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Phenolic Antioxidants of Barley Grains and Oil

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I. INTRODUCTION

The main antioxidants of barley are vitamin E and different phenolic acids (gallic acid, vanillic acid), cinnamic acids (caffeic acid, ferulic acid) and flavanols (prodelphinidin B3, catechin) [1]. The major proportion of phenolic compounds present in barley kernels exist in the insoluble-bound form, which contributes most to the total phenolic content (TPC) of barley [2]. Consumption of barley grain can lower LDL cholesterol level in blood and prevent from cardiovascular diseases and cancer [3].

II. RESULTS AND DISCUSSION

Our aim was to determine phenolic antioxidants and to compare their quantity in diverse barley varieties developed in Latvia. We used two hulled (varieties 'Jumara' and 'Rubiola') and four hulless (variety 'Irbe' and breeding lines PR-4651, PR-3808.2.1, PR-5099) barley varieties and breeding lines developed at Priekuli Plant Breeding Institute. The barley was grown both in organic and conventional farming; in the last case samples differ with rations (kg/ha) of used fertilizer: N1 (N90 P35 K70), N2 (N140 P50 K98) and N3 (N140 P50 K98+leaf fertilizer).

For TPC analysis we prepared barley grain extracts using 80% ethanol (mixing barley flour with solvent at room temperature for 24 h) and grain oils (obtained by reflux of barley flour in petroleum ether for 1.5 h). We determined TPC spectrophotometrically by Folin-Denis method and expressed TPC as gallic acid equivalents (GAE) per 100 g of grain. Results are summarized in tables I and II.

TABLE I
TOTAL PHENOLIC CONTENT IN BARLEY GRAIN OILS,
mg GAE/100 g GRAIN

Variety or breeding line	Farming type			
	Organic	Conventional		
		N1	N2	N3
'Jumara'	3.67	3.02	5.20	2.81
'Rubiola'	2.66	2.49	6.22	1.40
'Irbe'	1.57	2.32	4.17	2.18
PR-4651	2.28	3.91	8.52	5.98
PR-3808.2.1	2.41	6.80	6.94	2.00
PR-5099	2.20	2.53	4.56	2.47

TPC in barley grain oils varies from 1.40 to 8.52 mg GAE/100 g grain, but in 80% ethanol extracts it varies from 98.70 to 140.13 mg GAE/100 g grain.

It shows that alcohol extracts contain more phenolic compounds than oils. In case of barley grain oils the greatest TPC was achieved when fertilizer composition N2 was used for conventional farming. Oil obtained from hulled barley grown by organic farming was richer in phenolics than oils from hulless barley grown at the same conditions. In the case of 80% ethanol extracts there are differences in total phenolic

content depending on genotype of barley, for example, hulled barley varieties contain more phenolic compounds in conventionally grown samples, while hulless – in grains obtained by organic farming.

TABLE II
TOTAL PHENOLIC CONTENT IN BARLEY GRAIN
80% ETHANOL EXTRACTS, mg GAE/100 g GRAIN

Variety or breeding line	Farming type			
	Organic	Conventional		
		N1	N2	N3
'Jumara'	118.21	140.13	118.01	120.57
'Rubiola'	98.78	108.84	110.97	111.76
'Irbe'	122.64	115.33	112.64	109.51
PR-4651	135.95	111.38	108.17	119.21
PR-3808.2.1	128.65	104.67	105.64	105.34
PR-5099	135.22	116.00	114.58	111.30

For identification of individual phenolic compounds in barley we used reverse phase HPLC method and three types of extracts:

- 1) 80% ethanol extract;
- 2) alkali hydrolyzed barley extract (barley meal obtained after extraction with 80% ethanol was further treated with NaOH solution);
- 3) acid hydrolyzed barley extract (barley meal obtained from extraction with 80% ethanol first was hydrolyzed with alkali and after treated with HCl).

We found out that 80% ethanol extracts contain gallic acid, but barley extracts obtained by alkali and acid hydrolysis did not. Barley extract prepared by alkali hydrolysis mainly comprises quercetin, but extract obtained with acid hydrolysis – caffeic acid.

III. CONCLUSIONS

Our investigations improve that TPC depends on barley genotype, variety, farming type and solvent used for extraction of phenolic compounds. Barley grains of studied varieties and breeding lines contain gallic acid mainly as free acid which can be extracted without hydrolysis, while quercetin and caffeic acid are bound phenolics.

IV. REFERENCES

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