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INFLUENCE OF HIGH INTENSITY ULTRASOUND TREATMENT ON BIOACTIVE COMPOUNDS IN BUCKWHEAT AND PUMPKIN SEED CAKE FLOUR

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INTRODUCTION

High intensity ultrasound (HIU)
✓ robust, green and rapid technology

Pumpkin seed cake
✓ oil production by-product
✓ rich in protein (51%), fiber (16.6%), fat (21.8% of which 36% PUFA), and bioactive compounds
✓ potential in the gluten-free industry

Buckwheat
✓ gluten-free pseudocereal
✓ source of protein (15.6%), fiber (5.9%), fat (3.014% of which 41% PUFA) and phenolics

The research aimed to explore which of the two effects of HIU is prevailing: (1) the increase of free bioactive compounds from cell wall or (2) the generation of free radicals which can decrease the polyunsaturated fatty acid content.

METHODOLOGY

SAMPLE: 45 g of ground pumpkin seed cake and buckwheat in 300 ml of 50% aq. ethanol

	Control	HIU	Heating
Treatment	magnetic stirrer, room temp	titanium 400 W power probe, 22 mm diameter, 100% amplitude	magnetic stirrer, 55°C
Time	20 min	5, 12.5, 20 min	20 min

- **Antioxidant activity**: DPPH and FRAP methods (Čukelj, 2015); expressed as trolox equivalent (TE)
- **Total phenolic content** (TPC): Folin-Ciocalteu method (Čukelj, 2015.); expressed as galic acid equivalent (GAE)
- **Phenolic acids, tyrosol and rutin**: HPLC-PDA (Čukelj, 2015);
- **Polyunsaturated fatty acids (PUFA)**: GC-FID analysis, expressed as a percent of the total fatty acid content (Kraljić, 2013)
- **Statistics:** ANOVA with Tukey post-hoc test ($p \leq 0.05$); different letters mark significant difference

RESULTS

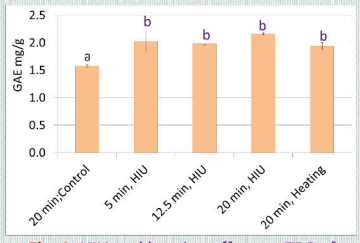

Fig. 1. HIU and heating effect on TPC of buckwheat flour

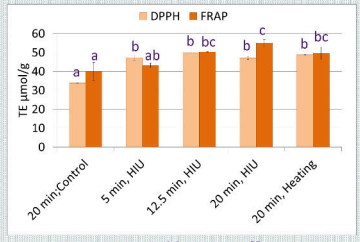

Fig. 2. HIU and heating effect on antioxidant activity of buckwheat flour

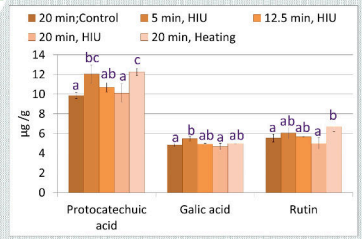

Fig. 3. HIU and heating effect on phenolic acids and rutin content of buckwheat flour

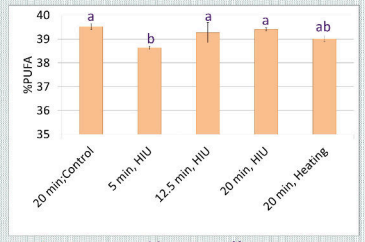

Fig. 4. HIU and heating effect on PUFA content of buckwheat flour

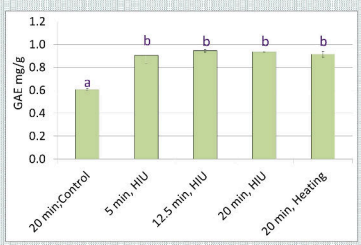

Fig. 5. HIU and heating effect on TPC of pumpkin seed flour

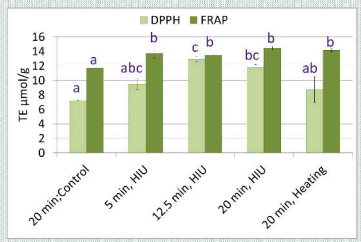

Fig. 6. HIU and heating effect on antioxidant activity of pumpkin seed flour

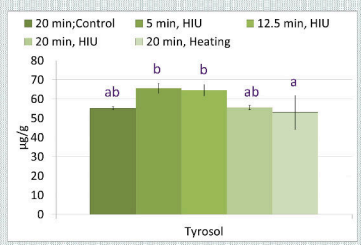

Fig. 7. HIU and heating effect on tyrosol in pumpkin seed flour

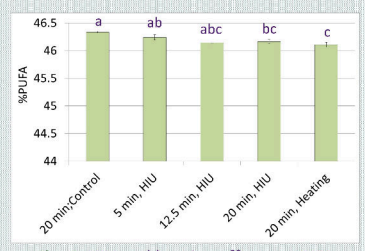

Fig. 8. HIU and heating effect on PUFA content of pumpkin seed flour

DISCUSSION AND CONCLUSIONS

- HIU treatment of buckwheat and pumpkin seed cake flour causes a significant increase of their total phenolic content and the antioxidant activity, regardless of the time of the treatment. Longer treatment time did not influence the TPC, but it did result in the even more increased antioxidant activity.
- Five minute HIU treatment significantly increases protocatehuic and galic phenolic acids in buckwheat, as well as tyrosol in pumpkin seed cake. However, opposite to TPC and antioxidant activity, the longer treatment time leads to the decline of the same compounds. Rutin content was not affected by HIU treatment.
- Although the application of heating in the extraction resulted in similar increase of bioactives as the HIU, the required time of treatment in case of HIU is shorter, that is, the HIU could reduce the processing time
- The PUFA content of pumpkin seed cake gradually decreased with HIU treatment and was significantly reduced after 20 minutes of HIU treatment, as well as by 20 minutes heating
- Shorter time of HIU treatment negatively effects the PUFA content of buckwheat flour, but with the longer HIU treatment time the PUFA content showed to be the same as in the control.
- Recommended time of HIU treatment for the increase of bioactives while maintaining the PUFA content is 5 minutes for pumpkin seed cake flour and 12.5 minutes for buckwheat flour. Pumpkin seed flour is more supcetible to the negative HIU effect probably due to already disrupted cell structures during oil production.

References: 1. Cukelj, N., Ajredini, S., Krpan, M., Novotni, D., Voucko, B., Vrana Spoljaric, I., Curic, D., Hruskar,M. (2015). Bioactives in organic and conventional milled cereal products from Croatian market. Croatian Journal of Food Technology, Biotechnology and Nutrition, **10** (1-2), 23-30. **2.** Kraljić, K., Škevin, D., Pospišil, M., Obranović, M., Neđeral, S., Bosolt, T. (2013) Quality of Rapeseed Oil Produced by Conditioning Seeds at Modest Temperatures. The Journal of American Oil Chemists' Society **90** (4), 589-599.