl-L-methionine, essential fatty acids, silibor, and valiliv) [2,9]. These substances induce selective positive effects on various organs. The therapeutic efficiency and the mechanism of effects of original natural plant preparation salsocollin (SC) [6] are extensively studied. This preparation is superior to essentiale, legalon, and silibor in the treatment of experimental toxic liver diseases. Clinical studies showed that SC is a promising drug for the therapy of acute and chronic hepatitides induced by toxicants and drugs [5].

The administration of SC during CCl_4-induced intoxication normalized phospholipase A_2 activity and serum lipids [6]. Metabolism of various substances (including lipids) in the plasma reflects liver metabolism. Effects of SC on plasma lipids during alcohol intoxication received little attention. Here we studied the effects of SC on the contents of lipid fractions in the plasma of rats during chronic administration of ethanol and after its withdrawal.

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MATERIALS AND METHODS

Experiments were performed on albino outbred male rats weighing 160-200 g. All animals were kept under standard vivarium conditions and had free access to water. For modeling of withdrawal syndrome (WS) [13] the rats received 25% ethanol (5 g/kg body weight) through a tube two times a day with 12-h intervals for 5 days. The animals were decapitated 3 (group 4) and 7 (group 6) days after the last alcohol adminictration. Control rats (group 1) received intragastric infusions of equivalent volume of physiological saline. SC (100 mg/kg body weight) in the form of a 21% alcohol solution containing 3.1 g saltwort extract/100 ml was administered intragastrically two times a day (200 mg/kg body weight/day). SC was administered to intact animals (group 3) for 7 days or to animals with WS for 3 and 7 days after ethanol withdrawal (groups 5 and 7, respectively). This dose of SC was shown to be the optimum [5]. Group 2 rats received intragastrically the same volume of 21% alcohol (1.5 g/kg body weight/day) for 7 days to differentiate the effects of SC extract components and alcohol. Each group consisted of 8 animals.

Saltwort plants (*Salsola collina Pall.*) belong to the *Chenopodiaceae* family. Saltworts are suffrutes-

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cent plants found naturally from the Lower Volga, Kazakhstan, and the South Siberia to the Far East. The preparation saltwort (hygienic certificate No. 1P/11-43 FITO-S) is a parapharmaceutical product (food additive) prepackaged (100 ml) and gifted by the Institute of Nutrition of the Russian Academy of Medical Sciences. Saltwort is recommended as a hepatoprotector. The alcohol extract of SC contains free sterols, steryl glycosides, glycine betaine, quaternary ammonium bases, choline, and alkaloids [6]. This preparation displays low toxicity and has no immunotoxic, allergic, embryotoxic, mutagenic, and teratogenic properties [5]. Thin-layer chromatography showed that SC contains lysophosphatidylcholine, sphingomyelin, phosphatidylcholine, phosphatidylethanolamine, and cardiolipin in concentrations comparable with their plasma concentrations in rats.

Plasma lipids were extracted as described elsewhere [12]. Phospholipids were fractionated by thin layer chromatography of Silica gel in a chloroform-methanol-water (65:25:4) system. The contents of lipid fractions were determined [4] and cholesterol/phospholipids (CH/PL) ratio was estimated.

The results were analyzed by Student's *t* test.

RESULTS

After 7-day moderate chronic alcohol intoxication, the plasma contents of total lipids, cholesterol, and triacylglycerols increased and the level of total phospholipids (primarily phosphatidylcholine) decreased. The CH/PL ratio increased 2-fold (group 2). These data agree with the results of other experiments [10,11].

Administration of SC to intact animals was accompanied by a decrease in the content of total lipids. SC did not prevent further decrease in the concentrations of cholesterol, total phospholipids, and sphingomyelin and had no effect on the CH/PL ratio. The levels of total lipids, triglycerides, and phosphatidylcholine (group 3) were normalized compared with the control. A comparative analysis of lipid indexes in groups 2 and 3 showed that the content of phosphatidylcholine was restored due to membrane reparation by SC phospholipids (for example, phosphatidylcholine) that substituted damaged molecules.

Plasma contents of total lipids and triacylglycerols increased 3 days after alcohol withdrawal. The blood phospholipid composition did not change (group 4). SC administered against the background of alcohol withdrawal had no protective effects on these lipids. Thus, administration of SC during WS was accompanied by phospholipase A_2 activation (from comparison of groups 5 and 1), which was confirmed by a decrease in the content of phosphatidylcholine and an increase in the concentration of lysophosphatidylcho-

TABLE 1. Effects of SC on Plasma Lipids in Rats during Ethanol Administration and after Withdrawal (*M*±*m*)

Parameter	Control (group 1)	Ethanol (group 2)	SC (group 3)	Withdrawal, 3 days (group 4)	Withdrawal+SC (group 5)	Withdrawal, 7 days (group 6)	Withdrawal+SC (group 7)
Total lipids, g/liter	4.17±0.10	5.00±0.44*	4.00±0.32+	5.08±0.43*	5.33±0.51*	6.07±0.72*	4.58±0.30+
Cholesterol, mmol/liter	1.35±0.05	2.26±0.20*	2.05±0.29*	1.74±0.23	1.33±0.05	1.40±0.05	1.56±0.10
Triacylglycerols, mmol/liter	1.38±0.08	1.72±0.09*	1.51±0.13	1.76±0.16*	1.63±0.06*	1.42±0.09	1.48±0.11
Total phospholipids, mmol/liter	2.98±0.21	2.42±0.14*	2.09±0.16*	2.64±0.19	1.91±0.16*+	2.29±0.21*	2.07±0.21*
CH/PL	0.45	0.93	0.98	0.66	0.70	0.61	0.75
Phospholipid fraction, % P							
lysophosphatidylcholine	14.9±0.9	16.1±1.2	14.4±0.5	14.4±0.9	17.3±0.5*+	16.3±0.9	15.5±0.9
sphingomyelin	21.7±0.6	20.5±0.9	18.1±0.7*+	21.1±0.7	21.1±0.7	19.1±0.7*	19.4±0.6*
phosphatidylcholine	24.9±0.7	23.1±0.6*	25.3±1.4	22.7±1.3	21.1±0.3*	22.4±1.1*	23.7±1.2
phosphatidylethanolamine	22.3±0.6	24.0±1.3	23.8±1.2	24.0±1.2	22.0±0.6	25.0±1.2*	23.9±1.7
cardiolipin	16.1±0.7	16.3±0.5	17.0±1.0	17.9±0.9	18.4±0.3*	17.2±1.2	17.4±1.3

Note. $p<0.05$: *compared with the control; +compared with the corresponding values in previous group.

line. Under these conditions, SC activated cardiolipin biosynthesis.

In WS (day 7), plasma contents of total lipids and phosphatidylethanolamine increased and the concentrations of total phospholipids, phosphatidylcholine, and sphingomyelin decreased (group 6). In group 7, SC against the background of WS decreased the concentration of total lipids elevated after alcohol withdrawal, potentiated its effects on phospholipids, and did not affect the decreased level of sphingomyelin. The concentrations of total lipids, phosphatidylcholine, and phosphatidylethanolamine returned to normal. The maximum SC activity in relation to these phospholipid fractions is probably due to the passage of phosphatidylcholine and phosphatidylethanolamine from this natural preparation into membranes.

Our experiments reveal considerable changes in blood plasma lipids during chronic alcohol intoxication and after withdrawal. SC affected the contents of total lipids, triglycerides, and phosphatidylcholine and potentiated the effect of ethanol on total lipids and sphingomyelin. During a 3-day WS, SC did not affect the increased levels of total lipids and triacylglycerols. Seven days after ethanol withdrawal, SC normalized the contents of total lipids, phosphatidylcholine, and phosphatidylethanolamine and did not affect the concentrations of total phospholipids and sphingomyelin.

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