Carbohydrates in the *Mahonia aquifolium* Antipsoriatic Extract

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The extracts of the bark derived from *Mahonia aquifolium* (Pursh) Nutt. have been used orally in folk medicine to treat various dermatological diseases [1]. Recently the Mahonia tincture has been introduced for topical treatment of psoriasis [2]. Preliminary pharmacological studies showed that the aqueous-ethanolic extract of *M. aquifolium* produced concentration-dependent antiphlogistic and antiproliferative effect [3, 4]. Because none of the main protoberberine and bisbenzylisoquinoline alkaloids of this extract was equally effective in inhibition of lipid peroxidation, 5-lipoxygenase inhibitory action, and antiproliferative activity [3—5], it is possible that other, not yet detected compounds may be responsible for the above-mentioned effects by modulation of unspecific immune system. In view of this and in recognition of biological activity of many plant polysaccharides [6], it was reasonable to analyze the antipsoriatic aqueous-ethanolic extract of the Mahonia drug for the presence of carbohydrates, not investigated thus far.

The starting Mahonia extract, obtained by maceration of stems (1 g) with 62 % aqueous ethanol (10 cm^3) and concentration of the extract to half volume [5], was exhaustively dialyzed against distilled water and the dialyzate was found to contain monomeric glucose and mannose in the mole ratio of 11 1 and trace amounts of oligomers, detected in the water eluate from gel filtration of the dialyzate on the Bio-Gel P-2 column. The undialyzable strongly coloured residue was, after batch separation on a DEAE-Ostsorb ion

Table 1. Sugar Composition of Polysaccharides

Polysaccharide	x_i/mole %					
	D-Glc	D-Gal	D-Man	L-Ara	D-Xyl	L-Rha
CP	48.9	20.9	7.2	8.9	12.6	1.5
1	28.9	25.5	7.2	30.2	7.2	0.9
2	62.3	12.7	5.7	7.2	11.2	0.8
3	58.3	6.9	6.4	5.0	22.0	1.3
4	48.0	26.8	8.1	3.0	12.0	2.0

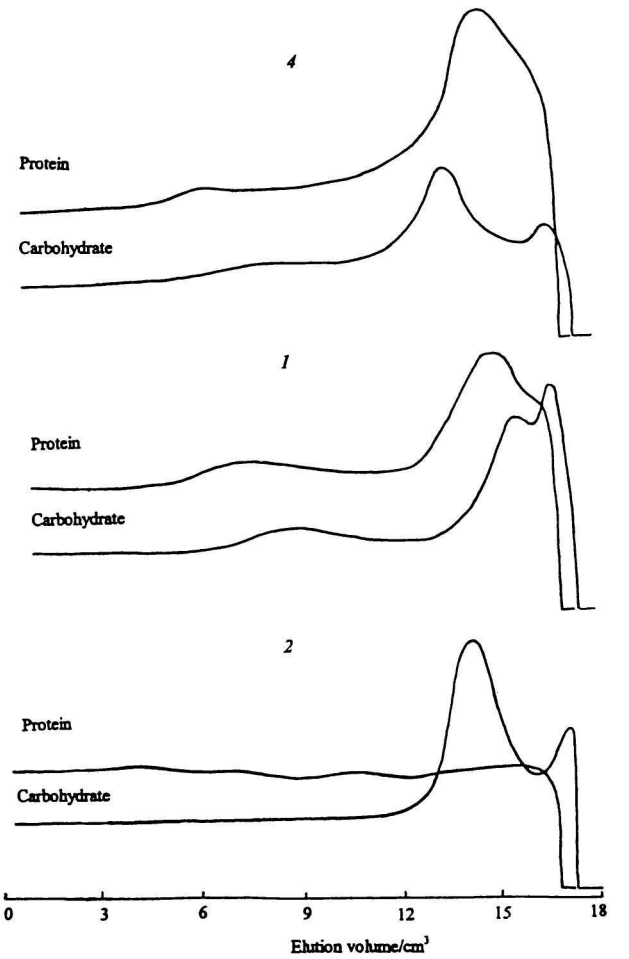

Fig. 1. HPGPC elution pattern of polysaccharide fractions *1*, *2*, and *4*.

exchanger to remove accompanying pigments, treated with 4 volumes of ethanol to give a brownish crude precipitate (CP) in 0.02 % yield per 100 g of extract. The product was proved to contain besides carbohydrates also 10 % of protein. Sugar compositional analysis showed that the carbohydrate moiety of the crude polysaccharide consisted of D-galactose, D-glucose, D-mannose, L-arabinose, D-xylose, and L-rhamnose, of which glucose and galactose dominated (Table 1). Fractionation of CP by ion-exchange chromatography on a DEAE-Sephadex A-50 column in carbonate form afforded four fractions (*1*, *2*, *3*, *4*) composed of the same neutral sugar components, but differing in their mole proportions (Table 1). The average relative molecular mass M_N, determined osmometrically, was low with all three fractions measured (fraction *3* was not analyzed due to low amount): 13 675 (*1*), 11 175 (*2*), and 8 314 (*4*). The HPGPC elution pattern of these fractions showed molecular heterogeneity (Fig. 1) and the RI response in the high elution volume region confirmed the low-molecular mass in all three cases (pullulan standards). The fractions *1* and *4* displayed also UV absorption, pointing to the presence of proteins. The coincidence of the carbohydrate and protein profiles suggested that protein might be an integrated part of the polysaccharide. The presence of protein in fractions *1* and *4* was confirmed also by their ^{13}C NMR spectra which revealed signals in the region of δ = 23—60 and 110—140, characteristic of amino acid carbon atoms [7]. These signals were absent in the spectrum of fraction *2*, in accordance with the absence of UV absorption on HPGPC.

It may be concluded that the antipsoriatic Mahonia extract contains, in addition to the already described alkaloids, both sugars and ethanol-precipitable polysaccharide species of low-molecular mass which are most probably conjugated to proteins. Activity tests of the isolated polysaccharides are in progress and will be the subject of further work.

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