STABILITY OF PLANT POLYPHENOL SUPPLEMENT DURING COOKING AND STORAGE OF MECHANICALLY DEBONED MEAT

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Introduction

Health-promoting functional foods on the basis of meat are becoming more and more popular. It is economically substantiated to use mechanically deboned (or recovered) meat (MDM) as a raw material for preparation of these products. Main problems connected with consumption of MDM are an elevated risk of bacterial intoxications and higher ingested doses of (per)oxidated potentially carcinogenic fatty acids comparing with the hand deboned meat. The plant polyphenolic additives should contribute an extra antibacterial as well as an antioxidant effect to the MDM.

There are papers concerning the effect of plant polyphenols on lipid oxidation (mainly estimation of TBARS) during long-time storage of MDM at subzero temperatures (Mielnik, 2003, Tang, 2002, Weisburger, 2002), but no data is available about the actual stability of added polyphenols during cooking and storage at low positive temperatures.

We have studied the dynamics of plant polyphenols content and spectrum in turkey MDM supplemented with 1,2 or 4% of dried sea buckthorn (SB) berry powder macerated in ethanol in the course of short-time cooking and storage at a low positive temperature.

Materials and Methods

SB-MDM samples preparation. Solid residue of SB berries after removal of juice by pressing was dried at 40°C, stored in polyethylene bags at room temperature and milled shortly before usage. Frozen turkey MDM was thawed overnight and respective amounts of berry residue, macerated during 20 hours in 15 ml ethanol were added to 240 g of MDM by mixing for 30 min. The products were divided into 2 parts and half of each sample was cooked during 3 minutes in microwave oven at 800 W. First samples were taken immediately, and both raw and cooked SB-MDM samples were stored during 6 days at temperature +6°C.

Chromatographic analysis. Sample preparation (Weisburger, 2002): 2 g of SB-MDM was extracted with 4 ml of methanol under shaking during 30 minutes and centrifuged. The supernatant was treated twice with 2 ml of hexane and the methanolic layer was passed through 100 mg reversed phase spe-column and kept at -40°C until analysed.

For chromatographic separation of SB polyphenols, the HPLC method on a Zorbax 300SB-C18 column (2.1×150 mm; 5µm) was used in a mobile phase gradient of 0.1% formic acid and acetonitrile at velocity 0.3 ml/min. For detection and quantitation of substances, Agilent 1100 Series LC/MSD Trap-XCT with an ESI interface (m/z interval 50-1000 in negative ion mode) and UV-Vis diode array detector were used.

Results and Discussion

SB berries contain large amounts of flavonol glucosides with UV absorption maximum at λ=370 nm as the main group of polyphenols (Guliyev, 2004). Areas under HPLC curves at 370 nm as a measure of total flavonol content are collected in Table 1. Some example chromatograms of 2% SB-MDM are presented in Fig. 1. Evidently the total flavonol glucoside content is unaffected by cooking, but is remarkably reduced during the storage of uncooked SB-MDM samples. The antioxidant content in cooked samples is only slightly reduced in the course of storage.

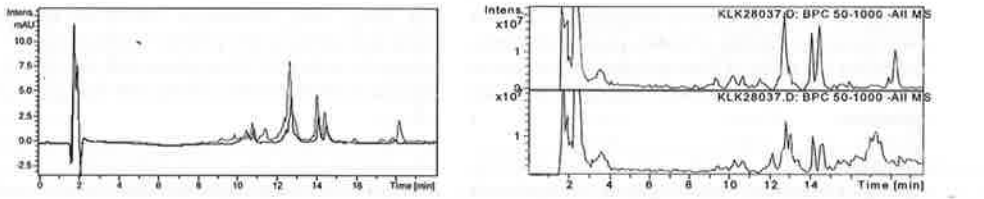
Table 1: Areas under curves of HPLC-DAD chromatograms (λ=370 nm) of raw and cooked SB-MDM-s on the 1st day and and after storage for 6 days.

% of SB in SB-MDM	1st day		6th day	
	raw	cooked	raw	cooked
1	241.9	292.9	109.4	236.5
2	551.3	597.2	230.5	510.6
4	1072.7	1255.0	651.4	1140.0

Table 2 and Fig.2 show that different flavonol glucosides behave differently during storage of uncooked SB-MDM, derivatives of isorhamnetin (excluded rhamnoside) and kaempferol being more stable than others.

Table 2: Extracted ion chromatogram (EIC) mass peak heights of the main polyphenols in 2% SB-MDM (t_R – retention time at LC/MS chromatogram at Figure 1, amu – atom mass units, * - not detectable).

t_R min	$[M-H]^-$ amu	EIC-peak height of raw and cooked SB-MDM-s				Flavonol glucoside
		Raw 1st day	Cooked, 1st d	Raw 6th day	Cooked, 6th d	
11.4	609	3341	4162	*	2164	Quercetin rhamnoside glucoside
12.5	623	20841	19320	14685	20941	Isorhamnetin rhamnoside glucoside
12.6	609	3020	4224	*	1550	Quercetin rutinoside
12.9	463	6478	6976	2905	3581	Quercetin glucoside
14.0	623	15351	17874	10492	16203	Isorhamnetin rutinoside
14.4	477	17531	18034	8339	18177	Isorhamnetin glucoside
15.9	447	2584	3729	*	*	Quercetin pentoside
17.8	593	3699	4533	2949	4147	Kaempferol rhamnoside glucoside
18.1	461	10967	14182	*	*	Isorhamnetin rhamnoside



a) b)

Figure 1: HPLC chromatograms of raw 2% SB-MDM: a) UV-chromatograms, λ=370 nm at 1-st day (light line) and 6th day (dark line); b) MS base peak chromatograms (BPC) at 1st day (upper) and 6th day (lower).

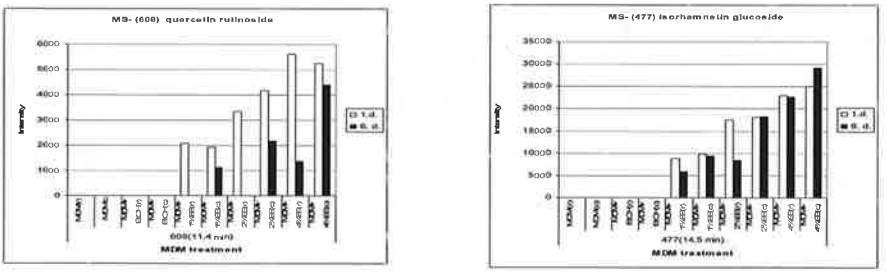


Figure 2: Comparison of dynamics of two flavonol glucosides during storage of different samples of SB-MDM

Conclusion

Potent antioxidant and antibacterial flavonols of sea buckthorn are well preserved during storage of cooked SB-MDM at +6°C, but about a half has been lost from the uncooked samples. Cooking has no effect on polyphenols of SB-MDM.

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