Investigation Of Some Properties Of Chestnut Honey Produced In Black Sea Region Of Turkey

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Geliş Tarihi/Received	Kabul Tarihi/Accepted	Yayın Tarihi/Published
11.10. 2017	22.11.2017	27.12.2017

ÖZ

Bu çalışmanın amacı karadeniz bölgesinde üretilen kestane bal örneklerinin fiziksel ve biyokimyasal özelliklerini belirlemektir. Nem içeriği, suda çözünmeyen madde, serbest asidite, diyastaz aktivitesi, fruktoz / glikoz oranı, toplam fruktoz + glikoz gibi fizikookimyasal parametreler; Sukroz ve hidroksimetilfurfural (HMF) içeriği ölçüldü. Nem içeriği% 18.13 ± 1.53, suda çözünmeyen madde tam numuneler% 0.00, serbest asitlik 20.78 ± 2.44 meq / kg, diyastaz aktivitesi 14.20 ± 2.87, fruktoz / glukoz oranı 1.44 ± 0.05, toplam fruktoz + glikoz 71.15 ± 2.26, Sukroz içeriği% 2.00 ± 0.56 ve HMF içeriği 0.57 ± 0.09 mg / kg olarak ölçüldü.

Anahtar kelimeler: Kestanebalı, Kimyasal içerik, Karadeniz bölgesi

Türkiyenin Karadeniz Bölgesinde Üretilen Kestane Balının Bazı Özelliklerininin Araştırılması

ABSTRACT

The aim of the present study was to characterize the physical and biochemical properties of black sea region chestnut honey samples. Physiochemical parameters, such as moisture content, water-insoluble substance, free acidity, diastase activity, fructose/Glucose ration, total fructose+glucose; sucrose and hydroxymethylfurfural (HMF) content were measured. The moisture content 18.13±1.53 %, water-insoluble substance full samples values 0.00 %, free acidity 20.78±2.44 meq/kg, diastase activity 14.20±2.87, fructose/glucose ration 1.44±0.05, total fructose+glucose 71.15±2.26 %, sucrose content 2.00±0.56 % and HMF content 0.57±0.09 mg/kg were founded.

Key words: Chestnut honey, Chemical content, Black sea region.

1.INTRODUCTION

The chestnut tree belongs to the same family as beeches and oaks. For thousands of years the chestnut was a primary source of nutrition in the mountainous areas of the Mediterranean where grains did not grow well. The primary honey producer, the sweet chestnut tree (*Castanea sativa*) is common in Europe where it was introduced from Sardis (in what is now Turkey) thousands of years ago, hence the name Sardinian Nut, now known simply as the chestnut honey, so called because it is produced on the Italian island of Sardinia. Chestnut honey has a strong aromatic taste and a slightly bitter after taste, rich in pollen content, mineral salts and tannin, with a high proportion of fructose that resists crystallization and a relatively low acidity. Dark in color, ranging from yellowish brown to almost black, sometimes with amber hues, it has an aromatic, pungent herbal aroma and taste and slightly tannic (due to the tannin in the tree).

The flavor is unique, not very sweet and with an almost bitter aftertaste and very persistent, highly appreciated by those who like a strong, less sweet honey (Anonymous, 2014).

The main constituents of honey are moisture, glucose, fructose, sucrose, minerals and proteins. The composition of honey is rather variable and primarily depends on the floral source; however, certain external factors also play a role, such as seasonal and environmental factors and processing. Honey is a product composed primarily of sugars, the main ones being glucose and fructose (in nearly equal proportions), which together represent 85 to 96 % of the total. The residual carbohydrates are disaccharides, trisaccharides, and oligosaccharides. Because the sugar concentration is so high, honey sometimes takes a semi-solid state known as crystallized or granulated honey. This is an undesirable process and must be prevented or retarded as much as possible, since it causes the product to become hazy and therefore to lose consumer acceptance (Al-Khalifa and Al-Arify, 1999). HMF is a decomposition product of fructose. In fresh honey it is present only in trace amounts and its concentration increases with storage and prolonged heating of honey. The HMF building process depends on the pH and thus in blossom honey it is built at a higher pace than in honeydew and darker honeys due to the higher pH of the former 71. Short term heat treatment, even at higher temperature the increase of the HMF content is only small 68, 69. The HMF content is used as a standard for freshness and overheating of honey. The Codex Alimentations and EU norm is a maximum of 40 mg/kg, and for honey from the tropics and blends with them the maximum value is 80 mg/kg. Chemical composition of the honey shows differences depending on many factors. The most important of these factors is the natural combination of the nectar and secretion. Also climatic conditions and the capability of the bees in making honey are the effective factors on the composition (Ünal and Küplülü, 2006). Determinations of the chemical qualities of the honey are important regarding the protection of public health and consumer rights. The present study was conducted in order to determine the suitability of the chestnut honey presented for production in Black sea region chemically regarding the Turkish Food Codex Honey Communicating (Anonymous, 2012).

2. MATERIAL AND METHOD

In this study, 10 strained chestnut honey samples from different honey producers in Black sea region were collected to use as materials. The samples were put in glass jars in approximately 300g each. Moisture content was measured using a refractometer (Anonymous, 2008a) and free acidity was determined by the titrimetric method (Anonymous, 2008b). Diastase measures held by the starch hydrolysis activity of diastase enzyme (Anonymous, 2008c). Invert sugar and Hydroxy-methylfurfural (HMF) was determined by high performance liquid chromatography (Anonymous, 2008d). Sucrose determination was done by the titration as methylene blue indicator against reduced sugar solution. Founded total sugar percentage was reduced within the invert sugar percentage and then multiplied by 0.95 rotating factor (Anonymous, 2008d).

3. RESULTS AND DISCUSSION

The moisture content in the investigated honey samples was between 15.50 and 19.70 % (Table 1), this variable depends on climatic factors, season of production and maturity of honey. Only one sample has more than 20 % of moisture, maximum allowed by local regulations to avoid fermentation. Moisture content is very important for the shelf life of honey during storage and can lead to undesirable honey fermentation due to osmotolerant yeasts, which form ethyl alcohol and carbon dioxide. Temperature and humidity where honey is stored, processing methods of the honey and air circulation can cause in the moisture content of honey (Ünal and Küplülü, 2006). The water content of honey should be less than 20 %. Generally, all of the investigated Turkey honey samples were of good quality, as indicated by the low moisture content. Water-in soluble substantial of chestnut honey are not determined. The moisture content of samples in permitted levels was found in the range of 15.50–19.70 %. Similar (Al-Khalifa and Al-Arify, 1999; Yücel and

Sultanoğlu, 2013; İsla vede., 2011) and higher (Kahraman vede, 2010; Buba vede., 2013) results were detected in previous studies. The different moisture content of honey depends on harvest season, the degree of maturity reached in the hive and moisture content of original plant (Finola vede, 2007).

Insoluble matter is defined as that material found by the procedure to be insoluble in water. In this work the insoluble matter in the all chestnut honeys determined as 0.00 g/100 g. The insoluble matter in the Hatay honeys ranged from 0.01 g/100 g to 0.07 g/100 g with the mean value of 0.03 g/100 g. All of the honeys analyzed had an insoluble matter value lower than permitted (at most 0.1 g/100 g) limit (Şahinler vede,2001).

The total free acidity shows a mean value of 20.78 with a range between 18.0 and 25.0, which is next to what is this value, represents the organic acids content in honey. Free acidity shows a mean value of 20.78 mg/kg; this value represents the organic acids content in honey. Ünal and Küplülü (2006) reported that total acidity of honey samples consumed in Ankara of Türkiye varied from 8.25 meq/kg and 40.88 meq/kg. In another study, total acidity of honey samples produced in Saudi Arabia was found between 16.0 meq/kg and 39.5 meq/kg (Al-Khalifa and Al-Arify, 1999). In another research, according to the chemical qualitative properties of different monofloral honeys produced in Türkiye, total acidity of the samples mean values 47.50 meq/kg (Özcan and Ölmez, 2014).

Honey is rich regarding the enzymes. Honey enzymes, as an indicator are representing the quality of the honey. The most prominent enzymes in honey are α-glucosidase (invertase or saccharose), α- and β-amylases (diastase), glucose oxidase, catalase and acid phosphatase (Belitz and Groch, 1999). Diastase activity in honey samples was found between 10.90 and 17.90. İsla vede,. (2011), Yücel and Sultanoğlu (2013) and Ünal and Küplülü (2006) reported that the diastase activity had a mean of 22.4%, 19.7%, 17.9% and 39.1%, respectively. In contrary, lower values were found by Al-Khalifa and Al-Arify (1999) and Duman vede, (2008). Enzymes, like diastase, play an important role in the biological value of honey. Exposure to high temperatures and long storage periods inactivate diastase. In the present study as in all honey samples diastase activities were recorded very low besides HMF counts were very high showed that these honey samples were treated with high temperature. Besides, as these samples displayed commercially available glucose, except one, coincided that these samples were tricky honeys.

Fructose/Glucose (F/G) ratio has been recommended to evaluate honey granulation, because glucose is less water soluble than fructose. The proportion of fructose to glucose depends largely on the nectar source (Habib *et al*., 2014). F/G ratio in the investigated honey samples was between 1.40 and 1.50 (Table 1). Our findings showed approximately similarity with the results in chestnut honey of Ruoff (2006).

The sucrose content of honey samples shows a mean value of 2.00 with a range between 1.20 and 3.00, which is next to what is normally accepted. The amount of sucrose in honey differs according to the maturity degree and nectar compound of the honey. Unripened honeys that are very early harvested contain too much sucrose. Depending on the latter, a trick comes to mind as the sucrose is more than the amount stated in the honey standard (Ünal and Küplülü, 2006). Honey is a product composed primarily of sugars, the main ones being glucose and fructose (in nearly equal proportions), which together represent 67.80 to 75.00 % of the total. The residual carbohydrates are disaccharides, tri-saccharides, and oligosaccharides. Because the sugar concentration is so high, honey sometimes takes a semi-solid state known as crystallized or granulated honey. Our findings showed approximately similarity with the results of Yilmaz and Yavuz (1999), Przybylowski and Wilczynska (2001) and Ouchemoukh vede., (2007).

Table 1 Chemical composition Black sea region chestnut honey in TURKEY

Samples	Moisture content (%)	Water-in soluble substant (%)	Total acidity meq/kg	Diastase enzyme activity	Fructose/ Glucose ratio	Fructose + Glucose (%)	Sucrose content (%)	HMF content mg/kg
1	15,50	0,00	25.00	17,90	1,50	67,80	1,90	2,75
2	15,60	0,00	21,20	13,90	1,50	68,70	1,60	0,00
3	19,20	0,00	24,00	13,90	1,50	70,00	2,40	0,11
4	18,60	0,00	23,00	10,90	1,50	69,30	1,20	0,00
5	18,30	0,00	20,40	17,90	1,40	71,00	3,00	1,40
6	19,10	0,00	18,90	13,90	1,40	72,00	2,10	0,75
7	17,30	0,00	18,80	17,90	1,40	73,60	2,70	0,24
8	19,70	0,00	19,00	13,90	1,40	71,40	1,50	0,42
9	19,10	0,00	19,50	10,90	1,40	75,00	2,00	0,00
10	19,00	0,00	18,00	10,90	1,40	72,70	1,60	0,00
X	18.13	0,00	20.78	14.20	1.44	71.15	2.00	0.57
±Sd	±1.53	±0.0	±2.44	±2.87	±0.05	±2.26	±0.56	±0.09

The level of sucrose differs according to the maturity degree and origin of the nectar compound of the honey. Cantarelli *et al*. (2008) reported sucrose content in honey samples at the average of 4.05 %. In another study, sucrose was detected between 2.21 % and 5.52 % (Rodriguez *et al*., 2004). Our findings showed approximately similarity with these results. Higher (Duman vede, 2008) and lower (Al-Khalifa and Al-Arify, 1999; Özcan vede, 2006) results were detected in previous studies. The result of this study indicates that honeys contain sugar; bees were fed with sugar solution instead of nectars, early harvesting before honey ripened in the honeycomb honeys have been mixed (Ünal and Küplülü, 2006).

The 5-hydroxymethyl-2-furaldehyde (HMF) one of the important quality criteria in honey is formed by dehydration of fructose and glucose. During the storage HMF is forming in different rates from the hexose sugar depending on the honey pH and heat in acid efficacy. High HMF content (40 mg/kg or more) indicates whether the honey is heated and/or sucrose, hydrolyzed with acid or cornflower syrup is added to the honey (Ünal and Küplülü, 2006). HMF is thus an essential parameter used to indicate honey purity. The HMF concentrations of honey samples were similar, ranging from 0.00 to 2.75 mg/kg (Table 1). The values are also within the allowed maximum limit of 40 mg/kg, as recommended by the Turkish Alimentarus Codex (Anonymous, 2000) for honey samples from tropical countries. Overall, the low HMF concentrations of the tested Algerian honey confirm that these samples are of good quality. Gidamis and Shayo (2004) reported that HMF values of honey samples collected in Tanzania were below 40 mg/kg. Azeredo vede,(2003) reported that HMF values of different originated honey samples produced in Brazil varied between 3.24 mg/kg and 4.12 mg/kg. Al-Khalifa and Al-Arify (1999) reported that HMF values of different originated flower honeys collected in Saudi Arabia varied between 3.54 mg/kg and 13.6 mg/kg. Ünal and Küplülü (2006) reported that HMF values of honey samples consumed in Ankara of Türkiye varied from 5.88 mg/kg and 125.32 mg/kg and Özcan and Ölmez (2014), according to the chemical qualitative properties of different honeys produced in Türkiye, HMF values of honey varied from 0.38 mg/kg and 42.00 mg/kg. Mendes vede, (1998) reported HMF levels in the range of 1.7–471 mg/kg.

4. CONCLUSION

The results obtained indicate that in chestnut honey from Black sea region of Turkey; have a low diastase activity, HMF and acidity values were found, which indicate honey freshness and good conservation. The low moisture content helps to protect honey from microbiological activity

and thus it can be preserved for longer periods of time. Honey presents high fructose+glucose content (71.15 %) and very low values of sucrose (2.00 %); the remaining quality parameters agree in general, with national regulations. To summarize, this searches shows novel results of chestnut honey composition. These results make the honey in Black sea region of Turkey, a product that offers good quality, showing good beekeeping practices, which must be standardized to maintain or to improve quality in the future. These results are also very important for commercialization of Black sea region chestnut honey both in the national and international markets. As a result, control of the chestnut honey produced in Black sea region should be analyzed more usually than before from farm to table both for the protection of public health and consumer rights.

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