A Comparative Analysis of Nutritional Composition: Plant-Based Drinks vs. Cow's Milk

Reto Portmann[1], Barbara Walther[1], Dominik Guggisberg[1], Rene Badertscher[1], Lotti Egger[1], Sebastien Dubois[1], Max Haldimann[2], Katrin Kopf-Bolanz[3], Peter Rhyn[2], Otmar Zoller[2], Rosmarie Veraguth[4], Serge Rezzi[4]

[1] Agroscope, Bern, Switzerland; www.agroscope.ch ; [2] Risk Assessment Division, Federal Food Safety and Veterinary Office, Bern, Switzerland ; [3] School of Agricultural, Forestry and Food Sciences, Bern University of Applied Sciences, Zollikofen Switzerland ; [4] Swiss Nutrition and Health Foundation, Épalinges, Switzerland

Introduction

Plant-based diets are becoming increasingly popular, and with that, the demand for plant-based milk alternatives has also increased. Twenty-seven plant-based drinks from eight different plant sources, such as almond, cashew, coconut, hemp, oat, rice, soy and spelt, and two whole milk samples were analyzed for protein, carbohydrate, fat, vitamins, and mineral contents, as well as herbicide residue levels.

Minerals

The rice, oat, spelt, and coconut drinks were generally low in minerals, whereas the soy drinks provided significant amounts of all minerals except sodium, iodine, and chloride. Compared with milk, the plant-based drinks contained lower amounts of phosphorus, potassium, calcium, zinc, sulfur, iodine, and chloride. All drinks without fortification had significantly lower calcium levels than milk.

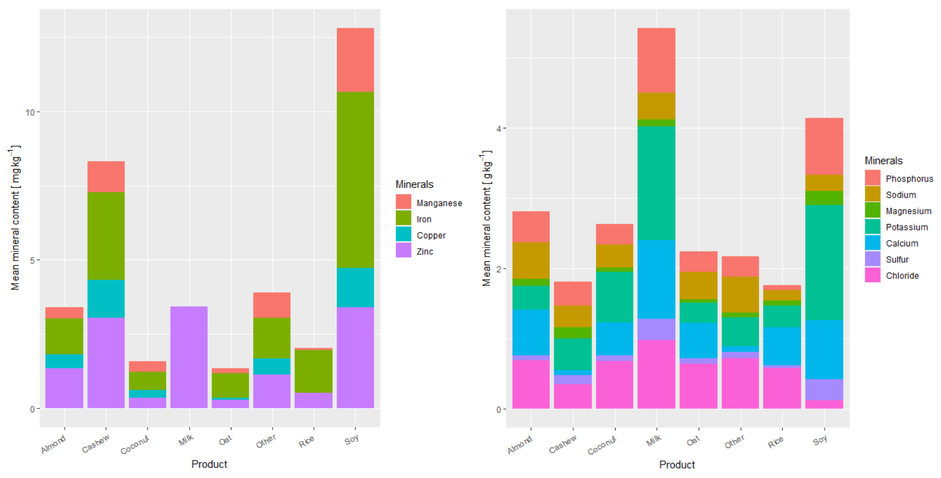

Figure 1. Mean values of minerals of the tested beverages.

Vitamins

Of the plant-based beverages, seven were fortified with various vitamins. Even with this fortification, the cashew, coconut, oat, and rice beverages were low compared to the other vegetable beverages, and vitamins C, A (carotenoids were not measured), and K2 could only be detected in the milk. Due to fortification with vitamin D in some beverages, they were significantly richer in this vitamin than milk and the non-fortified beverages. The addition of sunflower oil to the rice, oat, hemp and spelt drinks, resulted in higher vitamin E concentrations there.

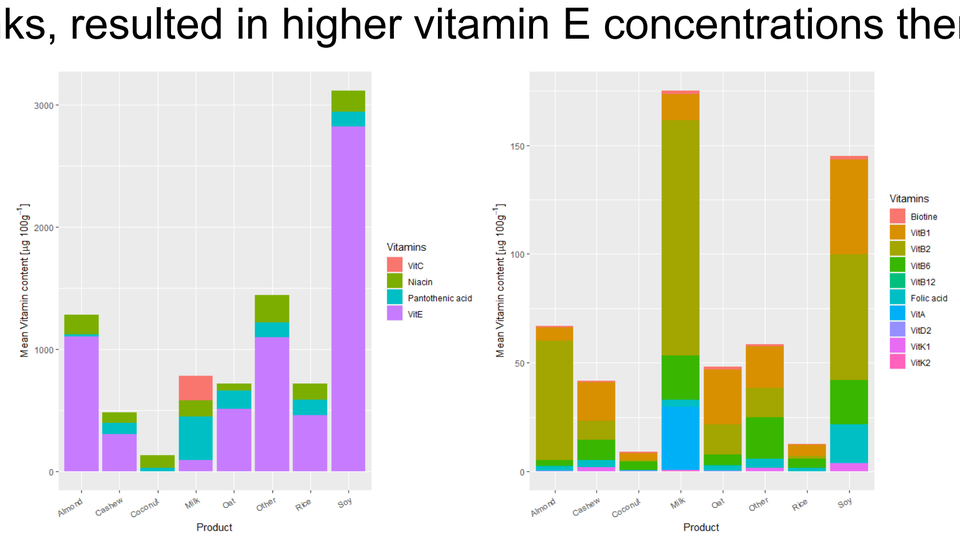

Figure 2. Overview of vitamins in plant-based drinks and cow’s milk

Protein and amino acids

The crude protein content of the plant-based beverages varied widely, from a minimum of 0.6 g/kg (rice beverage) to 43 g/kg (soy beverage), which is in the range of milk. The level of the individual amino acid were also very different, with the soy drinks being the most similar to milk.

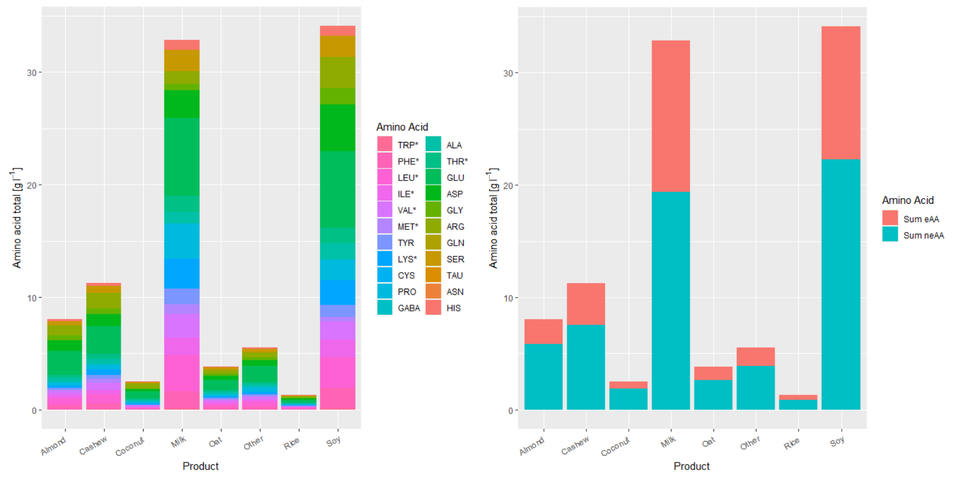

Figure 3. Amino acid profiles and their total values in essential and non-essential amino acids.

Digestible indispensable amino acid score (DIAAS)

Assuming that the proteins in the beverages were 100% digestible (but this remains to be tested), DIAAS (for children) values were calculated showing the excellent quality (>100%) of the milk protein, the good quality (>75%) of the soy beverage, and the low quality (<75%) of the remaining vegetable beverages.

Product		Reference Pattern					
		Infants (birth to 6 months)		Children (6 months to 3 years)		Older children, adolescents and adults	
	N	DIAAS (%)	1st Lim eAA	DIAAS (%)	1st Lim eAA	DIAAS (%)	1st Lim eAA
Almond Drink	4	27.1	Lys	32.9	Lys	39.0	Lys
Cashew Drink	2	51.2	Ile	66.4	Lys	78.8	Lys
Coconut Drink	3	39.1	TRP	62.8	Lys	71.9	Ile
Cow’s milk	2	65.4	TRP	123.5	SAA	145.0	SAA
Hemp Drink	1	38.4	Lys	46.5	Lys	55.2	Lys
Oat Drink	4	41.1	Lys	49.8	Lys	59.1	Lys
Rice Drink	5	30.0	Lys	36.3	Lys	43.1	Lys
Soy Drink	7	71.2	TRP	91.9	SAA	107.6	Val
Spelt Drink	1	28.5	Lys	34.5	Lys	41.0	Lys

Table 1. Calculated DIAAS values of the analyzed beverages

Summary

The beverages studied differed significantly in their nutrient composition. Only the soy-based beverages achieved similar protein levels to cow's milk, but had lower protein quality. In addition, milk is a significantly richer dietary source of micronutrients such as calcium, iodine, vitamin B2, pantothenic acid and biotin than plant-based beverages, which, in contrast, provide higher amounts of vitamin E and manganese, depending on the source. The measured nutrient values show that the plant-based beverages cannot be considered nutritionally equivalent to cow's milk in their current form. In the case of fortified beverages, the question arises as to the bioavailability of these added minerals and vitamins compared to milk.

Scan me to access the original research article

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
Agroscope

Agroscope good food, healthy environment