THE IMPACT OF MINIMAL PROCESSING AND PASTEURIZATION ON THE AROMATIC PROFILE AND MICROBIOLOGICAL QUALITY OF PEAR NECTAR

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Introduction

Protection and revival of old fruit trees is extremely important for the preservation of the traditional and recognizable environment, but also for the protection of a valuable source of genetic material, i.e., the characteristics of certain varieties. Although our autochthonous or domesticated pear varieties often lacking in appearance, they provide products with specific sensory properties and a particularly pronounced aroma.

The aim of the study was to investigate the effects of minimal processing and pasteurization on the aromatic profile of pear nectars of the traditional Miholjača variety. The processing and preservation of pear nectars included pasteurization as a conventional technique and minimal processing: ultrasound, microwave treatment and the combination of microwaves and ultrasound. The microbiological criteria of control (C, untreated) and treated samples were determined according to the Guidelines for Microbiological Criteria of Food after preparation and 30 days of storage (MP, Vodič za mikrobiološke kriterije za hranu, 2011).

Materials and Methods

The study was conducted with pears harvested in the Našice area (OPG Golub).

Sample preparation

The pears were washed and air-dried at room temperature. After cleaning and slicing, the pear slices were blanched in boiling water for 3 min, cooled and chopped with a hand blender. The puree was passed through a sieve with a pore size of 1 mm using an electric mill. The puree was processed by adding sugar (8%), citric acid (0.15%) and water to nectar, which contained 13% soluble solids. The nectar sample U were treated in an ultrasonic bath (Bandelin Sonorex RK 100, Germany) for 15 min, sample M in a microwave oven (Daewoo, KOR-63A5, South Korea) at 800 W for 2 min, and sample U+M in combinations. Pasteurized nectar (P) was prepared by pasteurization at 85 °C for 20 min. The nectars were stored at 4 °C for 30 days.

Aromatic profile

Aromatic profile was determined by Agilent 7890B gas chromatograph equipped with Agilent 5977A mass spectrometer (Agilent Technologies, Santa Clara, CA, USA). Solid-phase microextraction (SPME) was used as an sampling method.

Microbiological analysis

Microbiological analysis of samples included aerobic mesophilic bacteria (AMB; HRN EN ISO 4833:2003), molds and yeast (M&Y; HRN EN ISO 7954:2002), *Enterobacteriaceae* family (E; HRN EN ISO 11290-1:1999/Amd.1:2004), sulfite-reducing clostridia (SRC; HRN EN ISO 7937:2005), and *Salmonella* spp. (S; HRN EN ISO 6579:2003). Briefly, after diluting (buffered peptone water for *Salmonella* spp. or sterile saline for the rest microorganisms) and homogenization (Stomacher, 1 min), growth media and incubation were used according to ISO norms. After incubation time, colonies were checked (*Enterobacteriaceae*), counted, and expressed as log10. All analyses were performed in duplicate.

Results

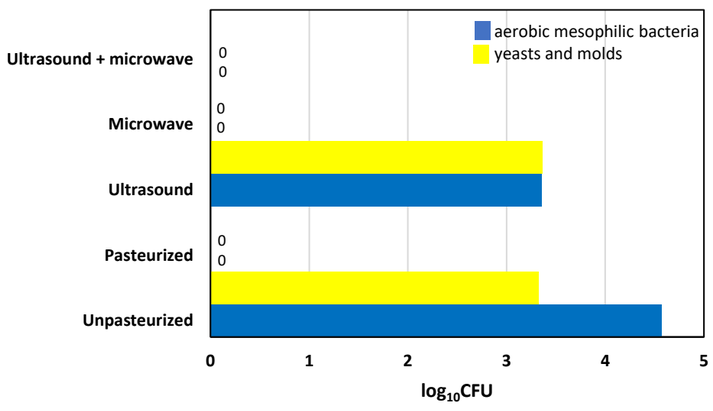

Figure 1 Bacteria and fungi in untreated (unpasteurized) and treated samples of pear nectars at day 0

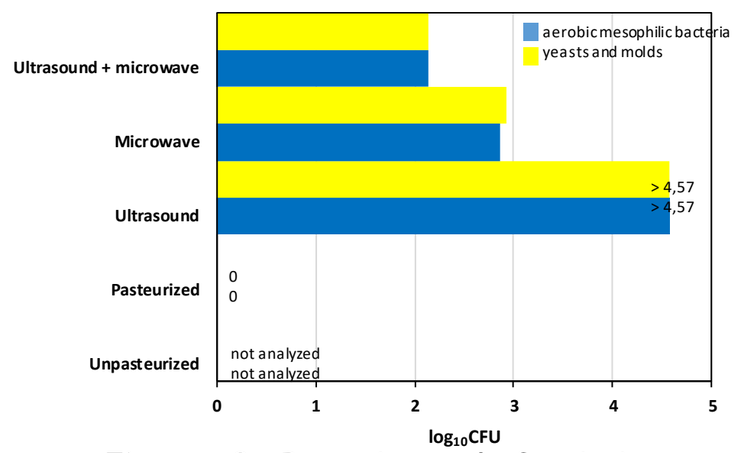

Figure 2 Bacteria and fungi in treated samples of pear nectars at day 30

Table 1 Aroma profile of nectar samples (µg/L)

Compound	RI	C	P	U	M	U+M
∑Carbonyl compounds		**276.48 ± 3.49**	**247.49 ± 1.76**	**357.78 ± 1.07**	**336.72 ± 4.35**	**477.12 ± 4.91**
2-octenal	1076	8.85 ± 0.04	16.62 ± 0.15	30.97 ± 0.11	22.06 ± 0.36	49.29 ± 0.46
2-nonenal	1183	10.02 ± 0.02	13.62 ± 0.12	31.66 ± 0.01	23.43 ± 0.22	28.07 ± 0.53
Decanal	1230	12.98 ± 0.61	18.48 ± 0.34	14.53 ± 0.05	12.62 ± 0.11	20.14 ± 0.59
2.4-decadienal	1309	208.01 ± 2.32	161.61 ± 0.19	212.57 ± 0.32	187.48 ± 0.44	231.45 ± 2.78
Dodecanal	1427	5.68 ± 0.06	6.54 ± 0.35	6.95 ± 0.03	8.99 ± 0.04	12.89 ± 0.07
Geranyl acetone	1472	20.22 ± 0.24	14.25 ± 0.49	19.67 ± 0.05	27.73 ± 2.75	69.27 ± 0.39
Lilial	1550	2.33 ± 0.13	7.64 ± 0.02	23.62 ± 0.45	34.53 ± 0.40	48.87 ± 0.05
α-hexyl cinnamaldehyde	1777	8.39 ± 0.07	8.73 ± 0.10	17.81 ± 0.07	19.88 ± 0.03	17.14 ± 0.04
∑Terpenes		**1123.11 ± 12.42**	**1003.48 ± 7.11**	**1240.09 ± 9.37**	**2077.50 ± 10.99**	**2106.14 ± 13.16**
α-terpineol	1199	34.12 ± 0.17	34.90 ± 0.06	21.93 ± 0.08	-	19.27 ± 0.16
cis-β-farnesene	1476	5.23 ± 0.02	3.34 ± 0.08	6.36 ± 0.14	9.80 ± 0.53	11.18 ± 0.21
α-farnesene	1532	449.25 ± 5.90	347.04 ± 0.21	928.08 ± 8.59	1763.19 ± 6.41	1736.66 ± 10.35
α-calacorene	1568	14.47 ± 0.04	7.90 ± 0.35	10.94 ± 0.26	20.24 ± 0.68	18.84 ± 0.40
Nerolidol	1585	17.83 ± 0.14	20.81 ± 0.10	11.53 ± 0.04	13.93 ± 0.08	16.62 ± 0.05
Trans-farnesol	1641	6.12 ± 0.07	-	16.25 ± 0.05	43.35 ± 0.29	26.59 ± 0.45
Dihydrofarnesol	1714	596.08 ± 6.08	589.48 ± 6.31	245.01 ± 0.20	226.99 ± 2.99	276.98 ± 1.53
∑Esters		**448.87 ± 6.46**	**371.17 ± 6.22**	**384.94 ± 5.64**	**447.95 ± 6.56**	**519.38 ± 5.24**
Hexyl acetate	1035	235.74 ± 2.01	207.30 ± 4.25	160.99 ± 2.55	71.99 ± 0.81	108.48 ± 0.66
Isoamyl isovalerate	1123	17.96 ± 0.29	15.16 ± 0.26	46.74 ± 0.10	47.38 ± 0.18	47.16 ± 0.29
Heptyl acetate	1134	11.74 ± 0.06	9.62 ± 0.01	21.78 ± 0.28	-	-
Octyl acetate	1237	7.11 ± 0.18	7.49 ± 0.07	-	-	-
Hexyl 2-methylbutanoate	1256	-	-	6.52 ± 0.02	-	-
2-phenethyl acetate	1265	9.91 ± 0.30	8.50 ± 0.01	-	-	-
Ethyl 2,4-decadienoate	1447	5.93 ± 0.03	4.82 ± 0.13	-	-	-
Hexyl benzoate	1599	27.99 ± 1.26	24.49 ± 0.10	24.39 ± 0.94	34.19 ± 0.02	36.73 ± 0.45
Ethyl myristate	1815	11.62 ± 0.58	10.21 ± 0.04	8.14 ± 0.10	11.55 ± 0.52	8.40 ± 0.08
Isopropyl myristate	1848	21.95 ± 0.42	13.83 ± 0.48	24.34 ± 0.42	42.00 ± 0.40	45.99 ± 1.18
Diisobutyl phthalate	1897	54.85 ± 0.05	57.58 ± 0.64	27.65 ± 0.31	32.39 ± 2.15	41.10 ± 0.70
Methyl palmitate	1949	5.87 ± 0.07	-	11.78 ± 0.68	16.35 ± 0.63	19.84 ± 0.16
Dibutyl phthalate	1992	5.20 ± 0.14	5.71 ± 0.12	5.97 ± 0.01	9.78 ± 0.13	8.61 ± 0.23
Ethyl palmitate	2017	9.90 ± 0.80	2.05 ± 0.08	17.26 ± 0.09	46.86 ± 0.80	41.06 ± 1.19
Methyl linoleate	2121	4.44 ± 0.03	-	3.59 ± 0.01	9.01 ± 0.24	9.49 ± 0.01
Methyl oleate	2127	3.19 ± 0.03	-	13.09 ± 0.10	42.06 ± 0.08	49.05 ± 0.15
Ethyl linoleate	2188	3.52 ± 0.16	-	2.17 ± 0.03	15.54 ± 0.08	16.33 ± 0.07
Ehtyl oleate	2193	11.93 ± 0.06	4.41 ± 0.02	10.53 ± 0.01	68.85 ± 0.52	87.13 ± 0.07
*internal standard: myrtenol 0.5 mg/L	1218					

RI-retention index

Conclusions

- ✓ Aroma compounds detected in the nectars were categorized into carbonyl compounds, terpenes and esters, with the highest values found in the sample treated with ultrasound and microwaves.
- ✓ Minimal processing resulted in rise or retention of aroma compounds, while decline in the total content in all groups of compounds in the pasteurized sample was observed.
- ✓ The use of pasteurization, microwaves and a combination of ultrasound and microwaves proved to be the most effective in preserving the microbiological quality of pear nectars, while the use of ultrasound was the least effective in reducing the number AEB, and M&Y.
- ✓ *Salmonella* and *Enterobacteriaceae* were not detected in any of analyzed sample.

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