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**Dietary acrylamide exposure among Finnish adults and children: The potential effect of reduction measures**

Journal:	<i>Food Additives and Contaminants</i>
Manuscript ID:	TFAC-2011-074.R1
Manuscript Type:	Original Research Paper
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Complete List of Authors:	Hirvonen, Tero; Finnish Food Safety Authority Evira, Risk Assessment Unit Jestoi, Marika; Finnish Food Safety Authority, Research Department Tapanainen, Heli; National Institute for Health and Welfare, Department of Lifestyle and Participation Valsta, Liisa; National Institute for Health and Welfare, Department of Lifestyle and Participation Virtanen, Suvi; National Institute for Health and Welfare, Department of Lifestyle and Participation Sinkko, Harri; National Institute for Health and Welfare, Department of Lifestyle and Participation Kronberg-Kippilä, Carina; National Institute for Health and Welfare, Department of Lifestyle and Participation Kontto, Jukka; National Institute for Health and Welfare, Department of Chronic Disease Prevention Virtamo, Jarmo; National Institute for Health and Welfare, Department of Chronic Disease Prevention Simell, Olli; University of Turku, Department of Pediatrics Peltonen, Kimmo; Finnish Food Safety Authority, Research Department
Methods/Techniques:	Exposure assessment, Statistical analysis
Additives/Contaminants:	Process contaminants – acrylamide
Food Types:	Cereals, Beer, Coffee, Snack products
Abstract:	A deterministic exposure assessment using the Nusser method that adjusts for within-subject variation and for nuisance effects among

Finnish children and adults was carried out. The food consumption data covered 2,038 adults (25–74 years old) and 1,514 children of one, three, and six years of age, with the data on foods' acrylamide content obtained from published Finnish studies. We found that acrylamide exposure was highest among the three-year-old children (median: 1.01  $\mu\text{g} / \text{kg bw} / \text{day}$ , 97.5th percentile: 1.95  $\mu\text{g} / \text{kg bw} / \text{day}$ ) and lowest among 65–74-year-old women (median: 0.31  $\mu\text{g} / \text{kg bw} / \text{day}$ , 97.5th percentile: 0.69  $\mu\text{g} / \text{kg bw} / \text{day}$ ). Among adults, the most important source of acrylamide exposure was coffee, followed by casseroles rich in starch, then rye bread. Among children, the most important sources were casseroles rich in starch and, then, biscuits and, finally, chips and other fried potatoes. Replacing lightly roasted coffee with dark roasted, swapping sweet wheat buns for biscuits, and decreasing the acrylamide content of starch-based casseroles and rye bread by 50% would result in a 50% decrease in acrylamide exposure in adults. Among children, substituting boiled potatoes for chips and other fried potatoes and replacing biscuits with sweet wheat buns while lowering the acrylamide content of starch-based casseroles by 50% would lead to acrylamide exposure that is only half of the original exposure.

Conclusions: Dietary modifications could have a large impact in decreasing acrylamide exposure.

Note: The following files were submitted by the author for peer review, but cannot be converted to PDF. You must view these files (e.g. movies) online.

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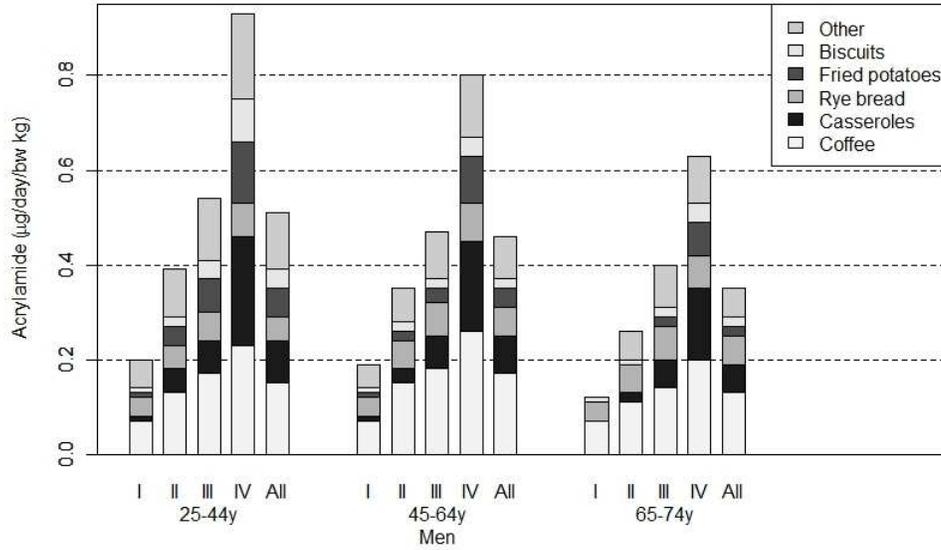
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**Table 1:** Acrylamide content ( $\mu\text{g}/\text{kg}$ ) of foods used in calculation of intake, with values for highest concentrations, most important sources, and substitutes to lower the intake (sweet wheat buns, coffee made from dark-roasted beans, and cooked potatoes)

Finnish studies					
Food	<i>n</i>	Mean (min.–max.)	Food	<i>n</i>	Mean (min.–max.)
Crispbread <sup>1</sup>	23	674 (<68–1,480)	Muesli <sup>1</sup>	10	100 (<68–100)
Crisps <sup>1</sup>	15	539 (100–1,470)	Rye bread <sup>2</sup>	3	51 (<40–80)
Sweet biscuits <sup>1</sup>	15	443	Karelian pastry <sup>2</sup>	1	43
Popcorn <sup>1</sup>	3	300	Cracker <sup>1</sup>	2	128 (120–134)
Chips and oven-baked sliced potatoes <sup>1</sup>	17	286	Wheat rusk <sup>1</sup>	1	0
Salted biscuits <sup>1</sup>	2	179 (134–224)	Beer <sup>2</sup>	2	0
Potato–ham casserole (heated) <sup>1</sup>	5	151 (0–223)	Sweet wheat bun <sup>1</sup>	2	0
Toast (heavily toasted) <sup>1</sup>	5	111 (<75–115)	Coffee, light roast <sup>2</sup>	4	15 (11–20)
			Coffee, dark roasted <sup>2</sup>	2	5 (<10)
Other studies					
Food	Value used	Food	Value used	Food	Value used
Doughnut <sup>4</sup>	<30–40	White bread (non-toasted) <sup>3</sup>	15	Fish finger <sup>2</sup>	15
Fried potato <sup>2</sup>	310	Sausage <sup>2</sup>	15	Sponge cake <sup>3</sup>	15
Danish pastry <sup>2</sup>	<30	American muffins <sup>2</sup>	50	Corn flakes <sup>3</sup>	121
Pasta <sup>2</sup>	15	Pancake <sup>2</sup>	15	Beef burger <sup>3</sup>	15

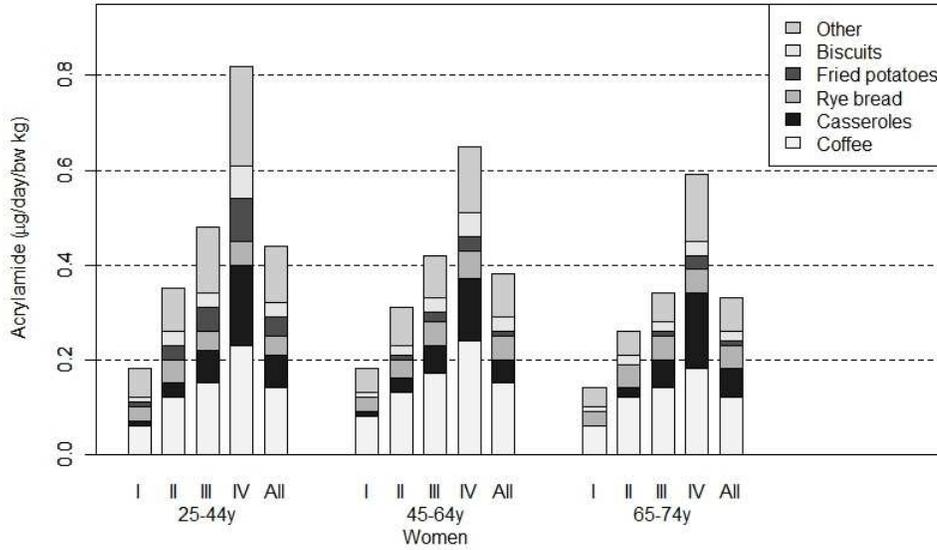
Formatted Table

<sup>1</sup> Erola et al. <sup>2</sup> Hirvonen et al. <sup>3</sup> Svensson et al. <sup>4</sup> Konings et al.



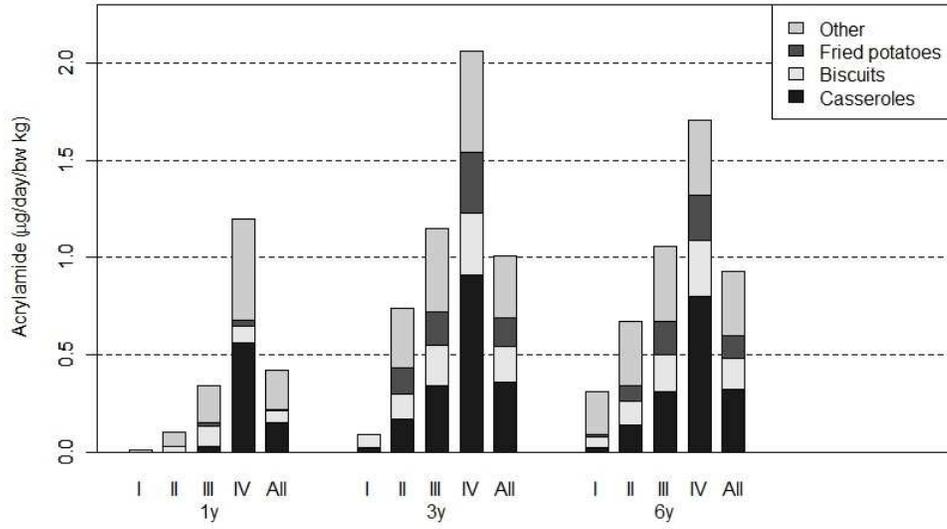
Dietary acrylamide exposure among men by major source, by age group, and by intake quartile. 293x194mm (72 x 72 DPI)

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Dietary acrylamide exposure among women by major source, by age group, and by intake quartile.  
293x194mm (72 x 72 DPI)

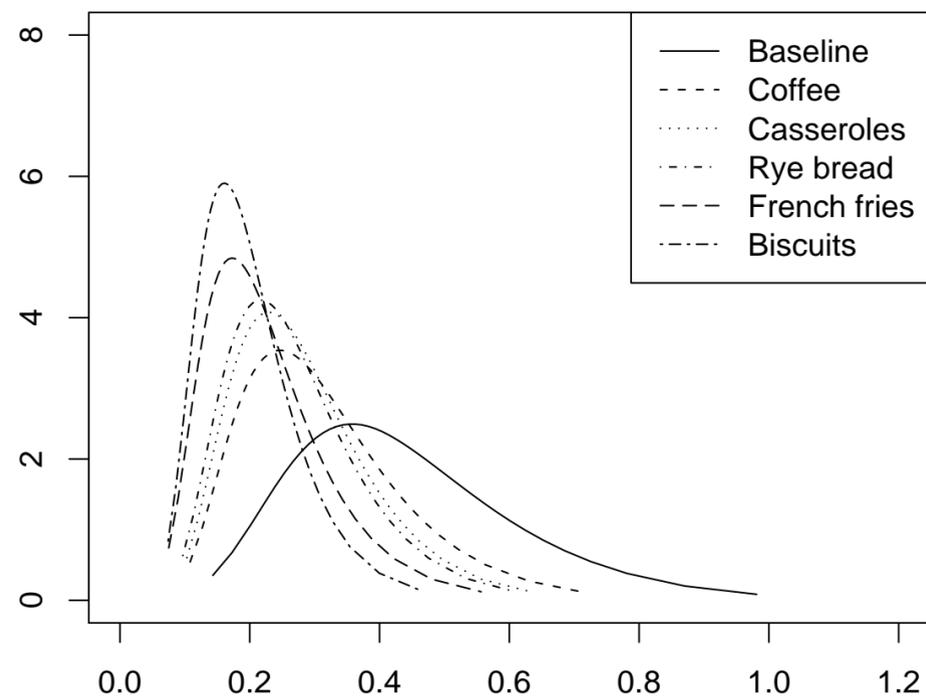
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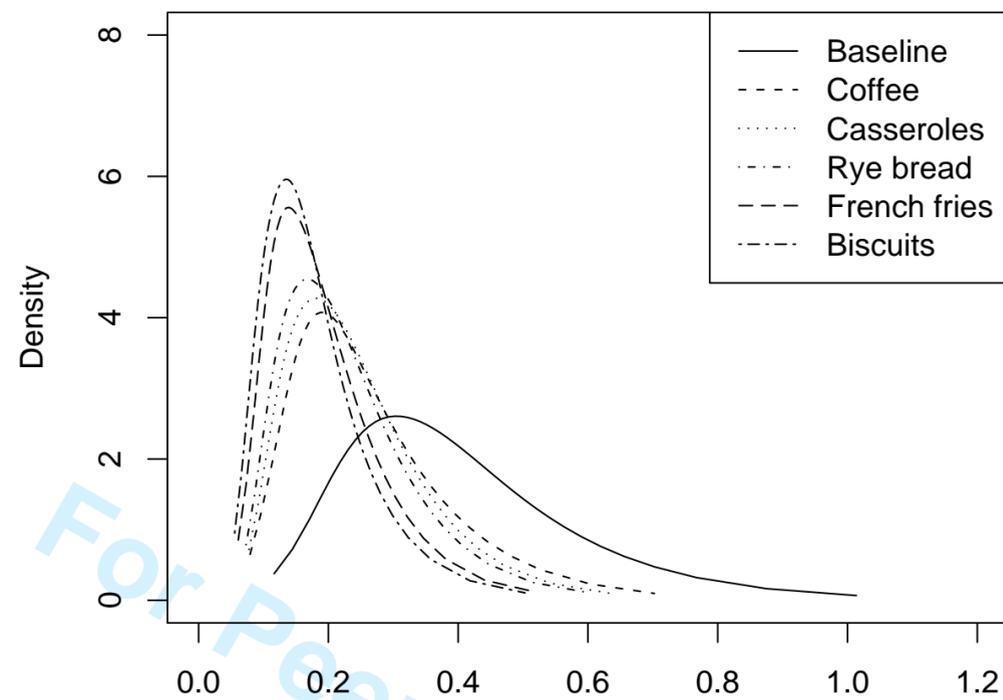
Dietary acrylamide exposure among children by major source, by age group, and by intake quartile.  
293x194mm (72 x 72 DPI)

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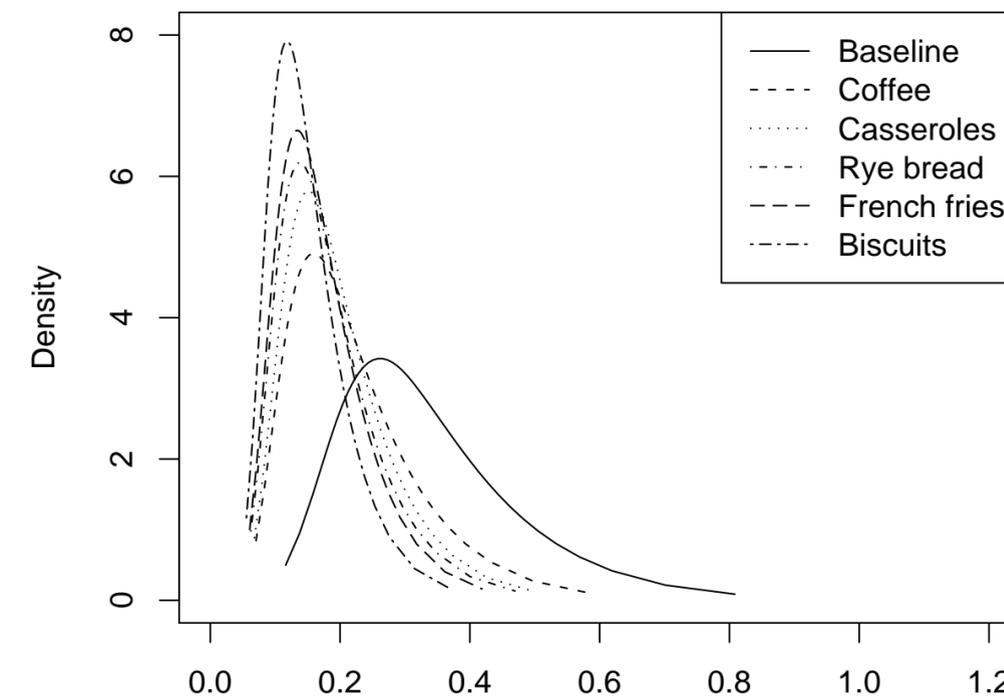
Men 25–44 years



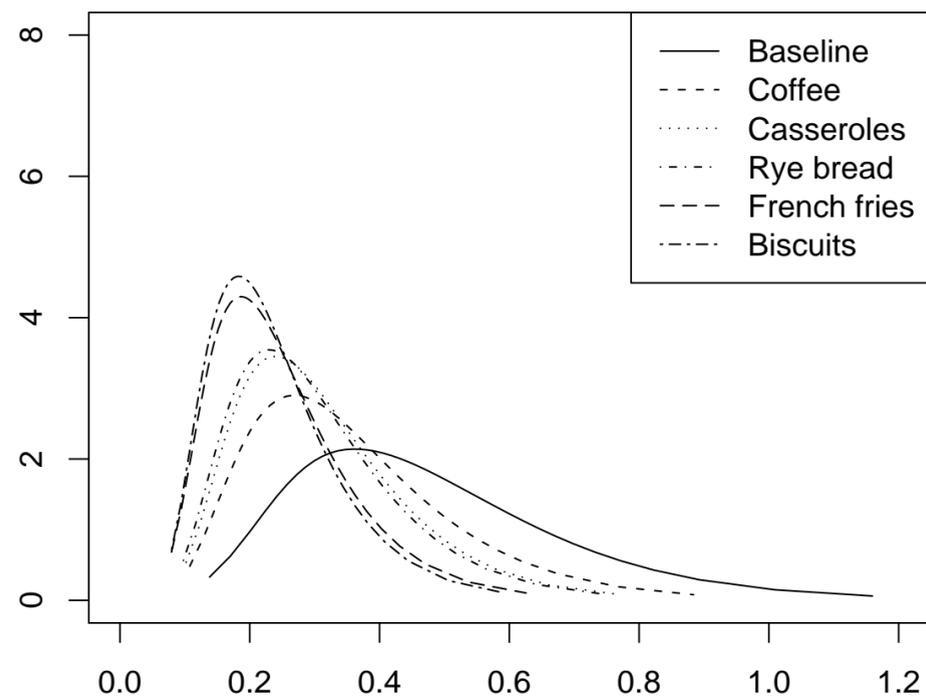
Men 45–64 years



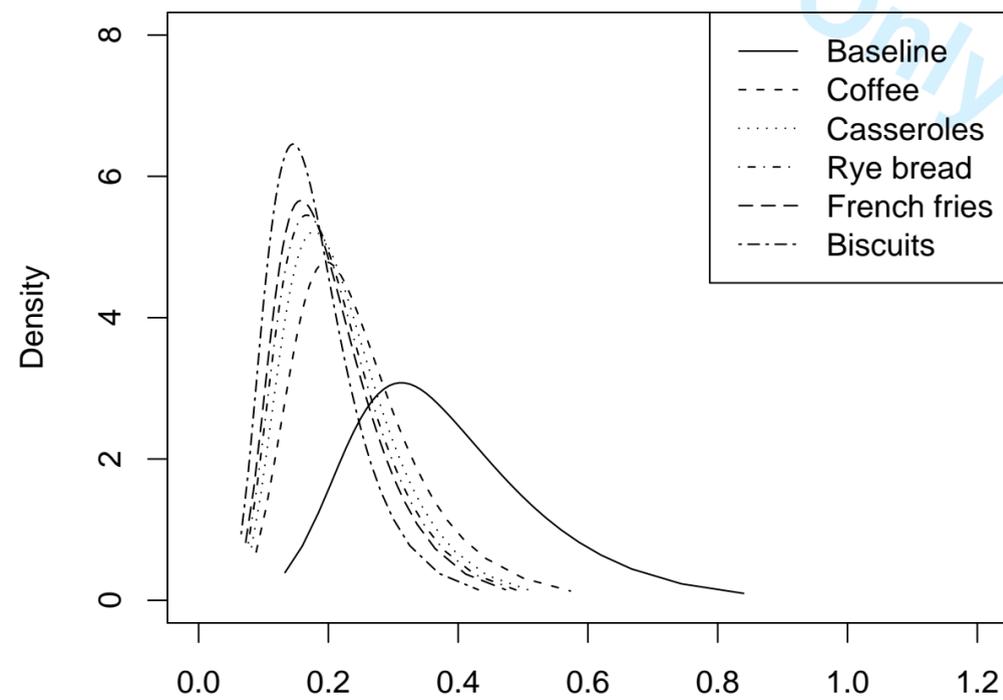
Men 65–74 years



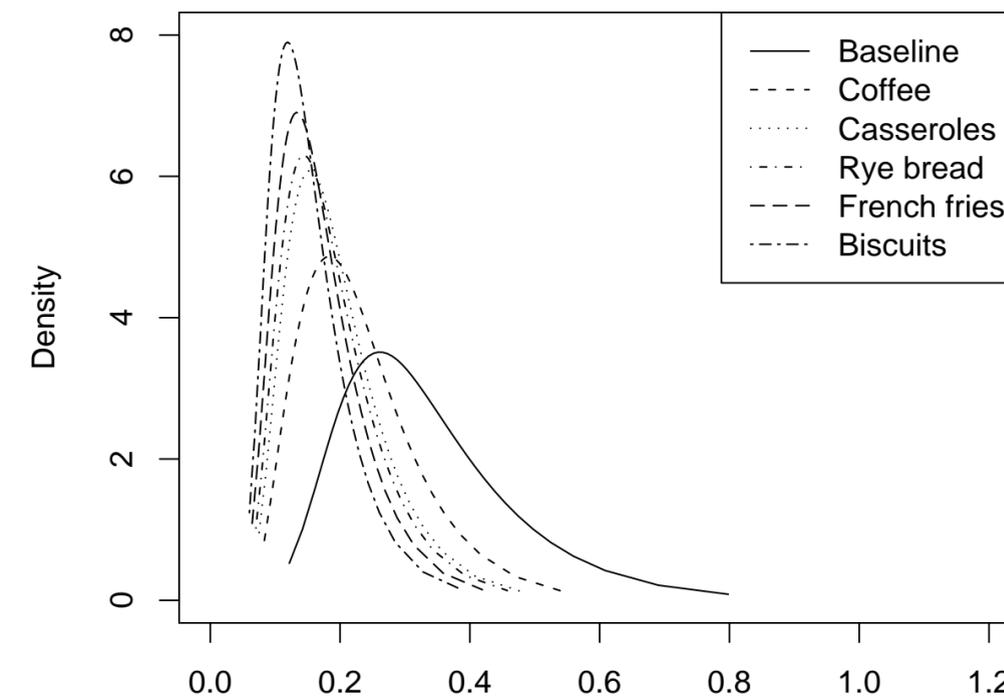
Women 25–44 years



Women 45–64 years



Women 65–74 years



### Children 1 years

### Children 3 years

### Children 6 years

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