

PHYSICOCHEMICAL CHARACTERIZATION AND ACCEPTABILITY OF SOME ARTISANAL MINT LIQUEURS

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Received: October, 27, 2017

Accepted: June, 04, 2018

Abstract: The medicinal herb *Mentha piperita* L. has been used for hundreds of years for its remarkable medicinal properties. Due to its composition rich in essential oil, terpenes, flavonoids etc., the peppermint is commonly used in various fields for obtaining cosmetics, medicines, and also in the food industry. The aim of the present study consisted in developing accessible recipes for preparation of artisanal dessert mint liqueurs by different extraction variants and determining their physicochemical and sensory analyses. Four types of mint liqueurs were prepared by maceration of peppermint leaves in alcohol, varying the extraction parameters: time, temperature or by changing the order of ingredients addition. For the obtained artisanal liqueurs samples the following physicochemical characteristics were determined: dry extract, alcoholic strength, soluble solids, total acidity, fixed acidity, volatile acidity, density, conductivity and refractive index. The samples prepared were organoleptically analyzed by a multi-sensory approach (appearance and clarity, color, odor and aroma, taste) using the scoring method and the results revealed that the artisanal liqueurs obtained are well accepted by the consumers.

Keywords: *extraction, maceration, Mentha piperita, physicochemical characterization, sensory analysis, valorization*

INTRODUCTION

Peppermint (*Mentha piperita*) represents an important medicinal and aromatic plant. The chemical components of peppermint leaves fluctuate with plant maturity, variety, geographical region and processing conditions [1]. The volatile profile of peppermint essential oils is mainly constituted by menthol (33 - 60 %), menthone (15 - 32 %), 1,8-cineole (eucalyptol) (5 - 13 %), menthyl acetate (2 - 11 %), menthofuran (1 - 10 %), isomenthone (2 - 8 %), limonene (1 - 7 %), etc. [1 – 4].

It is well known that aromatic plants have various beneficial effects to human health. The peppermint is traditionally used throughout the world as an antiseptic, bacteriostatic, antiemetic, antiallergic, carminative, diuretic, tonic and stimulant agent [4 – 14].

The peppermint leaves (fresh and dried) and the essential oil extracted from the leaves are used in pharmaceutical, perfume, cosmetics and food industries [5, 9, 15]. Due to the fact that the leaves present a pleasant warm, fresh, aromatic, sweet flavor with a cool aftertaste, the peppermint is used in food industry for obtaining different beverages, jellies, syrups, candies, ice creams and as a flavoring for teas and yoghurts, particularly in Arab cuisine.

The utilization of plant material as ingredient for spirit drinks represents an ancient process.

Liqueur is a spirit drink with a high sugar content, which can vary depending on the assortment. One of the biggest benefits of liqueurs is how versatile they are. Like many spirits, liqueurs can be used also in mixed drinks, over ice, with coffee or mixed with other non-alcoholic beverages such as cream or milk. Many can be used for cooking or in baking and certain liqueurs have even become the major highlight of many desserts.

The most known plants used for liqueurs preparation are mint, gentian, anise, angelica, rhubarb, etc. [16].

Different extraction techniques are applied in alcoholic and non-alcoholic beverage industries in order to obtain plant macerates, tinctures or other plant extract and essential oils, as base ingredients for digestives type beverages [13, 16]. Even if the maceration is the oldest method applied in beverages industry, it is used also nowadays. Because there are currently only a few assortments of mint liqueurs on the Romanian market, the objective of the present study was to develop accessible recipes for peppermint artisanal liqueurs and assess physicochemical and sensory differences among the prepared formulation.

MATERIALS AND METHODS

Liqueurs production

Mint liqueurs were obtained with:

- fresh leaves of *Mentha piperita* collected from Bacău district (Romania) and authenticated by our colleagues from the Biology Department of our university. After being washed in running water and dried in natural convection mode, the leaves were manually chopped.

- ethyl alcohol of agricultural origin 60 % vol. purchased from the company Prodvinco Cluj (Romania) [17];
 - natural mineral water "Bucovina" from S.C. Rio Bucovina S.R.L. Vatra Dornei (Romania) [18];
 - organic sugar "Mărgăritar" supplied by Agrana Romania S.A. Roman [19].
- No dyes or synthetic flavors were added.

For the preparation of mint liqueurs samples were used: fresh mint leaves (15 g), ethanol 60 % vol. (75 mL), natural mineral water (130 mL) and organic sugar (50 g). Different methods of obtaining mint-based alcoholic beverages have been considered by maceration and hot extraction. Four types of mint liqueurs were prepared by maceration of fresh peppermint leaves in alcohol, varying the extraction parameters: time, temperature or by changing the order of ingredients addition (Table 1).

Table 1. Procedure for obtaining artisanal mint liqueurs

V ₁	V ₂	V ₃	V ₄
Maceration of peppermint leaves in alcohol (at room temperature for 1 week)	Extraction of peppermint leaves with hot alcohol (60 ° C, 1 h)	Syrup preparation of peppermint leaves with sugar and water (60 °C)	Maceration of peppermint leaves in alcohol and sugar (at room temperature for 1 week)
	Maceration (24 hours)	Maceration (24 hours)	
Filtration			
Addition of sugar syrup*	Addition of sugar syrup*	Addition of alcohol	Addition of water
Maturation (30 days)			
Final filtration			

* the sugar syrups were mildly heated only for sugar dissolution

After production, the mint liqueurs were maintained at temperature room (21 °C) away from the light and with manual agitation in the first seven days. The filtrations were carried out to remove the plant residues.

After maturation, physicochemical and sensory analyses were realized.

For comparison, a commercial mint flavored liqueur "Antaro" produced by S.C. Alcoprod Service S.A. Urziceni (Romania) was purchased from Romanian market. The ingredients for commercial mint liqueur are: softened water, ethyl alcohol of agricultural origin, mint extract 1 %, mint flavor, food acidifiers E330, food colorants E104 and E131.

Physicochemical and sensory analyses

Physicochemical analyses

The physicochemical analyses carried out according to methodologies presented in official methods of analysis by the Association of Official Analytical Chemistry (AOAC) [20, 21] were: dry extract, alcoholic strength, soluble solids, total acidity, fixed acidity, volatile acidity, density, conductivity and refractive index.

All the reagents used (sodium hydroxide, phenol red and indigo carmine) were of analytical grade and were purchased from Sigma-Aldrich.

All the analyses were done in duplicate.

Dry extract of mint liqueurs samples expressed in $\text{g}\cdot\text{L}^{-1}$ was determined by gravimetric method.

Alcohol strength was evaluated by distillation and density evaluation; the results are presented as volumetric percentage of ethanol in beverage. The density was measured by pycnometer and it is expressed in $\text{g}\cdot\text{mL}^{-1}$.

Total acidity was evaluated by titration with 0.05 M NaOH in the presence of a mixture of indigo carmine and phenol red until the yellow-green color changes to red-brown.

Fixed acidity was evaluated by titration with 0.05 M NaOH of the water solutions of dry extract according to the same protocol as for the determination of total acidity and the results are expressed in grams of acetic acid per liter.

Volatile acidity was calculated by the difference between total and fixed acidity.

The conductivity was determined by HACH Sensions conductometer and it is expressed in $\mu\text{S}\cdot\text{cm}^{-1}$.

Soluble solids and the refractive index were measured using a Kruss D22297 Optronic refractometer.

Sensorial analysis

The samples prepared were organoleptically analyzed by a multi-sensory approach (appearance and clarity, color, odor and aroma, taste) using the scoring method. Thus, it is possible to determine differences in acceptance among the consumers and the size of this difference, depending on the scale [22, 23]. For the sensory evaluation of our mint liqueurs samples, the scoring system with 20 points was used.

Twenty both male and female untrained tasters took part in the acceptance test. The samples were coded with V_0 (for commercial sample) and V_1 to V_4 (for obtaining artisanal mint liqueurs) and were served at room temperature in liqueur glasses and under white natural lighting. Water was provided for mouth rinsing between samples.

The panelists accorded points for each descriptor by filling out an evaluation form (Table 2).

Table 2. Evaluation form for sensory analysis of mint liqueurs

Attributes	Scoring limit [points]	Accorded score [points]	Overall impression and other observations
Appearance, clarity	0-2		
Color	0-2		
Odor, aroma	0-4		
Taste	0-12		
Total points	0-20		

RESULTS AND DISCUSSION

Physicochemical analyses

Table 3 shows the results obtained for the physicochemical analyses conducted for the four mint liqueur samples obtained in the laboratory (V_1 - V_4) and for commercial mint liqueur (V_0).

Table 3. *Physicochemical characteristics of the mint liqueur samples*

Physicochemical characteristic	Samples				
	V ₀	V ₁	V ₂	V ₃	V ₄
Dry extract [g·L ⁻¹]	239.1	253.5	254.5	261.6	222.7
Alcoholic strength [% vol.]	16.00	15.58	15.02	15.45	16.00
Soluble solids [°Bx]	24.57	25.82	26.07	27.32	24.57
Total acidity [g of acetic acid / L]	1.836	0.192	0.372	0.348	0.132
Fixed acidity [g of acetic acid / L]	1.248	0.120	0.168	0.132	0.084
Volatile acidity [g of acetic acid / L]	0.588	0.072	0.204	0.216	0.048
Density [g·mL ⁻¹]	1.055863	1.059419	1.060338	1.061716	1.051279
Conductivity [μS·cm ⁻¹]	1176	942	1034	1231	1203
Refractive index	1.3710	1.3730	1.3735	1.3760	1.3710

The alcohol content found in the analyses pointed no major differences between samples (15 - 16 % vol.) which is in accordance to the standards.

In the case of commercial sample (V₀), from all the psychochemical parameters, the acidity values are significantly higher (3 to 14 times higher than our prepared samples) due to the presence of citric acid (E330) as ingredient.

V₃ is the sample with the higher registered values for: dry extract content which is correlated with density value and conductivity.

A possible explanation for the higher values of acidities for V₂ and V₃ samples could be that those two samples are the only ones in which the heating (60 °C) was used for their preparation.

Sensory analysis

In the Figure 1 are shown the mint liqueurs samples submitted to the tasters for sensory analysis.

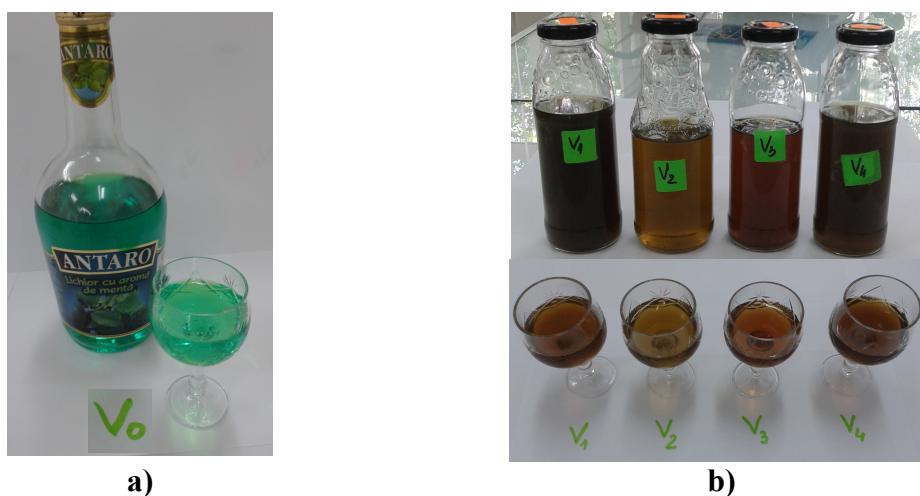


Figure 1. *Mint liqueurs samples: commercial (a) and artisanal (b)*

The sensory profile of the mint liqueurs samples evaluated for their various attributes is presented graphically in Figure 2.

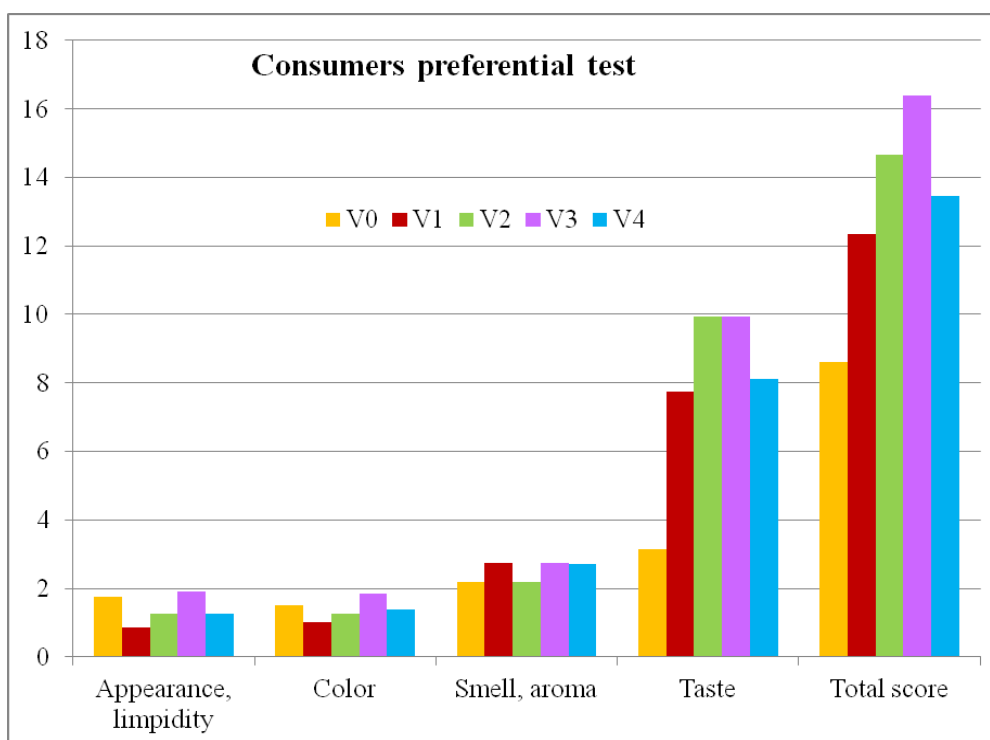


Figure 2. Values for sensory analysis

Concerning the appearance, limpidity and color aspects only the V₃ sample was rated with a better score than V₀ sample.

On the contrary, the sensory perception concerning the smell, aroma and taste attributes for all the artisanal mint liqueurs was considerably better than that of commercial liqueur.

Regarding the scores accumulated by samples V₂ and V₃, it seems that using heating (60 °C) for the preparation positively influenced the final taste compared to maceration at room temperature (samples V₁ and V₄). Thus, it is evident that in the case of V₂ and V₃, the taste is significantly correlated with higher values of volatile acidities.

The V₃ sample was the most appreciated by consumers having the highest total score (16.4 / 20).

CONCLUSIONS

In the present preliminary study, accessible recipes for peppermint artisanal liqueurs were developed.

The results of psychochemical and sensorial analyses showed perceptible differences between the samples obtained by the different methods of preparation.

All the artisanal mint liqueurs obtained in the present study received good tasters' acceptance. The artisanal sample V₃ obtained the highest score almost double than the commercial liqueur.

Since all the ingredients used have been carefully selected and no dyes or synthetic flavors were added, we consider that the artisanal mint liqueurs obtained in this study may represent an ecological alternative to the offer already existing on the market.

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