



Mineral essential elements for nutrition in different chocolate products



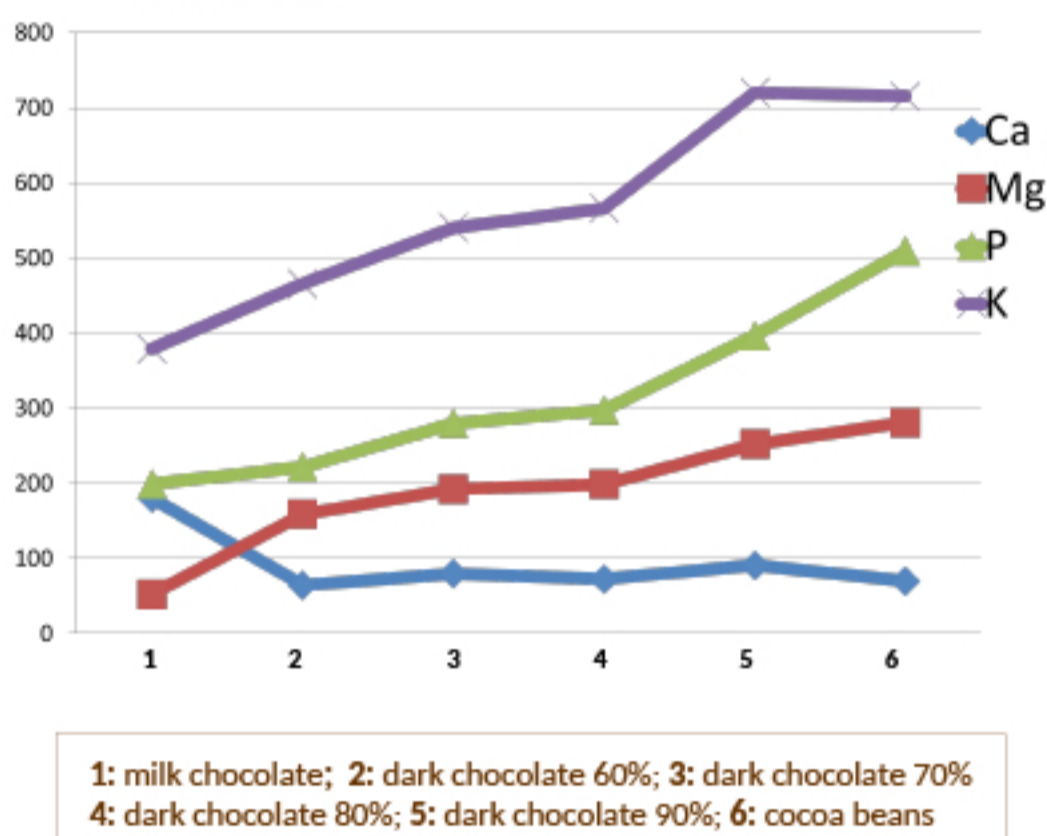
Luciano Cinquanta¹; Giancarlo Salvatori¹; Cinzia Di Cesare¹; Remo Manoni²; Angela Piano³; Piero Roberti³

¹University of Molise, Campobasso, Italy; ²ARPAM Molise, Campobasso, Italy; ³COSIB, Termoli, Italy

Introduction

Cocoa is an extremely rich source of many essential minerals. Chocolate has the potential to provide significant amount of minerals in the human diet, in particular macro-elements: Calcium, Potassium, Magnesium, Phosphorus and micro-elements: Copper, Iron, Zinc and Selenium⁽¹⁾.

Figure 1. Macroelements concentrations in different chocolates and cocoa beans



Aim, materials and methods

Aim of this work is to test the essential mineral nutritional elements in different chocolate products: dark and milk, collected from the Dolceamaro srl company (Monteroduni-Italy). The mineral content, measured by Varian ICP 710 OES, are evaluated respect to the reference levels of nutrients: NRVs - Nutrient Reference Values⁽²⁾ and LARN - Reference levels of intake of nutrients and energy⁽³⁾.

Results

The content in macroelements overall raises significantly increasing the percentage of cocoa in chocolate. Milk chocolate has the highest content of Calcium (180.4 mg/100g). Chocolate is a strong source for Magnesium: the highest content is observed in the chocolate 90%, corresponding to about 67% NRV. Dark chocolate (90%) is also richer in Potassium (720 mg/100g), and Phosphorus (396.5 mg/100g), although the significant decrease respect to the cocoa beans (Fig.1).

Chocolate is also a source of micronutrients: all samples of chocolate are particularly rich in Selenium (Tab.2). The Copper content is high with the exception of milk chocolate. However the consumption of 100g/day of dark chocolate does not reach the levels of toxicity to the Copper (UL = 5 mg/day). The Zinc in dark chocolate 90% covers between 30-35% of the needs/day with values far away by UL (25 mg/day). The dark chocolate 90% is an excellent source of Iron also taking account of its high bioavailability due to the almost complete absence of phytates.

Table 1. Percentage of macroelements dietary intake from 100g of chocolate compared with reference levels of

	milk chocolate		dark chocolate 60%		dark chocolate 70%		dark chocolate 80%		dark chocolate 90%		LARN adults	NRV adults
	%NRV	%LARN	%NRV	%LARN	%NRV	%LARN	%NRV	%LARN	%NRV	%LARN	mg/day	mg/day
Ca	22.5	18.0	8.0	6.4	9.9	7.9	9.0	7.2	11.3	9.0	1000	800
K	18.9	9.7	23.2	11.9	27.0	13.8	28.2	14.5	36.0	18.4	3900	2000
Mg	13.7	21.7	42.3	66.1	51.2	80.0	53.0	82.8	67.2	105.0	240	375
P	28.4	28.4	31.6	31.6	39.9	39.9	42.5	42.5	56.6	56.6	700	700

Table 2. Mean of microelements (mg/100g) compared with reference levels of nutrients

	Milk chocolate	Dark chocolate 60%	Dark chocolate 70%	Dark chocolate 80%	Dark chocolate 90%	P	LARN, adults (mg/day)	NRV, adults (mg/day)
Cu	0.31 ^A	1.43 ^B	1.83 ^C	1.78 ^C	2.02 ^D	<0.001	0.9	1
Fe	1.19 ^A	9.73 ^B	9.84 ^B	11.24 ^C	10.8 ^C	<0.001	10 (M) - 18 (F)	14
Se	0.06 ^A	0.08 ^{AB}	0.09 ^B	0.10 ^B	0.10 ^B	<0.001	0.055	0.055
Zn	0.94 ^A	2.24 ^B	3.19 ^C	2.85 ^{BC}	3.52 ^C	<0.001	12	10

^{A,B,C,D} Scheffé test, unequal letter within same row indicate significative difference (P < 0.01).

References

- 1) Sager M. Chocolate and Cocoa Products as a source of essential elements in nutrition. J. Nutr Food Sci., 2:123; 2012.
- 2) Nutrient Reference Value (NRVs), Regulation (EU) n°1169/2011 of the European Parliament and of the Council Official Journal of the European Union, 2011.
- 3) LARN: Livelli di Assunzione di Riferimento di Nutrienti ed energia, IV revisione, Società Italiana di Comunicazione Scientifica e Sanitaria S.r.l., 2014.

Conclusion

Intake of dark chocolate products is a reasonable strategy to improve the nutritional status of some essential elements especially for vegan and vegetarians.