

## IMPROVING QUALITY AND FUNCTIONAL PROPERTIES OF TEA-BASED DRINKS

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### ABSTRACT

The authors have investigated the possibility of making functional drinks by adding natural plant-based additives to black tea. They conducted an experiment on four different tea samples, by evaluating changes in their quality and properties, such as tannin, caffeine, vitamin C and P, and antioxidant activity. As a functional additive, they were used hibiscus and rosehip powders that derived from respective plants. The study shows that hibiscus powder increased antioxidant activity significantly, 1.68 times higher than rosehip. But rosehip increased vitamin C more than hibiscus, 275 mg% and 128 mg% respectively. Also, the total flavonoid content in hibiscus supplement is 410 mg of catechins per 100 g: which is 3.3 times higher than rosehip. Vigorous stirring method was used to mix the tea with herbal supplements. Two samples of "Azerçay" tea were mixed with rosehip additives, while two samples of "Berga" tea were mixed with hibiscus additives. When rosehip was added, the vitamin C content in the test sample was increased from 63% to 154 mg%, while the addition of hibiscus increased it from 86% to 104 mg. With the addition of the rosehip, the vitamin P content increased 2.25 times and 2.17 times with the addition of hibiscus.

**Keywords:** drink, tea, evaluation of quality, hibiscus, Rose hip, functional properties.

### Introduction

Using food products can be the best medicine for people and producing healthy food may help millions of people offer an alternative : being healthy and not being treated. Researches show that significant part of Azerbaijan's population suffers from imbalance in nutritions. In the modern functional drinks market, there is a huge demand for functional drinks, as they have a natural base with high content functional ingredients, and for their enrichment in fruit and berry and vegetable raw materials containing a large number of biologically active substances.[1-7] That's why we decided to develop functional drinks based on black long tea using food additives from hibiscus and rose hips.

### Objects and methods of research

The Azerbaijanian consumer market offers a wide range of different types of tea. Black long tea is the most popular; its quality has been studied using various methods in the works of various authors. [8-13]

The objects of the study were four samples of black long tea grown in Azerbaijan ("Azerçay", "Lənkəran", "Final" and "Berga").

Sample No. 1. “Azərçay” – 100% original Ceylon large-leaf tea of the highest grade. The tea was produced and packaged by Azərsun, Azerbaijan.

Sample No. 2. “Lənkəran 100 gr” is a premium black loose-leaf tea. The tea is grown and harvested and packaged in Lankaran, Azerbaijan by Gilan Holding.

Sample No. 3. “Final”– 100% original Ceylon large-leaf tea of the highest grade. The tea was produced and packaged by Azərsun, Azerbaijan.

Sample No. 4. “Berga” – 100% original Ceylon large-leaf tea of the highest grade. The tea was produced and packaged by Azərsun, Azerbaijan.

The organoleptic properties of tea were determined using a 10-point scale. On this scale, the lowest quality teas can be rated 1.5 points, and the highest quality ones can be rated 5.5 points or higher. A rating of 9–10 points for tea is still considered unattainable. The results are shown in table 1.

**Table 1.**

Tea sample number	Rating, points	ISO 6078:1982 grade
Sample No. 1	3.75	Medium
Sample No. 2	3.88	Medium
Sample No. 3	4.52	Good medium
Sample No. 4	4.86	Good medium

The research results showed that samples no. 1 and no. 2 were rated according to organoleptic indicators as Medium tea. Tea of this variety should receive a score of 3.25–4 points and belongs to the OR group; the leaf consists of long, pointed juicy leaves larger than those in tea FOP, leaves. Since the collection from which it is made is carried out after the apical buds have opened, there are almost no tips in it.

Samples No. 1, no. 5 and no. 6 for such organoleptic indicators as aroma and taste; infusion; the color of the boiled leaf was rated as Good medium teas, which should have a score of 4.25–5 points. These teas belong to the FOP group and are made from the collection of buds with the first leaf; They are a high-quality, balanced mixture of well-rolled, tender leaves and unopened buds. The infusion is exceptionally delicate and aromatic, soft and pleasant to the taste.

The results of determining the physicochemical parameters of tea samples are given in table 2.

An important indicator of tea quality are water-soluble extractive substances. They include all the water-soluble components of tea - caffeine, tannins, nitrogenous substances, carbohydrates, minerals. The mass fraction of extractives depends on the type of tea.

Determination of the functional properties of tea was determined by six indicators characterizing various functional properties. The research results are presented in table 3.

Tea tannin determines not only the organoleptic properties of tea, but also the biological value of the product. Tannin is part of the phenolic compounds of tea, where its share accounts for up to 20.0%. Different fractions of tea tannin have different effects on the taste of tea infusion: catechins give it a bitter taste, and astringency, bright color and other properties are due to tannins. At the tea sample

No. 1 has the lowest tannin content, which may indicate that the tea has been stored for a long time or is made from low-grade raw materials. The remaining samples are characterized by average tannin content [14–16].

In dry black long tea, the vitamin C content ranges from 156 to 233 mg%, but when brewed, about 70–90% passes into the infusion. When brewing, vitamin C is practically not destroyed, as it is in strong combination with tannins. Tea sample No. 1 had the lowest vitamin C content, which is consistent with the organoleptic assessment and the results of determining water-soluble extractives - 26.5% [17].

The main vitamin of tea, which determines its functional properties, is vitamin P - in terms of its content, tea has no equal among products of plant origin. Vitamin P enhances the effectiveness of ascorbic acid, promotes its absorption, accumulation and retention in the body. In addition, vitamin P strengthens the walls of blood vessels, preventing internal hemorrhages. The lowest vitamin P content was in sample No. 1 – 3.2 mg%.

Tea flavonoids determine important functional properties, as they suppress the development of liver enzymes - cytochrome P450-dependent monooxygenases. In addition, they enhance intercellular interaction and stimulate the growth of pancreatic  $\beta$ -cells. However, the most important are the antioxidant properties of its constituent flavonoids, which not only directly “quench” reactive oxygen species, but are also able to bind metal ions, which prevents them from entering into the Fenton and Haber-Weiss reactions that generate hydroxyl radicals [16].

**Table 2.**

Indicator name	Sample 1	Sample 2	Sample 3	Sample 4
Moisture content, %	8	8.2	6	7.7
Mass fraction of water-soluble extractive substances, %	25.65	32.4	35.6	35.1

From the data given in table. 3, it is clear that the antioxidant activity of tea completely correlates with the content of flavonoids in tea.

**Table 3**

Indicator name	Sample 1	Sample 2	Sample 3	Sample 4
Mass fraction of tannin,%	9,94	12,31	13,27	13,1
Mass fraction of vitamin C, mg%	63	86	132	129
Mass fraction of vitamin P, mg%	3,2	9,8	21,3	19,8
Mass fraction of caffeine, mg%	25	27	48	52
Total flavonoid content mg%	34	72	119	152
Antioxidant activity, (g rutin/100 g product)	5,4	6,8	17,5	19,7

Among tea alkaloids, the most famous is caffeine, which belongs to the group of purine alkaloids. Caffeine in tea does not appear in isolation, but in combination with tannin to form the compound caffeine tannate. It has a more indirect and milder effect on the cardiovascular and central nervous system than coffee caffeine. Tea caffeine does not linger or accumulate in the human body, which eliminates the risk of caffeine poisoning with the most frequent use of tea. It stimulates the activity of the kidneys, acting as a diuretic, increases the rate of metabolism in cells and the absorption of oxygen by tissues, and also dilates the blood vessels of the brain and

increases mental activity [16].

Having analyzed the data obtained on the quality indicators and functional properties of the tea samples, it was decided to use the “Azərçay” and “Lənkəran 100 gr” tea samples, which had the lowest indicators in terms of the content of all functional ingredients. The physiological value of tea can be increased not only by enriching it with the functional ingredients already present in it, but by introducing new active components [18]. In order to expand the range of functional tea drinks, recipes for functional tea drinks with fruit herbal additives from hibiscus and rose hips were developed.

The choice of raw materials for the manufacture of additives was determined by their chemical composition. The amount of ascorbic acid in hibiscus grown in different geographical areas of the country varies over a wide range (from 9 to 264 mg). The dynamics of ascorbic acid in fruits and leaves is identical, and fully ripe fruits always have the most amount of it. The concentration of ascorbic acid usually changes in parallel with the sugar content in fruits. Rose hips contain an average of 650 mg% vitamin C. In dried rose hips, vitamin C is almost not destroyed, since rose hips practically do not contain the enzyme ascorbic oxidase, which oxidizes and destroys vitamin C during storage, drying, etc. processing methods.

The fruits of hibiscus and rose hips were thoroughly washed, sorted (the rose hips were separated from the seeds) and dried at a temperature of 45–50 °C in an electric air dryer. After drying, the fruits were crushed to particles 1.5–2.0 mm in size and sifted through a sieve with fine holes (2.0 mm). For these food additives, organoleptic indicators that allow them to be identified and well-defined antioxidant properties are very important [19, 20]. The hibiscus supplement was a dark beet color; with a grainy consistency; pronounced odor, characteristic of dried hibiscus fruits; the taste is sour. The dietary supplement from rose hips had a red-brown color; grainy consistency; smell characteristic of dried rose hips; the taste is slightly sour. The results of determining the functional properties of additives are given in Table. 4.

The results shown in table. 4 show that the content of vitamin C in the dietary supplement from rose hips is 2.1 times higher than in the supplement from hibiscus fruits. The content of flavonoids in the hibiscus supplement is 3.3 times higher than in the rose hip supplement. The research results showed that the hibiscus supplement had a pronounced antioxidant activity - 32.44 (g rutin/100 g cont.); the antioxidant activity of the rosehip supplement was slightly lower - 19.32 (g rutin/100 g cont.).

**Table 4.**

<b>Additive name</b>	<b>Vitamin C content in mg%</b>	<b>Total flavonoid content (mg catechin/100 g cont.)</b>	<b>Antioxidant activity, (g rutin/100 g cont.)</b>
From hibiscus	132	410	32,44
From rosehips	275	124	19,32

Blending of tea and herbal food additives was carried out by mixing with intensive stirring. Three samples of “Azerchay” tea with rosehip additives were made in the tea/additive ratio: sample No. 7 (90/10); sample No. 8 (80/20) and sample No. 9 (75/25); three tea samples

“Lankaran 100 gr” with the addition of hibiscus fruits in the tea/additive ratio: sample No. 10 (90/10); sample No. 11 (80/20) and sample No. 12 (75/25). According to the tasting data, sample No. 9 and sample No. 10 were recognized as the best. The infusion of sample No. 9 has a pleasant

aroma of rose hips, a balanced taste, a reddish tint, and sample No. 10 has a tea aroma with a light fruity aroma, the taste is balanced, the infusion is dull, light reddish-violet hue. The work determined indicators characterizing the functional properties of prototypes. The results are shown in table 5.

As can be seen from the data given in table 5, the introduction of additives from hibiscus and rose hips led to a decrease in the content of tannin and caffeine. The introduction of an additive from rose hips increased the vitamin C content in the test sample by 2.4 times, and the addition of hibiscus – by 1.2 times. In the test samples, the content of vitamin P and antioxidant activity also increased significantly. In sample No. 9, the vitamin P content increased by 2.25 times, antioxidant content by 2.3 times; the total content of flavonoids is 1.97 times. In sample No. 10, the content of vitamin P increased by 2.17 times, antioxidant activity – by 2.38 times; the total content of flavonoids is 1.36 times.

Analysis of the studies conducted showed that:

- the addition of hibiscus and rosehip additives significantly increases the content of vitamins C, P, total flavonoid content, and antioxidant activity in tea samples;
- low-grade teas with a low content of functional ingredients can be recommended to be used as a basis for creating functional drinks based on the use of additives from plant raw materials: chokeberry and rose hips.

**Table 5.**

Additive name	Characteristics of tea	
	№ 9	№ 10
Mass fraction of tannin,%	8,54	10,25
Mass fraction of vitamin C, mg%	154	104
Mass fraction of vitamin P, mg%	7,2	21,3
Total flavonoid content mg%	67	98
Antioxidant activity, (g rutin/100 g product)	12,4	16,2

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# ÇAYIN FUNKSIONAL XÜSUSİYYƏTLƏRİNİN VƏ KEYFİYYƏTİNİN ÖYRƏNİLMƏSİ

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## XÜLASƏ

Müəlliflər qara çaya təbii bitki mənşəli əlavələr əlavə etməklə funksional içkilər hazırlamaq imkanını araşdırıblar. Onlar tanin, kofein, vitamin C və P və antioksidant aktivlik kimi keyfiyyət və xüsusiyyətlərindəki dəyişiklikləri qiymətləndirərək, dörd fərqli çay nümunəsi üzərində təcrübə aparıblar. Funksional bir əlavə olaraq, onlar müvafiq bitkilərdən əldə edilən hibiskus və qızılgül tozlarından istifadə edilmişdir. Tədqiqat göstərir ki, hibiskus tozu antioksidant fəaliyyətini əhəmiyyətli dərəcədə artırır, itburnu ilə müqayisədə 1,68 dəfə yüksəkdir. Lakin qızılgül C vitaminini hibiskusdan daha çox, müvafiq olaraq 275 mq% və 128 mq% artırdı. Həmçinin, hibiskus əlavəsindəki ümumi flavonoid tərkibi 100 q-da 410 mq katexin təşkil edir: bu, qızılgüldən 3,3 dəfə yüksəkdir. Çayı bitki mənşəli əlavələrlə qarışdırmaq üçün güclü qarışdırma üsulundan istifadə edilmişdir. “Azərçay” çayının iki nümunəsi qızılgül, “Berqa” çayının iki nümunəsi isə hibiskus əlavələri ilə qarışdırılıb. İtburnu əlavə edildikdə sınaq nümunəsində C vitamininin miqdarı 63%-dən 154 mq%-ə, hibiskusun əlavə edilməsi isə 86%-dən 104 mq-a yüksəlmişdir. İtburnu əlavə edildikdə, P vitamininin tərkibi 2,25 dəfə, hibiskus əlavəsi ilə isə 2,17 dəfə artmışdır.

**Açar sözlər:** içki, çay, keyfiyyətin qiymətləndirilməsi, hibiskus, itburnu, funksional xassələri.

## ИЗУЧЕНИЕ КАЧЕСТВА И ФУНКЦИОНАЛЬНЫХ СВОЙСТВ НАПИТКОВ НА ОСНОВЕ ЧАЯ

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## АБСТРАКТ

Авторы исследовали возможность приготовления функциональных напитков путем добавления в черный чай натуральных добавок растительного происхождения. Они провели эксперимент на четырех различных образцах чая, оценивая изменения их качества и свойств, таких как танин, кофеин, витамины С и Р, а также антиоксидантную активность. В качестве функциональной добавки использовались порошки гибискуса и шиповника, полученные из соответствующих растений. Исследование показывает, что порошок гибискуса значительно повышает антиоксидантную активность: в 1,68 раза выше, чем у шиповника. Но шиповник увеличивает содержание витамина С больше, чем гибискус, на

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275 мг% и 128 мг% соответственно. Также общее содержание флавоноидов в добавке гибискуса составляет 410 мг катехинов на 100 г: что в 3,3 раза выше, чем в шиповнике. Для смешивания чая с травяными добавками использовался метод энергичного перемешивания. Два образца чая «Азерчай» были смешаны с добавками шиповника, а два образца чая «Берга» - с добавками гибискуса. При добавлении шиповника содержание витамина С в исследуемом образце увеличивалось с 63% до 154 мг%, а при добавлении гибискуса — с 86% до 104 мг. При добавлении шиповника содержание витамина Р увеличилось в 2,25 раза, а при добавлении гибискуса - в 2,17 раза.

**Ключевые слова:** напиток, чай, оценка качества, гибискус, шиповник, функциональные свойства.