

Sensory and physical-chemical characterization of some range of beers from the Romanian market

Corina I. Megyesi^{1*}, Nicoleta G. Hădărugă¹, Ariana B. Velciov¹, Laura Rădulescu¹, Adrian Riviș¹, Gabriel Bujancă², Alexandru Rinovetz¹, Despina Bordean²

¹*Department of Food Science, University of Life Sciences "King Mihai I" from Timișoara, Calea Aradului 119, 300645 – Timișoara, Romania*

²*Department of Food control and expertise, University of Life Sciences "King Mihai I" from Timișoara, Calea Aradului 119, 300645 – Timișoara, Romania*

**Corresponding author: corina.megyesi@usvt.ro*

Abstract

Beer is the first alcoholic drink consumed by humans, and the recipe for its manufacture is one of the oldest in human history. Beer is rich in nutrients such as calcium, phosphorus, potassium or zinc. This abundance is due to the fact that it is made of plants: barley, wheat and hops. It is a drink beneficial to the health of the human body (if it is consumed in adequate quantities), the soluble fibers in beer helping to prevent constipation and improve digestion.

The aim of the study was to perform a sensory characterization of two types of light (pale) beer, purchased from the Romanian market. This involves a sensory evaluation, but also a centralization of the results from a group of tasters. Also, a physical-chemical characterization of the two types of beer was carried out, determining the alcohol concentration, total acidity and mass fraction of CO₂.

Key words: beer, hops, sensory and physical-chemical analysis

1. Introduction

Thousands of years ago beer was discovered and today it is often consumed by people because of its refreshing and pleasant taste, especially as a reason for social interaction, disconnection or relaxation [2,10].

Barley is the main raw material for malt production, dates back to around 7000 BC and was discovered in the Near East. This drink is supposed to come from bread that became moist and then fermented. Historical sources from the beginning of Sumerian and Egyptian writing attest to the fact that in that period barley (with 6 rows of grains per spike) was the most widespread plant cultivated in that period, numerous writings also refer to beer. Even the famous Greek writer Sophocles encouraged moderation and recommended a diet consisting of "vegetables, healthy fruits, bread and zythos (beer)" [4,5].

Malt, or as it is also called "the soul of beer", is the basic material used in the production of beer. This malt results from the germination process of grains. The composition of the malt is influenced by the composition of the raw material barley, but also by the malting technology used. The differences between the data provided by some authors, regarding the chemical composition of the barley and the respective malt, derive from the fact that the influences due to the following factors were taken into account: the malting equipment used, soil, variety, pedoclimatic conditions, agrotechnics and technology [6,13,14].

Beer, as it is known nowadays, cannot be produced without barley. All attempts to artificially reconstruct the wort starting from recognized ingredients and then using yeast for alcoholic fermentation resulted in a drink distinctly different from beer. When raw

materials other than barley malt are used in beer production, such as unmalted grains, other sugary or amylase raw materials, it is important that barley malt is at least 50% of the total forming raw materials of extract [1,3,12,16].

Beer, from a chemical point of view, is a

colloidal system with the main components: water, ethyl alcohol and malt extract. In addition to these, beer also contains a series of chemical compounds that enrich the nutritional value of the product [8,9,13,15]. The following nutrition information is provided by the USDA for beer.

Table 1. Nutritional information of beer

Characteristics	Alcoholic drink, beer, light*	Characteristics	Alcoholic drink, beer, light *
Energy (kcal)	29	Potassium, K (mg)	21
Water (g)	94,88	Sodium, Na (mg)	4
Protein (g)	0,24	Zinc, Zn (mg)	0,01
Total lipid (fat) (g)	-	Copper, Cu (mg)	0,006
Ash (g)	0,09	Manganese, Mn (mg)	0,006
Carbohydrate, by difference (g)	1,64	Vitamin C, tot. ascorbic acid (mg)	-
Sugars, total (g)	0,09	Thiamine (Vitamin B1) (mg)	0,005
Calcium, Ca (mg)	4	Riboflavin (Vitamin B2) (mg)	0,015
Iron, Fe (mg)	0,03	Niacin (mg)	0,391
Magnesium, Mg (mg)	5	Vitamin B6 (mg)	0,034
Phosphorus, P (mg)	12	Choline (total) (mg)	8,8
		Ethyl alcohol (g)	3,1

* (Average quantity in 100g product)

Following the conducted researches, it was concluded that moderate beer consumption may be associated with a lower risk of heart disease, improved blood sugar control, stronger bones and a reduced risk of dementia. However, excessive alcohol consumption has opposite effects. Some scientists claim that beer outranks wine when it comes to B vitamins, phosphorus, folic acid and niacin. Beer also has a significant protein content, but also some fiber. Beer is among the few important dietary sources of silicon that research shows may help prevent osteoporosis. Beer can also contain prebiotics that feed the good bacteria in our gut [7,11].

2. Material and methods

From the sensory point of view, 2 varieties of light beer were subjected to analysis: BB1 and BB2, obtained from the Romanian market. Sensory evaluation was performed by a group

of 10 tasters (male and female), aged between 22 and 57 years, with no sensory evaluation experience. Samples provided to the panel were labeled with random numbers according to a Williams Latin Square design. The following sensory attributes were evaluated: appearance, foam, color, aroma and taste. Later, the beer samples were also subjected to physical-chemical analyses, namely: determination of alcohol concentration (based on the relative density, determined with the pycnometer), determination of total acidity (by the titration method with a NaOH solution) and determination of carbon dioxide (by titration) (according to STAS 4230-68).

3. Results and Discussion

The tables below show the results obtained from the sensory analysis of the two types of beer - BB1 and BB2.

Table 2. Sensory characteristics for the BB1 beer sample - centralization

No.	Evaluator name	Appearance	Foam	Color	Aroma	Taste
1	D1	3	4	4	4	3
2	D2	4	4	4	4	3
3	D3	3	4	4	3	3
4	D4	3	4	4	4	4
5	D5	3	3	4	3	4
6	D6	3	4	4	4	3
7	D7	3	4	3	3	4
8	D8	4	4	4	3	3
9	D9	3	4	3	4	4
10	D10	4	4	4	4	4
Average score		3,3	3,9	3,8	3,6	3,5
Total average score				3,62		

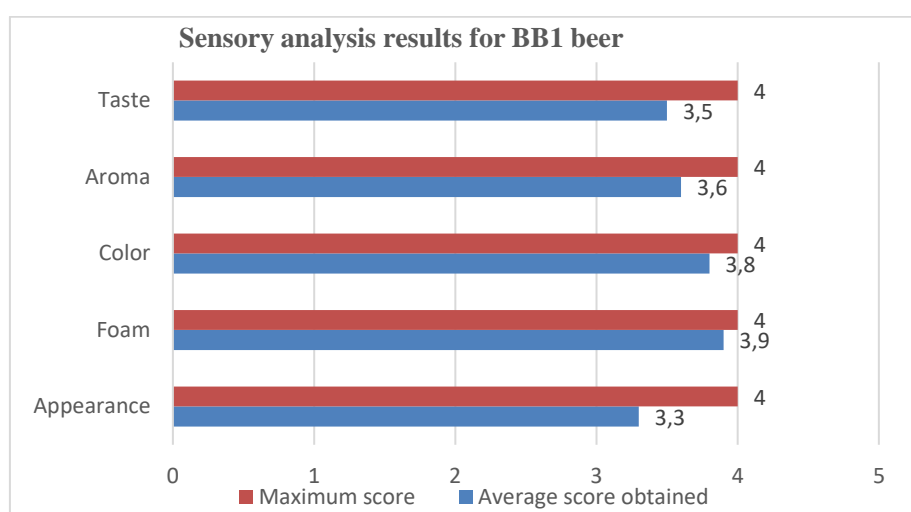


Figure 1. Graphic representation of sensory analysis for the BB1 beer sample

Following the sensory analyzes carried out, we can conclude that the beer with the highest score, namely 3.62 points, in the sensory profile analysis, is BB1 beer. When the beer is poured into the tilted glass, the foam is three

cm thick, it is consistent and creamy with small bubbles of carbon dioxide and persists for about 5 minutes, leaving a lacy white mark on the glass. The color of the beer is golden with a strong smell corresponding to the assortment.

Table 3. Sensory characteristics for the BB2 beer sample - centralization

No.	Evaluator name	Appearance	Foam	Color	Aroma	Taste
1	D1	2	1	4	1	1
2	D2	2	1	4	1	2
3	D3	3	2	4	3	3
4	D4	3	3	4	2	3
5	D5	3	2	4	2	2
6	D6	2	1	4	2	2
7	D7	3	2	3	1	2
8	D8	2	1	4	2	3
9	D9	3	2	4	2	1
10	D10	3	3	4	1	2
Average score		2,6	1,8	3,9	1,7	2,1
Total average score				2,42		

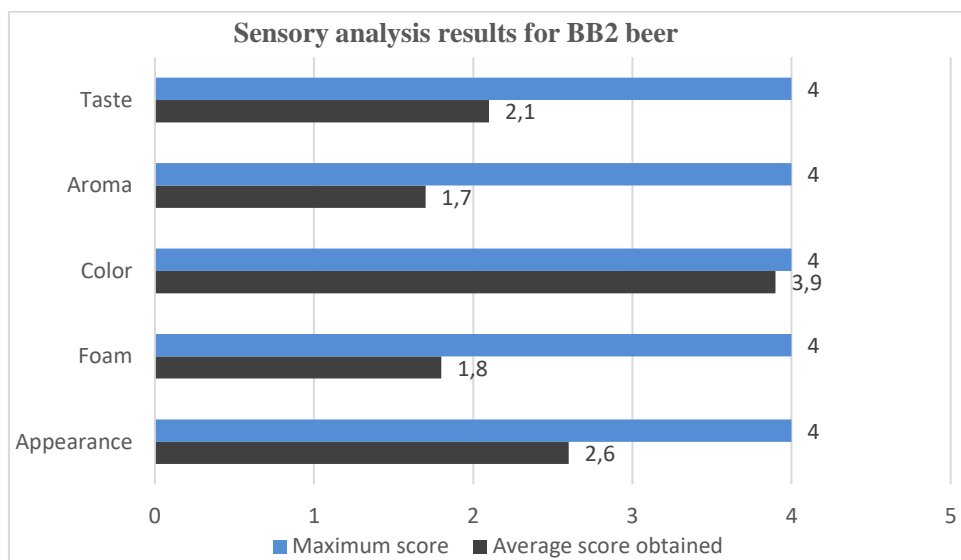


Figure 2. Graphic representation of sensory analysis for the BB2 beer sample

The taste after the first sip is strongly bitter and aromatic, at the end it leaves a sweet taste with hints of vanilla. In terms of appearance, the beer is clear, without impurities and we can observe the presence of fine bubbles of carbon dioxide that persist.

Following the analysis of the sensory profile, a lower average score was obtained for BB2 beer (2.42 points). When pouring the beer into the glass, the foam is almost non-existent, about 5 mm, it is not consistent and persists for about 3

minutes, leaving no white mark on the glass. The color of the beer is golden yellow and has a weak smell. The taste is bland and slightly aromatic, and the acidity makes the taste seem harsh. The beer is clear in terms of appearance, without impurities and we can observe the presence of fine bubbles of carbon dioxide that persist.

The results of the physical-chemical examination of the samples are presented in the following figure.

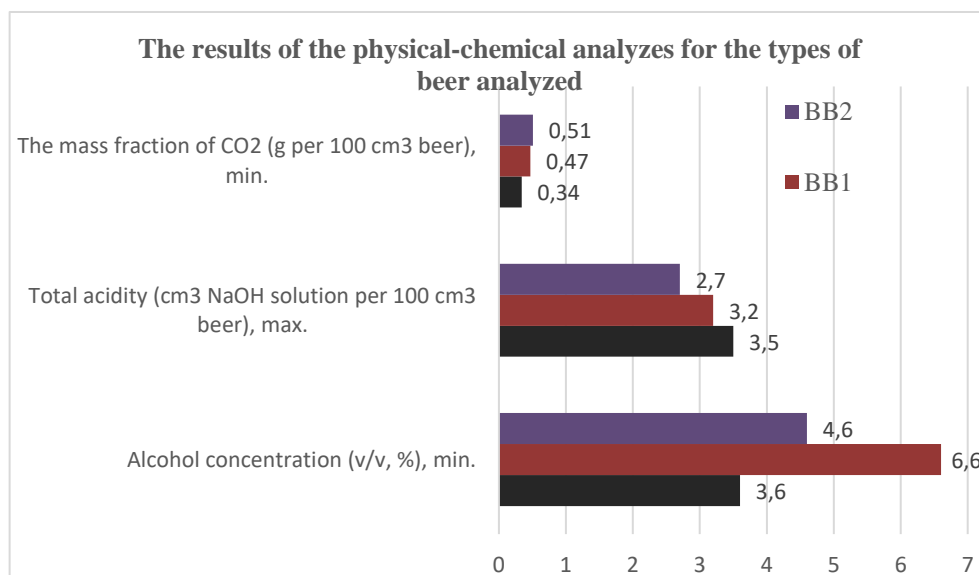


Figure 3. Physical-chemical characteristics of the beer samples

4. Conclusion

The results of the study carried out show that the alcoholic concentration, for both types of analyzed beer coincided with the values

displayed on the product labels, 6.6% vol. alc., respectively, 4.6% vol. alc., the minimum value accepted by STAS for light beer being 3.6% vol. alc. The total acidity recorded for

investigated beer samples was below the maximum permitted value of 3.5 cm³ 1N NaOH per 100 cm³ of beer. The values determined for the mass fraction of CO₂ for the 2 types of beer analyzed are above the accepted value, the minimum value accepted by STAS for this characteristic being 0.34 g per 100 cm³ of beer. Our data clearly showed by sensory evaluation and physico-chemical characterization the compliance of the two types of beers sampled on the local market with the standard requirements.

References

1. Araújo, F.B., Silva, P.H.A., Minim, V.P.R., Sensorial and physical-chemical evaluation of beers deriving from two segments of Brazilian market, *Food Science and Technology*, **2003**, 23, 121-128;
2. Bamforth, C.W., Beer: an ancient yet modern biotechnology, *The Chemical Educator*, **2000**, 5, 102-112;
3. Brown, G.M., Williamson, J.M., Biosynthesis of riboflavin, folic acid, thiamine, and pantothenic acid, *Advances in Enzymology and Related Areas of Molecular Biology*, **1982**, 53, 345-381;
4. Brunswick, P., Manners, D.J., Stark, J.R., Degradation of isolated barley endosperm cell walls by purified endo-(1→3)(1→4)-β-D-glucanases and malt extracts, *Journal of Cereal Science*, **1988**, 7(2), 153-168;
5. Cadenas, R., Caballero, I., Nimubona, D., Blanco, C.A., Brewing with starchy adjuncts: Its influence on the sensory and nutritional properties of beer, *Foods*, **2021**, 10(8), 1726;
6. Codină, G.G., Mironeasa, S., Leahu, A., Predicting the organoleptic quality of some romanian beers from physical-chemical data using multivariate analysis, *Food and Environment Safety Journal*, **2017**, 10(1);
7. De Gaetano, G., Costanzo, S., Di Castelnuovo, A., Badimon, L., Bejko, D., Alkerwi, A., Iacoviello, L., Effects of moderate beer consumption on health and disease: A consensus document, *Nutrition, Metabolism and Cardiovascular Diseases*, **2016**, 26(6), 443-467;
8. Doretto, D.D.A., Figueira, R., Sartori, M.M.P., Venturini Filho, W.G., Physical-chemical and sensorial analysis of Brazilian commercial beers, *Energia na Agricultura*, **2018**, 33(3), 277-283;
9. Hough, J.S., Briggs, D.E., Stevens, R., Young, T.W., Hough, J.S., Briggs, D.E., Young, T.W., Chemical and physical properties of beer, *Malting and Brewing Science: Volume II Hopped Wort and Beer*, **1982**, 776-838;
10. Humia, B.V., Santos, K.S., Barbosa, A.M., Sawata, M., Mendonça, M.D.C., Padilha, F.F., Beer molecules and its sensory and biological properties: A review, *Molecules*, **2019**, 24(8), 1568;
11. Kaplan, N.M., Palmer, B.F., Denke, M.A., Nutritional and health benefits of beer, *The American journal of the medical sciences*, **2000**, 320(5), 320-326;
12. Kim, K.H., Park, S.J., Kim, J.E., Dong, H., Park, IS., Lee, J., Noh, B. S., Assessment of physicochemical characteristics among different types of pale ale beer, *Korean Journal of Food Science and Technology*, **2013**, 45(2), 142-147;
13. Mastanjević, K., Krstanović, V., Lukinac, J., Jukić, M., Vulin, Z., Mastanjević, K., Beer—the importance of colloidal stability (non-biological haze), *Fermentation*, **2018**, 4(4), 91;
14. Parker, D.K., Beer: Production, sensory characteristics and sensory analysis, *Alcoholic beverages*, Woodhead Publishing, **2012**, 133-158;
15. Sohrabvandi, S., Mortazavian, A.M., Rezaei, K., Health-related aspects of beer: A review, *International Journal of Food Properties*, **2012**, 15(2), 350-373;
16. Sung, S.A., Lee, S.J., Physicochemical and sensory characteristics of commercial top-fermented beers, *Korean Journal of Food Science and Technology*, **2017**, 49(1), 35-43.