

Changing Dietary Trends and Pesticide Residues: An Investigation of Previously Neglected Edible Plant Parts

Anne Benkenstein, Leonie Moser, Kathi Hacker, Ellen Scherbaum

E-Mail: anne.benkenstein@cvas.bwl.de



#zerowaste trend

The #zerowaste trend, which involves using all edible parts of plants in the kitchen (e.g., radish leaves, carrot leaves, and banana peels), is giving previously neglected parts of plants new regulatory relevance. As part of the leaf-to-root movement, social media platforms are presenting a wide variety of recipes that promote for example pesto made from carrot leaves or smoothies made from banana peels as particularly healthy.

Regulatory Aspects

There are different legal situations for the matrices mentioned with regard to the availability of maximum residue levels (MRLs) in accordance with Regulation (EC) No. 396/2005: For bananas, the MRLs apply to the entire fruit with peel; for radish leaves, the MRLs for arugula can be applied since January 2025; and for carrot leaves, there are no MRLs set.

Results

All samples were analyzed for over 800 active substances, metabolites and contaminants by QuEChERS and QuPPE methods. All samples were official samples taken from the German market. All findings above their specific levels of quantitation are included in this evaluation.

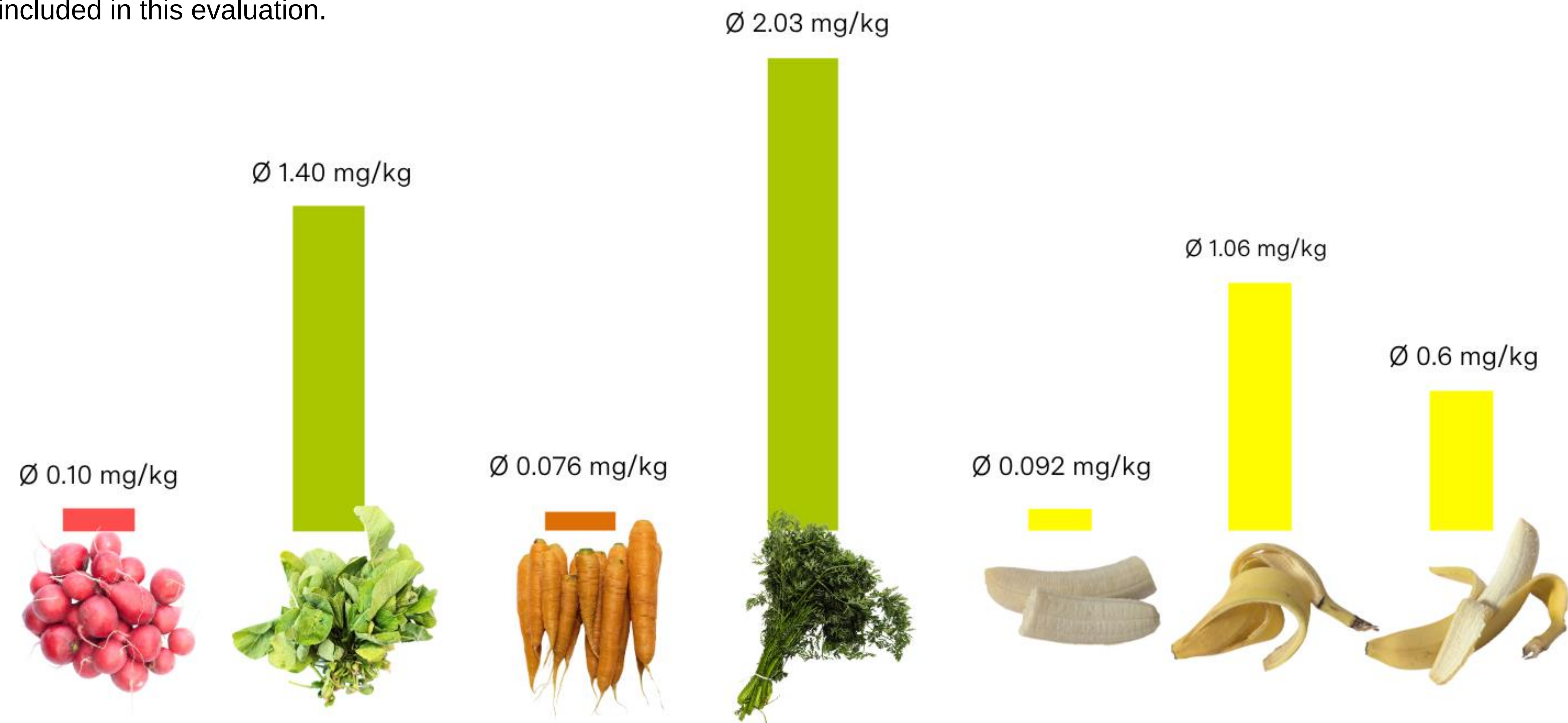


Illustration 1: Average residue levels of roots and leaves or fruit and peel in comparison

The detected residue levels in the radish leaves are about 14-times higher than the levels observed in the roots. The situation for the carrots is even more distinct, the residue levels in the leaves are over 25-times higher than those detected in the carrots. Possible reasons for the significantly higher residue levels that were present in the leaves are the higher surface of the leaves compared to the roots and the

leaves being above the soil and therefore more exposed to the applied pesticides than the roots.

For the bananas the observed residue levels in the peel was around 11-times higher than the levels detected in the fruit flesh.

The number of detected substances was also higher in the usually not eaten plant parts (leaves and peel, see table 1).

Table 1: Residues in comparison

		No. Samples	Substances per Sample	No. of substances above MRL
Radish	Roots	25	3.6	1*
	Leaves		7.7	0
Carrot	Roots	14	5.9	1**
	Leaves		13.6	13 (9 samples)***
Banana	Fruit flesh	11	3.8	-
	Peel		6.9	-
	Whole fruit with peel		6.6	0

*Chlormequat amount over MRL, but unverified considering measurement uncertainty

**Dimethomorph amount over MRL, but unverified considering measurement uncertainty

***no MRLs for carrot leaves are available, MRLs for arugula were used as comparison

Table 2: Frequently detected active substances

Active substance	Radish		Carrot		Banana		
	Roots	Leaves	Roots	Leaves	Fruit flesh	Peel	Whole fruit with peel
Azoxystrobin	10 (40 %)	14 (56 %)	11 (79 %)	13 (93 %)	11 (100 %)	11 (100 %)	11 (100 %)
Fludioxonil	16 (64 %)	20 (80 %)	10 (71 %)	13 (93 %)	-	-	-
Pendimethalin	-	4 (16 %)	14 (100 %)	14 (100 %)	-	-	-
Thiabendazole	-	-	-	2 (14 %)	8 (73 %)	9 (82 %)	9 (82 %)

The fungicide azoxystrobin was frequently detected in all three matrices, however, it was found in all the banana samples and only in 40 % of the radishes. Fludioxonil was found frequently in carrots and radishes but not at all in the bananas, while thiabendazole was found mostly in the bananas. The herbicide pendimethalin was found in 100 % of the carrot samples.

Summary

Overall, it was found that the parts of the plant that are not normally consumed have significantly higher residue levels.

The results show that it is necessary to take changing consumption habits into account when planning and collecting samples and, where necessary, to adapt the legal basis for evaluation.

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Literatur

[1] Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC

[2] Internetarticle Radish: Radish Leaves in Smoothies and Salad – How Does the 2025 Season Look?

[3] Internetarticle Carrot: Pesticides in Carrots: a Comparative Analysis of Roots and Greens

[4] Internetarticle Banana: With or Without the Peel – It's All Bananas



Baden-Württemberg