Does home cooking have an effect on phthalate levels in food?

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Phthalates or diesters of ortho-phthalic acid are among the world's most used groups of plasticisers and some of them (e.g. di(2-ethylhexyl) phthalate (DEHP)) are suspected to cause detrimental effects to human health (Latini et al., 2004). Food products can be contaminated with these chemical substances due to the environment – i.e. transfer via soil, water or air – or as a result of migration from phthalate containing contact materials used during cultivation, transport, production, storage as well as during cooking at home (Bradley et al., 2007; Cao, 2010). Because foodstuffs like potatoes and meat are mainly eaten as cooked dishes (i.e. after some kind of heat treatment), it is interesting to know whether cooking food at home influences present phthalate levels in a positive or rather in a negative way.

For this purpose, 15 foodstuffs regularly eaten by the Belgian population were purchased from various Belgian shops. Food samples included starchy products (potatoes, rice and pasta), vegetables (carrot, cauliflower, onion and paprika) and meat and fish (minced meat, pork chop and salmon). Concerning starchy products, several cultivars, varieties and/or packaging types of a certain food item were bought. The considered heat treatments in this study were: boiling, steaming, frying (with margarine in a frying pan and without margarine in a non-stick frying pan), deep-frying and grilling (with and without the use of aluminium foil). Before as well as after cooking, the levels of eight phthalates – i.e. dimethyl phthalate (DMP), diethyl phthalate (DEP), diisobutyl phthalate (DiBP), di-n-butyl phthalate (DnBP), benzylbutyl phthalate (BBP), di(2-ethylhexyl) phthalate (DEHP), dicyclohexyl phthalate (DCHP) and di-n-octyl phthalate (DnOP) – were analysed in the food samples by means of gas chromatography-mass spectrometry (Fierens et al., 2012).

In general, phthalates like DMP, DnBP, DCHP and DnOP were rarely present in the investigated foods. On contrary, DEHP was determined in all raw samples, but after processing, this phthalate could only be detected in 65.4 % of the samples. Boiling food products, especially starchy products, decreased the contents of almost every investigated phthalate. The same trend could more or less also be observed for steaming and deep-frying. Foodstuffs fried in a non-stick frying pan without margarine contained more DiBP and DEHP compared to products that were fried in a frying pan with margarine. Grilling salmon increased the level of DEHP, especially when the fish was wrapped in aluminium foil. During each of the investigated cooking methods, it seemed that several factors influenced changes in phthalate concentrations. For instance, some foodstuffs took up water during cooking whereas other products lost water, which ultimately ended in a dilution or concentration, respectively, of the present phthalates. Phthalate levels could also decrease because phthalates degraded or evaporated during cooking or – due to their lipophilic character – were removed together with the fat phase of a food product. In contrast to the latter, the use of phthalate containing cooking media (frying oil, non-stick cookware products, etc.) can be a reason why phthalate levels increased during processing.

Besides the influence of processing, differences in phthalate contents were noticed between cultivars, varieties and/or packaging materials of a certain foodstuff in this study. For instance, a 'chips' potato cultivar contained five times more DEHP than a 'waxy' cultivar. Wholemeal pasta was less contaminated with DiBP, DnBP and DEHP than white pasta, although both varieties were packed in cardboard and were produced by the same company. Furthermore, contents of DiBP, DnBP, BBP and DEHP were higher in loose rice than in boil-in-bag rice, both from the same brand. Considering packaging types, food packed in cardboard contained in general more DiBP, DnBP, BBP and DEHP than food packed in plastic.

In conclusion, in this study, the occurrence of eight phthalates was investigated in starchy products, vegetables and meat and fish after treatment with different preparation methods. Overall phthalate concentrations generally declined after processing. Phthalate levels seemed not only to depend on the cooking procedure that was used, but also on the packaging material, in which the food was stored or on the cultivar or variety of a food item purchased. All this needs to be taken into account in order to correctly assess human's dietary exposure to phthalates.

More information about this study can be found in the following publication:

Fierens, T., Vanermen, G., Van Holderbeke, M., De Henauw, S., Sioen, I., 2012. Effect of cooking at home on the levels of eight phthalates in foods. Food Chem. Toxicol. 50, 4428-4435.

References

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Cao, X.L., 2010. Phthalate esters in foods: Sources, occurrence, and analytical methods. Compr. Rev. Food. Sci. Food Saf. 9, 21-43.

Fierens, T., Servaes, K., Van Holderbeke, M., Geerts, L., De Henauw, S., Sioen, I., Vanermen, G., 2012. Analysis of phthalates in food products and packaging materials sold on the Belgian market. Food Chem. Toxicol. 50, 2575-2583.

Latini, G., Verrotti, A., De Felice, C., 2004. Di-2-ethylhexyl phthalate and endocrine disruption: A review. Curr. Drug Targets: Immune Endocr. Metabol. Disord. 4, 37-40.