

## CORRELATION BETWEEN THE QUALITY OF THE BLONDE BEER ORIGINATING FROM A PROFIL UNIT IN THE NORTH-EAST OF ROMANIA AND FOOD SAFETY

Carmen Daniela PETCU<sup>1</sup>, Oana Mărgărita GHIMPEȚEANU<sup>1</sup>, Oana Diana OPREA<sup>1</sup>,  
Ioana Marina BACIU<sup>1</sup>

e-mail: carmen28petcu@gmail.com

### Abstract

Natural, traditional beer is an alcoholic beverage, naturally saturated with carbon dioxide, which is obtained from barley malt, water, hops and yeast for fermentation. This is the third most consumed drink in the world, after water and tea, and the oldest alcoholic beverage on the entire planet. In this context, the main purpose of the research was to analyze the quality of the different types of blonde beer within a profile unit in northeast of Romania. In order to identify the technological features of beer production, the technological flow within the study unit was followed. The researched material was represented by 20 blonde beer samples, which came from four different types of beer (Suceava clasic, Călimani, Bermas and Solca), produced in the study unit. The samples were analysed organoleptically and then subjected to physico-chemical analyzes, determining: apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO<sub>2</sub> concentration. Sensory analysis was performed by the scoring method, evaluating the appearance, colour, smell, taste, CO<sub>2</sub> impregnation and persistence of the foam, the four types of beer evaluated having a good or very good quality. pH is one of the most important parameters regarding the taste and beer stability, the values obtained falling within the range 4.35-4.8, imposed in the study unit by product standards. CO<sub>2</sub> concentration is another important parameter, all four types of blonde beer falling within the range of 0.3 - 0.5%. After analyzing all the results obtained, it is concluded that these products comply with the quality standards imposed by the legislation in force.

**Key words:** beer, hops, alcohol concentration

Beer is a non-distilled alcoholic beverage, obtained by the fermentation with yeast of a wort made of malt and water, boiled with hops (Muste S. et al., 2005; Masschelein C.A. et al., 2008; Ghimpețeanu, M., 2017). This can be: beer with alcohol (contains about 5% alcohol) and beer without alcohol (contains between 0 and 0.5% alcohol) (Branyik T., 2012). The ideal temperature for beer consumption is between 6°C and 8°C (Banu C., 2009; Hlatky M., 2013).

As a drink with a wide variety, the beer can be: blonde, brune, filtered, unfiltered, but also flavored with lemon, orange, grapefruit juice or different spices.

Beer contains the nutritional components of malt and new products resulting from alcoholic fermentation: organic acids (acetic, malic, lactic acid), aldehydes, higher alcohols, water-soluble vitamins from yeast (B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, PP, H), growth factors such as biotin, inositol, pantothenic acid, but also mineral substances (potassium, magnesium, calcium, phosphorus, iodine)

(Berzescu P., 1981; Banu C., 2001; Banu C., 2009).

Consumed in moderation, this beverage can be beneficial to health, due to the natural ingredients from which it is obtained. Beer cereals, especially barley, are an important source of protein, fiber and vitamins. Also called green gold, hop is a source of antioxidants, and beer yeast contains 17 vitamins, 14 minerals and 16 essential amino acids to the human body (Banu C., 2009).

The researchers recommend the consumption of unpasteurized beer, because pasteurization reduces the nutritional value by removing the "live" components, and the best type of beer is the unfiltered, because the filtration eliminates the yeast, rich in vitamin B.

### MATERIAL AND METHOD

The study took place between March-December 2018 in a brewery located in northeast of Romania.

In order to identify the different

<sup>1</sup> University of Agronomic Sciences and Veterinary Medicine of Bucharest, Bucharest

particularities regarding the technology of brewing, the technological flows of their manufacture within the processing unit were followed. Initially, the organoleptic properties of the beer were analyzed in the units own laboratory, the samples being subjected to physico-chemical analyzes, determining: apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO<sub>2</sub> concentration. The Alcolyzer Beer Analyzing System was used to determine the physico-chemical parameters (figure 1).

Some determinations were made, both at the beginning and at the end of the fermentation period, but for the finished product, all the parameters were determined.



Figure 1 Alcolyzer Beer Analyzing System

Four types of blonde beer were analyzed in the study (Suceava classic, Călimani, Bermas and Solca), five samples from each assortment.

**Suceava classic** is a blonde beer for consumption with a 4.4% alcohol concentration and a carbon dioxide content of at least 0.4g/100ml beer. This type of beer is obtained from water, malt, unmalted cereals (barley) and natural hops from two varieties grown in Transylvania.

Suceava classic is packaged in Mold ½ bottles and has a shelf life of 120 days.

**Călimani** is a blonde beer that bears the name of the mountainous massif from the Eastern Carpathian chain and is obtained from water, malt, unmalted cereals (barley) and natural hops from two varieties grown in Transylvania. This beer has a 4.6% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. Is packaged in NRW ½ bottles and has a shelf life of 180 days and at keg barrels of 50 liters with a shelf life of 30 days.

**Bermas** is a blonde beer and is made from water, malt and German hop. This beer has a 5.2% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. Is packaged in NRW ½ bottles and has a shelf life of 180 days.

**Solca** is a trademark with tradition that appeared in 1810. It is a superior blonde beer, obtained from water, malt and Romanian hop. Solca has a 4.8% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. This beer is packaged in NRW ½ bottles and has a shelf life of 180 days.

Sensory analysis of the four assortments of beer was performed by the scoring method, evaluating each organoleptic property (appearance, colour, smell, taste, CO<sub>2</sub> impregnation and persistence of the foam). The total score was calculated by summing the average scores for each organoleptic characteristic in part, after multiplying them by the specific weighting factor (table 1). The levels of appreciation of the sensory quality of the beer are established according to the total score obtained and based on it, the level of product quality is determined (table 2) (Mihaiu M., 2013; Ghimpețeanu M., 2017).

Table 1

Calculation of the score of organoleptic characteristics (Ghimpețeanu M., 2017)

Score	Appearance	Colour	Smell	Taste	CO <sub>2</sub> impregnation	Persistence of the foam
Individual score	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5
Weighting factor	0.6	0.8	0.2	1.4	0.6	0.4

Table 2

Beer evaluation based on score method (SR 13355-1:1997)

Total score	Appreciation step	Product characterization
18.1 – 20	Very good	Beer has positive, specific, well-defined organoleptic properties. There are no visible gaps or defects.
15.1 – 18	Good	Beer has positive, specific, defined organoleptic properties. It presents insignificant deficiencies/defects.
12.1 – 15	Satisfactory.	Beer has specific organoleptic properties, poorly shaped. It has small defects due to which the product is at the minimum level allowed by the product standard.
7.1 – 12	Unsatisfactory	The beer presents defects due to which it is of an inferior quality to the minimum limit of the product standard. It can be used for consumption only after admitted remediation by technology that do not contravene the rules of food hygiene.
0 - 7	Inappropriate	The beer has major defects, which makes it inappropriate for consumption.

## RESULTS AND DISCUSSIONS

### Results and discussions from the sensory analysis of the finished beer

**Suceava clasic** is a clear beer, without suspensions or sediment (5p). CO<sub>2</sub> impregnation is continuous, of short duration (4p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is dark yellow (3p) and the smell is characteristic, pleasant with slight aroma of hops and malt (4p). The taste is specific, remnant pleasant, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The total score, after applying the weighting factors is 17.2, which indicates that this beer is of good quality.

**Călimani** is a clear beer, without suspensions or sediment (5p). CO<sub>2</sub> impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is yellow (4p) and the smell is characteristic, pleasant with aroma of hops and malt (5p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The Călimani assortment is a very good beer. It registered the value of 18.8 points after calculating the total score resulted from the sensory analysis.

**Bermas** is a clear beer, without suspensions or sediment (5p). CO<sub>2</sub> impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is yellow (4p) and the smell is characteristic, pleasant with slight aroma of hops and malt (4p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). This assortment has positive, specific, well-defined

organoleptic properties and does not present any visible deficiencies or defects. The total score obtained is 18.6, which shows that this beer is of very good quality.

**Solca** is a clear beer, without suspensions or sediment (5p). CO<sub>2</sub> impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is straw yellow (5p) and the smell is characteristic, pleasant with aroma of hops and malt (5p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The total score of 19.6 indicates that this beer is of very good quality.

### Results and discussions regarding the physico-chemical parameters of the beer during the fermentation period

The initial extraction takes place when the beer is directed into the fermentation tank, the first determinations of the initial extract, pH and acidity being made, for all four types of beer: Suceava clasic, Călimani, Bermas and Solca, at this stage. From the results of the analyzes obtained, it can be observed that the average values of the initial extract, pH and acidity fall within the values imposed at the unit, not exceeding the values established by the organization within the documentation of the food quality and safety management system (*figure 2, figure 3, figure 4*).

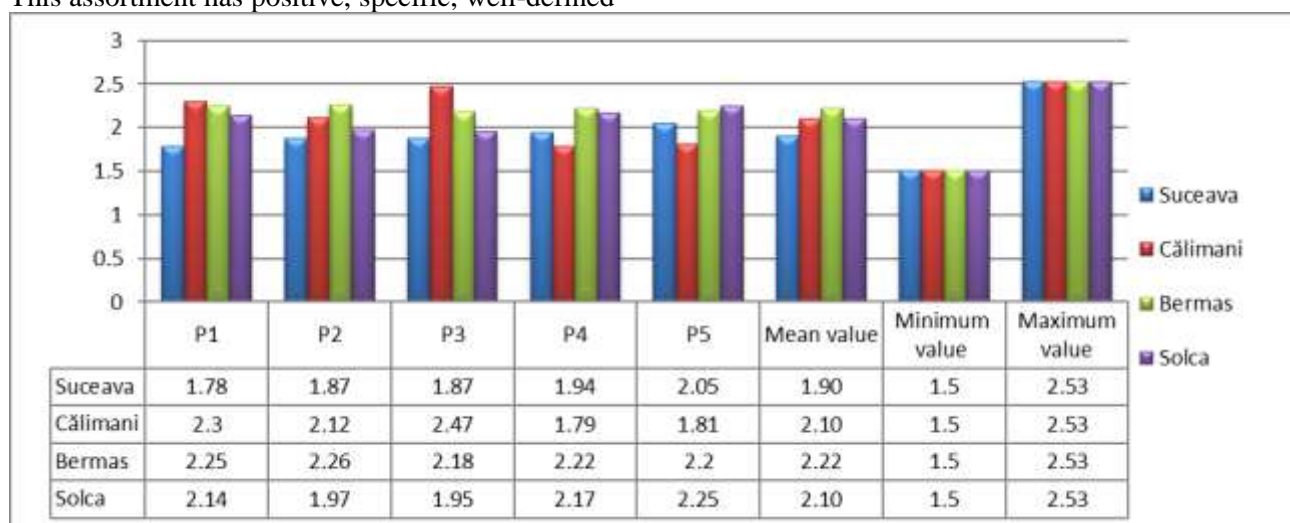


Figure 2 Evolution of the values obtained after determining the initial extract

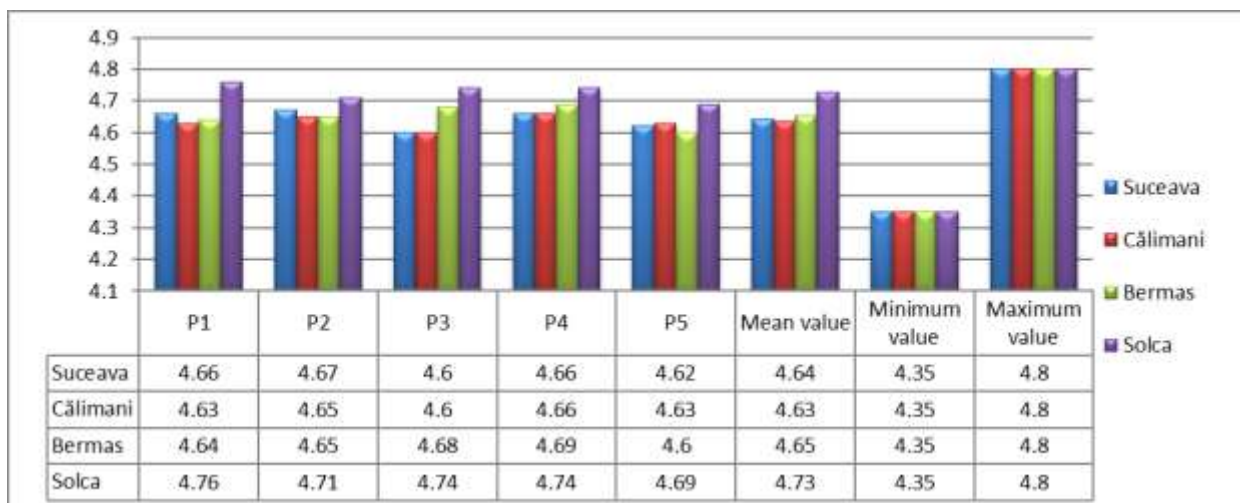


Figure 3 Evolution of the values obtained after determining the pH

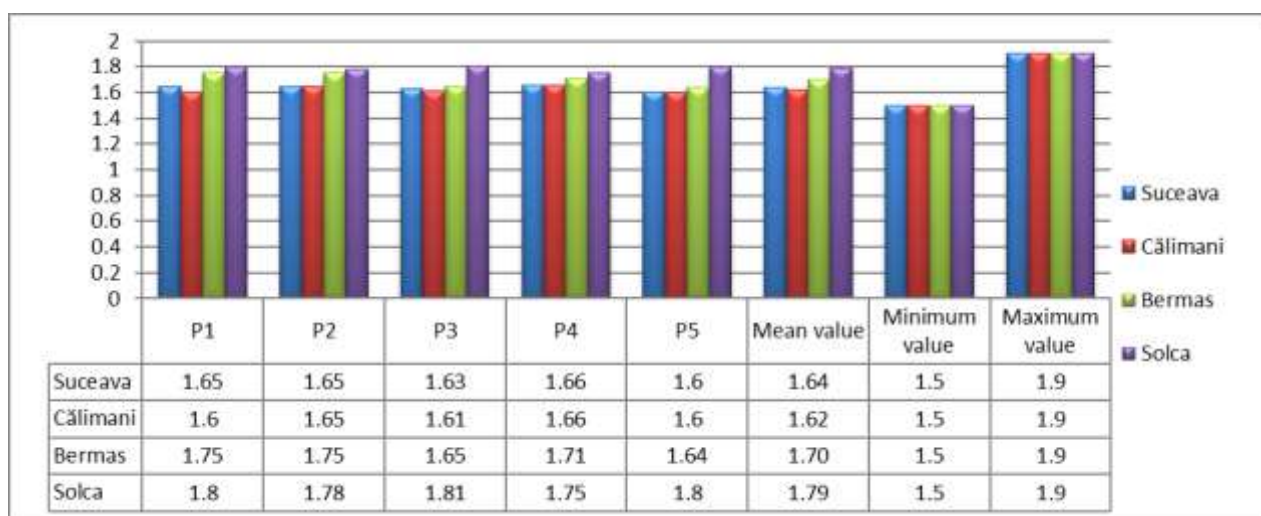


Figure 4 Evolution of the values obtained after determining the acidity

### Results and discussions regarding the physico-chemical parameters of the beer at the end of the fermentation period

At the end of the fermentation period, the tasting is carried out and the last physico-chemical analyzes are performed for the four types of beer.

Analyzing the results obtained from the laboratory determinations, it was found that the parameters considered (apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO<sub>2</sub> concentration) fall within the allowed limits, according to the veterinary sanitary norms in force.

#### The results of the final analyzes of the apparent extract

From the analysis of the values obtained for the apparent extract, it can be observed that the average value for the Suceava classic beer assortment is 1.59°P, for Călimani beer 1.87°P, for Bermas beer 2.12°P and for Solca beer 1.62°P, the values falling within the limits

imposed by the profile unit product standard (figure 5).

#### The results of the final analyzes of the real extract

Following the determination of the real extract of the beer in the unit's laboratory, an average value of this parameter of 3.18°P was obtained for the Suceava classic beer, 3.70°P for the Calimani beer, 4.07°P for the Bermas beer and 3.66°P for Solca beer, all values falling within the limits imposed by the profile unit product standard (figure 6).

#### The results of the final analyzes of the pH

The average pH value recorded is 4.62 for Suceava classic beer, 4.56 for Călimani beer, 4.58 for Bermas beer and 4.56 for Solca beer, the values falling in the range 4.35-4.8, imposed in the study unit. pH is one of the most important parameters in terms of taste and stability of beer (figure 7).

Comparing the results obtained in the present study, regarding the pH value, with the results obtained by Mudura E. et al. in 2006, it

was found that similar results were obtained, which fall within the reference range 4.35-4.8.

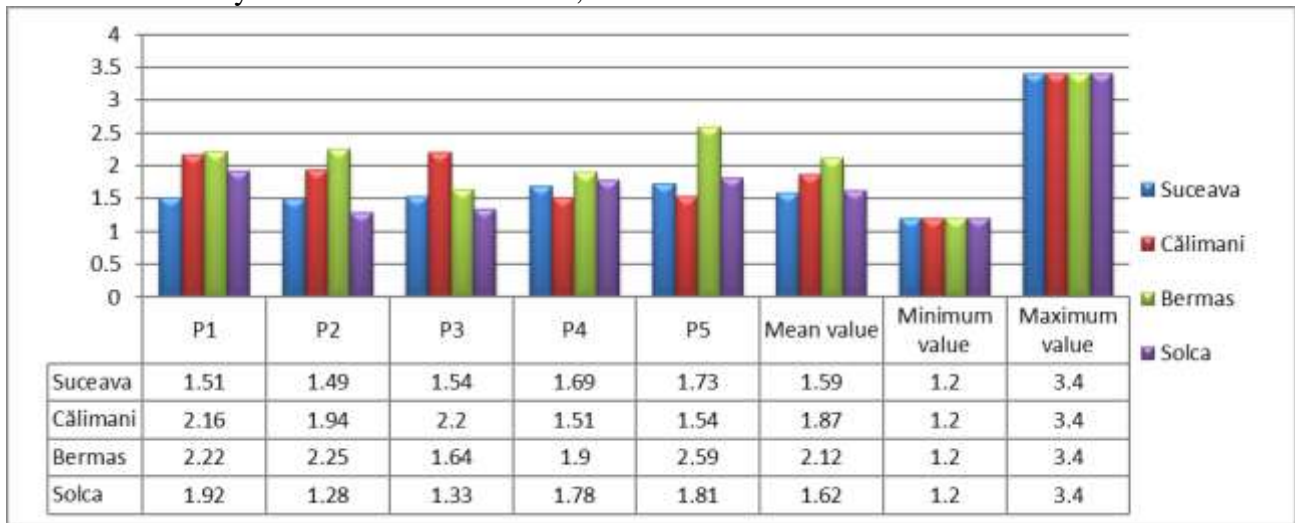


Figure 5 Evolution of the values obtained after determining the apparent extract (°P - Plato degrees)

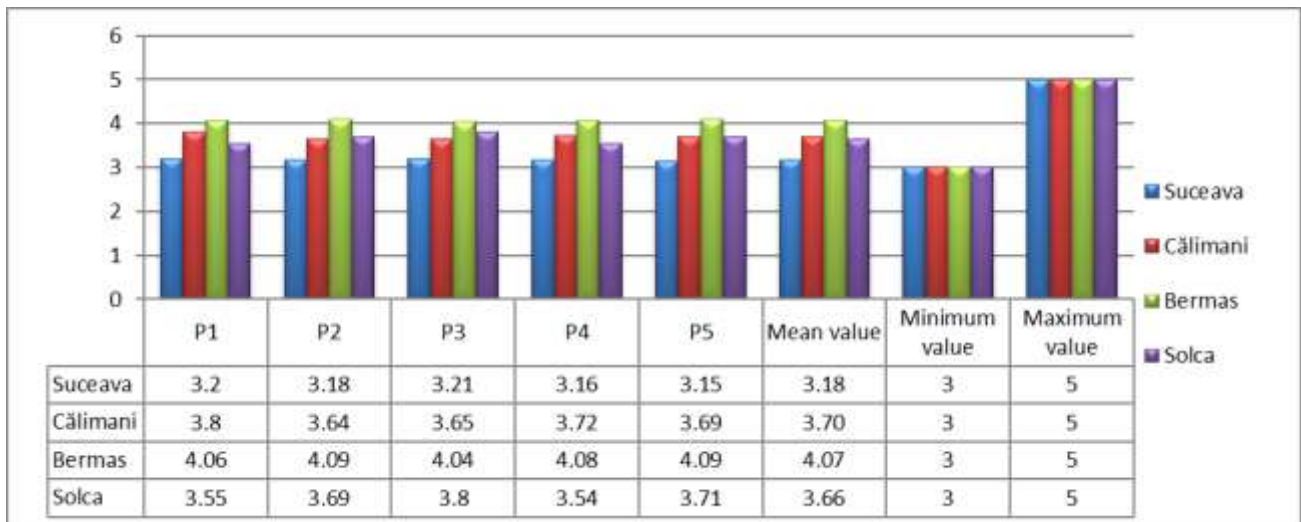


Figure 6 Evolution of the values obtained after determining the real extract (°P - Plato degrees)

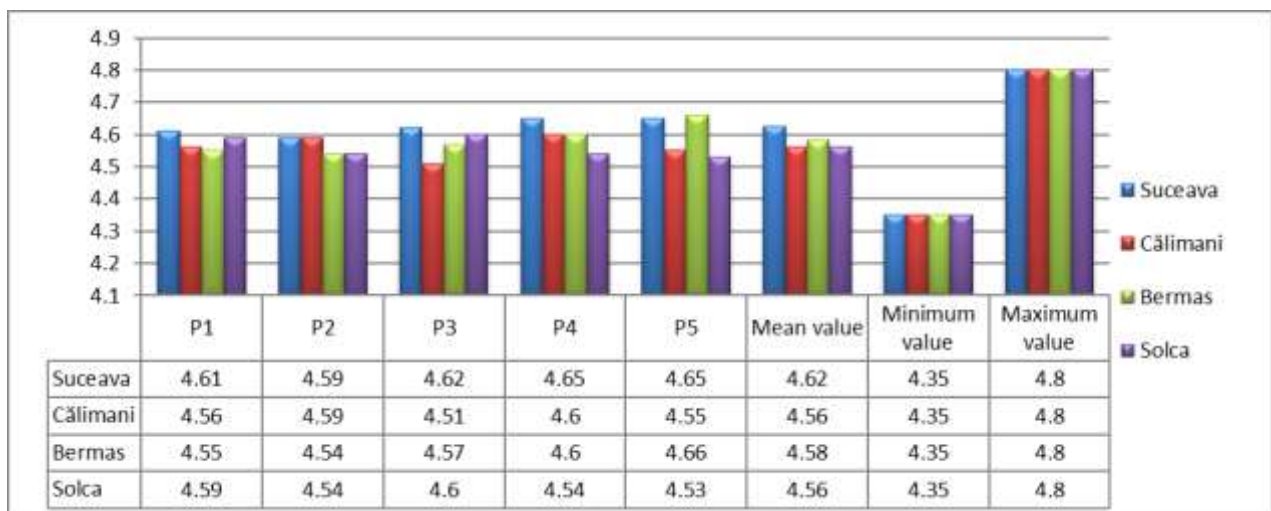


Figure 7 Evolution of the values obtained after determining the pH

**The results of the final analyzes of the alcohol concentration**

From the analysis of the obtained values, it can be observed that the average value of the alcoholic concentration of the Suceava clasic beer is 4.58%, of the Călimani beer 4.67%, of the Bermas beer 5.13% and of the Solca beer 5.09%, values that falls within the range imposed at the profile unit by the product standard (figure 8).

**The results of the final analyzes of the total acidity**

After determining the total acidity for the four varieties of beer, it can be observed an average value of 1.72 for Suceava clasic beer, 1.67

for Călimani beer, 1.99 for Bermas beer and 2.07 for Solca beer, the interval of reference imposed at the profile unit by the product standard being 1.6 - 4 ml solution NaOH/100 ml of beer (figure 9).

**The results of the final analyzes of the bitter value**

In the graph below, carried out after the determination of the bitter value for the beer assortments studied, it is noted that the average of this parameter is 23.04 bitter units for Suceava clasic beer, 20.72 bitter units for Călimani beer, 21.31 bitter units for Bermas beer and 21.14 bitter units for Solca beer, the values respecting the reference range required by the product standard (figure 10).

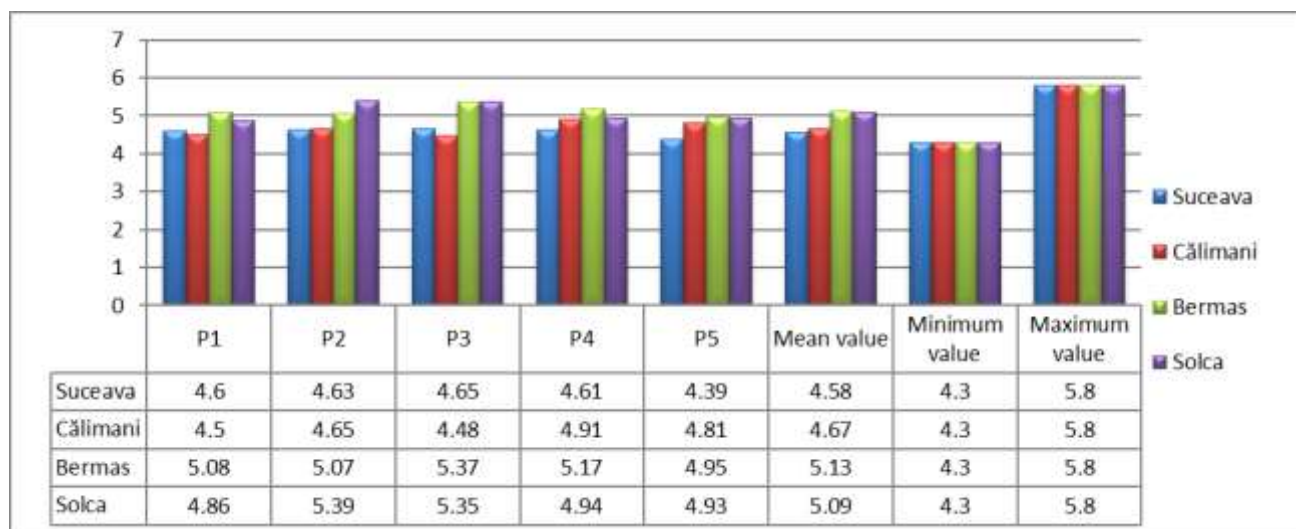


Figure 8 Evolution of the values obtained after determining the alcohol concentration (%)

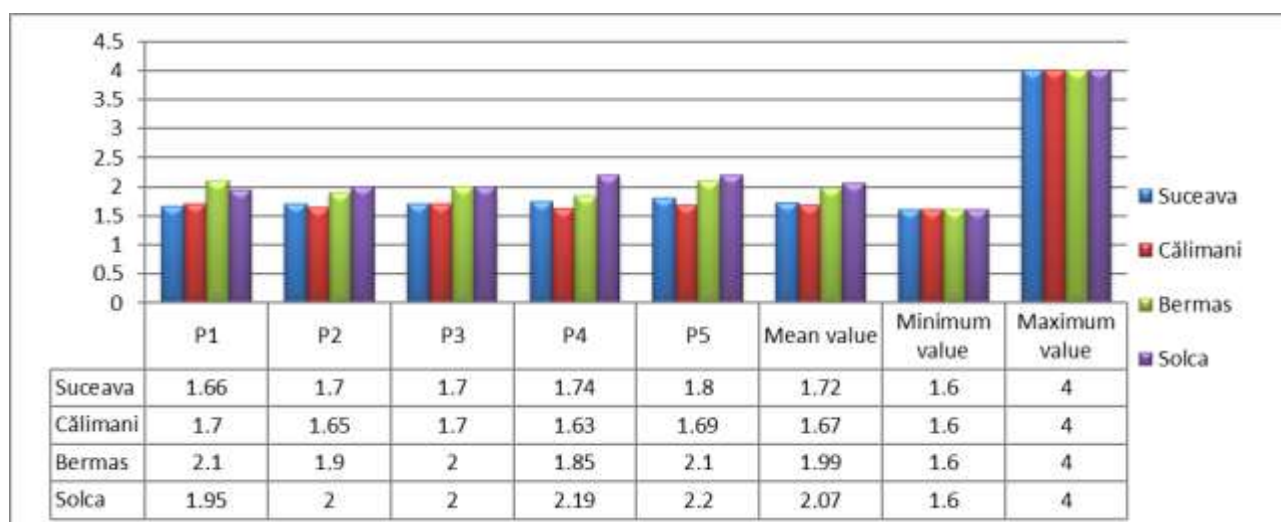


Figure 9 Evolution of the values obtained after determining the total acidity (ml solution NaOH 1 N/100 ml of beer)

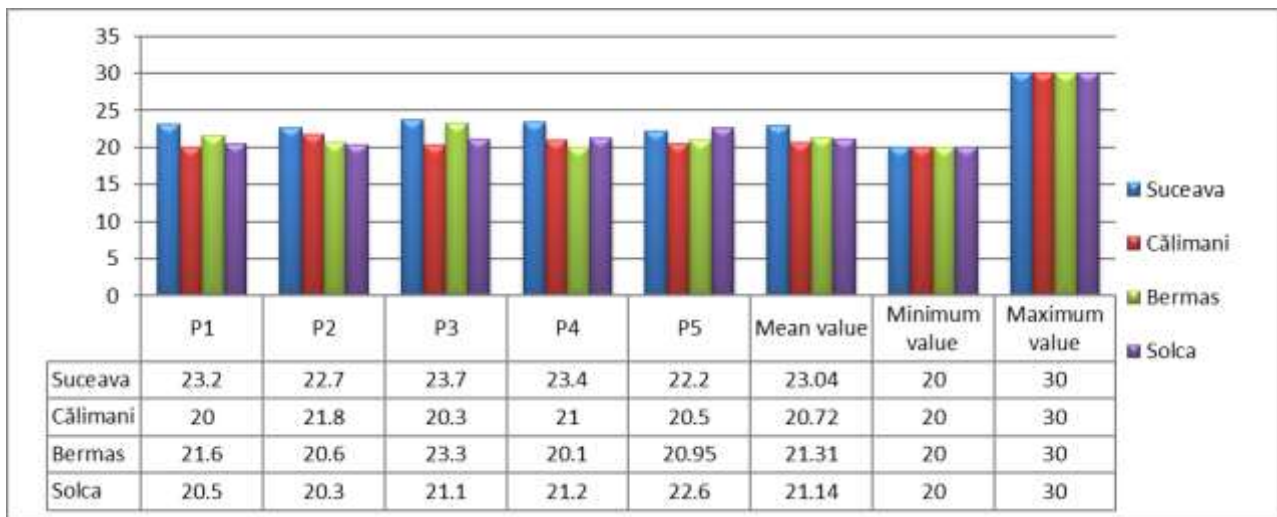


Figure 10 Evolution of the values obtained after determining the bitter value (bitter units)

**The results of the final analyzes of the CO<sub>2</sub> concentration**

The CO<sub>2</sub> concentrations fall within the range of values imposed at the profile unit for this

parameter, namely 0.3-0.5%, registering an average value of 0.45% for Suceava classic beer, 0.40% for Călimani beer, 0.41% for Bermas beer and 0.46% for Solca beer (figure 11).

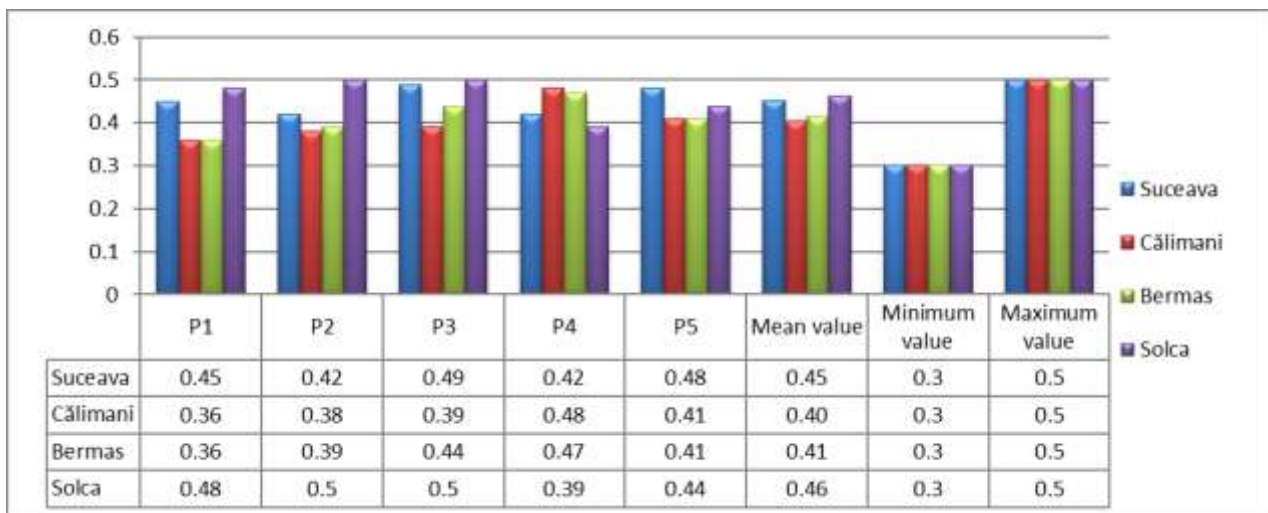


Figure 11 Evolution of the values obtained after determining the CO<sub>2</sub> concentration (%)

**CONCLUSIONS**

Following the laboratory analyzes of the four types of beer (Suceava clasic, Călimani, Bermas and Solca) obtained in the study unit, resulted that for the analyzed parameters, the obtained values fall within the allowed limits, according to the veterinary sanitary norms in force, respectively the four types of blonde beer have a good or very good quality.

Following the determination of the apparent extract, the lowest value was registered in Solca beer, being 1.28°P and the highest value in Bermas beer of 2.59°P. These results fall within the limits imposed at the profile unit by the product standard.

pH is a very important indicator in the beer industry, the reference range being between 4.35 and 4.8, the highest value obtained being at Bermas beer, respectively pH=4.66.

The concentration in alcohol is another important parameter, all the four types of blonde beer falling in the range 4.3 - 5.8% alcohol, and limits between which the results of the determination of the CO<sub>2</sub> concentration were included, were between 0.3% and 0.5%.

The products obtained within the study unit correspond to the quality requirements imposed by the standards in force and the consumption of these products does not present any risk to the consumer.

It is recommended to maintain the frequency of the laboratory determinations, because this way, obtaining products with constant parameters is guaranteed.

#### REFERENCES

- Banu C., 2001** - Tratat de știință și tehnologia malțului și a berii, vol II, Editura Agir, București.
- Banu C., 2009** - Tratat de industrie alimentară – Tehnologii alimentare, Editura ASAB, București.
- Berzescu P., Dumitrescu, M., Hopulele, T., Kathrein, I., Stoicescu, A., 1981** - Tehnologia berii și a malțului, Editura Ceres, București.
- Branyik T., Silva D.P., Baszczynski M., Lehnert R., E Silva J.B.A., 2012** - A review of methods of low alcohol and alcohol-free beer production. *Journal of Food Engineering*, 108(4): 493-506.
- Ghimpețeanu, M., 2017** - Tehnologii de obținere a băuturilor alimentare – Aplicații practice, Editura EX TERRA AURUM, București.
- Hlatky M., 2013** - Fabricarea berii la îndemâna tuturor, Editura M.A.S.T.
- Masschelein C.A., Ryder D.S., Simon J.P., 2008** - Immobilized Cell Technology in Beer Production. *Critical Reviews in Biotechnology*, 14(2):155-177.
- Mihaiu M., Necula V., Babii M., Marina A., 2013** - Analiză senzorială, Editura Universității Transilvania, Brașov.
- Muste S., Tofană, M., Mudura, E., Mureșan, C., Laslo, R., 2005** - The effects of hops quality parameters on beer characteristics. *Buletinul USAMV-CN*, 61:333-338.
- Mudura E., Muste, S., Tofană, M., Mureșan, C., 2006** - Risk management of beer fermentation – diacetyl control. *Buletinul USAMV-CN*, 62:303-307.
- SR 13355-1:1997** Bere. Metode de analiză. Analiza senzorială.