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SENSORY AND CHEMICAL EVALUATION OF PLUM, APRICOT AND PEAR DISTILLATES

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Abstract

This study was conducted to evaluate the sensory properties and certain parameters of the chemical composition of twelve samples of alcoholic beverages. The test samples included: six samples of plum distillates produced in different years (1985., 1997., 2000., 2004., 2007 and 2010), three samples of apricot distillates and three samples of pear distillates produced in the years 2004., 2007. and 2010. All samples were collected in the region of Čačak. The sensory properties analysed were: colour, smell, taste, clarity and typicality. The following chemical characteristics were evaluated: ethanol content, total acidity, volatile acids, nonvolatile acids and esters. The quality of the distillates analysed depended both on the type of fruit used to obtain the distillate and year. The analyses showed that the 1985 plum distillate exhibited the best sensory properties (total score 19.30) as well as the highest values for both the alcohol content (55% v/v) and total acidity (2.76 g/l). Volatile acids, nonvolatile acids and esters in the sample were found at 1.992 g/l, 0.768 g/l and 1520 mg/laa, respectively.

Key words: alcoholic beverages, chemical composition, sensory properties

Introduction

The Rulebook on the Quality of Alcoholic Beverages (Official Gazette of Serbia and Montenegro, issue 24/) includes a provision stipulating that alcoholic beverages include brandies made from fruits, grapes, edible forest fruits, cereals and other agricultural raw materials, spirits and liqueurs exhibiting specific sensory characteristic coming from the raw materials and additives used and having an alcohol content within the range of 15%v/v to 55%v/v, and fruit wines having an alcohol content of 5-15%v/v.

Fruit brandies are alcoholic beverages obtained by distillation from fermented pomace, mash or juice of fruit, with an alcohol content of at least 25%v/v, unless otherwise stipulated by the Rulebook for certain types of fruit brandies. Fruit brandies must be qualified by the name of the fruit from which they derived. Fruit brandies are marketed in bottles made of glass or other suitable material. The label on fruit brandies must report a statement of the ethanol content. A fruit brandy distillate must not contain more than 86%v/v ethanol. Brandy is an alcoholic beverage with a very long tradition in Serbia and produced by distillation of fermented fruits (Pecic et al., 2013).

Fruit brandies placed on the market must satisfy the following requirements:

- must be clear, colourless or having a colour typical of the particular type of brandy;
-the odor and taste must be characteristic of the particular type of brandy;
- must not have an unpleasant odor and taste;
- must not contain strength enhancers (pepper, paprika, and the like), free mineral acids, nonvolatile organic acids in amounts exceeding the levels considered normal for particular type of brandy and other substances prohibited by the Rulebook.

The Serbian word for brandy “rakija“ is of Arabic origin. It derives from the word "al-rak", loosely translated as “sweat“. The word arrived in this region with the Turks in the 14th and 15th centuries.

Initially, it referred to the arak beverage produced in Indonesia, Malaysia and other countries in the Far East. Arak was obtained by distillation of the fermented juice or wine made from special types of palm trees. The 15th century marked the beginning of the production of “national drinks" in European countries, i.e.gin in England, schnapps in Germany, aquavit in Scandinavia, vodka in Russia and Poland, and rakija (brandy) in the Balkan Peninsula. At first, they were used not only for therapeutic and medical purposes but also as mood enhancers. In the regions of Serbia, brandy was obtained from different fruit crops, mostly plums. Brandy production in Serbia did not start until the end of the 19th century, after the phylloxera epidemic had destroyed vineyards and reduced wine production.

Major plum cultivars used for brandy production include’Požegača’, ’Crvena Ranka’, ’Metlaš’, ’Trnošljiva’, ’Myrobalan’, ’Čačanska Rodna’, ’Čačanska Lepotica’. These cultivars show resistance to pests and diseases, and are generally regular croppers producing stable yields. As their flesh is very difficult to separate from the stone, these cultivars are not suitable for either fresh consumption or industrial processing into non-alcoholic beverages. Therefore, they are solely used for brandy making purposes (Nikicevic, 2008).

Plum brandy making technology involves the following operations: harvesting, transport of plums to fermentation vessels, crushing, flesh/stone separation, alcoholic fermentation of the plum mash, distillation of the fermented mash, ageing and finishing.

Apricot cultivars suitable for brandy making include ’Roksana’, ’Hungarian Best’, ’Kečkemetska Ruža, ’Nagit’, ’Cegledi Bibor’.

The apricot brandy making technology involves the following stages: harvesting ripe or overripe fruits, crushing, stone/flesh separation, alcoholic fermentation of fruits in closed vessels, distillation of the fermented mash, ageing and finishing.

Pear cultivars suitable for brandy making include ’Vilijamovka’, ’Boskova Bočica’, ’Kleržo’, ’Kaluđerka’, ’Karamanka’, ’Krasanka’ (Ilic, 1987).

The basic steps in pear brandy making technology include: harvesting, storage for a period of 2-4 weeks, crushing, alcoholic fermentation of fruits, distillation of the fermented mash, ageing and finalisation.

Distillation is the major step in brandy making technology involving the partial or complete separation of a liquid mixture of two or more substances into its component fractions based on their different vapour pressures i.e. boiling points at the same temperature. The main components of a distillate are ethanol, water and a small amount of foreign material (Nikicevic and Teševic, 2008). In the production of strong alcoholic beverages, distillation is not used to separate all volatile components from the initial feed into the distillate or to separate all foreign material from alcohol, but rather to separate alcohol at a favourable alcohol/foreign material ratio, thus conferring the quality and character typical of each type of the initial feed material. Substantial amounts of water and foreign material have an unfavourable effect on distillate quality. Therefore, a crude distillate is generally not used in finished products; rather, it is subjected both to increases in the alcohol content and decreases in the amount of water and foreign matter, through redistillation, deflegmation and rectification.

Ethanol is the key component of distillates, ranking second in dominance after water. Its boiling point is 78.3˚C. Ethanol concentration decreases uniformly during distillation.

Acetic acid is the most dominant volatile acid in brandies. The concentration of volatile acids is the lowest in the initial fraction of the distillate, and it increases progressively in the intermediate and final fractions.

Ethyl acetate is the most dominant ester in brandies. It boils at a temperature of 77.2˚C. Almost all its content is distilled at the start of the distillation process. Apart from ethyl acetate, brandies contain the following esters: aromatic esters, ethyl caprate, ethyl caproate, ethyl aurate, ethyl lactate.

Organoleptic evaluation includes the following brandy attributes: colour, clarity, typicality, odor and taste.

Materials and methods

Plum, apricot and pear brandies produced over different years from 1985-2010 in the Čačak region were used in the experiment. Analytical quality parameters were assessed by conventional methods: the ethanol content by an alcoholometer; total acids by the volumetric method using 0.1 M NaOH titration; the nonvolatile acids content by the volumetric method after extract determination; volatile acids were calculated from the difference between total acids and nonvolatile acids. Esters were determined by retitration. Organoleptic evaluation was made by students and teachers at the Faculty of Agronomy, Čačak, using the positive 20-point scale system.

Results and discussion

Table 1. Chemical analysis of plum distillates

Year of production	Ethanol % v/v	Total acids g/l	Nonvolatile acids g/l	Volatile acids g/l	Esters mg/laa
1985	55	2.76	0.768	1.992	1520
1997	54	2.52	0.888	1.632	1335
2000	53	2.40	1.032	1.368	1456
2004	54	2.35	0.720	1.632	1494
2007	54	2.28	1.008	1.272	1331
2010	53	2.21	0.528	1.680	892

Table 2. Chemical analysis of apricot distillates

Year of production	Ethanol % v/v	Total acids g/l	Nonvolatile acids g/l	Volatile acids g/l	Esters mg/laa
2004	42	0.360	0.312	0.048	471.4
2007	43	1.368	0.648	0.720	972
2010	43	1.872	1.176	0.696	1309

Table 3. Chemical analysis of pear distillates

Year of production	Ethanol % v/v	Total acids g/l	Nonvolatile acids g/l	Volatile acids g/l	Esters mg/laa
2004	47.5	2.016	0.960	1.056	787
2007	44.5	1.440	0.960	0.480	761
2010	43	0.960	0.672	0.288	956

Table 4. Sensory evaluation of plum, apricot and pear distillates

Sample	Colour 0-1	Clarity 0-2	Typicality 0-2	Odor 0-6	Taste 0-10	Σ
Plum brandy 2010	0.65	1.00	1.55	4.80	7.70	15.70

Plum brandy 2007	0.85	1.00	1.80	5.25	8.85	17.75
Plum brandy 2004	0.90	1.00	1.90	5.60	8.90	18.30
Plum brandy 2000	0.95	1.00	1.95	5.60	8.90	18.40
Plum brandy 1997	0.95	1.00	2.00	5.70	9.20	18.85
Plum brandy 1985	1.00	1.00	2.00	5.80	9.50	19.30
Apricot brandy 2010	0.95	1.00	1.95	5.50	8.60	18.00
Apricot brandy 2007	0.95	1.00	1.95	5.40	8.80	18.10
Apricot brandy 2004	0.95	1.00	2.00	5.80	9.05	18.80
Pear brandy 2010	0.95	1.00	1.85	5.00	8.10	16.90
Pear brandy 2007	0.95	1.00	1.90	5.10	8.25	17.35
Pear brandy 2004	0.95	1.00	1.95	5.25	8.30	17.45

The results of the chemical analysis of the plum distillate samples showed that the 1985 plum brandy had the highest values for the ethanol content (55% v/v), total acids content (2.52 g/l) expressed as acetic acid, volatile acids (1.992 g/l) and ester content (1520 mg/laa), whereas the highest nonvolatile acid content was found in the 2000 plum brandy.

The results of the chemical analysis of apricot distillates showed an identical ethanol content (43% v/v) in the 2007 and 2010 samples, the highest contents of total acids (1.872 g/l), nonvolatile acids (1.176 g/l) and esters (1309 mg/laa) in the 2010 sample and the highest content of volatile acids in the 2007 sample (0.72 g/l).

The results of the chemical analysis of pear distillates showed that the 2004 sample had the highest contents of ethanol (47.5% v/v), total acids (2.016 g/l) and volatile acids (1.056 g/l), whereas the ester content was highest in the 2010 sample (956.5 mg/laa).

The results of the sensory evaluation of plum, apricot and pear distillates revealed the highest sensory performance in the 1985 plum brandy (average score 19.30), 2004 apricot brandy (average score 18.80) and 2004 pear brandy (average score 17.45), respectively.

Conclusion

The chemical analysis and sensory evaluation of plum, apricot and pear distillates were performed in this study to evaluate the effect of different type of fruit and production year on the quality of the distillates obtained.

The results of the organoleptic assessment of the distillates showed that the average score increased with distillate age, with plum brandy produced in 1985 exhibiting the best sensory attributes.

The results of the chemical analysis of plum, apricot and pear distillates are in agreement with the Rulebook on the Quality of Strong Alcoholic Beverages (Rulebook on Strong Alcoholic Beverages, 2004).

The chemical analysis and sensory evaluation of home-made plum, apricot and pear distillates in the Čačak region were conducted to identify potential improvement in brandy making technology and to obtain products that can satisfy the quality requirements of consumers at the local and foreign market levels.

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