COMPARISON OF FLASH THERMAL PRETREATMENT AND ULTRASONIC PRETREATMENT IN THE PRODUCTION OF VIRGIN OLIVE OIL

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„Impact of innovative technologies on the nutritional value, sensory properties and oxidation stability of virgin olive oils from Croatian autochthonous olive varieties"

„Project of career development of young researchers - training of new PhDs" (DOK-2021-02)

INTRODUCTION

- Problem in VOO production → malaxation –time and energy consumption
- Solution → innovative technologies – Y ↑, phenolic composition ↑↓?
- Influence of olive variety crucial

AIM

- to investigate the influence of
  - flash thermal treatment (FTT) and ultrasound (US) as pretreatments of malaxation on the
  - oil yield (Y),
  - oxidative stability index (OSI)
  - and phenolic composition (PC)
  - in virgin olive oils (VOOs) from autochthonous Croatian olive varieties: Istrian Bjelica, Levantinka and Oblica.

MATERIALS AND METHODS

1) VOO production

CLEANING AND WASHING

CRUSHING

INNOVATIVE TECHNOLOGY (FTT/US)

MALAXATION

CENTRIFUGAL EXTRACTION

STORAGE

MATERIALS AND METHODS

1) VOO production

Parameters of innovative technologies

FTT

Sample	Temperature (°C)
1-control	/
2	15
3	20
4	25
5	30
6	35
7	40

US

Sample	Time (min)	Ultrasonic bath power (W)
1-control	0	0
2	10	256
3	5	320
4	15	320
5	3	448
6-central	10	448
7	17	448
8	5	576
9	15	576
10	10	640

MATERIALS AND METHODS

2) Oxidation stability index

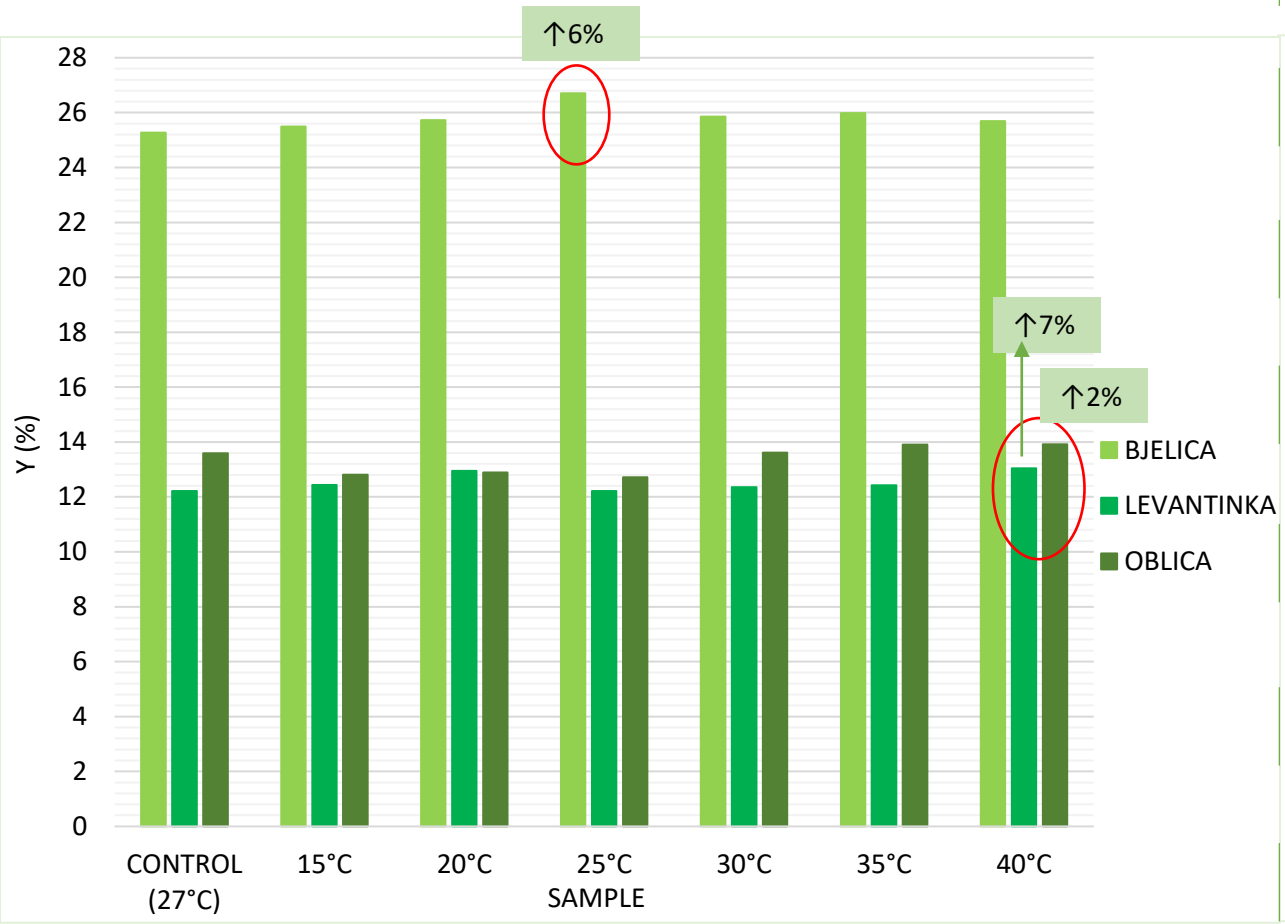
3) Phenolic composition

*International Olive Council (IOC) Determination of biophenols in olive oils by HPLC (2022) Madrid, Spain

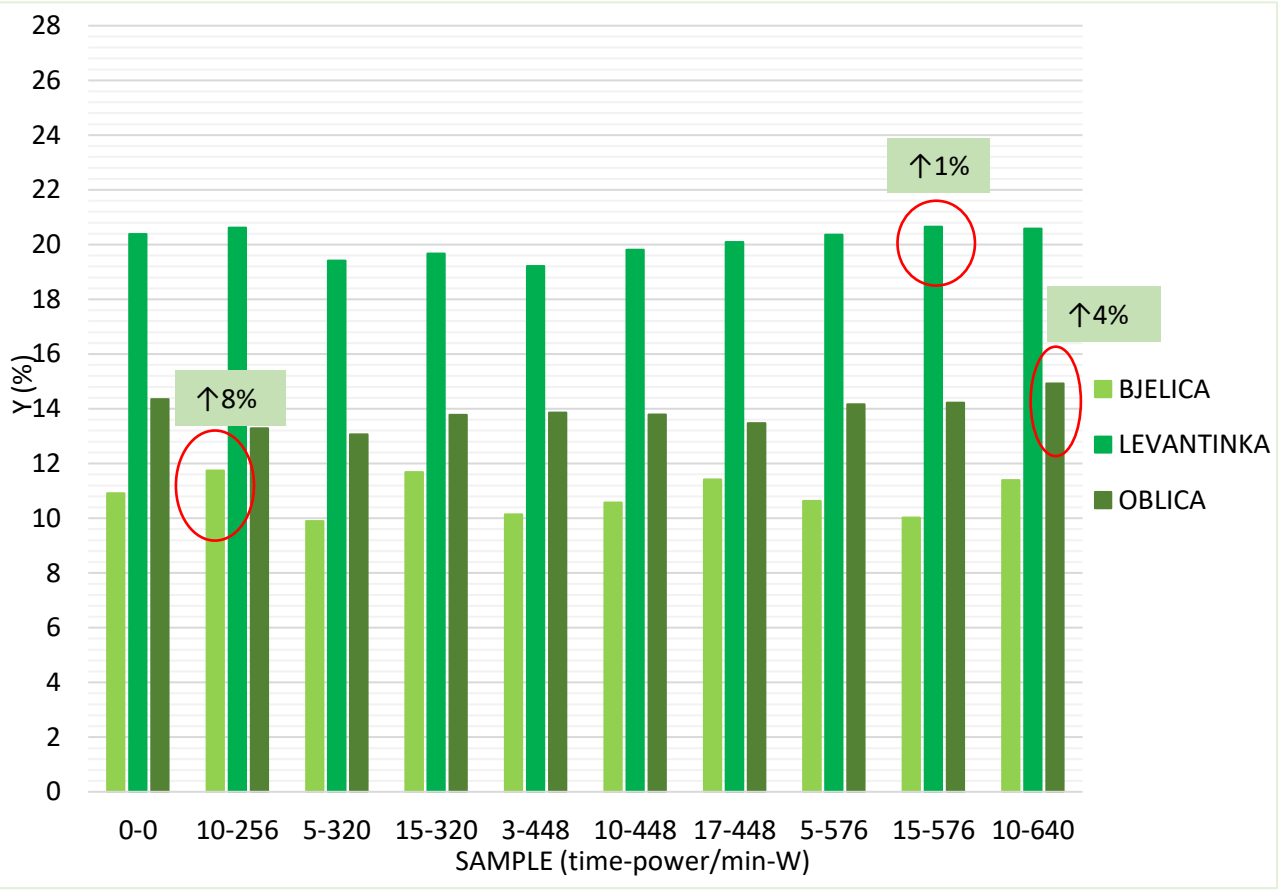
RESULTS

1) Oil yield

$$Y = \frac{Vvoo \times \rho}{m} \times 100$$



FTT

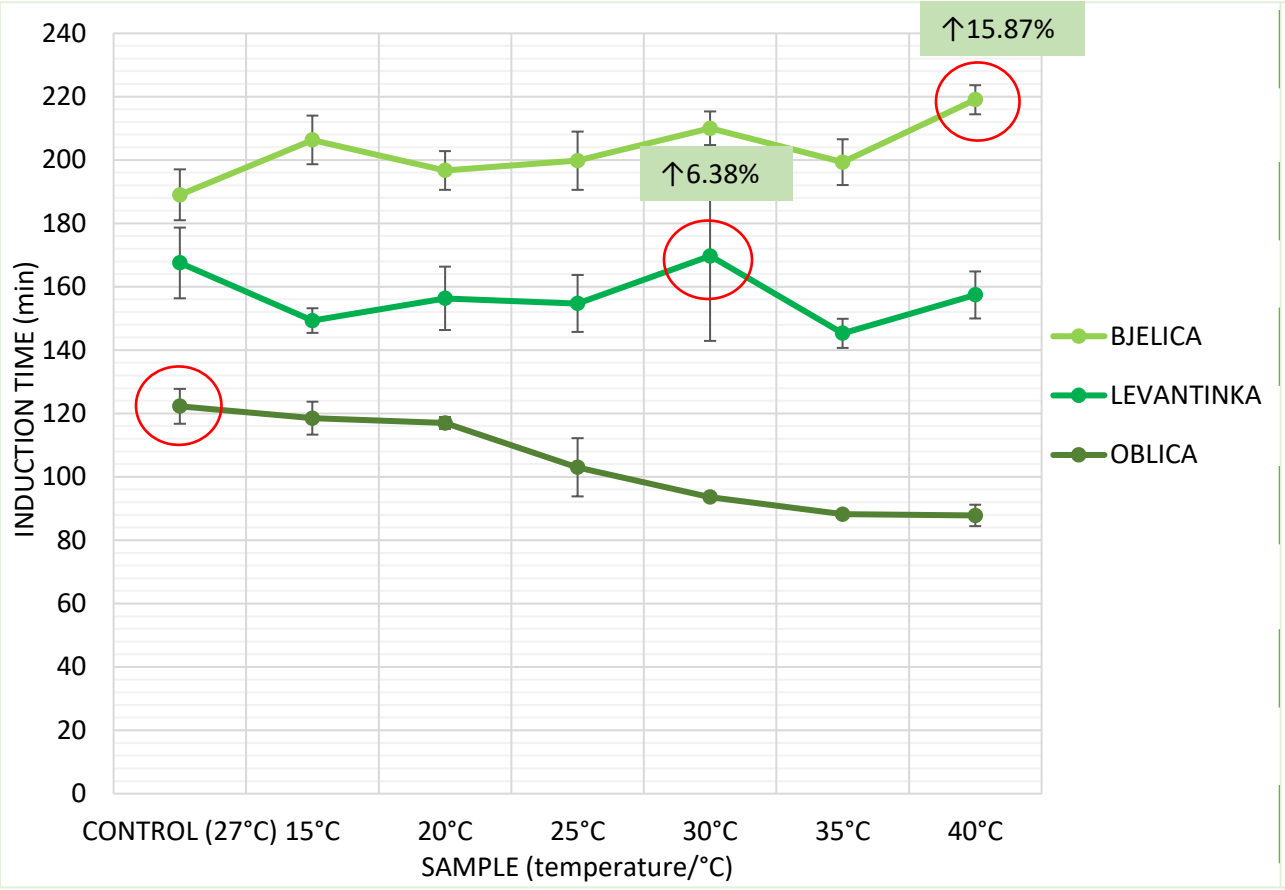


US

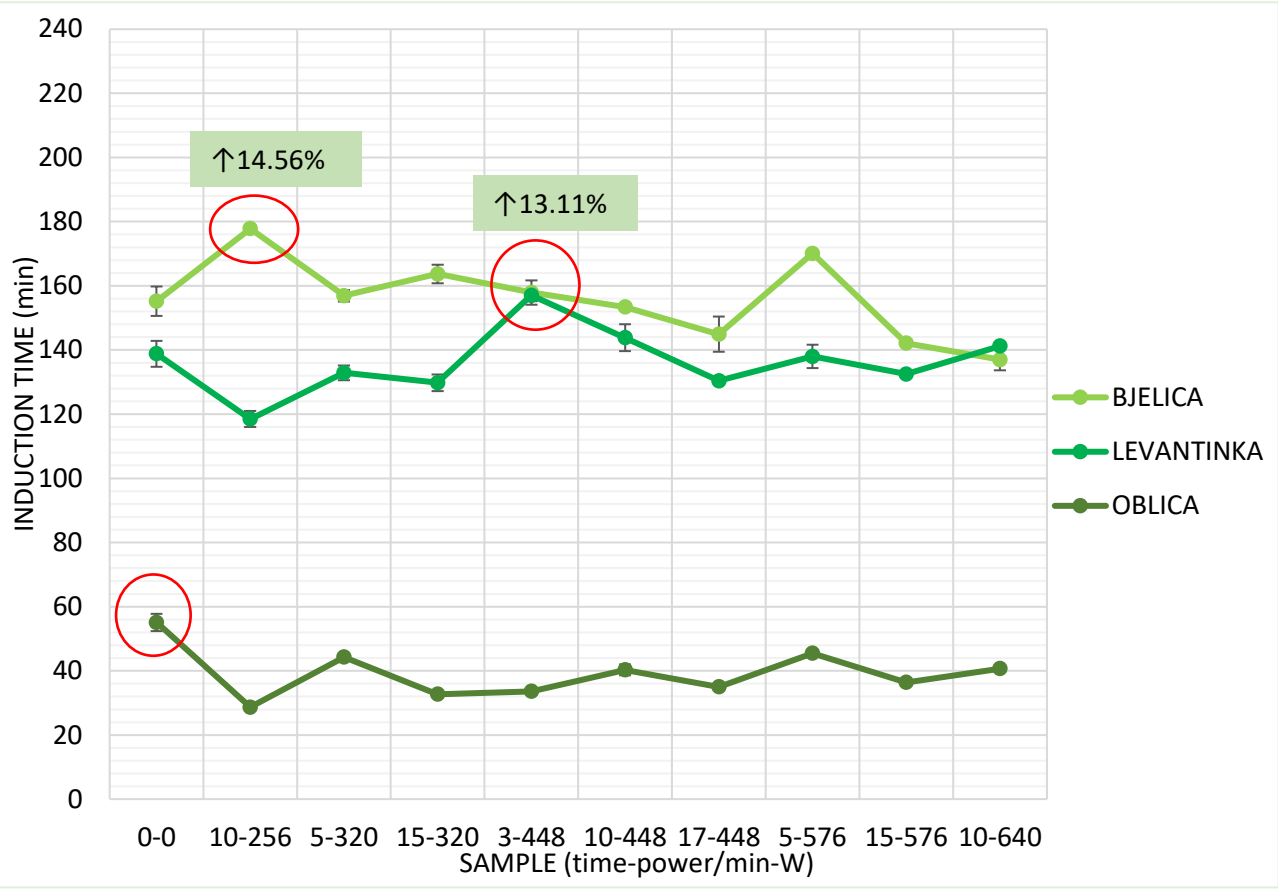
*F. Peres, L. L. Martins, S. Ferreira-Dias, Laboratory-scale optimization of olive oil extraction:Simultaneous addition of enzymes and microtalcimproves the yield. Eur. J. Lipid Sci. Technol. 116 (2014) 1054–1062. https://doi.org/10.1002/ejlt.201400060.

RESULTS

2) Oxidation stability index



FTT



US

RESULTS

3) Phenolic composition - FTT

OLIVE VARIETY	SAMPLE (temperature/°C)	Phenolic compounds (mg/kg)							
		Hydroxityrosol	Tyrosol	Oleacein	Oleuropein	Oleocanthal	Ligstroside	Oleuroside	Total phenols
BJELICA	CONTROL (27°C)	36±4	16±1	77±12	1±1	107±8	58±6	nd	856±90
BJELICA	15°C	39±2	18±1	70±3	3±2	↑534%	56±1	nd	903±31
BJELICA	20°C	41±3	↑18%	↑35%	6±1	102±3	↑5%	nd	892±33
BJELICA	25°C	42±5	21±6	67±22	↑2%	112±10	53±2	nd	857±37
BJELICA	30°C	38±2	18±1	78±13	4±3	111±7	53±4	nd	878±50
BJELICA	35°C	40±2	19±1	71±4	4±1	108±2	58±2	nd	900±24
BJELICA	40°C	40±2	18±1	76±2	3±1	111±2	57±1	nd	913±14
LEVANTINKA	CONTROL (27°C)	15±1	5±1	83±7	3±0	83±4	12±1	nd	357±21
LEVANTINKA	15°C	16±1	9±4	60±9	2±2	79±3	15±5	↑32%	↑200%
LEVANTINKA	20°C	24±13	12±9	60±23	3±2	82±11	16±3	20±2	385±12
LEVANTINKA	25°C	16±11	10±8	63±25	3±1	72±15	7±5	7±7	295±25
LEVANTINKA	30°C	14±	↑79%	↑179%	2±1	85±2	14±1	nd	360±20
LEVANTINKA	35°C	27±23	14±13	53±33	3±0	74±15	↑10%	nd	346±19
LEVANTINKA	40°C	17±1	7±1	82±9	3±0	91±2	15±3	nd	383±18
OBLICA	CONTROL (27°C)	23±2	12±2	56±11	1±1	61±5	37±4	nd	470±45
OBLICA	15°C	19±1	8±1	57±10	↑11%	63±5	31±1	nd	432±20
OBLICA	20°C	21±1	↑37%	↑87%	0±1	62±3	↑6%	nd	440±9
OBLICA	25°C	32±24	22±22	54±18	2±2	65±9	22±4	nd	412±46
OBLICA	30°C	25±2	12±1	61±5	4±1	62±5	26±2	nd	423±29
OBLICA	35°C	22±0	10±0	50±5	4±0	↑300%	23±0	nd	370±10
OBLICA	40°C	21±2	9±0	62±5	4±1	61±1	21±1	nd	381±22

↑7%

↑8%

*nd-not detected

RESULTS

3) Phenolic composition - US

OLIVE VARIETY	SAMPLE	Hydroxityrosol	Tyrosol	Oleacein	Oleocanthal	Ligstroside	Total phenols
BJELICA	0-0	3±0	4±0	136±23	94±2	22±4	449±10
BJELICA	10-256	4±2	4±0	164±4	106±2	26±0	526±16
BJELICA	5-320	2±0	4±0	136±0	93±0	19±0	417±0
BJELICA	15-320	2±0	4±0	146±3	107±1	22±0	471±3
BJELICA	3-448	2±0	4±0	136±2	93±1	17±0	404±0
BJELICA	10-448	2±0	4±0	140±15	100±5	18±3	440±24
BJELICA	17-448	1±2	2±3	134±1	99±18	18±1	438±11
BJELICA	5-576	7±2	4±0	179±1	108±1	19±0	505±12
BJELICA	15-576	1±1	4±0	149±1	102±1	12±0	402±5
BJELICA	10-640	nd	4±0	118±0	104±1	16±1	407±3
LEVANTINKA	0-0	14±22	11±15	71±18	60±4	13±1	311±11
LEVANTINKA	10-256	nd	nd	50±0	59±0	10±0	275±6
LEVANTINKA	5-320	nd	nd	61±0	63±0	13±0	251±2
LEVANTINKA	15-320	3±0	9±0	50±1	58±1	10±0	213±11
LEVANTINKA	3-448	1±1	nd	94±0	63±0	15±0	324±5
LEVANTINKA	10-448	13±16	12±14	55±12	59±5	11±1	249±20
LEVANTINKA	17-448	nd	nd	65±1	66±0	9±0	232±1
LEVANTINKA	5-576	nd	nd	62±1	65±1	12±0	251±3
LEVANTINKA	15-576	nd	nd	77±2	66±1	10±0	251±5
LEVANTINKA	10-640	nd	nd	72±1	70±1	13±0	281±5
OBLICA	0-0	nd	4±0	38±8	46±1	10±2	173±29
OBLICA	10-256	nd	6±0	[illegible]	40±1	4±0	102±3
OBLICA	5-320	45±1	47±1	nd	23±1	4±0	151±2
OBLICA	15-320	nd	5±0	9±0	34±0	3±0	93±0
OBLICA	3-448	15±0	21±0	8±0	33±2	5±2	116±7
OBLICA	10-448	5±10	10±11	16±6	39±5	5±2	113±11
OBLICA	17-448	17±0	21±0	6±0	31±1	4±1	111±6
OBLICA	5-576	33±0	32±0	13±0	34±0	6±0	155±1
OBLICA	15-576	17±1	22±0	7±0	32±0	4±0	112±1
OBLICA	10-640	nd	5±0	24±0	43±1	6±0	124±3

↑18% ↑17% ↑160% ↑31% ↑15% ↑33% ↑18% ↑4% ↑17% ↑446% ↑1000%

*nd-not detected

CONCLUSIONS

- Pretreatments increased most of the investigated parameters
- Variety had the greatest influence in all analyses

Variety	Bjelica		Levantinka		Oblica	
Innovative tech.	FTT	US	FTT	US	FTT	US
Y		✓	✓			✓
OSI	✓			✓	/	
Hydroxityrosol		✓	✓			✓
Tyrosol	✓		✓			✓
Oleacein		✓		✓	✓	
Oleuropein	✓			/	✓	
Oleocanthal		✓		✓	✓	
Ligstroside		✓	✓		/	
Oleuroside			✓			
Total phenols		✓	✓		/	

10 min-640 W
5 min-576 W

40, 35 and 20°C


Thank you for your attention!