QUALITY ANALYSIS OF SOME ASSORTMENTS OF MILK CHOCOLATE AND WHITE CHOCOLATE SOLD IN ROMANIA

Gabriela FRUNZĂ[1]

e-mail: frunza.gabriela@uaiasi.ro

Abstract

The study consisted in the comparative assessment of the quality of some varieties of milk chocolate and white chocolate sold in Romania, following their sensory, chemical (including energy value), economic and aesthetic characteristics. Were analyzed 48 samples from eight varieties of chocolate (milk chocolate was coded M1, M2, M3, M4 and white chocolate was coded W1, W2, W3, W4, six samples for each producer, from different batches). The sensory characteristics were analyzed by tasting (using the scoring scales method of 0-5 points). The content of water, dry matter and lipids was determined by classical standardized methods; the results obtained were compared with the values declared on the label by producers. Following the sensory analysis, five products were included in the category of good products (near under the 18 points) and three in the class of very good quality (over 18.1 points). According to the information on the labels the products studied had as main ingredient the sugar, for white chocolate an average of 58.73%, then an average of 33.48% lipids, 5.58% proteins and 0.30 % salt; for milk chocolate was found an average of 59% carbohydrates from which 58.25% sugars, 31% lipids, 4.55% proteins and 0.25% salt. The lipids determined by Soxhlet method for white chocolate was closed in average to the information on the labels (33.26% vs 33.48%), but for milk chocolate was determined 29.09%, compared with 31% from the label, with 1.91 percentage points difference.

Key words: food analysis, milk chocolate, white chocolate, sugar

The relationship between food and health is complex, and concern regarding the safety of food has increased exponentially in western societies in the past years. Functional foods containing bioactive components have emerged as a convergence between diet and health, providing long-term positive physiological responses and health benefits (Batista de Oliveira T.T. *et al*, 2021).

One of the most popular foods is chocolate. This substance contains fats, carbohydrates and cocoa. Depending on the content of sugar and cocoa powder, they are classified into different types, such as dark, milky or white and so on (Razavizadeh B.M., Tabrizi P., 2021). Chocolate milk is obtained by mixing soluble cocoa powder, refined sugar, malt extract, and/or maltodextrin. It can additionally contain salt, milk powder or whey milk, vitamins, minerals, and other approved food substances, which should be mentioned on the label (Batista de Oliveira T.T. *et al*, 2021). Milk chocolate is composed of milk components added as solid particles (milk powder and whey powder) refined with cocoa liquor and sugar, which are dispersed within the fat phase (Atik E. *et al*, 2020). The main fat component, cocoa butter, holds all the solid sugar and cocoa particles together (Lapcíkova B. *et al*, 2022).

Chocolate comprises solid particles dispersed in a matrix of crystallized fat composed mainly of (Ewens H. *et al*, 2021). Unfortunately, cocoa butter world demand is increasing, and current production does not meet this; therefore, the availability of this fat is limited (Norazlina M.R. *et al*, 2021; Castro-Alayo E.M. *et al*, 2023).

The cocoa butter crystallizes in six polyforms, known as γ, α, β2', β1', β2, and β1, characterized according to their melting temperatures (17.3, 23.3, 25.5, 27.5, 33.8, and 36.3 °C, respectively) (Castro-Alayo E.M. *et al*, 2022; Declerck A. *et al*, 2021). In the manufacture process of chocolates, the form β2 is required until a level of 60–80% (Pirouzian H.R. *et al*, 2020) because it gives chocolate its sensory characteristics of flavor release (Yao Y. *et al*, 2020), texture, gloss, melting, and mouthfeel (Chen J. *et al*, 2021). Knowing the cocoa butter crystallization rate (Pirouzian H.R. *et al*, 2020) as well as controlling the size, shape, number, and polyforms of the crystals, becomes a critical factor for obtaining high-quality chocolates (Castro-Alayo E.M. *et al*, 2023).

[1] Iasi University of Life Sciences, Romania

The aim of this study consisted in the comparative assessment of the quality of some varieties of milk chocolate and white chocolate sold in Romania, following their sensory and chemical characteristics.

MATERIAL AND METHOD

Were analyzed 48 samples from eight varieties of chocolate (milk chocolate was coded M1, M2, M3, M4 and white chocolate was coded W1, W2, W3, W4, six samples for each producer, from different batches).

The sensory characteristics were analyzed by tasting (using the scoring scales method). The evaluation of the sensory quality of white chocolate and milk chocolate was carried out in a Sensory Analysis Laboratory of USV Iasi by the participation of a group of sixty students in food engineering, each receiving an individual sheet (*table 1*). The sensory analysis was performed in natural, diffuse light. The tasting of the samples was done carefully, without haste, with relaxation breaks of about 2 minutes between the portions of the sample; 5-10 g of product were taken for tasting. Before and after tasting each sample, the tasters rinsed the oral cavity with drinking water to eliminate the remaining taste. The evaluation of each sensory characteristic (SP 3196-83) was performed by scoring scales of 0-5 points and then by comparing it with a scale from 0 to 20 points (*table 2*). The samples were prepared in the same way for all tasters and distributed in equal quantities, in identical vessels. As a result, was taken the arithmetic mean obtained from the score given by all tasters for each characteristic.

The content of water, dry matter, ash and lipids was determined by classical standardized methods: the lipid content was determined by the Soxhlet method, the ash content by calcination method (at 550 °C for 24 h, after carbonization), and the moisture and the dry matter by the drying method in the oven (at 105°C). The results obtained were compared with the values declared on the label by producers.

Table 1

Individual assessment sheet of the sensory quality of white chocolate and milk chocolate

Characteristics	Characteristics description	Score
Appearance	Regular shape, glossy, smooth surface, without stains and scratches; well-contoured drawings	4
	The surface is smooth, has small scratches and irregularities in design and shape	3
	The surface is matte, with small irregularities in shape and design	2
	The surface is slightly matte, showing obvious scratches, irregularities in shape and design	1
	The surface is totally uneven, showing traces of melting	0
Color	Uniform and appropriate on the entire surface of the product	4
	Uneven on a certain region of the product	3
	Uneven on the entire surface of the product	2
	Stains of different shades that are not specific to the product	1
	Inappropriate product, with foreign shades, color unsuitable for the assortment	0
Smell	Well defined, pleasant, characteristic of the assortment	4
	Specific, poorly defined characteristic of the assortment	3
	Poorly pronounced, without foreign taste and smell	2
	Indefinite or too vague	1
	Unpleasant, foreign or odour is missing	0
Consistency	Strong, fine, creamy	4
	Strong, slightly creamy	3
	Soft, slightly creamy	2
	Soft, semi-rough	1
	Soft, rough	0
Taste	Well defined, fragrant, pleasant	4
	Typical of the assortment, slightly aromatic, pleasant	3
	Poorly defined, characteristic of the aroma used	2
	Indefinite or too vague	1
	Uncharacteristic, astringent, rancid, unpleasant	0

Table 2

Classification of the products in the appropriate quality class according to standards

Total average score	Provided qualifying
18.1 ÷20	Very good
15.1÷18	Good
11.1÷15	Satisfactorily
7.1÷11.0	Unsatisfactory
0÷7	Tainted

RESULTS AND DISCUSSIONS

The white chocolate and milk chocolate ingredients are presented in table 3.

It was observed that in two of the four milk chocolates studied (for 50%) the cocoa butter was replaced with other types of vegetable fats (palm, shea).

Table 3

List of the ingredients in the order shown on the label by producer for white chocolate and milk chocolate

W1	W2	W3	W4	M1	M2	M3	M4
sugar	sugar	sugar	sugar	sugar	sugar	sugar	sugar
cocoa butter	cocoa butter	cocoa butter	cocoa butter	fats (palm, shea)	fats (palm, shea)	cocoa butter	cocoa butter
skimmed milk powder	whole milk powder	whole milk powder, skimmed milk powder; whipped cream powder;	whole milk powder, skimmed milk powder;	derived from powdered whey	whey powder	skimmed milk powder	cream powder (13%)
whey powder (from milk);	milk fat	sweetened whey powder; lactose;	cocoa butter equivalent (non-hydrogenated palm oil, shea butter, illipe butter),	cocoa powder	low-fat cocoa	cocoa mass	cocoa paste
milk fat	skimmed milk powder	butter fat	milk fat	skimmed milk powder 1.7%	emulsifiers (soy lecithin, E476, sunflower lecithin)	whey powder milk fat	whole milk powder (5.4%) concentrated butter
emulsifier (soy lecithin)	emulsifier: soy lecithin	emulsifier (soy lecithin)	emulsifiers (soy lecithin, E476)	emulsifiers (soy lecithin, E476	skimmed milk powder (1%)	emulsifier (soy lecithin) hazelnut paste	emulsifiers (lecithin and soy)
flavor	flavor: vanilla 0.15%.	natural vanilla flavor	vanilla flavor	flavor	flavor	flavor	vanilla extract

Following the sensory analysis (*table 4.*), five products were included in the category of good products (near under the 18 points) and three in the class of very good quality (over 18.1 points).

Table 4

Total score obtained for the sensory analysis of the white chocolate and milk chocolate

Products	Total score	Quality class
W 1	17.93	Good
W 2	18.74	Very good
W 3	17.89	Good
W 4	17.54	Good
M 1	16.31	Good
M 2	16.69	Good
M 3	18.78	Very Good
M 4	18.34	Very Good

The score obtained for the sensory analysis of the white chocolate and milk chocolate are relatively close (*figure 1*).

Chemical composition and energy value of the white chocolate and milk chocolate are presented in *table 5*.

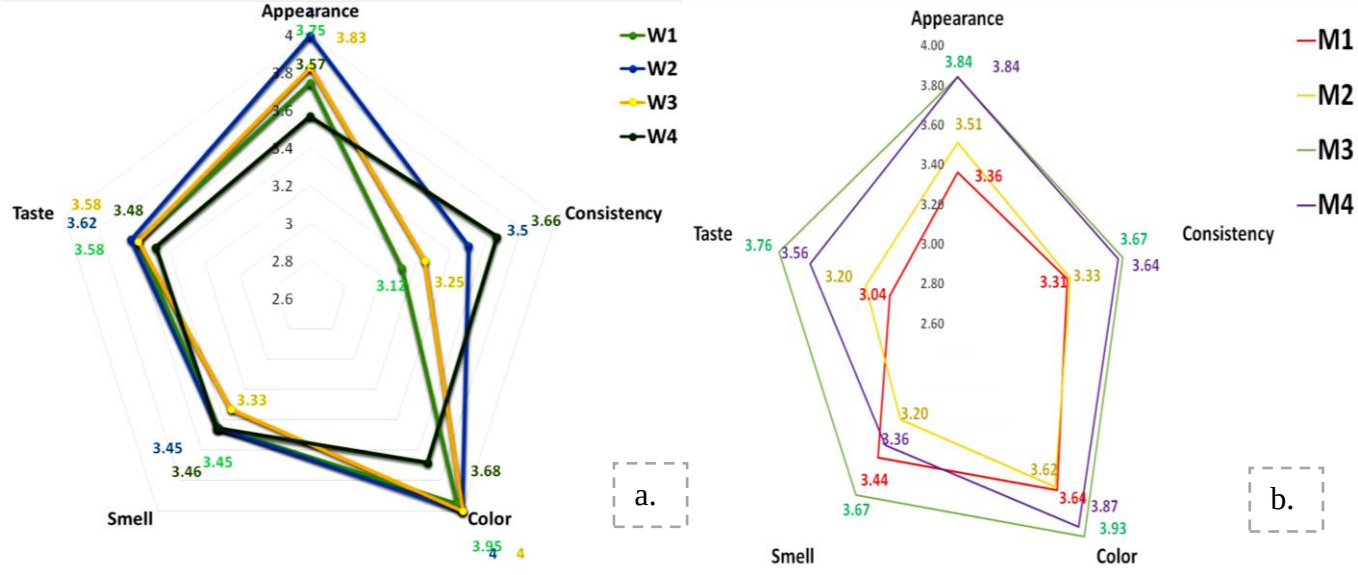

Figure 1 **The score obtained for the sensory analysis of the white chocolate (a.) and milk chocolate (b.)**

It is observed that, on average, the values presented on the label of product are close for the white chocolate and milk chocolate (58.73 % carbohydrates for white chocolate compared with 59.00 % for milk chocolate).

Table 5

Chemical composition and energy value of the white chocolate and milk chocolate

Products	Carbohydrates (%)	Lipids (%)	Proteins (%)	Salt (%)	Energy (kcal/100g)
W1	65.00	28.00	4.30	0.36	532.00
W2	55.00	39.00	4.70	0.18	590.00
W3	58.00	33.00	5.50	0.38	551.00
W4	56.90	33.90	7.80	0.29	558.00
Average	58.73	33.48	5.58	0.30	557.75
M1	60.00	32.00	2.80	0.06	545.00
M2	62.00	28.00	3.70	0.42	523.00
M3	59.00	29.00	6.30	0.37	530.00
M4	55.00	35.00	5.40	0.14	560.00
Average	59.00	31.00	4.55	0.25	539.50

The lipids determined white chocolate was closed in average to the information on the labels (33.26% vs 33.48%), but for milk chocolate was 29.09%, compared with 31% from the label, with 1.91 percentage points difference (*table 6*).

Table 6

The chemical content determined for the white chocolate and milk chocolate (average for all product)

Average /Products	Water%	Dry matter%	Ash %	Lipids %
Milk chocolate	0.72	99.28	1.52	33.26
White chocolate	0.69	99.31	1.48	29.09

CONCLUSIONS

According to the information on the labels the products studied had as main ingredient the sugar, for white chocolate an average of 58.73%, then an average of 33.48% lipids, 5.58% proteins and 0.30 % salt; for milk chocolate was found an average of 59% carbohydrates from which 58.25% sugars, 31% lipids, 4.55% proteins and 0.25% salt. The lipids determined for white chocolate was closed in average to the information on the labels (33.26% vs 33.48%), but for milk chocolate was found 1.91 percentage points difference.

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