

ORGANOCHLORINATED COMPOUNDS IN BRAZIL – UHT MILK SAMPLES PURCHASED FROM RIO DE JANEIRO CITY SUPERMARKETS

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Introduction

Contamination due to legacy persistent organic pollutants like the organochlorinated pesticides on food is a serious threat for human and for the environmental health, given their high toxicity, bioaccumulation and persistence. In the present work, pasteurized cow milk is used to study the persistence of these chemicals in the environment. Because of the milk's importance and its role on dairy products that are commonly given to our children, we focused in pasteurized milk (UHT - ultra high temperature) commercialized at supermarkets Rio de Janeiro, Brazil. According to FAO, world milk production has increased by more than 50% in the last three decades, from 500 million tons in 1983 to 769 million tons in 2013. Currently, Brazil is the fifth largest milk producer in the world¹

Milk is one of the main agribusiness products in Brazil. According to the IBGE (Brazilian Institute for Geography and Statistics), in 2020 Brazil produced 34 billion tonnes of milk, generating an income of US\$ 17 bi, an amount that corresponded to 76% of the value generated by livestock. Dairy farming is present in the vast majority of Brazilian municipalities. In 2010, of the 5,564 municipalities in the country and only 67 did not registered milk production^{2,3}

Milk production in Brazil grew gradually until 2014, when it reached its peak of production. According to the Municipal Livestock Survey (PPM) in 1974, Brazil produced 7.1 billion liters and in 2014 produced 35.12 billion liters of milk. In 40 years, Brazil quintupled its milk production^{4,5}. For many years, the southeastern region was the main producer in the country. However, over the years, other regions increased their participation, and in 2014, the southern region became the top of the ranking^{6,7}. Consequently, in Rio de Janeiro city you can buy milk produced all over the country.

Materials and methods

Three batches of eight different UHT milk brands were tested, all available in supermarkets/markets in the city of Rio de Janeiro, totaling 32 different milk samples (n=32). The milks were purchased between the period of January 2016 and April 2017, with their manufacturing dates between 12/31/2015 and 03/21/2017. All milks had a federal inspection seal (SIF).

Twenty-four markets in different neighborhoods of the city were visited and all available UHT whole milk brands registered. 29 different brands of milk were counted. The selected brands were those that were found in the largest number of markets, being, therefore, more available to the population. Seven brands were selected, and from each brand selected, three lots were analyzed (e.g. three different UHT1 liter paper boxes).

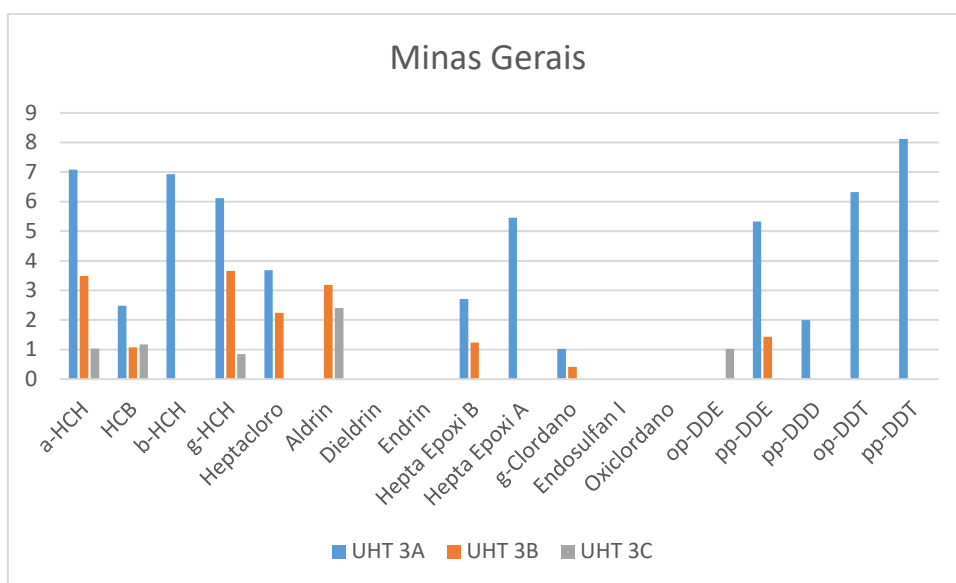
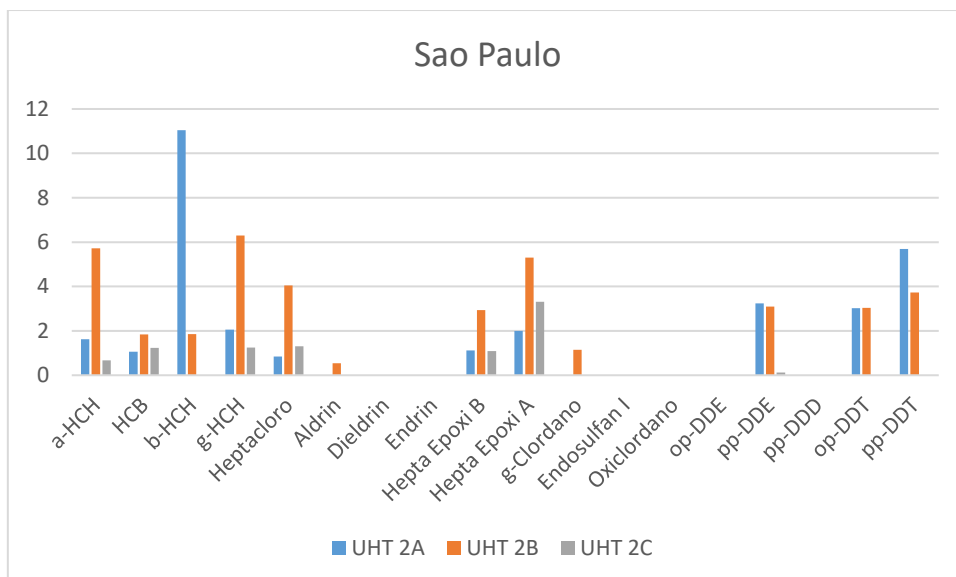
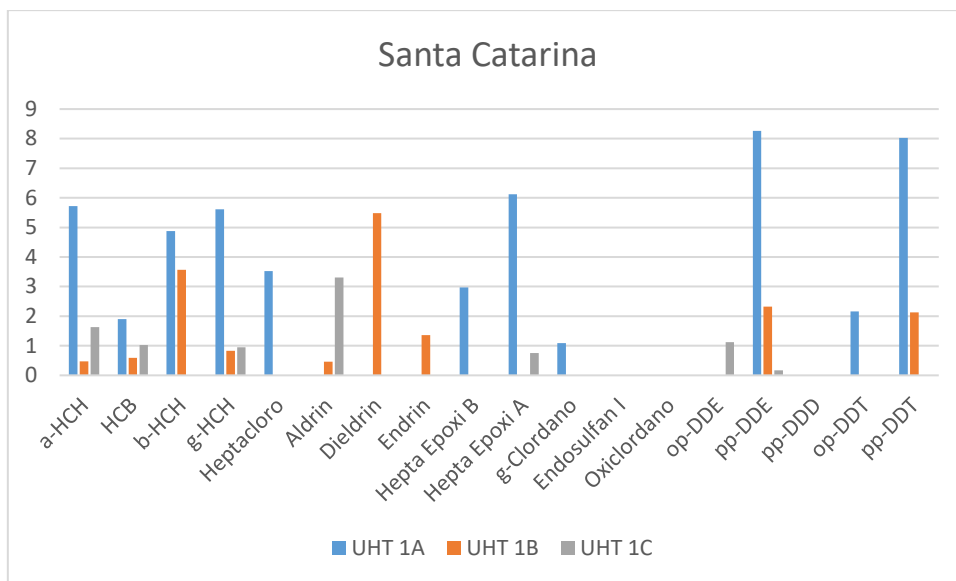
Among the brands chosen, there were five producing states: Santa Catarina (one brand), São Paulo (one brand), Minas Gerais (two brands), Rio de Janeiro (two brands) and Rio Grande do Sul (one brand).

All the milk box content (1-L samples) were freeze-dried before extraction using pesticide grade non-polar solvents (n-hexane, isooctane) in all glass continuous Soxhlet apparatus for a minimum of four hours. The clean-up of the extracts was done by passing them through acidic silica gel in open glass columns. After the addition of the internal standard TCMX, one microliter of the extracts was injected in split less mode into a 30 m DB-1 capillary GC-⁶³Ni ECD from Shimadzu (GC 14B, Japan). Hits were confirmed by a second injection on a GC-MSq from Agilent running in EI-SIM mode. All of the values are expressed in a dry weight basis.

Different DDT and HCH isomers as well as CHLs and endosulfan were analyzed.

Results and discussion

We could find several organochlorine compounds in all of the analyzed samples (Figure 1). Most of these residues can be related to the intense past use of such compounds in agriculture and urban/industrial sites throughout the whole country, and in particular at the south and southeastern regions where are located the factories where the milk is processed.



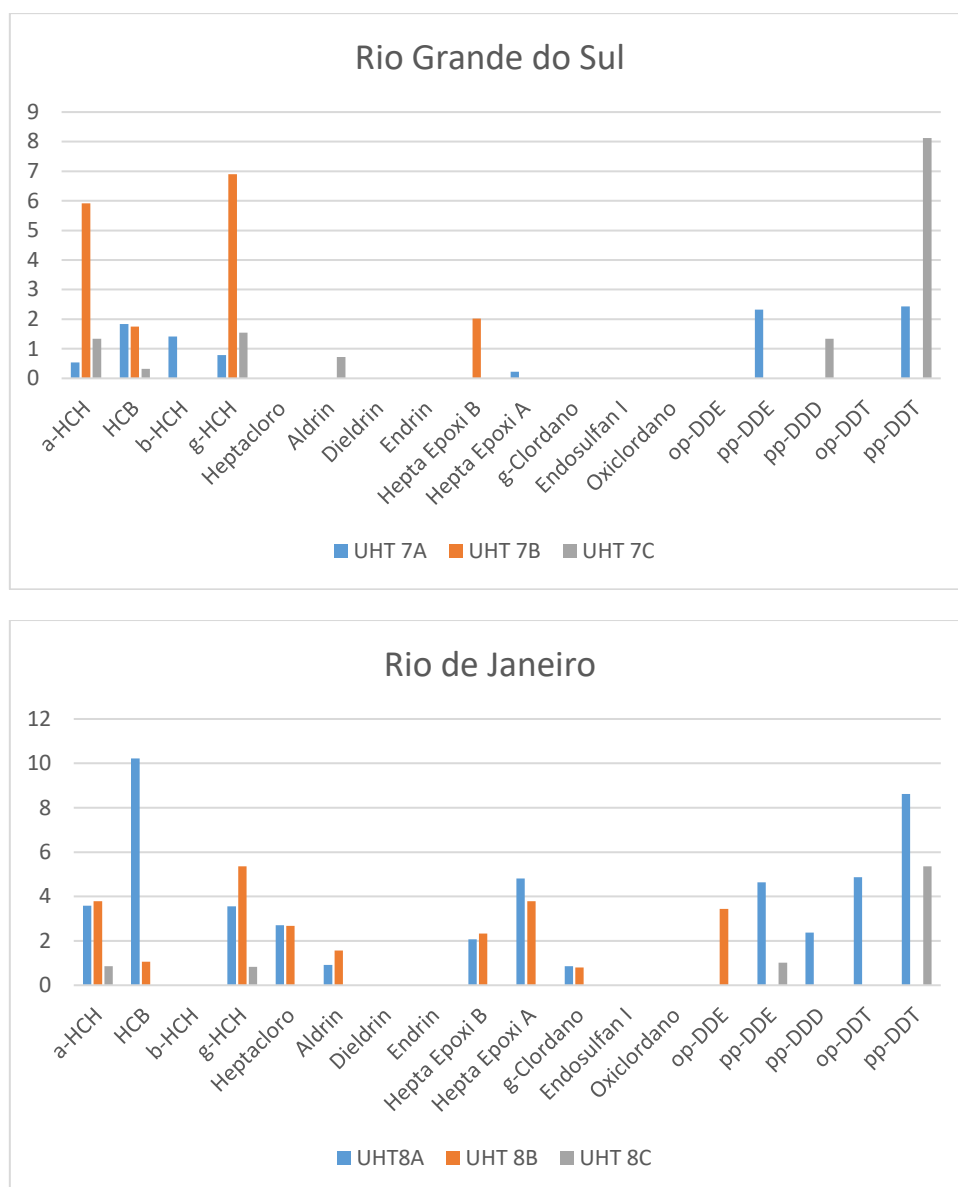


Figure 1- Levels of OCPs in Milk from Brazil values expressed in $\mu\text{g.kg}^{-1}$. UHT means polled sample code.

Conclusion

More than 50 years after the first restrictions of organochlorinated pesticides trace levels can still be found in our food supply.

In the past, Brazilian legislation used limits of $4 \mu\text{g/kg}$ for α -HCH, $10 \mu\text{g/kg}$ for γ -HCH, $6 \mu\text{g/kg}$ for aldrin, $6 \mu\text{g/kg}$ for dieldrin, $2 \mu\text{g/kg}$ for endrin, $4 \mu\text{g/kg}$ for heptachlor, $2 \mu\text{g/kg}$ for chlordane, $10 \mu\text{g/kg}$ for metoxychlor, $40 \mu\text{g/kg}$ for DDT and metabolites in milk.

Since 2009, all production and uses of DDT is forbidden in Brazil⁸

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