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Determination of proximate composition for some dark chocolate types

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Abstract

The purpose of this paper is to determine the proximate composition of some types of dark chocolate with different cocoa mass contents (between 60 - 85%). Carbohydrates, proteins, fats, minerals and moisture concentration were determined from samples represented by three brands of imported dark chocolate with 60-85% dry cocoa mass, commercialized in hypermarkets of Timisoara. The obtained results show that the analyzed chocolate samples contain important quantities of nutrients, depending on the type of chocolate and analyzed nutritional parameter: 1.24 - 1.36 % moisture; 1.58- 2.11 % minerals; 40.12 – 45.81 % fats; 6.31 - 11.33 % protein and 20.45 – 43.52 % carbohydrates.

In order to highlight the difference between nutritional properties of the dark chocolate in comparison with milk chocolate, a milk chocolate sample was analyzed.

It can be seen that an increase in the mass content of cocoa, leads to a decrease in the concentrations of proteins, fats and even moisture and a decrease in the carbohydrate content. Increasing the cocoa content and decreasing the lipid content of dark chocolate contributes to accentuating the beneficial effects on the body's health.

Keywords: dark chocolate, proximate composition, beneficial effects

1.Introduction

Traditional chocolate, obtained from cocoa and different amounts of cocoa butter, vegetable fats, powdered milk sugar, lecithin, flavors, etc., is one of the most appreciated and consumed sweets [1].

This dessert is appreciated, not only due to its special sensory qualities (flavor and pleasant taste) but also due to the rich content of easily digestible nutrients: carbohydrates, protein, fats, minerals, vitamins, etc. [2, 3], as well as biologically active compounds (flavonoids and other antioxidants) [4, 5, 6, 7].

The nutrients contained by chocolate (proteins, carbohydrates, fats, etc.) can provide a significant part of nutritional needs, and biologically active compounds exert a series of protective effects for the human body.

Moderate consumption of chocolate, especially dark chocolate, brings a number of beneficial effects on the body, such as: protecting the cardiovascular system, improving glucose homeostasis, preventing and ameliorating cancer, preventing obesity, has positive effects on the growth of intestinal microbiota, regulating immune cells involved in immunity, protection of the central nervous system and neurological functions by decreasing cognitive disorders and other age-related disorders, can act as an aphrodisiac, etc. [2, 4, 7, 8].

The beneficial effects of chocolate are mainly due to the properties of cocoa, their main component. Cocoa contains significant amounts of fats (40-50% as cocoa butter), proteins and methylxanthines (theobromine and caffeine), minerals (potassium, phosphorus, copper, iron, zinc, and magnesium), as well as significant amounts of antioxidants (dietary polyphenols: catechins, anthocyanidins and proanthocyanidins) [4, 9, 10].

Polyphenols are associated with beneficial effects and therefore only dark chocolate with high

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percentages of cocoa, flavonoids, theobromine and low sugar content would be associated with health promoting effects. Due to the high content of cocoa (which is very rich in flavonoids) dark chocolate has beneficial effects that are superior to milk chocolate. In addition, the intestinal absorption of flavanoids is reduced in white chocolate due to the interference of milk proteins **[8]**.

Dark chocolate, synonymous with black chocolate or semisweet chocolate, is obtained using high percentages of cocoa (70 - 99%) and cocoa butter instead of milk powder **[11]**.

The interest in knowing the nutritional and therapeutic properties of dark chocolate, as well as the promotion for consumption of this type of chocolate is due to its many physiological functions of regulating blood pressure and insulin levels, vascular functions, participation in oxidation processes, prebiotic effects, homeostasis glucose and lipid metabolism [4,7].

This paper aims to determine some nutritional parameters (moisture, minerals, fat, proteins, and carbohydrates) of imported chocolates marketed in Timisoara (Romania). The samples were represented by some dark chocolates (with 70-85% cocoa mass) and milk chocolate.

2. Material and Methods

2.1. Materials

To carry out the proposed experiment, four samples of imported chocolate were taken from three markets in the city of Timisoara (Romania): three samples of dark chocolate with 60, 70 and 85% cocoa mass, and one sample of milk chocolate. These samples from the same chocolate producer formed the basis for the samples to be analyzed.

The types of dark chocolate contain approximately the same basic ingredients: cocoa mass (between 60 - 85%), cocoa with low fat content, cocoa butter, sugar, emulsifier, but in different quantities. Milk chocolate, according to producer's statement contains the following basic ingredients: cocoa dry matter minimum 32% cocoa, sugar, cocoa butter, skimmed milk powder, cocoa mass, clarified butter, soy lecithin emulsifier and vanilla essence. Until the moment of the analysis, the chocolate samples were kept in a dry place and protected from the sun's rays at 18-20 ^{0}C.

2.2. Methods

The determination of the nutritional parameters of the milk chocolate and dark chocolate samples was performed through AOAC procedures [12]. Humidity was determined by drying in an oven at 105 to 105 ± 2 °C to constant weight. The mineral (ash) content of the chocolate was determined by gravimetric method, by calcination at 550 °C for 4 hours to constant weight. The Kjeldahl method was used to determine the proteins; 6,25 was used as the conversion factor to calculate the protein content of the chocolate. The total fats were made using the Soxhlet method, using hexane as solvent. The carbohydrate content was determined by calculation using the relation: 100 - (% moisture +% ash +% crude nitrogen +% total lipids).

3.Results and Discussion

The results obtained from the analyzed chocolate samples are presented in table 1.

From the data presented above, it can be seen that in the analyzed composition of dark chocolate are found important amounts of nutritional principles, which can provide a significant part from the recommended nutritional requirement.

Table 1. Nutritional parameters of some chocolate types

Chocolate types	**Nutritional parameters, %**				
	Moisture	**Minerals**	**Fats**	**Proteins**	**Carbohydrates**
Milk chocolate (MC)	*1.42±0.35*	*1.74*±0.53	*35.83±5.13*	*7.12*±0.74	*52.73*±3.52
Dark chocolate, 60 % cocoa mass (DK 60%)	1.24±0.25	1.58±0.37	40.12±7.08	6,31±0.70	43.52±4.07
Dark chocolate, 70% cocoa mass; (DK70%)	1.29±0.31	1,76±0.49	42.62±7.36	8.72±0.93	31.76±3.96
Dark chocolate, 85% cocoa mass; (DK 85%)	1.36±0.34	2.11±0.45	45,81±6.10	11.33±1.44	20.45±3.11

Concentrations of nutritional parameters has different values depending of the type of dark chocolate and the analyzed parameter: 1.24 - 1.36 % moisture; 1.58 - 2.11 % minerals; 40.12 – 45.81% fats; 6.31 - 11.33% protein and 20.45 – 43.52% carbohydrates.

Among the nutritional parameters analyzed, the carbohydrates were determined in the highest concentrations, which decrease with increasing cocoa mass content: 43.52 (DK 60 %) > 31.76% (DK 70%) > 20.45% (DK 85%).

The fat content of dark chocolate has values between 40.12 – 45.81% and increases as the mass of cocoa mass in the chocolate increases: 40.12 (DK 60 %) < 42.62% (DK 70%) < 45.81 % (DK 85%).

Concentration of proteins from dark chocolate types, it changes depending on the cocoa mass content, this increases with increasing percentage of cocoa mass, as follows: 6.31 (DK 60%) < 8.72% (DK 70 %) < 11.33% (DK 85%).

The humidity of chocolate types has relatively close values, this increasing slightly with the increase of the percentage of cocoa in chocolate :1.24 % in DK 60 %; 1.29 % in DK 70 %; 1.36 % in DK 85 %.

The total concentration of minerals from the analyzed dark chocolate types, increases directly proportional with cocoa percentage, but less pronounced than in the case of carbohydrates and proteins. The richest in mineral salts is the chocolate with 85% cocoa mass (2.11 %), followed by chocolates with 70% cocoa mass (1.76 %) and 60% cocoa mass (1.58%).

The obtained data are graphically represented in figure 1.

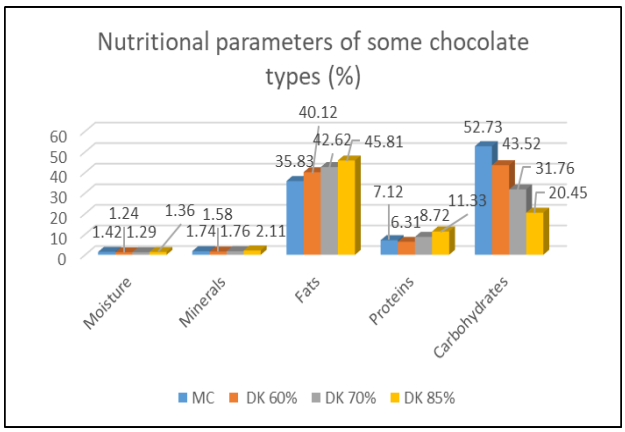

Figure 1. Determination of nutritional parameters of some chocolate types

From what is presented it can be seen that nutritional values of dark chocolates are conditioned by the quantities of ingredients from their composition. The increase in the percentage of cocoa mass results in decreased carbohydrate content and increasing the content of protein fats and mineral salts. The results obtained from the analysis of the types of dark chocolate are comparable to those reported in the literature [13, 14, 15,16,17].

Regarding the nutritional properties of milk chocolate, it can be seen that this type of chocolate with minimum 32% cocoa, has different nutritional factors: 1.42 % moisture, 1.74 % minerals, 35.83% fats, 7.12 % protein and 52.78 % carbohidrates, compared to the types of dark chocolate. These differences are mainly due to the higher milk and sugar content and lower cocoa mass and milk chocolate composition. After comparing proximate composition of dark chocolate with milk chocolate, we can suggest that dark chocolate has substantially lower carbohydrate and higher fat contents. Protein and mineral levels in dark chocolates DK 70% and DK 85% is above the levels of proteins and minerals in milk chocolate.

Due to the high concentrations of cocoa mass, lower carbohydrate content, lack of milk (added to milk chocolate), types of dark chocolate have more beneficial effects on the body in comparison with milk chocolate.

4.Conclusion

The types of dark chocolate with contents of 60, 70 and 85% cocoa mass has important contents of nutritional factors,which differs depending on the percentage of cocoa mass.

Increasing of the percentage of cocoa mass in dark chocolate has the effect of decreasing the carbohydrate content and increasing the fat content,proteins and minerals. A less pronounced increase is also in the case of humidity.

Comparing the values of the nutritional factors of dark chocolates with milk chocolate, it can be said that dark chocolates have substantially lower carbohydrate and higher fat contents. The levels of proteins and minerals in dark chocolate with 70% and 85% mass of cocoa are above the levels of proteins and minerals from milk chocolate.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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