EFFECT OF HEAT TREATMENTS ON TOXIC COMPOUNDS ACCUMULATION IN POTATOES AND SWEET POTATOES

By

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B.Sc. Agric. Sci. (General Division), Fac. Agric., Menia Univ., 2001
M.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Menia Univ., 2006

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ABSTRACT

The objective of the present study was undertaken to investigate the effects of pre-frying treatments on acrylamide reduction in potato and sweet potato chips, and to investigate the biological effects of acrylamide.

The chemical composition of potato (*Solanum tuberosum* L.) and sweet potato (*Ipomoea batatas* L. lam) were studied. The proximate analysis was found to be 81.3%, 74.1% and 77.4% moisture; 2.75%, 3.24% and 1.95% crude fiber; 1.6%, 1.73% and 1.83% total lipid; 11.73%, 12.54% and 12.2% crude protein; 81.27%, 78.86% and 79.75% total carbohydrate and 5.13%, 6.58% and 5.83% ash for potato and sweet potato, respectively.

It was found that the highest acrylamide content for local marketing chips was 4549.1 µg/kg. While, the lowest acrylamide content of potato chips for soaked in NaCl 5% and fried in sunflower containing rosemary 0.5% at 175°C was 121.0 µg/kg. The highest acrylamide content of white sweet potato chips for blanched at 100°C/25 min and dried at 200°C/30 min was 1769.0 µg/kg. While, the lowest acrylamide content of white sweet potato chips for soaked in NaCl 5% and fried in sunflower containing rosemary 0.5% at 175°C was 216.5 µg/kg. Also, the highest acrylamide content of orange sweet potato chips for control was 2256.9 µg/kg. While, the lowest acrylamide content of orange sweet potato chips for soaked in NaCl 5% and fried in sunflower containing rosemary 0.5% at 175°C was 198.7 µg/kg.

The HMF concentration of potato chips in all treatments was not detected. The highest HMF concentration of white sweet potato chips for blanched at 90°C/1 min and soaked in 1.0 % citric acid and fried in blend oil at 170°C was 31.5 mg/kg. Also, the highest HMF concentration of orange sweet potato chips for blanched at 90°C/1 min and soaked in 1.0 % citric acid and fried in blend oil at 170°C was 122.9 mg/kg.

The highest 3-chloropropane-1,2-diol (3-MCPD) concentration of frying oil was 1227.0 µg/kg and potato chips for local marketing was 1814.3 µg/kg. While, the lowest soaked in NaCl 5% and fried in sunflower containing rosemary 0.5% at 175°C was 671.0 µg/kg.

The oral administration of acrylamide (15000 µg/kg b. wt.) to rats (group 2), potato chips (30% of meal) contained 1696.0 µg/kg and 121.0 µg/kg of acrylamide were fed to group 3 and group 4, respectively led to a significant decrease in HDL cholesterol (24 mg/dl) for group 2 compared to negative control (35.71 mg/dl). Also, there was a significant decrease in GSH in liver and lung (27.96 and 25.88 mmol/g wet tissue, respectively) for group 2 compared to negative control (43.13 and 40.27 mmol/g wet tissue, respectively) and SOD in liver and lung (763.94 and 628.96 U/g wet tissue, respectively) for group 2 compared to control (1384.21and 1130.59 U/g wet tissue, respectively). However the dose of acrylamide in group 2 led to a significant increase in total cholesterol, triglycerides, LDL cholesterol, creatinine, AST and ALT activities (101.62 mg/dl 116.73 mg/dl, 42.8 mg/dl, 2.84 mg/dl, 166.63 U/L and 64.85 U/L respectively) Compared to negative control (61.67 mg/dl, 95.55 mg/dl, 16.3 mg/dl, 1.07 mg/dl, 102.55 U/L and 35.53 U/L respectively).

Keywords: Potato, sweet potato, acrylamide, HMF, 3-MCPD, biological evaluation.

DEDICATION

I dedicate this work to my parents and brothers for all the support they lovely offered during my post-graduate studies.

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LIST OF ABBREVIATIONS

NO	Abbreviations	
1	**AA**	Acrylamide
2	**ALT**	Alanine transaminase
3	**AOB**	Antioxidants of bamboo
4	**AST**	Aspartate transaminase
5	**CFAC**	Codex Committee on Food Additives and Contaminants
6	**CIAA**	Confederation of the Food and Drink Industries of the EU
7	**CML**	N(6)-(carboxymethyl)lysine
8	**DPPH**	2, 2-diphenyl-1-picrylhydrazyl
9	**DTNB**	5.5 dithiobis (2 – nitrobenzoic acid)
10	**EFSA**	European Food Safety Authority
11	**EGT**	Extract of green tea
12	**FL**	N (6) - (fructosyl) lysine
13	**GO**	Glyoxal
14	**GSH**	Glutathione reduced
15	**HDL**	High-density lipoprotein
16	**HMF**	Hydroxymethylfurfural
17	**HVP**	Hydrolyzed vegetable protein
18	**IARC**	International Agency for Research on Cancer
19	**MCPD**	Monochloropropane-1,2-diol
20	**LDL**	Low-density lipoprotein
21	**MDA**	Malondialdehyde
22	**MR**	Maillard reaction
23	**MRP**	Maillard reaction products
24	**PBS**	Phosphate buffered saline
25	**PME**	Pectin methyl esterase
26	**PPM**	Polypropylene metalyz
27	**SCF**	Scientific Committee for Food
28	**SNFA**	Swedish National Food Administration
29	**SOD**	Superoxide dismutase
30	**SP**	Sweet potato
31	**TBA**	Thiobarbituric acid
32	**TDI**	Tolerable daily intake
33	**$VOSO_4$**	Vanadyl sulphate
34	**VOs**	Vegetable oils

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