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Trace Metal Evaluation in Mint Teas: Balancing Nutritional Benefits and Toxicological Risks

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Abstract: The study analyzed the mineral composition of mint teas (*Mentha* spp.) from the Romanian market using X-ray fluorescence spectroscopy. Results showed significant differences between samples, influenced by origin and processing. Sample CM1 had the best nutritional and safety profile, with optimal mineral levels and no toxic metals. Findings emphasize the role of mint teas as functional foods with real health benefits.

Introduction

In the current context of concerns about healthy and balanced nutrition, aromatic and medicinal plants, such as mint species (*Mentha* spp.), represent a valuable source of bioactive compounds and essential minerals, with multiple applications in the food and pharmaceutical industries. Mint teas, appreciated for their pleasant aroma and therapeutic properties, contain active compounds such as menthol, polyphenols and flavonoids, along with macro elements (Ca, K, Mg) and microelements (Fe, Cu, Mn, Zn), which contribute to maintaining the health of the body.



Material and method

The objective of this study was to evaluate the mineral composition of some mint tea varieties available on the Romanian market, using modern analytical methods. The water content was determined by the thermogravimetric method using a Sartorius thermobalance, and the mineral analysis was performed by X-ray fluorescence spectroscopy, using the Hitachi MET8000 equipment.



Results and discussions

The results revealed significant differences between the analyzed samples (CM1–CM5), determined by provenance, degree of processing and drying conditions. Sample CM4 was distinguished by a high content of essential minerals, but presented increased levels of cadmium, which affects its food safety. CM5 had the lowest content of nutrients, while CM1 demonstrated the best balance between nutritional value and safety for consumption, with optimal intake of calcium, iron and copper and without exceeding the limits for toxic metals (Hg, Pb, Cd, Tl).

By calculating the relative score of essential minerals and toxic metals, it was confirmed that CM1 presents the best integrated quality-food safety profile. The study highlights the importance of evaluating minerals in mint teas for identifying superior quality products and for developing innovative products with real nutritional and functional benefits.

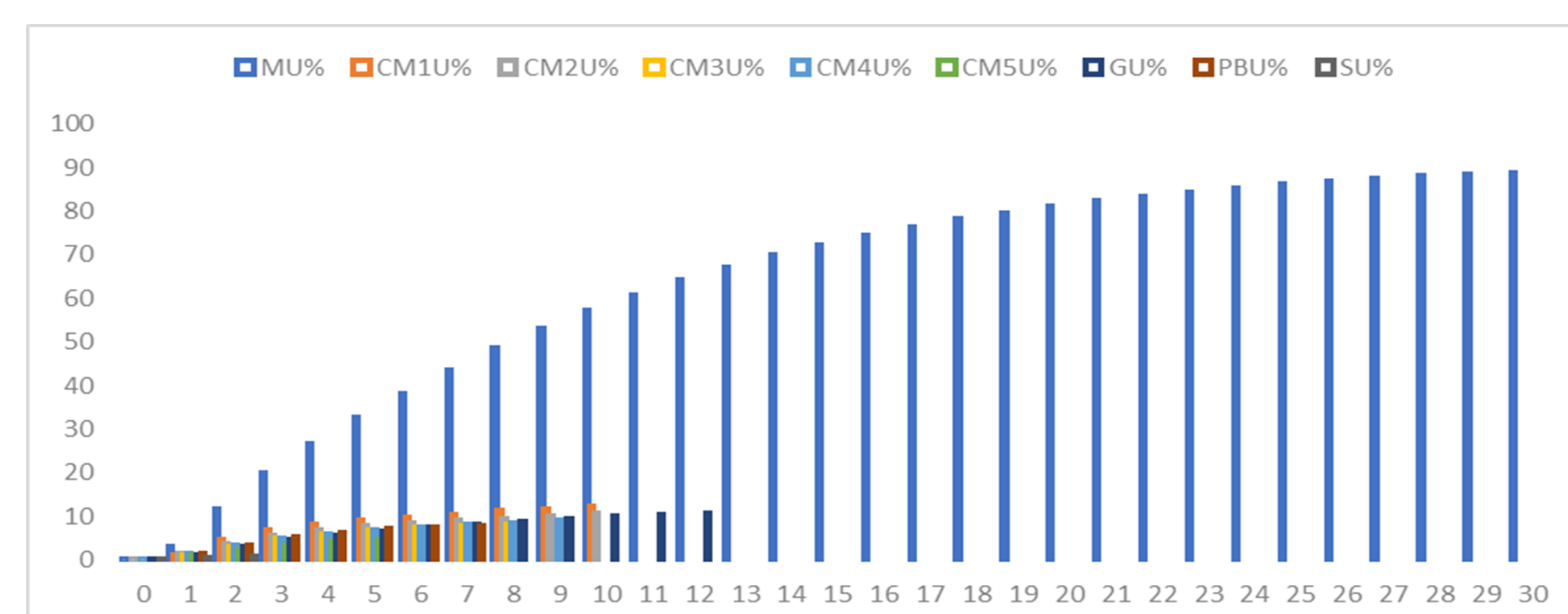


Figure 1. The dehydration curves of mint teas and fresh mint

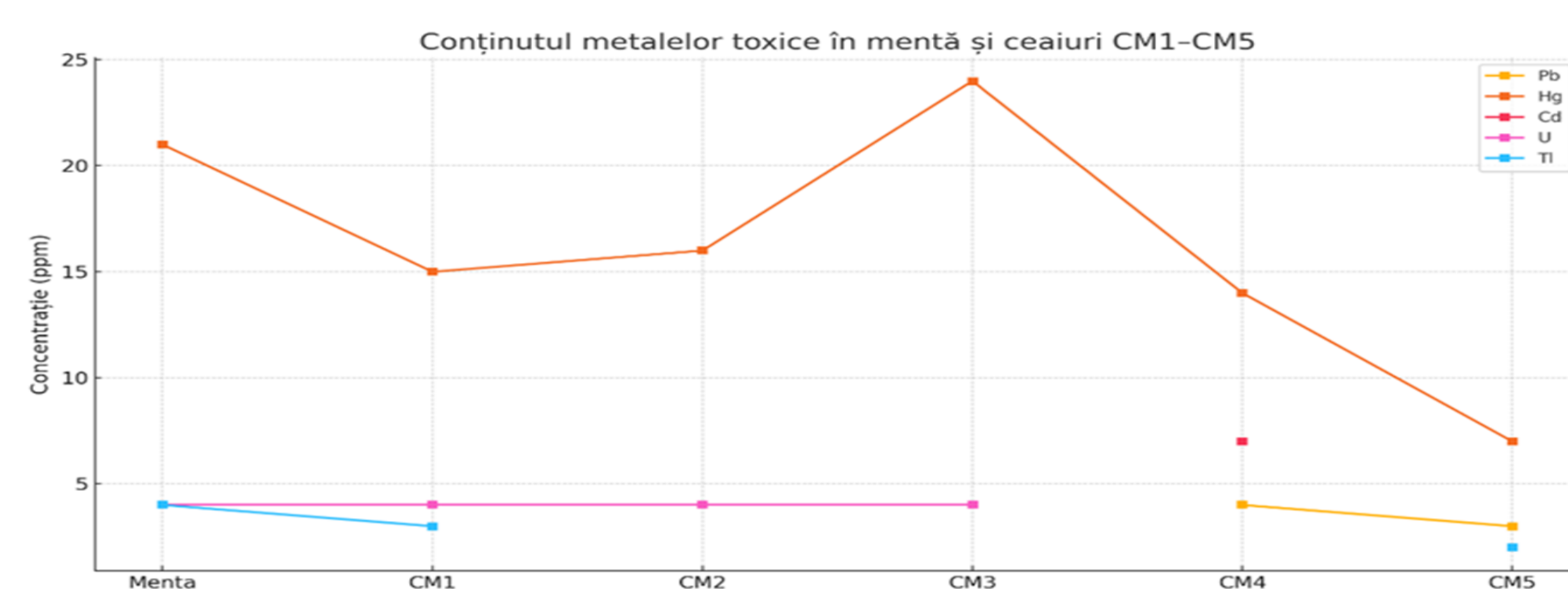


Figure 2. Graphical representation of the essential element contents in mint and mint teas

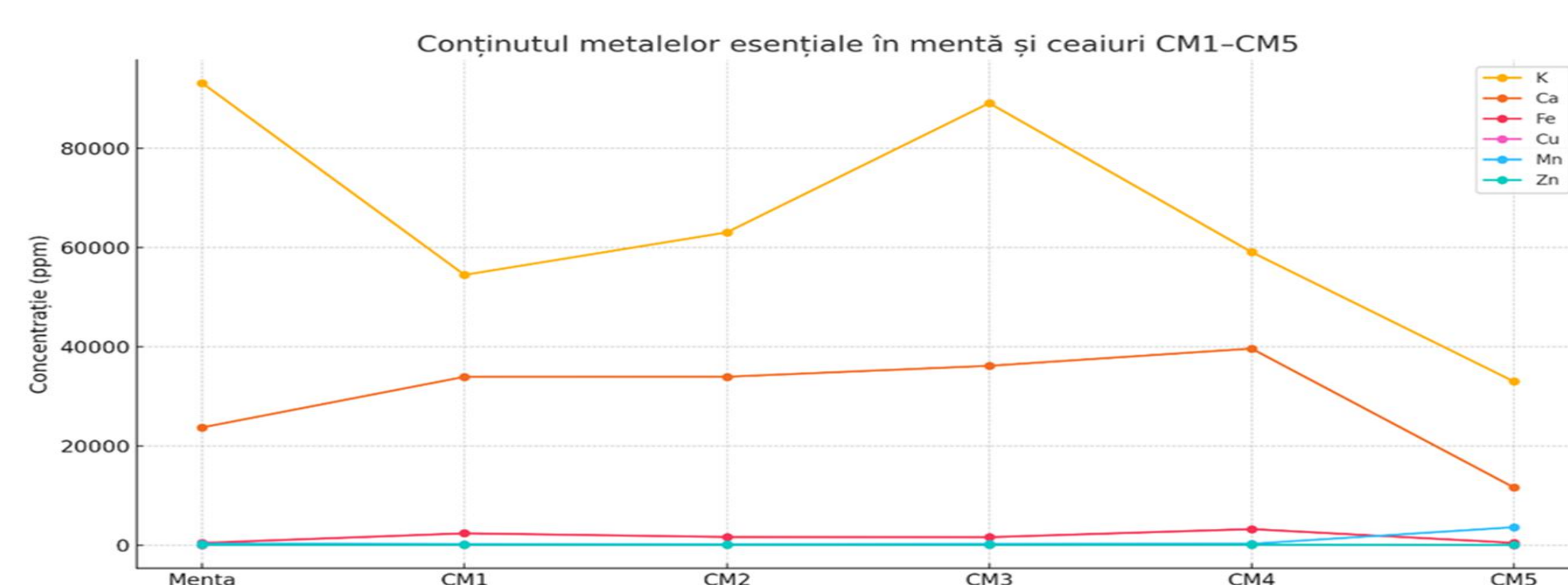


Figure 3. Graphical representation of the toxic element contents in mint and mint teas

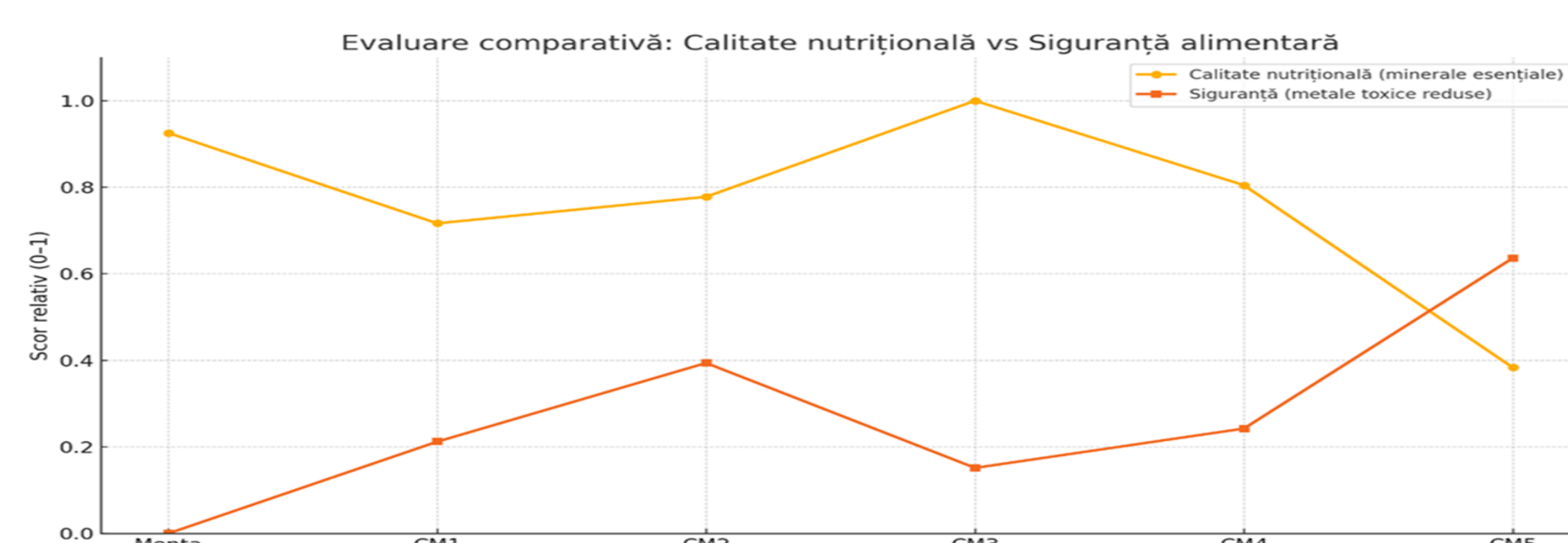


Figure 4. Comparison chart for toxicity versus essentiality

Conclusions

The general conclusions show that mint teas constitute an important natural source of minerals, and careful selection of species and technological control can contribute to optimizing nutritional value and promoting a healthy and sustainable diet. The results obtained support the valorization of mint not only as an aromatic ingredient, but also as a functional component in the development of innovative food products, which have beneficial potential for consumers' health.

KEYWORDS: Portable XRF, Elemental composition, Herbal infusions, Functional beverages, Food safety risk