

THE NUTRITIONAL EVALUATION OF SOME CHOCOLATE BARS ASSORTMENTS

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Abstract: In this paper, we made a comparative evaluation from the point of view of the nutritional value for eight assortments of chocolate bars. The content of fats, saturated fatty acids, carbohydrates, fibers and proteins was analyzed. These parameters differ greatly from one assortment to another, some assortments recording high values of sugars and saturated fatty acids. In the laboratory, we analyzed the mineral content using the XRF (X-ray fluorescence) technique. The experimental results show that these chocolate bars are a very good source of minerals such as K, Ca, Fe, Mn, Zn and Cu and the consumption of such a bar contributes to ensuring the daily requirement of these elements.

Key words: FRX method, nutritional value, minerals

INTRODUCTION

Chocolate is a food source noted for its flavonoid content. Cocoa has the highest flavanol content of all foods and contributes to greater dietary intake of flavonoids than fruits, tea, and vegetables [4,5,6,13,14,15]. Based on flavonoid and mineral content, the consume of dark chocolate with low sugar and higher cocoa content are recommended in terms of supporting bones health [8,9,12].

Supported by epidemiological evidence chocolate, who contains flavanol, is considered as a possible modulator of cardiovascular risk. An increasing number of clinical studies suggest a protective effect of this product against atherogenesis [2].

Chocolate bars are snacks that can contain a wide variety of ingredients. The most frequently encountered are: sugar, glucose syrup, fructose, stevia, artificial sweeteners, hydrogenated vegetable fat, low-fat cocoa powder, carrageenan, milk, emulsifiers, stabilizers, acidifiers, flavors, etc.

The most commonly used commercial artificial sweeteners are sugar alcohols such as xylitol and maltitol. There is numerous studies on the positive and negative effects of these polyols on human health [3] and the excessive consumption of these artificial sweeteners is associated with a variety of digestive disorders [7].

Some studies show that concentrations of K, Mg, Cu, Mn and Zn in chocolate bars increase with the cocoa content, while an opposite effect was observed for Ca [10].

In this paper, we made a comparative evaluation from the point of view of the nutritional value, for eight assortments of chocolate bars, available on Romanian market.

MATERIALS AND METHODS

Types of sample of chocolate bars are:

- Chocolate bar with added sugar, with 15.5% cocoa (type 1),
- Chocolate bar with maltitol sweetener, with 9.5% cocoa (type 2),
- Chocolate bar with maltitol sweetener with 24% cocoa (type 3),
- Chocolate bar with erythritol sweetener, with 40% cocoa (type 4),

- Chocolate bar with fructose, with 45% cocoa (type 5),
- Chocolate bar with glucose and fructose syrup, with 28% cocoa (type 6),
- Chocolate bar with added sugar, with 22% cocoa content (type 7),
- Chocolate bar with stevia, with 60% cocoa (type 8).



Figure 1. Chocolate bar assortments samples

The analysis of the mineral content of chocolate bar assortments was made using X-ray fluorescence analyzer device (X-MET8000). We expressed the results in ppm (mg/kg dry weight).

RESEARCH RESULTS

In table 1 are presented the nutritional parameters of the chocolate bars assortments.

Table 1.

The nutritional parameters of the chocolate bars assortments

Types of sample	Cocoa %	Energetic value Kcal/100g	Fats g/100g	Saturated fatty acids g/100g	Carbohydrates g/100g	Proteins g/100g	Fiber g/100g
1	15.5	440	18.0	7.5	67.0	2,1	3.6
2	9.5	476.4	32.3	19.4	49.7	9.6	3.6
3	24.0	464.3	33.9	20.5	45.8	5.9	9.4
4	40.0	286	24.0	14.0	33.0	4.7	-
5	45.0	613	45.6	28.0	43.0	6.7	2.0
6	28.0	479	23.0	14.0	64.0	3.3	-
7	22.0	473	23.0	14.0	61.0	3.1	-
8	60.0	424.9	38.2	22.7	30.5	6.0	19.4

From the graph below, we notice that in most samples, a high carbohydrate content is associated with a low cocoa content.

Among the minerals identified by the FRX method:

- potassium recorded values between 14239 ppm (type 6) and 33433 ppm (type 1)
- calcium recorded values between 2737 ppm (type 3) and 11301 ppm (type 2)
- iron recorded values between 438 ppm (type 2) and 1550 ppm (type 8).

Regarding the content of Mn, Zn, Cu and Ni, it differs from one assortment to another, assortment 1 recorded the highest values and assortment 6 the lowest values of these parameters.

The results obtained in the analysis of chocolate bar samples are comparable to those found in the literature [2,10,12].

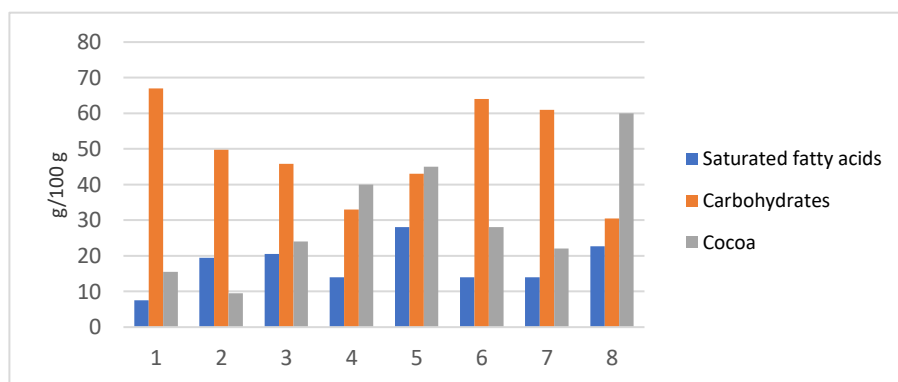


Figure 1. The correlations between nutritional parameters of chocolate bar types

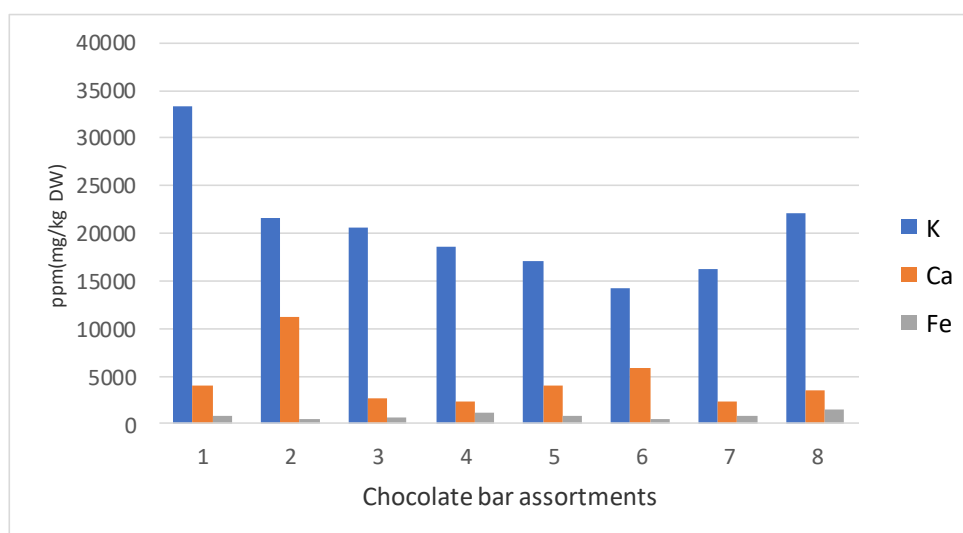


Figure 2. The K, Ca and Fe contents (mg/kg dry weight) in chocolate bar types

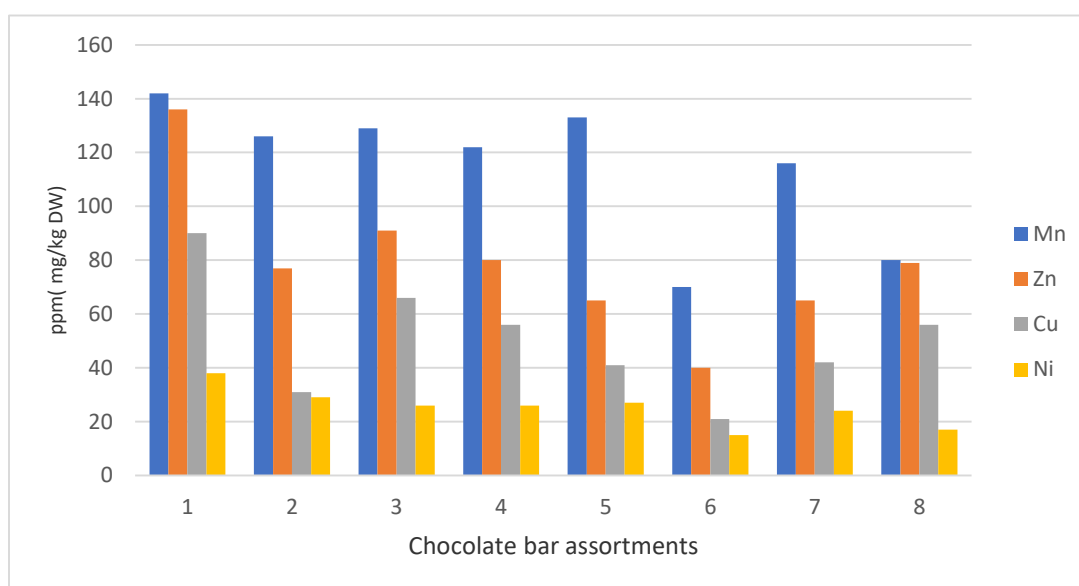


Figure 3. The Mn, Zn, Cu and Ni contents (mg/kg dry weight) in chocolate bar types

CONCLUSIONS

We find the presence of a very large number of additives in chocolate bar samples, and the consumption of large quantities of these products can pose health risks.

All varieties of chocolate bars have a high content of K, Ca and Fe, being able to be consumed in order to ensure the daily requirement of these minerals, but the high caloric content of these products imposes caution in uncontrolled consumption.

REFERENCES

- [1]. **COZMA ANTOANELA, POPESCU SOFIA, RADA MARIA, MIHUT CASIANA, VELCIOV ARIANA**, 2022, Development and mineral characterization of milk chocolate fortified with chicken eggshell powder, International Multidisciplinary Scientific GeoConference: SGEM, 22(6.2), 143-150
- [2]. **ENGLER M. B., ENGLER M. M.**, 2006, The emerging role of flavonoid-rich cocoa and chocolate in cardiovascular health and disease, Nutrition reviews, 64(3), 109-118
- [3]. **GASMI BENAHMED, GASMI A., ARSHAD M., SHANAIDA M., LYSIUK R., PEANA M., BJORKLUND G.**, 2020, Health benefits of xylitol. Applied Microbiology and Biotechnology, 104, 7225-7237
- [4]. **LEE K.W., KIM Y.J., LEE H.J., LEE C.Y.**, 2003, Cocoa has more phenolic phytochemicals and a higher antioxidant capacity than teas and red wine, J Agric Food Chem, 51, 7292-7295
- [5]. **MANACH C., SCALBERTA, MORAND C., REMESY C., JIMENEZ L.**, 2004, Polyphenols: food sources and bioavailability, Am J Clin Nutr, 79, 727-747
- [6]. **MOIGRADEAN DIANA, POIANA MARIANA ATENA, GRUIESCU R.D., ALDA LIANA MARIA, BORDEAN DESPINA MARIA**, 2022, Developing of innovative value added chocolate formulas by rosehip and carob powder incorporation, International Multidisciplinary Scientific GeoConference: SGEM, 22(6.2), 135-141
- [7]. **OKU T., HONGO R., NAKAMURA S.**, 2008, Suppressive effect of cellulose on osmotic diarrhea caused by maltitol in healthy female subjects, Journal of nutritional science and vitaminology, 54(4), 309-314
- [8]. **SEEM S.A., YUAN Y. V., TOU J.C.**, 2019, Chocolate and chocolate constituents influence bone health and osteoporosis risk, Nutrition, 65, 74-84
- [9]. **VELCIOV ARIANA BIANCA, RIVIS A., LALESCU D., POPESCU S., COZMA ANTOANELA, KISS A.A., RADA MARIA**, 2021, Determination of some nutritional parameters of dark chocolate, Journal of Agroalimentary Processes and Technologies, 27(3), 271-276
- [10]. **VILLA J. E., PEREIRA C. D., CADORE S.**, 2015, A novel, rapid and simple acid extraction for multielemental determination in chocolate bars. Microchemical Journal, 121, 199-204
- [11]. **VINSON J.A., PROCH J., ZUBIK L.**, 1999, Phenol antioxidant quantity and quality in foods: cocoa, dark chocolate, and milk chocolate, J Agric Food Chem, 47, 4821-4824
- [12]. **YANUS R.L., SELA H., BOROJOVICH E.J.C., ZAKON Y., SAPHIER M., NIKOLSKI A., GUTFLAIS E., LORBER A., KARPAS Z.**, 2014, Trace elements in cocoa solids and chocolate: an ICPMS study. Talanta 119:1-4
- [13]. *** <https://www.webmd.com/diet/health-benefits-chocolate>
- [14]. *** <https://www.liebertpub.com/doi/abs/10.1089/ars.2010.3697>
- [15]. *** <https://link.springer.com/article/10.1007/s12161-020-01722-6>