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## ORIGINAL ARTICLE

# Physico-chemical and Sensory Characteristics of beverages based on Cinnamon, Licorice, Clove, Nutmeg, Vanilla and Malt extracts

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**ABSTRACT**
*Herbal extracts are used increasingly in soft drinks because of their health effects, however their market is not currently so extensive and dedicated. There are different herbal extracts used in soft drinks. Because of the fact that the health is so important for people, the natural health effects of functional products on the body which have been proven scientifically, are so interested. In this study, functional beverages based on malt, cinnamon, licorice, clove, nutmeg and vanilla extracts in different ratios of malt (31, 30, 29, 28, 27 and 26 grams per liter), licorice (0.025, 0.030, 0.035, 0.040, 0.045, 0.050 grams per liter), cinnamon (0.025, 0.030, 0.035, 0.040, 0.045, 0.050 grams per liter), nutmeg (0.025 grams per liter), cloves (0.025 grams per liter) and vanilla extract (0.218 grams per liter) were produced and physicochemical tests including Brix, specific gravity, color and turbidity were carried out within 30 days of storage. Data analysis was performed using mean data comparison by Duncan test in a completely randomized design for 5 treatments and a control in 3 replicates. Sensory evaluation test was conducted on the first, 15$^{th}$ and 30$^{th}$ by 9 sensory assessment experts. The color and turbidity increased significantly during the storage (0.01< p). The specific gravity and Brix were relatively constant. The analysis showed that the treatment F1 containing 31gr of malt extract, 0.025gr of licorice, 0.025gr of cinnamon, 0.025 gr of nutmeg, 0.025 gr of cloves, 0.218 gr of vanilla and 70gr of sugar obtained the highest overall acceptance in terms of sensory evaluation and has been recognized as the best treatment.*
***Key words**: malt extract, licorice extract, cinnamon extract, nutmeg extract, clove extract, vanilla extract, soft drink*

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## INTRODUCTION

Malt extract, a concentrated barley malt syrup, is produced with a sugar content of 70 to 80% [11]. Barley, with the scientific name of *Hordeum Vulgare* is the most important cereal after wheat, rice and maize which its cultivation dates back to about ten thousand years ago. Some favorable changes occur during the germination due to its crust and certain chemical compounds. Barley is frequently used in malting, beverages, food and forage for livestock and poultry. Malting is the most important food application of barely[11], [20]. Barley malt is one of the main ingredients in beer making. The features of barley used in malting should meet the properties required in malt industry. Barley quality depends on the condition growth, harvest and storage. The barley used in the brewery industry has to be of a high germination capacity and a low protein content, purity and grading [5]. It should be noted that the nutritional value of wheat is higher than that of barley, but the health benefits of barely is higher than that of wheat, and unlike wheat, its bran does not have anti-calcium matter. Malt extract is concentrated barley malt syrup containing a content 70 to 80% of sugar [11]. Malt is used in various food industries such as confectionary, biscuits, fermented cracker, different types of caramel, confetti, vinegar, alcohol, brewery, breakfast cereals, beverages, drinking milks including chocolate milk, bakery, baby food as a supplement [19]. Cinnamon: its scientific name is *Cinamomum verrum*. It belongs to the laurel family and is native to Sri Lanka [15]. The cinnamon characteristics have been known over thousands of years and

even mentioned in the Bible. According to the reviews, cinnamon was one of the ingredients of Moses cream [12]. Cinnamon is consumed as spice, seasoning and sweets in most countries. It is used in Iranian confectionaries in the forms of essence, extract and powder [14]. The recommended daily allowance of cinnamon based on the type of consumption is so variable. Some references permitted the daily consumption of 2 to 4gr of cinnamon powder and 0.05 to 0.2 ml of diluted essential oil [14].
Licorice its scientific name is *Glycyrrhiza glabra*. It belongs to the main family of legume and papilionaceous subfamily and Rosales order [21]. Babylonians used it about 4,000 years ago as strengthener of the body. Also, the ancient Egyptians developed its root extract; its root was found in the tomb of Tutankhamun in 1923. The ancient Egyptian doctors introduced licorice extract to soften the bitterness of drugs and treatment of diseases of the liver and digestive system [2]. Licorice flavoring also was used in soft drinks and it gives a pleasant taste to herbal medicines. It would also reduce the unpleasant tastes of some drugs. Dutch young people often prepare their own licorice drinks [22]. If you drink more than 20 gr per day, it is possible to occur adverse effects [23]. The most important property of licorice is affecting the gastrointestinal tract. This plant is used for treating duodenal and gastric inflammation and ulcer, and has a desired effect on gastric cancer [23]. Clove, the scientific name is *Syzygium aromaticum*. This tree is native to the islands of Indonesia and Oceania. Due to the special beauty, it is currently grown and used as an ornamental tree in most parts of the world [3]. The main ingredient of clove is eugenol (causing pungency taste), carbophillin, bezillic alcohol, benzoate dermetyl, furfural and ethylene. Eugenol, the main ingredient of clove, is soothing and disinfectant. It is used in dentistry to soothe toothaches [10]. Eugenol which is the main active ingredient of clove has analgesic properties. That is why it is used in dental analgesic compounds and the special taste of this product results from eugenol [10]. Nutmeg *Myristica fragrans* is the scientific name for nutmeg tree. Nutmeg tree is an evergreen perennial plant. Its aromatic compounds are propanol, benzoxide, methoxymiostigin, safranol and eugenol. Nutmeg abuse has repeatedly reported in the studies, but only one fatal poisoning has been reported due to 4 mg ml of myristin in a 55 year old woman's blood [24]. Vanilla: The scientific name is*Vanilla planifolia (Mexican vanilla)*. This plant is native to the humid and tropical regions and grows in the moist forests of southeast of Mexico and Central America and West India and South America. Vanilla is a climbing perennial plant producing vanilla pod. Vanilla grows well in humid tropical climate with an average annual rainfall of 2300-1900 ml [17]. The main component of vanilla is vanillin, which is produced synthetically. It is derived from the lignin contained in sulphite liquor of whey and obtained synthetically from eugenol and guaiacol [13]. Vanilla is available in the forms of powder and essential oil on the market extract [1]. Vanilla essence reduces the inflammation and hyperactivity of all functional systems of the body, such as respiratory, circulatory, digestive, nervous, disposal and also reduces the inflammation caused by fever, convulsions, anxiety, stress and allergies etc. [1].

## MATERIALS AND METHODS

Material:
Malt extract syrup was prepared from Zamzam (West) Co. and other extracts were provided from Etolcelje Co. which made in Slovenia.
Sample preparation (beverage formulation):
Malt, licorice, cinnamon, nutmeg, cloves and vanilla extracts, sugar and carbon dioxide gas were mixed in given ratios as demonstrated in Table 1.

**Table 1.** The treatments used in the study

| Citric acid (gr) | sugar (gr) | vanilla (gr) | clove (gr) | nutmeg (gr) | cinnamon (gr) | (gr) Licorice | Malt extract (gr) | |
|---|---|---|---|---|---|---|---|---|
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.025 | 0.025 | 31 | **F1** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.030 | 0.030 | 30 | **F2** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.035 | 0.035 | 29 | **F3** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.040 | 0.040 | 28 | **F4** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.045 | 0.045 | 27 | **F5** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | 0.050 | 0.050 | 26 | **F6** |
| 0.4 | 70 | 0.218 | 0.025 | 0.025 | - | - | - | **C** |

*Assessment of sample characteristics:*
*Physical test:*
Water soluble solids measurement (Brix): the Brix was measured by a digital refractometer (ATAGo–RX 7000α made in Japan) [3].

Density measurement: the density was determined by densitometry method [4].
Measurement of foreign particles: the sediment and foreign particles was detected according to the national standard of Iran No. 1249 [5].
*Chemical tests:*
Determination of turbidity: a turbidimeter of model Memmert made in Germany was used for measuring the turbidity in NTU [Nephelometric turbidity unit] [5].
Sensory evaluation: 9 food specialists conducted the sensory evaluation of the samples [12]. For this purpose, the acceptance of the beverages by consumers in terms of sensory were assessed factors based on 9 level method and an average value was considered for each level from 9 to 1 for the highest level to the lowest one.
Statistical analysis: the experiment was conducted in a completely randomized design with 5 treatments and a control in triplicates. The results were examined by the software SPSS 20. The data was analyzed by ANOVA and Duncan's test.

**RESULTS**
Water soluble solids measurement: Figure 1 shows the effect of storage time on the Brix during the 30 days of storage. The comparison of the mean values showed that there was a significant difference between the control (C) and all the treatments in terms of Brix in the first day ($p<0.05$). There was no significant difference between the Brix of the treatments F1 and F2 on the first day ($p>0.05$). The lowest and the highest level of the Brix on the 15th day were related to the control and the treatment F1, respectively. The lowest Brix on the 30$^{th}$ day was related to the control and the highest one was related to F1. The increased Brix during the storage was due to the increase of sugar. The Brix level on the first day of storage was constant in all the treatment. However, a significant difference was observed between the control and other treatments on the 15$^{th}$ day. The lowest and the highest Brix on the 30$^{th}$ day were related to F2 and the control (F6), respectively. The treatments F3, F4 and F5 showed similar increasing trends for Brix. Generally the Brix increased within the 30 days of storage, but it was different for F2. The Brix was almost constant in other treatments. During the storage the increased Brix was due to the increase of sugar.

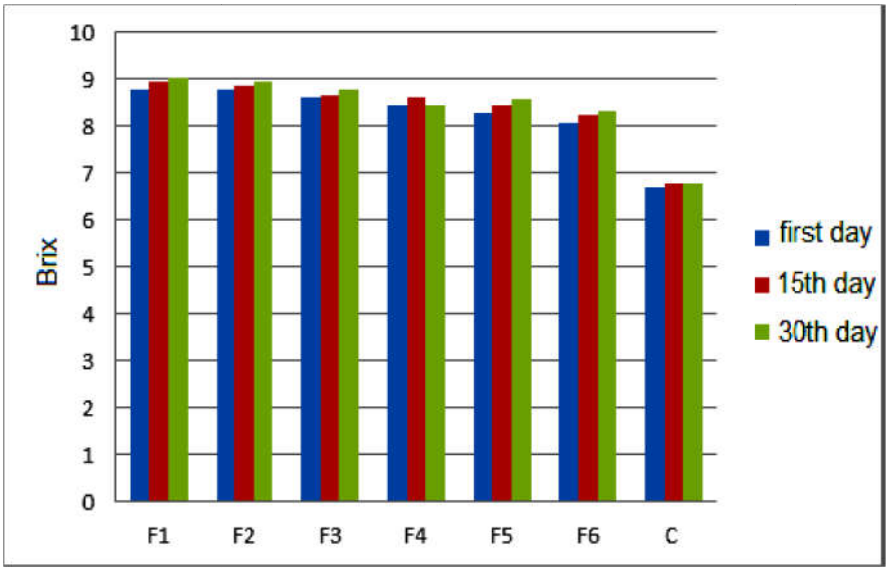


**Figure 1**- the effect of storage on the Brix

Turbidity measurement: Figure 2 shows the effect of storage time on the beverage turbidity. It can be observed that the lowest level of turbidity during the 30 days of storage at ambient temperature was related to the control and the lowest one was related to F1 on the first day of storage. Generally, the turbidity had a significant reduction in the storage period.
Color measurement: Figure 3 shows the effect of storage time on the beverage color. The control had the lowest level of color during the storage. The trends of changes were similar on the three examination days. Generally, it was observed that the beverage color declined during the period of storage at ambient temperature.

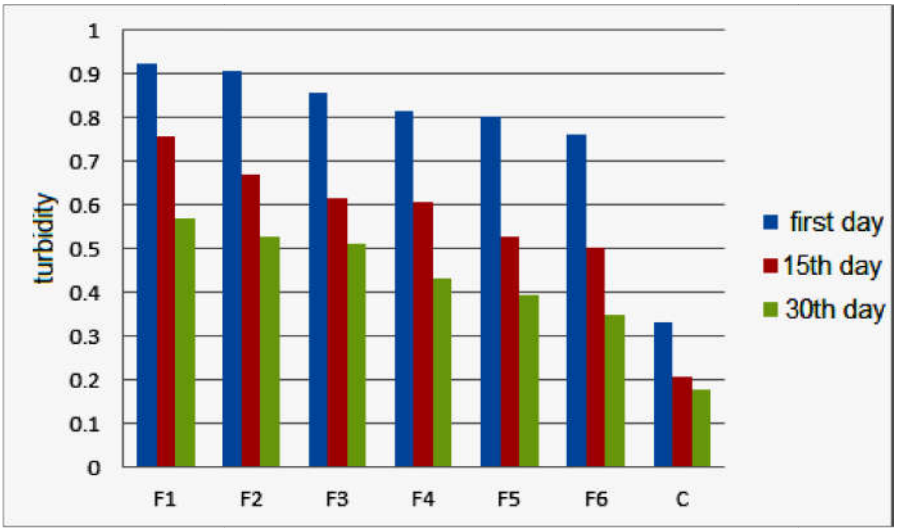


**Figure 2** - the effect of storage on the Brix

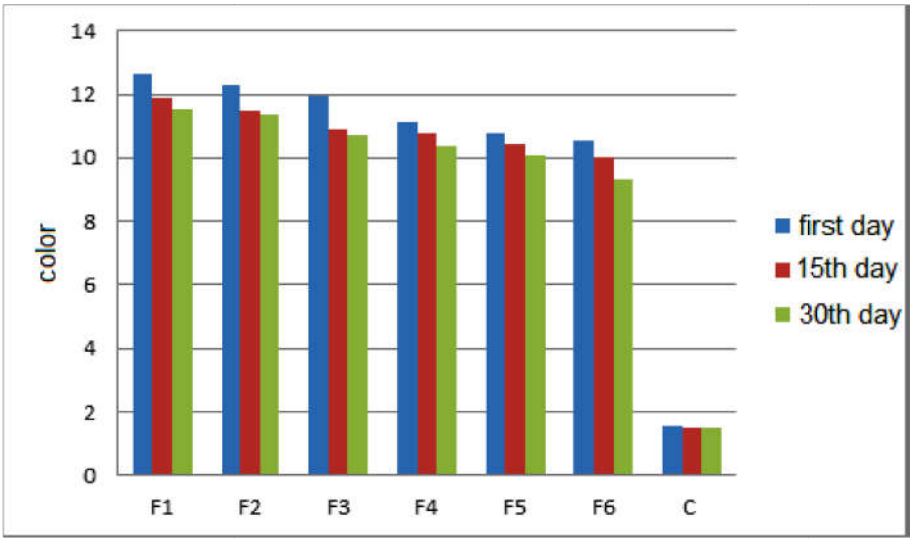


**Figure 3**- the effect of storage on the color

Sensory evaluation: Figure 4 shows the sensory evaluation of the beverages. The control and F1obtained the lowest and the highest points for general acceptance, respectively.

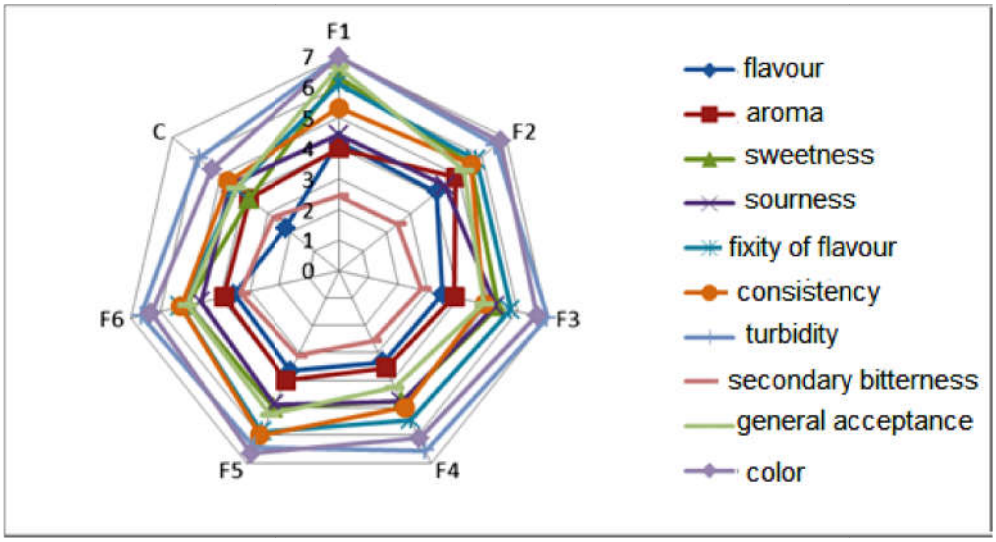


**Figure 4**- the sensory evaluation of the beverage

## DISCUSSION AND CONCLUSION

The results showed that the Brix significantly changed during the 30 days of storage in all the treatments. The significant increase of the color and opacity values as a result of the increased amount of malt extract was due to the presence of carbohydrates in the malt extract, as well as its opacity.

The water soluble solids increased with the increase of malt extract due to its high content of water soluble solids. Hosseini *et al.* [8] evaluated the physicochemical properties and storability of soft drinks made from malt barley and oats (oatmeal). In this study, the malt-based beverage was produced and physicochemical tests were performed during the 6 months of storage. The results showed that the color increased with the increase of oat malt content in the beverages. The reason is melanoidin and other compounds contained in malt affecting the color of malt beverages. The results of this study were consistent with the present study. Generally, the Brix in all the treatments was proportional to the amount of malt extract. Saniah and Samsiah [23] studied the use of Stevia as a sugar substitute in carbonated drinks. In this research, Stevia and sucrose in the range of 0.2-0.5% (Stevia) 0-54% (sucrose) were used in the treatments and their effects on the physicochemical properties and sensory acceptability were evaluated. The results of this study showed that the Brix value of carbonated drinks is dependent on the amount of sugar added. Moreover, it could be understood that sucrose was the main cause of the increase in Brix. So the authors stated that there is a direct relationship between the contents of sucrose and Brix. These findings were consistent with the present study.

Based on the results obtained, among the treatments, F1 had the greatest influence on all sensory properties, so the treatment F1 with the formulation of 31 g malt extract, 0.025 g licorice, 0.025 g cinnamon, 0.025 g nutmeg, 0.025 g cloves, 0.218 g vanilla and 70 g sugar was selected as the best treatment. Ejechi *et al* [21] examined the effect of ginger and nutmeg on mango juice during 3 months of storage. The microbial growth was significantly inhibited and a product with an acceptable taste was obtained. This was corresponded perfectly to the present study.

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