

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

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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 (1384.21 and 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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