ELEMENTAL ANALYSIS OF MANGO FLESH AND PEEL BY INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

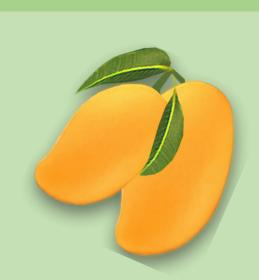


Michaela Zeiner¹, Ema Mihalić², Iva Juranović Cindrić², Ivan Nemet², Heidelore Fiedler¹

¹ Örebro University, School of Science and Technology, Man-Technology-Environment Research Centre,

Fakultetsgatan 1, 70182 Örebro, Sweden





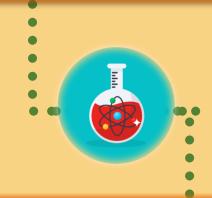
INTRODUCTION

Mango (Mangifera indica, L.) is a tropical fruit that can be consumed fresh or as dried fruit. Dried fruit is fruit from which water has been removed using various drying techniques. The nutrients in mango are concentrated, and the energy value is six times higher compared to fresh fruit.

It is rich in essential nutrients such as vitamins, minerals, and dietary fiber, as well as biologically active substances. Vitamins A and C contribute to the health of the metabolism, skin, and hair, while dietary fiber and antioxidants contribute to heart and digestive health. Minerals are extremely important for the normal functioning of the body since our body cannot create or expend them. Each has a specific function, and there are recommended daily allowances (RDA) for essential elements. [1]

In addition to essential elements, dried mango may also contain potentially toxic elements. Their presence in the fruit is relevant for assessing its nutritional value and to exclude harmful effects.

To determine the content of individual elements, the method of inductively coupled plasma mass spectrometry was used after acidic digestion.







MATERIALS AND METHODS

A total of six commercially available samples were analyzed – four dried mango samples, as well as two fresh ones, as flesh (mesocarp) and peel, which were subsequently dried. The samples underwent acidic microwave-assisted digestion using appropriate reagents or their mixture (Figure 1). To achieve optimal sample preparation conditions, the following reagents were used: concentrated HNO₃ (14 mol/L), diluted HNO₃ (7 mol/L), and H_2O_2 (30% w/w). Multi-element analysis was carried out using inductively coupled plasma mass spectrometry (ICP-MS), with the instrument used being the Agilent 7500cx ICP-MS.



Figure 1. Sample preparation for analysis.

DISCUSSION & CONCLUSION

The most abundant elements in all samples were macroelements: K, Ca, Mg and Na, while the microelements present in the highest mass fractions are Mn, Cu, Zn. Toxic elements were not found in amounts above the permissible levels that would pose a danger to human health according to WHO guidelines.

There is no significant difference in the mass percentages of elements among various commercially available samples of dried mango, while significant differences exist in elemental pattern in the mesocarp and peel. Removing the peel can thus reduce the intake of toxic elements such as Pb or Cd.

A small amount of dried mango, which can easily meet the recommended daily intake (RDA) of essential elements, and its high nutritional value make dried mango an excellent and healthy snack.

RESULTS

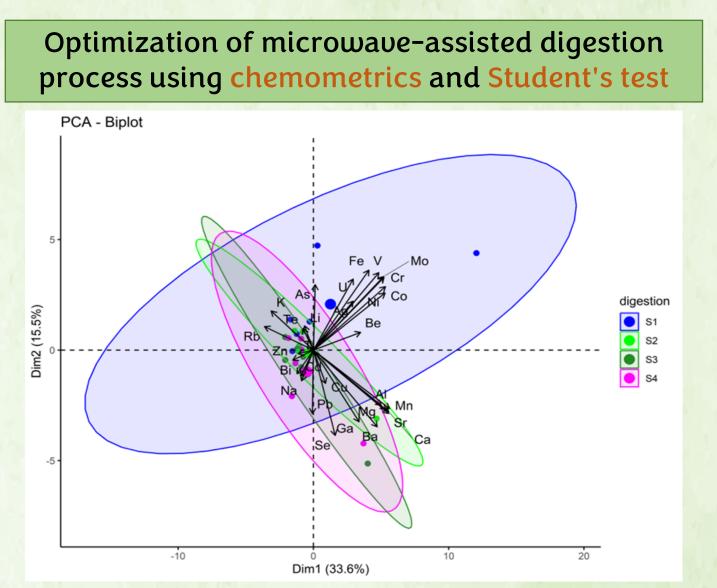


Figure 2. Results of PCA analysis

Series of digestions: S1 - 6 mL HNO₃ conc.

 $S1 - 6 \text{ mL HNO}_3 \text{ conc.}$ $S2 - 6 \text{ mL diluted HNO}_3$

 $S3 - 6 \text{ mL HNO}_3 \text{ conc.} + 3 \text{ mL H}_2\text{O}_2$

 $S4 - 6 \text{ mL diluted HNO}_3 + 3 \text{ mL H}_2^2 \text{O}_2$

Principal component analysis (PCA) - a multivariate statistical technique used for analyzing and simplifying complex datasets

There is a significant difference between digestion S1 and digestions S2, S3, S4, which do not differ significantly among themselves. This was determined using two statistical tools – multivariate data analysis and Student's t-test.

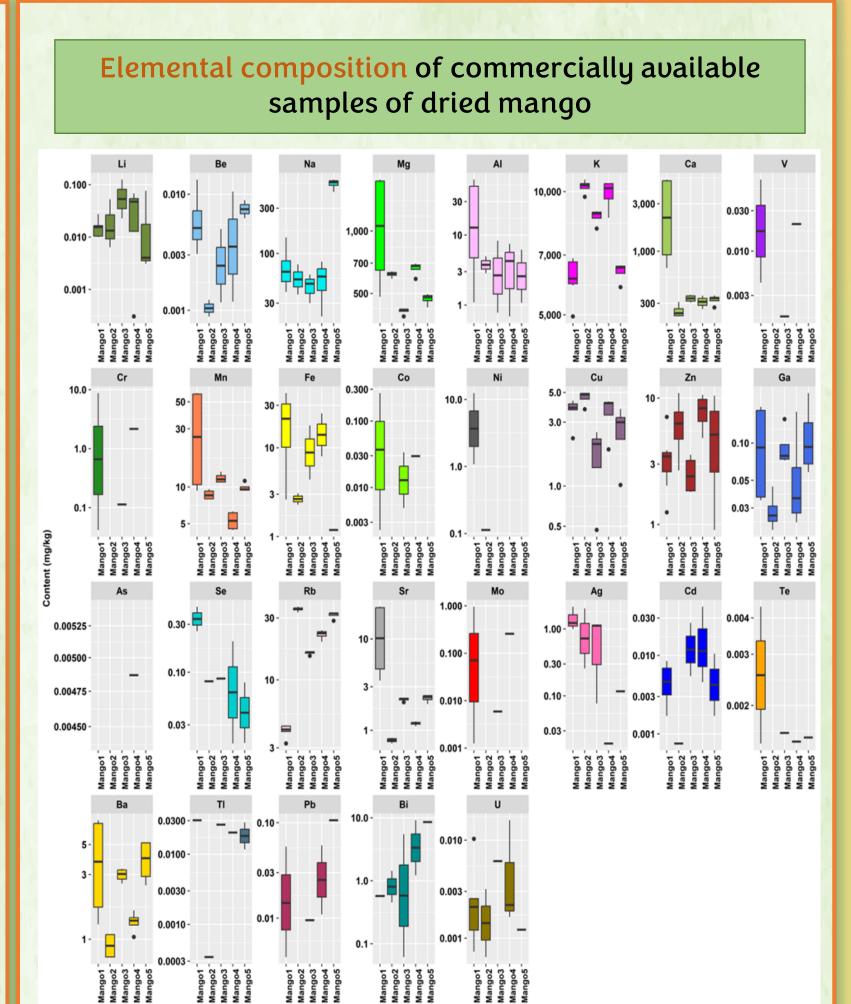


Figure 3. Total values of the content of individual elements in the analyzed samples of dried mango

Consumption of dried mango as an excellent way to intake essential elements

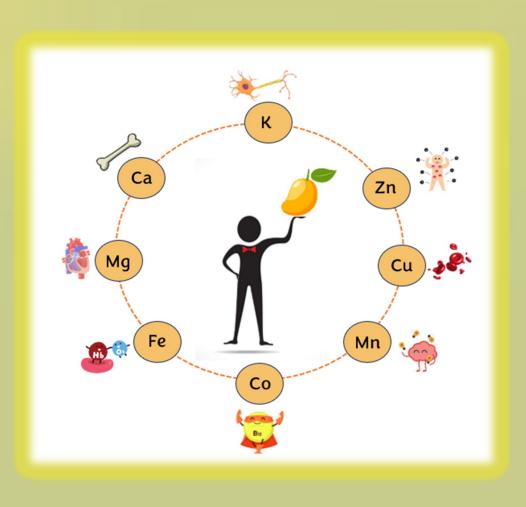
Table 1. Comparison of the quantity of essential elements present in the sample of dried mango with RDA/AI

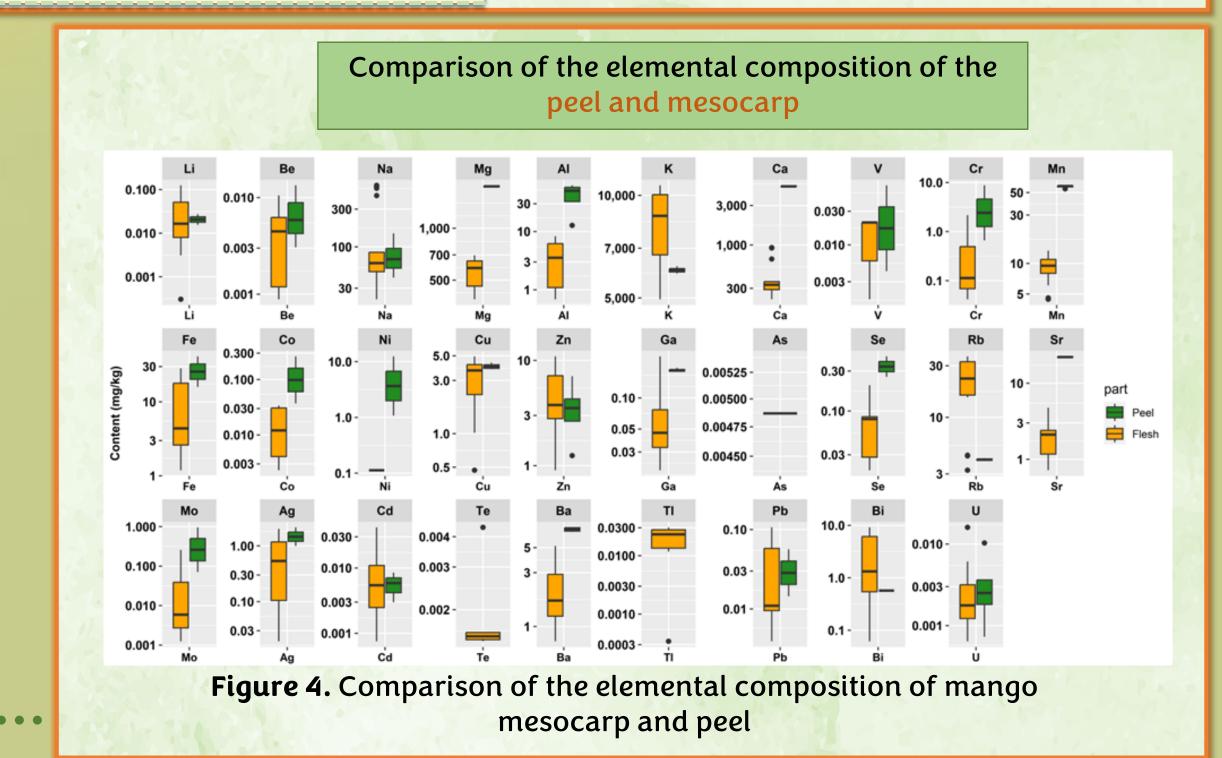
prosent in the sample of artea mange with heavy					
	Element	w / mg kg⁻¹	Mass/mg in 40 g of sample (one portion)	RDA or AI*/mg per day (men/women)	Element mass in 40 g of sample /RDA or Al
	Na	76.7	3.07	1200-1500*	0.20-0.26 %
	Mg	639	25.6	310-320/400-420	8.1%/6.2 %
	К	10699	428	4700/4700	9.1 %
	Ca	251	10.04	1000/1200	1.0 %/0.8 %
	Mn	8.01	0.32	2.3/1.8*	13.9 %/17.8 %
	Cu	4.73	0.19	0.9/0.9	21,1 %
	Zn	6.92	0.28	11/8	2.5 %/3.5 %

RDA - Recommended Dietary Allowance Al - Adequate intake

Table 1 displays the essential elements present in the sample of dried mango. The mass of each element in a 40 g sample of dried mango was calculated because this quantity corresponds to the recommended single serving size.

The results are compared with RDA/AI. [2] Finally, it is shown what percentage of the RDA/AI can be supplied by consuming one serving of dried mango.







LITERATURE: [1] Chang, S.Kiat, C. Alasalvar, F.Shahidi, *J. Funct. Foods* **21** (2016) 113-132.

[2] National Research Council(1989) Recommended Dietary Allowances: 10th Edition. Washington, DC: The National Academies Press. [3] WHO (1998) Quality control methods for medicinal plant materials, Geneva.



