

Quantitation of Minerals in Sports Drinks via ICP-AES and flame-AAS

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Structured Abstract

Background: Sports drinks are widely consumed due to their ability to replace fluids, carbohydrates and electrolytes that are lost during physical activities. However, while being beneficial for athletes, there are concerns regarding the inconsistency of mineral labelling, potential adulteration and adolescents' consumption of commercially available sports drinks. This study aims to quantify and compare the essential elements in various brands of sports drinks (Na, K, Mg and Ca) with their declared concentrations on labelling by using ICP-AES and FAAS.

Methods: Six commercial sports drinks were purchased locally. Standard solutions of Na and K (0.1–1.0 ppm. While Mg, and Ca (0.5–5.0 ppm) were prepared from 1000 ppm stock solutions. Each drink samples (2mL) was treated with 1% HNO₃ then marked up with deionized water. Na and K were analysed by ICP-AES, and Mg and Ca by FAAS using PerkinElmer instruments. All measurements were performed in triplicate.

Results: External standard calibration curve for all elements showed $R^2 > 0.91$, reflects the experimental data fit with the linear regression line. In all brands, Na and K are the most prominent elements in the sport drink compared with Mg and Ca. Concentration range for Na, K, Mg and Ca measured across brands are 99.2-800.3ppm, 159.7-2128.7ppm, 2.1-16.3ppm and 7.1-22.2ppm respectively. Compared to the declared elements on labelling for all six brands, all elements showed under-labelling. Elements in brands that shows acceptable under-labelling with percent bias $< \pm 20\%$ are Na in Gatorade, Gorilla and 100Plus, K in Gorilla and Ca in Pocari Sweat. All samples showed % RSD less than 6, indicate good repeatability in the measurements.

Conclusion: In conclusion, ICP-AES and FAAS can be precisely used to quantify Na, K, Mg and Ca in commercially available sports drinks brands using external calibration method. Na and K were present in significantly higher concentrations than Mg and Ca. All elements present in in each brands show higher concentrations that declared. This highlights importance of quality control in elements labelling especially when the sports drinks are being highly marketed to adolescents.

Keywords: Sports drinks, elements, ICP-AES, FAAS, adolescents

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