LIPIDS FROM THE VELVET ANTLERS OF REINDEERS

N. F. Ivankina, S. V. Isai,
and N. G. Busarova

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Velvet antlers (nonossified soft furry skin of a deer growing antlers) have long been used as an effective tonic agent, having regenerating, stimulating, anti-inflammatory, anti-stress action. The Russian pharmaceutical industry markets pantocrin – an alcoholic extract of velvet antlers of spotted deer (Cervus nippon) and is also about to release a new preparation rantorine – from velvet antlers of reindeer (Rangifer tarandus). Studies of the biological activity and pharmacological properties of rantorine showed that it has the same pharmacological effect as pantocrin [1, 3]. However, no data are available in the literature on the chemistry of rantorine and the velvet antlers of reindeer.

The aim of the present work was to study the lipids from reindeer velvet antlers. We examined the composition of phospholipids and fatty acids of freshly cut velvet antlers of female and male reindeers.

EXPERIMENTAL

After being cut and after preliminarily removing the skin, the velvet antlers were fixed in a 1:2 chloroform:methanol mixture. The lipids were extracted by a procedure based on the principles of the Folch [5] and Bligh and Dyer [4] methods.

The phospholipids were studied by two-dimensional micro-TLC. Glass plates with a layer of KSK silica gel fixed by gypsum, 6 × 6 cm in size were used in the following systems of solvents – system one: chloroform–methanol–water–28% ammonia 65:30:10:6; system two: chloroform–methanol–benzalacetone–acetic acid–water 70:30:10:5:4:1 [9], and also system I – chloroform–methanol–ammonia 65:35:5, II – chloroform–acetone–methanol–acetic acid–water 50:20:10:10:5 [7]. For identification, authentic samples of phospholipids were used. the lipids were detected with the following reagents.

TABLE 1. Content of Phospholipids in Freshly Cut Velvet Antlers of Spotted Deer and Reindeer

Phospholipids	Content of phospholipids in lipid extract, %			
	velvet antlers (without skin)			skin of velvet antlers
	of a male reindeer	of a female reindeer	of a spotted deer	of a male reindeer
Phosphatidylcholine	25,3	25,2	6,2	20,6
Phosphatidylethanolamine	7,0	11,6	3,3	18,6
Sphingomylein	10,9	9,7	6,1	11,8
Phosphatidylserine	5,5	1,8	4,5	2,9
Phosphatidylinosite	1,0	1,5	1,6	
Diphosphatidylglycerin	0,4	0,6		0,5
Phosphatidic acid	—	Tr.	Tr.	0,2
Sum of phospholipids (relative to total lipids)	50,1	50,4	22,0	54,6
Total lipids	0,60	0,97	0,70	1,80

*tr -traces

Blagoveslhchenskii State Medicinal Institute. Pacific Institute of Bioorganic Chemistry, Russian Academy of Sciences, Vladivostok. Translated from Khimiko-farmatsevticheskii Zhurnal, Vol. 26, No. 6, pp. 29-30, June, 1992. Original article submitted May 28, 1991.

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TABLE 2. Content of Fatty Acids in Lipid Extracts of Freshly Cut Velvet Antlers and Skin of Velvet Antlers of Spotted Deer and Reindeer

Fatty acids	% Relative to sum of methyl esters of fatty acids			
	velvet antlers (without skin)			skin of velvet antlers
	of a spotted deer	of a male reindeer	of a female reindeer	of a male reindeer
10:0	—	—	—	—
12:0	Tr.	Tr.	Tr.	Tr.
14:0	2,4	1,2	1,0	0,3
14:1	0,9	0,1	0,1	—
15:0	1,1	0,7	0,6	0,1
16:0—i	—	0,9	0,8	0,5
16:0	22,9	18,9	18,4	1,9
16:1	5,7	4,5	4,2	0,3
16:3	—	—	—	6,3
17:0—i	0,6	1,4	1,2	2,9
17:0	1,0	1,0	1,0	—
17:1	0,8	0,4	0,7	—
18:0	13,7	11,7	13,4	13,6
18:1—i	—	—	0,8	—
18:1	30,7	29,8	17,4	17,7
18:2 (9,12)	7,0	7,1	7,8	30,2
18:2 (6,9)	—	0,4	0,4	0,5
18:3	0,4	—	0,3	1,6
20:1	0,8	1,0	0,4	1,5
20:2 (8,11)	0,1	2,8	3,0	1,8
20:2 (11,14)	—	0,5	0,4	0,5
20:3	4,9	12,3	14,9	2,6
20:4	—	0,2		13,9
22:1	—	0,8	1,0	1,8
22:2	—	1,4	—	0,7
22:6	—	—	3,6	0,7
24:0	0,5	0,1	1,6	—
24:3	—	0,2	4,2	0,3
24:4	—	2,3	1,9	0,5
26:0	6,3			—
Saturated acids	48,5	35,7	37,9	19,2
Unsaturated acids	51,4	63,9	61,1	80,7

10% sulfuric acid in methanol, the Dragendorf reagent, ninhydrin in acetone, the molybdate reagent for phospholipids [8], a reagent based on malachite green, the Schiff reagent [2]. The quantitative composition of the phospholipids in the lipid extracts was determined by a method described in [8].

GLC OF FATTY ACIDS

The methyl esters of fatty acids were obtained by the method of Hartman [6] and were analyzed on a "Tsvet-100" chromatograph with a flame ionization detector. A glass column (3 m × 3 mm), phase – 6.5% diethylene glycol– adipate on chromaton 0.160-0.200 mm were used. The temperature of the evaporator was 250°C, temperature of the column – 197°C, carrier gas argon, flow rate of the carrier – 30 ml/min.

RESULTS AND DISCUSSION

The results of the examination of the composition of phospholipids of freshly cut velvet antlers of male and female reindeer are listed in Table 1. For comparison we recall our previous data on the composition of phospholipids of the spotted deer velvet antlers. In contrast to reindeer, the velvet antlers of the spotted deer grow only in the males, and therefore the sex of the spotted deer is not mentioned in the further discussion. We also studied the composition of lipids in the skin of the velvet antlers, which was separated during the preparation of medicinal preparations and was not utilized.

It was shown that the qualitative composition of phospholipids of freshly cut velvet antlers of female and male reindeer is the same and is represented by the same set of phospholipids, which is characteristic of the velvet antlers of spotted deer: phosphatidylcholine, phosphatidylethanolamine, sphingomyelin, phosphatidylserine, phosphatidylinosite, phosphatidylglycerin, phosphatidic acid. At the same time, substantial differences in their

quantitative composition have been detected. The content of phospholipids in the velvet antlers and skin of the velvet antlers of reindeer is two times higher than that in the velvet antlers of spotted deer. In reindeer velvet antlers a high content of phosphatidylcholine was detected.

It should be noted that a qualitative and quantitative composition of phospholipids in the skin of the reindeer velvet antlers practically does not differ from that in the velvet antlers themselves. Phosphatidylethanolamine, whose content in the skin is much higher, is an exception.

COMPOSITION OF FATTY ACIDS FROM REINDEER'S VELVET ANTLERS

The data obtained (Table 2) show a wide spectrum of fatty acids in velvet antlers of reindeer, especially the unsaturated acids. The ratio of the saturated to the unsaturated fatty acids in the velvet antlers of spotted deer is practically the same; in reindeer velvet antlers this ratio is approximately 1:2 and in the skin of velvet antlers – 1:4.

The content of certain polyenic acids is particularly different, especially of eicosatrienoic acid ($C_{20:3}$), in spotted deer velvet antlers – 4.9%, and in male reindeer velvet antlers – 12.3%, and in female – 14.9%. The skin of the reindeer velvet antlers is noteworthy due to its high unsaturated fatty acid content. A considerable amount of arachidic ($C_{20:4}$) – 13.9% and linoleic ($C_{18:2}$) – 30.2%, acids has been detected in it.

It was thus shown that the composition of the fatty acids of reindeer velvet antlers is different from that of spotted deer. The high content of unsaturated fatty acids in reindeer velvet antlers is probably due to adaptive reactions, since reindeer live under more severe conditions, and also proves the value of the reindeer velvet antlers as a medicinal raw material. The data obtained by us also show that not only the velvet antlers should be utilized, but also their skin, in which a substantial amount of biologically active compounds has been found: phospholipids, polyunsaturated fatty acids, which at present are used as medicinal preparations.

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