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Dietary exposure assessment to chemical migrants from food contact coatings of metal cans in the Spanish adult population

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Introduction

The food contact surface of metal cans is usually covered by polymeric coatings acting as barrier between food and metal surface. Reaction products, residual monomers, etc. may remain in the final product and have the potential to migrate into the foods (1,2). Migrating substances may affect the safety of the packed food, consequently packaging materials are subjected to risk evaluations. Realistic approaches to estimate the exposure, as a key step in the risk assessment process, are required.

Aim(s): This study aimed to estimate, from the results found in several foods packaged in coated cans, the dietary exposure to chemicals migrated, combining the concentration of the migrant in the food with the food consumption data obtained from the Spanish dietary survey ENALIA 2 (3).

Materials & methods

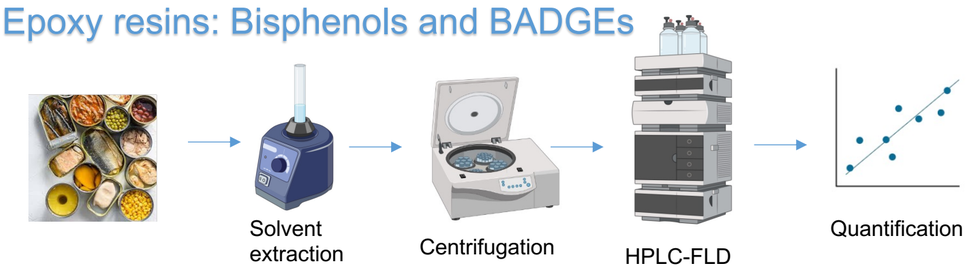
Table 1.- Food and coating samples description

Food sample	pH	Metal can coating
Tuna (olive oil) (BN)	6,4	Epoxy
Squid (sunflower oil) (CH)	6,5	Epoxy
Sardine (olive oil) (SCO)	6,4	Epoxy
Mussels (pickle) (ME)	4,4	Epoxy

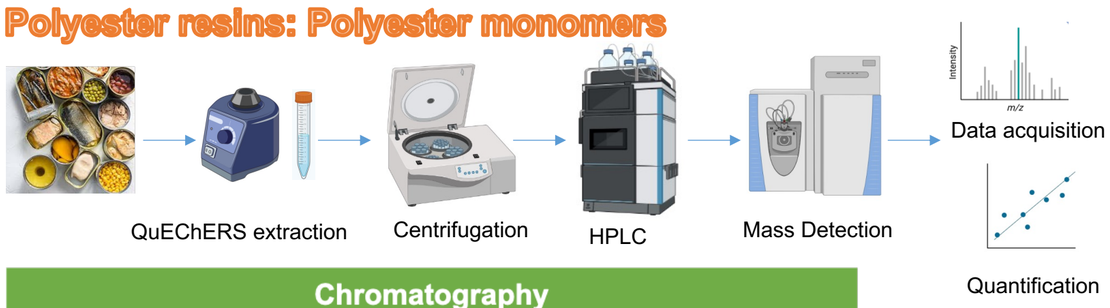
Food sample	pH	Metal can coating
Lentils with vegetables (LEV)	5,2	Polyester
Lentils (LE)	5,6	Polyester
Green peas (GUIB)	6,1	Polyester
Sardines (SCA)	6,4	Polyester

Food analysis

Epoxy resins: Bisphenols and BADGEs



Polyester resins: Polyester monomers

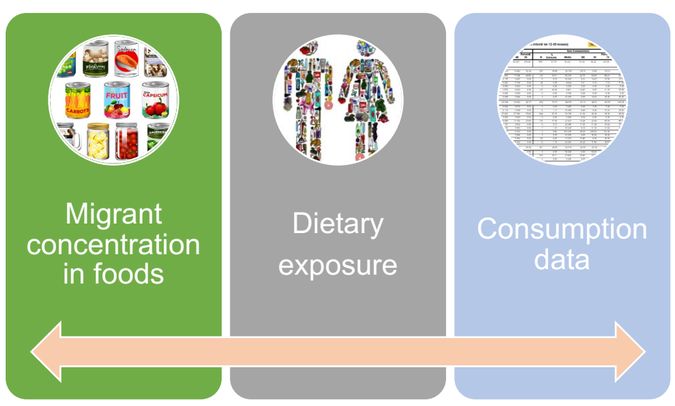


Chromatography

Epoxy
Column:Phenosphere ODS(2) (150 x 4.6 mm, 3µm)
Mobile Phase: gradient of ACN and water

Polyester
Column:Gemini C18 (150 x 3 mm, 5µm)
Mobile Phase: gradient of ACN and water acidified with 0,1% formic acid

Exposure assessment



Results

- Epoxy resins: Bisphenols and BADGEs

Table 2.- Estimated dietary exposure to Bisphenols and BADGEs, migrated from can coatings (µg/kg bw per day).

Migrants (Dietary exposure µg/kg$_{bw}$ per day)	Samples BN	CH	SCO	ME
BADGE.2H$_2$O	0.333	0.151	0.492	0.0395
BPA	0.0256	0.0547	0.0378	0.00219
BADGE.H$_2$O.HCl	0.0205	0.00684	0.0567	0.00219
CyclodiBADGE	0.210	0.410	0.416	0.0482

BPA: Bisphenol A; BADGE: Bisphenol A diglycidyl ether

- BPA, BADGE.H$_2$O, BADGE.H$_2$O.HCl and CyclodiBADGE were identified in the food samples analyzed.
- Low exposure to BPA (0.00219-0.0547 µg/kg bw/day) was found, in all cases below the temporary tolerable daily intake (t-TDI) of 4 µg/kg bw per day.
- The highest values were found for CyclodiBADGE, dietary exposure varies from 0.0482 µg/kg bw/day to 0.41 µg/kg bw/day.
- The estimated exposure to BADGE and its hydrolysis products did not exceed in any case the TDI (0.15 mg/kg bw).

- Polyester resins: Polyester monomers

Table 3.- Estimated dietary exposure to polyester monomers, migrated from can coatings (µg/kg bw per day).

Migrants (Dietary exposure µg/kg$_{bw}$ per day)	Samples LEV	LE	GUIB	SCA
AA	0.00362	0.00906	0.181	0.00189
TMA	0.0254	0.00362	0.00362	0.00189
TPA	0.0327	0.0851	0.0453	0.00189
IPA	0.00362	0.00362	0.00906	0.00189

AA: Adipic acid, TMA: Trimellitic acid; TPA: Terephthalic acid; ISA: Isophthalic acid

- Low exposure to carboxylic acids were observed in the studied population.
- AA and TPA were the ones with the highest values, 0.00189-0.181 µg/kg bw per day and 0.00189-0.0851 µg/kg bw per day, respectively.

Conclusions

In general, our results suggested a low dietary exposure to the migrants evaluated in the analysed samples, however, combined exposure to several chemicals should be considered in future studies.

Bibliography

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Ackwnoledgements

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