NUTRITIONAL EVALUATION OF A PILSEN MALT BEVERAGE ENRICHED WITH TAXO (PASSIFLORA TRIPARTITA)

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ABSTRACT

The malt-based, it is made from fermented malted cereals. The research project was carried out in order to evaluate the nutritional and organoleptic characteristics of a malt-based drink enriched with Taxo. For the study, 5 treatments were proposed including a control with 100% malt, treatment 3 3 (Malt 85% and taxo 15%) presented: 3.58 pH, 0.64 acidity and 10.88 ° Brix, values that are found within the limits established by the NTE INEN 2302-2009 standard. The samples were sensory evaluated in which the panel chose treatment 3 (Malta 85% and taxo 15%), as the best formulation in terms of its color, odor, flavor and appearance characteristics, demonstrating the influence of taxa on color, smell and taste in its sensory properties. The nutritional content of the drink per 100 ml is: 0.45% (0.45 g) proteins, 0.16% (0.16 g) lipids, 8.13% (8.13 g) carbohydrates.

Keywords: Nutritional Drink, Malt, Taxo.

INTRODUCTION

Malt-based beverages are a type of beverage that may or may not contain alcohol in its composition, and are made using cereals that are malted and fermented (FAO, 2013).

Malt extract is one of the fundamental ingredients most commonly used for the manufacture of beers and non-alcoholic malt beverages, these products are the result of industrial processes to which whole grains are subjected in order to carry out starch hydrolysis (Angulo, 2016).

The main component of malt is maltose, in addition to hydrolyzed proteins, vitamins and minerals (Delgado, 2015). Among the types of malts that exist, light malts are called base malts because their grains are baked at low temperatures and for a shorter time (Salvat, 2016).

It is known that the cultivation of Taxo is produced in the provinces of Carchi, Imbabura and mainly in Tungurahua, which according to a study by the National Autonomous Institute of Agricultural Research INIAP, the crop is also found in the cantons: Pelileo (62%); Tisaleo (21%); Mocha (15%) and Ambato (3%), and constitutes a source of economic resources for farmers who are dedicated to exploit it (Angulo, 2016).

Taxo pulp is important because it is one of the fruits with high nutritional values, per 100 g of pulp it contains: 92 g moisture, 25 kcal, 0.6 g protein, 6.3 g carbohydrates, 0.3 g fiber, 0.7 g ash and 70 mg ascorbic acid (Vasco, 2009).

MATERIALS AND METHODS

This research was carried out in the pilot plant of the Faculty of Agricultural Engineering (Agro-industrial Mention) of the Agrarian University of Ecuador, Milagro canton - Guayas province. The bromatological analyses were carried out in certified laboratories (UBA).

Experimental design

The designs applied in the research were DCA for the quantitative variables (acidity, pH and ° Brix), considering four replicates for each treatment. For the qualitative variables (color, odor, flavor and texture), a DBCA completely randomized block design was used, in which the blocking source was the sensory panel represented by 30 tasters, under a hedonic criterion.

The information obtained from these trials, both in the case of quantitative and qualitative

variables, was subjected to analysis of variance to detect significant differences. Likewise, the Tukey test was used as a test for comparison of means. These analyses were performed with a 5% probability of type I error.

Table 1. Base and taxo malt concentrations

No. Treatment	% Base malt (Pilsen)	Taxo
1	70%	30%
2	75%	25%
3	85%	15%
4	90%	10%
5	100%	(Witness)

Prepared by: Paguay, 2021

For the development of this research, we began with the reception of the raw material, at this stage of the process we verified that the raw material Malt base (Pilsen) and Taxo were of optimum quality, in the case of the fruit, that it had an optimum maturity index of 5°Brix and a maximum pH of 5.5. The Pilsen base malt and Taxo were weighed according to the percentages established in the treatments.

The malt was milled using mechanical methods (mill), previously disinfected, until the grains were broken. Once the grains were milled, mashing (converting starches into sugar) was carried out. Water was added to the base malt in a 2.5:1 ratio (2.5 liters of water for every 1000 ml of Taxo).

To obtain the wort, approximately 2 liters of water were added when the malt temperature had reached 74 °C (74 °F). The hops were added and allowed to reach a temperature of 100°C. Once this temperature was reached, the wort was filtered and the temperature was lowered to 60°C to add the Taxo pulp, at this temperature the vitamin C in the fruit is not degraded. The temperature was lowered again to 20°C to proceed with the gasification process, using the agitation method, which consisted of placing the beverage in the Co2 tank for 3 to 5 minutes.

The beverage was taken to refrigeration after 60 minutes, the must was left to rest and then in the final product so that it would not cause a turbidity defect, until it reached a temperature of 3 to 5 °C. In the cold maturation, it was left to rest in well covered stainless-steel pots for maturation for 4 days at a temperature of 6 - 8 °C. Once matured, it was left to rest for 48 hours at a temperature of 2-3°C. The malt beverages were bottled in glass bottles (336 ml) previously sterilized and sealed under pressure.

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In the cold maturation, it was left to rest in tightly covered stainless steel pots for maturation for 4 days at a temperature of 6 - 8 °C. Once matured, it was left to stand for 48 hours at a temperature of 2-3°C. The malt beverages were bottled in glass bottles (336 ml) previously sterilized and sealed under pressure.

The physicochemical parameters Ph, °Brix, acidity was evaluated. For each evaluation, 30 ml samples were taken from each treatment before packaging. In accordance with INEN Standards

ISO 750, 1842, 2173.

For the pH analysis, a pH meter with a scale graduated in 0.05 pH units and a glass electrode were used for each of the treatments with 4 replicates of each sample. For the °Brix analysis, the samples were placed in the refractometer to observe the ° Brix of the malt beverage. For the acidity tests, sodium hydroxide c (NaOH) = 0.1 mol/l in the presence of phenolphthalein, 10 g, 1 g of a solution in 95 % (volume) ethanol as indicator, distilled water was used.

The most acceptable malt beverage was evaluated by a panel of 30 semi-trained tasters according to the attributes color, odor, taste and appearance, using a 6-point hedonic scale in which 1 I do not like and 6 I like very much. The nutritional value (ascorbic acid, carbohydrates, proteins, energy and ash) of the malt beverage best evaluated by the sensory panel was analyzed in UBA laboratories, according to INEN Standard 2324.

The microbiological analysis of molds, yeasts and mesophilic aerobes was carried out according to INEN Standard 1529-10 and 1529-6, respectively. For this reason, the best evaluated sample was sent to a certified laboratory for analysis after 15 and 30 days.

RESULTS

Physical and chemical characteristics (acidity, pH, °Brix) of a barley-based beverage enriched with taxo (passiflora tripartita).

Table 2. Statistical averages of physical or chemical variables

No.	Treatments	pH	Acidity	°Brix
1	T1: 70% Malt 30% Taxo	3.58 c	0.64 ab	9.83 c
2	T2: 75% Malt 30% Taxo	4.13 b	0.62 c	10.55 b
3	T3: 85% Malt 30% Taxo	4.18 b	0.64 a	10.88 ab
4	T4: 90% Malt 30% Taxo	4.18 b	0.53 b	11.45 a
5	T5: 100% Malt (Witness)	5.43 a	0.37 a	11.60 a
	CV (%):	4.95	10.99	4.29

Equal letters do not differ significantly from each other according to Duncan's test at 5% probability.

Paguay, 2021

Equal letters do not differ significantly from each other according to Duncan's test with 5% probability (Paguay, 2021).

Table 2 describes the averages of the physical-chemical analysis of the samples. In the case of pH, significant differences were observed, except for T2, T3 and T4, which presented equal letters, i.e., they did not differ significantly among themselves. T3 (Malt 85% Taxo 15%) presented a pH of 4.18 and the lowest pH was presented by T1 (Malt 70% Taxo 30%) with an average of 3.58 and T5 (Malt 100%) obtained the highest value of 5.43. The treatments with taxo in their formulation obtained lower pH values than the control treatment.

Thus, it was evident that the higher the amount of taxo, the lower the pH. Also, with the values obtained being within the permitted ranges, the beverage did not present any chemical or biological alteration. To preserve shelf life, beverages should have a pH between 3 and 4.

DISCUSSION OF RESULTS

According to Onofre (2018), when making nutritional beverages from exotic fruits in which he included taxo, he indicates that they must have a final pH of 4.00 to 5.5 to be considered a quality beverage, same parameters that coincide with those obtained in the current research. Both values are within the requirements established by NTE INEN 2 302 2009-05.

According to the results of acidity obtained in the treatments indicate that there are significant differences between them, the lowest acidity was presented by T5 (Malt 100%) with an average of 0.37 and T1 (Malt 70% Taxo 30%) and T3 (Malt 85% Taxo 15%) with 0.64 were the highest values, according to the standard NTE INEN 2662 should contain a total acidity of 0.3 therefore treatment 5 is found to have a total acidity of 0.3.

The NTE INEN 2 302 2009-05 standard indicates that the acidity values in carbonated beverages should be less than 1% to ensure the quality of the product, concluding that the beverage is suitable for consumption and considered a quality product.

The ° Brix indicate the percentage of soluble solids present in each of the treatments, the averages show that the control treatment with 11.60 ° Brix and T3 (Malt 85% Taxo 15%) obtained the highest soluble solids content and treatment 1 with 9.83 ° Brix presented the lowest value.

Charley (2016), who mentions that “Non-alcoholic beverages must contain a margin of 9 to 14 °Brix, in the same way complies with the requirements established by the NTE INEN 2 302 2009-0 standard.

Sensory evaluation of the treatments based on the attributes: color, flavor, color and appearance.

Table 3. Statistical averages of sensorial variables

No.	Treatments	COLOR	ODOR	TASTE	APPEARANCE
1	**T1: 70% Malt 30% Taxo**	3.40 c	3.40 c	3.40 c	3.33 b
2	**T2: 75% Malt 30% Taxo**	3.67 bc	4.00 b	3.40 c	3.37 b
3	**T3: 85% Malt 30% Taxo**	5.37 a	5.53 a	5.53 a	5.07 a
4	**T4: 90% Malt 30% Taxo**	4.23 b	3.43 bc	3.60 bc	3.87 b
5	**T5: 100% Malt (Witness)**	3.40 c	3.77 bc	4.17 b	3.73 b
	CV (%):	**21.89**	**19.77**	**24.74**	**21.9**

Equal letters do not differ significantly from each other according to Duncan's test at 5% probability.

(Paguay, 2021)

The statistical averages of the sensory analysis of the treatments are shown in Table 3. It is observed that the means of the color attribute show significant differences between them.

The control treatment (100% taxo) and T1 (Malt 70% and taxo 30%) did not obtain good sensory acceptance and treatment 3 (Malt 85% and taxo 15%) presented the highest mean.

According to the evaluation of the odor attribute with a cv of 19.77%, treatment 3 with 5.53 was the best evaluated by the sensory panel and treatment 1 with 3.43 obtained less sensory acceptance, the results are due to the incidence of taxo in the formulations, the treatments with less taxo obtained a better score is due to the color and characteristic odor of the fruit that was not to the liking of the judges.

As for the sensory characteristics of taste and appearance, it was observed that the taxo did influence the taste of the treatments, with the samples that had the least amount of taxo in their formulation showing greater sensory acceptance.

The treatments presented statistical differences and interactions among themselves, highlighting treatment 3 with an average of 5.53 and 5.07 respectively, as the formulation with the highest sensory acceptance. According to the averages of the statistical analyses performed on the

treatments, it can be observed that the sensory panel chose treatment 3 (Malt 85% and taxo 15%) as the best formulation in terms of its color, odor, flavor and appearance characteristics.

In the same way Yola (2016), conducted an investigation of natural beverages from taxo in which he states that the raw material positively influences the organoleptic characteristics of the products when applied in values less than 25%. This assertion is corroborated by the current research because among the treatments evaluated was the control without taxo, however, the sensory panel chose a treatment with 15% taxo in its formulation.

Nutritional evaluation (ascorbic acid, energy, phenolic content, and antioxidant capacity) to the treatment with the highest sensory acceptance.

Treatment 3 (Malt 85% and taxo 15%) was the best evaluated by the sensory panel, and the nutritional content of the product was evaluated in a certified laboratory. The results shown in Table 4 are based on 100 ml of beverage analyzed.

PARAMETERS	METHODS	RESULTS	UNIT
Proteins	AOAC 984.13 (VOLUMETRY)	0.45	%
Lipids	Folch Modified (Gravimetry)	0.16	%
Ash	AOAC 942.05 (Gravimetry)	0.22	%
Carbohydrates	Clegg-Antrone (Spectrophotometry)	8.13	%
Energy	Calculation	35.76	kcal/100
Vitamin C	Montoya and Molina 1995 (Chromatography)	52.32	mg/kg
Total polyphenols	Folin-Ciocalteau (Spectrophotometry)	0.51	%
Antioxidant activity DPPH (IC50)	(DPPH Method)	4.87 x 10^6 (Gallic Acid)	mg/mL
		1.37 x 10^6 (Ascorbic Acid)	mg/mL

(Paguay, 2021).

The nutritional analysis was carried out at T3 (Malt 85% Taxo 15%), the following results were evidenced: 0.45 % (0.45 g) of protein, 0.16 % (0.16 g) of lipids, 8.13 % (8.13 g) of carbohydrates and 35, 76 kcal per 100 ml of beverage. In addition, the presence of polyphenols (0.51 g) and

vitamin C 52.32 mg can be observed.

The values of antioxidant capacity analyzed in certified laboratories, by spectrophotometry using the 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) technique, presented 4.87 gallic acid and 1.37 ascorbic acid, values that show low antioxidant capacity in the malt beverage.

Likewise, León (2016), evaluated the obtaining of a dehydrated base from taxo pulp preserving carotenes and phenolic compounds, in his research he states that the taxo has bioactive compounds of interest such as β-carotenes (9.84 ± 0.45) and soluble phenolic compounds (4 102.92 ± 33.59), due to the values that his final product presented. This assertion is verified by the current research, in which the presence of polyphenols in the malt beverage enriched with taxo was demonstrated by laboratory analysis.

Shelf life of the most sensory acceptable beverage.

The stability analysis was performed on treatment 3, which was the best scored by the sensory panel, according to the results obtained it can be observed that, at 0 days, there was no microbial growth, then after 15 and 30 days of the sample in analysis it is evident that there was no presence of colony forming units, the results were compared with the standard NTE INEN 1529-10: 2013. Thus, the beverage is considered fit for human consumption.

Likewise, Gallardo (2014), in his research addressed the study of obtaining two beverages, non-alcoholic beer (malt) and beer, from white sorghum UDG-110, research in which he conducted microbiological analysis concluding that the final product has a stability of 30 days, using sodium benzoate as a preservative. In both investigations, the stability of the final product was maintained at 30 days, demonstrating the preservative effect of sodium benzoate.

The results obtained in the research according to the experimental conditions concluded that treatment 3 (85% Malt-15%Taxo) had greater acceptance in the sensory analysis. The physicochemical analyses pH, °Brix, and acidity of this treatment showed that they are within the parameters of the INEN ISO 750, 1842, 2173 standards. In the nutritional analysis after 24 hours of processing, the following results were observed: 0.45 % (0.45 g) of proteins, 0.16 % (0.16 g) of lipids, 8.13 % (8.13 g) of carbohydrates and 35.76 kcal per 100 ml of beverage. In addition, the presence of polyphenols (0.51 g) and vitamin C 52.32 mg can be observed.

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