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Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Edjabou, V. M. E., Pivnenko, K., Petersen, C., Scheutz, C., & Astrup, T. F. (2015). *Compositional data analysis of household food waste in Denmark*. Poster session presented at 6th International Workshop on Compositional Data Analysis, Spain.

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Compositional data analysis of household food waste in Denmark



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Background and objectives

Food waste is a growing public concern because the food waste production and distribution exert enormous pressure on scarce natural resources such as land, water and energy, and leads to serious environmental, social and economic impacts. Thus, the European Commission has aimed to reduce the total amount of discarded edible food waste to 50% by 2020.

Reliable data on the amount of food waste is essential to map the current food waste situation and to assess the performance against the food waste reduction targets. However, a better understanding of food waste data is a fundamental prerequisite in order to propose adapted and practical solutions of reducing food waste.

Although food waste composition datasets carry relative information, no attempt was made to analyse food waste composition as compositional data. Thus, practitioners continue to analyse food waste composition data by mean of classical statistics.

The overall aim of this study is to investigate the behaviour of Danish households related to food waste generation. This was achieved mainly by correlation test.

Methodology



The waste was collected at household level following the existing residual waste collection schedules. A total of 12 tonnes residual household waste (RHW) was collected from about 800 households and sorted manually into:

- Avoidable vegetable food waste (VeAvoid)
- Avoidable animal food waste (AnAvoid)
- Unavoidable food waste (UAvoid).

The waste was generated during two weeks.

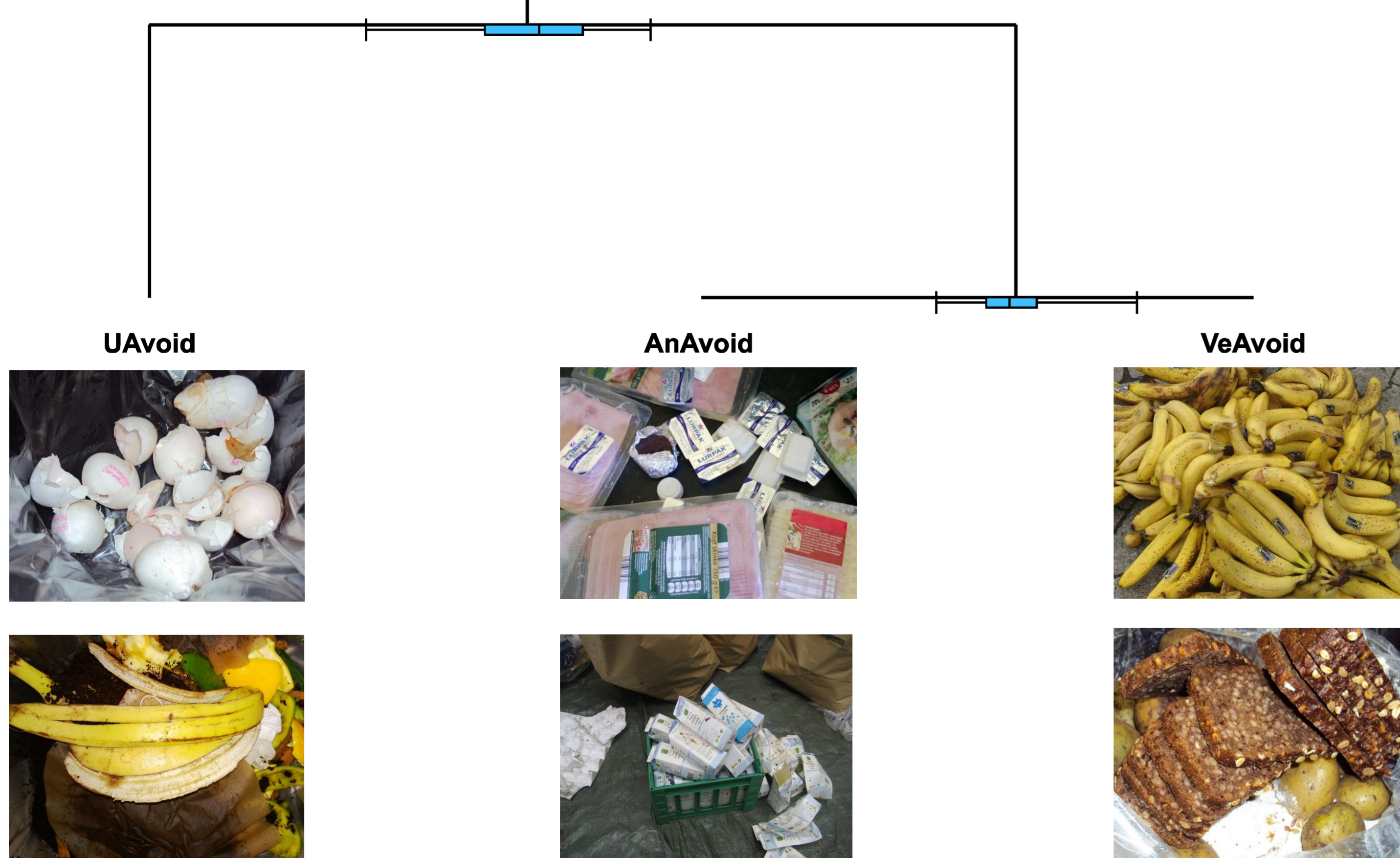


Figure 1: CoDa-dendrogram of food waste and illustration of waste sampling, sorting and pictures showing examples of food waste fractions

Acknowledgments

The authors wish to acknowledge the Danish Strategic Research Council for financing this study via the IRMAR (Integrated Resource Management & Recovery) project (nr. 11-116775).

Results

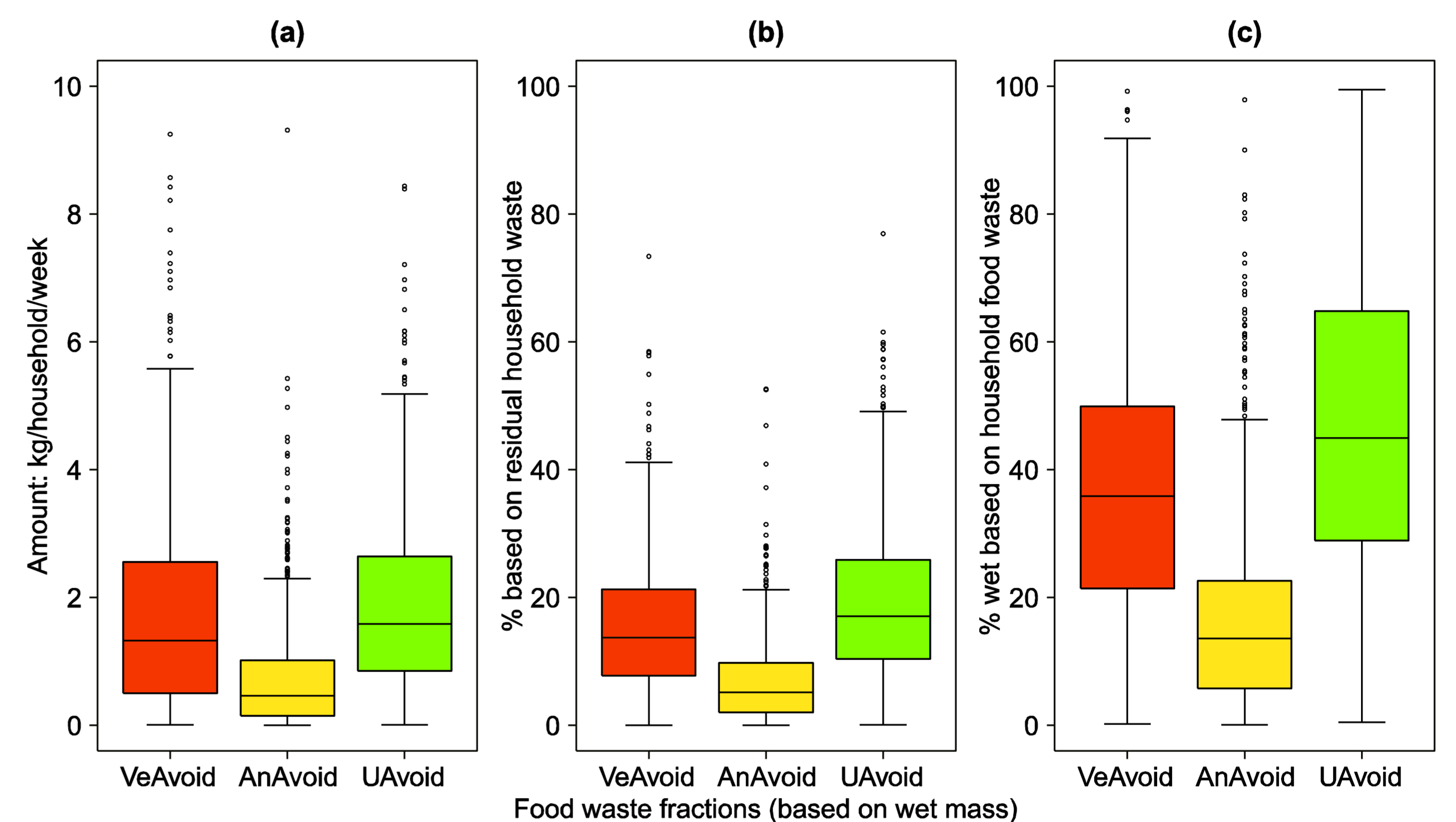


Figure 2: Distribution of the Danish household food waste based on: (a) the amount of food waste (kg per household per week); (b) percentage of food waste based on the total residual household waste; (c) percentage of food waste based on total food waste.

Table 1: Pearson correlation coefficients between food waste fractions (FW: Food waste, RHW: Residual household waste)

	AnAvoid	VeAvoid	UAvoid	Datasets
AnAvoid	-	0.46	0.17	Amount (a)
	-	-0.14	-0.53	RHW (b)
	-	0.09	-0.23	FW (c)
VeAvoid	-	-	0.25	Amount (a)
	-	-	-0.76	RHW (b)
	-	-	-0.22	FW (c)

Table 2: Percentage of total variance and variation array. Upper triangle shows pairwise log-ratio variances in percentage of total variance; Lower triangle shows pairwise log-ratio means (FW: Food waste, RHW: Residual household waste)

	AnAvoid	VeAvoid	UAvoid	% clr variances	Datasets
AnAvoid	-	2.95	3.73	1.25	Amount (a)
	-	2.95	3.73	1.25	RHW (b)
	-	2.95	3.73	1.25	FW (c)
VeAvoid	1.18	-	2.14	0.72	Amount (a)
	1.18	-	2.14	0.72	RHW (b)
	1.18	-	2.14	0.72	FW (c)
UAvoid	1.53	0.35	-	0.98	Amount (a)
	1.53	0.35	-	0.98	RHW (b)
	1.53	0.35	-	0.98	FW (c)
Means			Total variance	2.94	Amount (a)
				2.94	RHW (b)
				2.94	FW (c)

Conclusions

Log-ratio analysis is a powerful tool to assess consistently the correlation and variation between food waste fractions. It enables to discover the true relationship between food waste fractions regardless of the dataset used. However, the Pearson correlation test provides different results according to food waste datasets.

The permutation test of the variance of log-ratio showed a significant correlation between avoidable food waste and unavoidable food waste. These results suggest that a reduction of avoidable food waste may lead to a reduction of unavoidable food waste, and overall the residual household waste.

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