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Ziziphus jujuba Mill. IN ROMANIA - SENSORY EVALUATION OF SOME FRESH FRUITS AND JUJUBE PROCESSED PRODUCTS

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Abstract

Jujube (Ziziphus jujuba Mill.) is the most important species of Rhamnaceae family and is one of the oldest cultivated fruit trees in the world. In Romania it was introduced for the first time in Dobrogea region, close to the Black Sea, some 2000 years ago. The first cultivated varieties, more than 20 genotypes, were introduced after 1997 at the Didactic Experimental Field, within the Faculty of Horticulture in Bucharest, from Shanxi Province, China. The purpose of this paper is to present the sensory evaluation of some fresh jujube fruits cultivars and customers' perception on some innovative products. The results were obtained during the international workshop "Prospective of Chinese jujube (Ziziphus jujuba Mill.) cultivation in Romania" organized in 2nd of October 2020, at the USAMV Bucharest. Among the most common jujube cultivated in Romania, only the ones that arrived at the ripening stage: Jun Zao, Hu Ping Zao, Hu Ping AA and Early Hu Ping Zao, were tasted. The fruit size and shape, fruit colour, firmness and juiciness, taste and flavour were noticed with grades from 1 to 5, five being the highest value. The jujube tested products were: dehydrated jujube (simple, with walnuts or almonds), jujube liqueur (with honey, with rose petals, with plums and honey, with plums and rose petals), jujube tea, jujube compote and jujube tart. The consumers' panel for sensory evaluation was represented by farmers, researchers, professors, specialists and ordinary people. The results showed that, fresh fruits and processed jujube products, was being positively appreciated by most of the participants and varied with the age, gender and origin.

Key words*: food products, sensory evaluation, Ziziphus jujuba Mill.*

INTRODUCTION

Jujube is an edible and delicious fruit, which has various health benefits. It is extensively cultivating in tropical and subtropical regions, especially in East Asia (China, India), North Africa, and Middle Eastern countries. However, most of the species of jujube (*Ziziphus jujuba* Mill.) are native to China, where it has been cultivated from more than 4.000 years. There are over 400 cultivars available in China (Al-Saeedi et al., 2016; Li, et al., 2007; Liu et al., 2016; Raswan et al., 2020).

In Romania, jujube populations were found in the Dobrogea region (Ciocârlan, 2000), between the Danube and the Black Sea in the neighbourhood of antique sites as Greek, Roman, and Byzantine ruins at Ostrov, Jurilovca, and Mahmudia. Probably, those old civilizations had an important role in the introduction of this Asian plant to the area (Stănică, 2000; Stănică, 2009). The plant, nearly unknown, is named Dobrogea olive by the locals and the fruits are rarely used for eating. Only, Ostrov type, a real *Ziziphus jujube* tree, has interesting fruit for fresh and dry consumption (Ciocârlan, 2000; Stănică, 2009). Even it was introduced in the Dobrogea region, some 2.000 years ago by the Greek and Roman colonists, jujube plants and fruits are nearly unknown, as it happens in other countries from the Mediterranean basin (Stănică, 2009).

The first cultivated varieties were introduced at the Faculty of Horticulture in Bucharest from Shanxi Province, China within a common research project in 1997 (Stănică, 2019; Stan G. et al., 2021).

The peel and pulp of the fruits are considered the main part, which contains most of the bioactive compounds. The scientific evidence has shown that jujube fruits contain a high amount of various bioactive compounds, including

ascorbic acid, phenolic acids, amino acids, saponins, cerebrosides, polysaccharides, flavonoids and mineral constituents (Xu et al., 2019; Feng et al., 2019a; Ji et al., 2017; Raswan et al., 2020).

Therefore, jujube fruit is consumed as traditional and functional food worldwide. It can be consumed as freshly squeezed jujube pulp or it can be used for the preparation of some food products, such as beverages, jams, jelly as well as pickles, liqueur and compotes. The dried pulp can also be used as active ingredient in the food industries, such as dried products (Chinese dates, the ingredient of tea, slices snack, bread, cakes, etc.). Moreover, it can be added to other foods/products to improve the nutritional value and quality of the final products (e.g., goat milk yogurt, red jujube yogurt, etc.) (Feng et al., 2019b; Krška et al., 2009; Raswan, 2020; Wojdyło et al., 2016).

In today's society, the consumption preferences are varied and deeply changed comparative with the past; consumers are no longer categorized only about income, lifestyle and demographic variables (Popa et al., 2017; Farruggia et al, 2016). Now, consumer preference is influenced also by intrinsic quality attributes discovered before (colour, taste, flavour, and texture) (Sulistyawati et al., 2020). This perception is used to assess other more quality attributes of the product, such as health (nutritional value) and to determine the overall quality of a food product (Asioli et al., 2017; Sulistyawati et al, 2020). Besides product sensory and health properties, a key role in consumers' food choice is played by product familiarity and health consciousness, including for fresh fruit (Pollard et al., 2002) and dried fruits (Asioli et al., 2019). Moreover, healthiness of the product is another reason in consumers' food choice (Grunert, 2013; Milošević et al., 2012; Januszewska et al, 2011) and is often associated with flavour, taste, colour, texture and natural content characteristics (free of additives and with natural ingredients) (Chambers et al., 2018; Puska & Luomala, 2016; Stan et al., 2020).

Shin et al. (1992) investigated various processing methods for *Ziziphus jujuba* fruits. Based on sensory evaluation and chemical analysis it was found that dried fruits, nectar, jam, fruit extracts and a powdered tea were the most promising products.

The aim of this study is to evaluate different products of *Ziziphus jujuba* Mill. accepted by consumers and how they characterize the final product.

MATERIALS AND METHODS

The products with jujube (**fresh fruit**: Jun Zao, Hu Ping Zao, Hu Ping AA and Early Hu Ping Zao; **dehydrated**: simple, with walnuts or almonds; **tart**; **compote** and **liqueur**: with honey, with rose petals, with plums and honey, with plums and rose petals) were evaluated by consumers, represented by 60% women and 40% men, with ages between 22 and 53 years old.

From of all the jujube varieties grown in our country, only the ripe ones (at that moment), were tested.

The fruits were harvested, sorted and washed (Figure 1).

Figure 1. Fresh jujube

Dehydrated jujube

Drying was removing moisture from jujube fruit. The fresh and fully ripened jujube fruits were selected.

Any fruits that showed mould decay, or bruises were sorted and discard out. Such defects could affect all foods being dried. Then they were dried at 45°C in dehydrator.

The length of time needed to dry fruits would depend on the size of the pieces being dried, humidity and the amount of air circulation in the dehydrator.

At a drying temperature of 45°C, 40 to 48 h were planned for jujube fruits.

Figure 2. Dehydrated jujube (simple, with walnuts or almonds)

Jujube tart

For jujube tart were used the same ingredients as for traditional apple tart, such as: flour, eggs, milk, butter, salt, baking powder and jujube slices. All the ingredients were put in the oven and seasoned with powdered sugar.

Jujube compote

Fruits were cleaned and the unwanted parts of the fruit were discarded. The natural sugar in jujube should be calculated. When the fruits had low natural sugar more sugar must be added to the solution. The glass was filled with fruits, 1 spoon of sugar, water and for flavour were added cloves. All the ingredients were mixed together and then it was sterilized in water bath at 85°C for 15 min.

The jujube tart is presented in Figure 3 and the jujube compote is presented in Figure 4.

Figure 3. Jujube tart

Figure 4. Jujube compote

Jujube liqueur

For liqueur was used fruits, honey, alcohol with 96% strength and water. The fruits (jujube and plums) were washed, putted in a 2000 ml jar, over which was added honey and alcohol. For flavour were added rose petals. After few days was added water, until 32 vol. %.

The jujube liqueur is presented in Figure 5.


Figure 5. Jujube liqueur

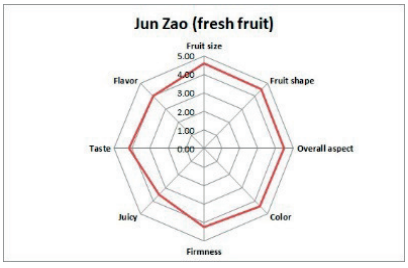
RESULTS AND DISCUSSIONS

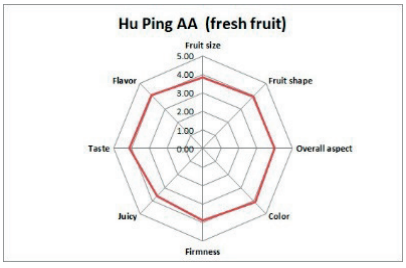
All the products were prepared at the Research Center for Studies of Food Quality and Agricultural Products, in the Integrated Fruit Growing Laboratory. The products were evaluated by consumers with ages between 22 and 53 years old (Figure 6).

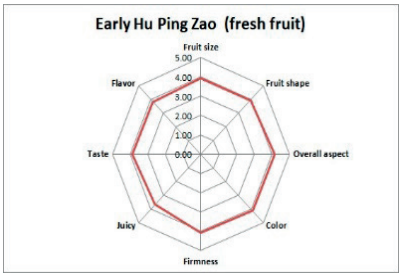
The fruit size and shape, fruit colour, firmness and juiciness, taste and flavour were noticed with grades from 1 to 5, five being the highest value. For the fresh fruit, **Jun Zao** was the most appreciate. **Hu Ping AA** for simple dehydrated jujube and **Hu Ping Zao** for dehydrated fruit with nuts.

All results can be found in the following figures.


Figure 6. Workshop "Prospective of Chinese jujube (*Ziziphus jujuba* Mill.) cultivation in Romania"







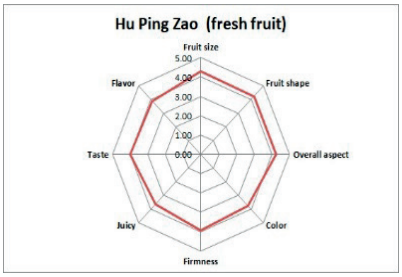


Figure 7. Consumer acceptability scores on a 5-point Hedonic scale for jujube fresh fruit

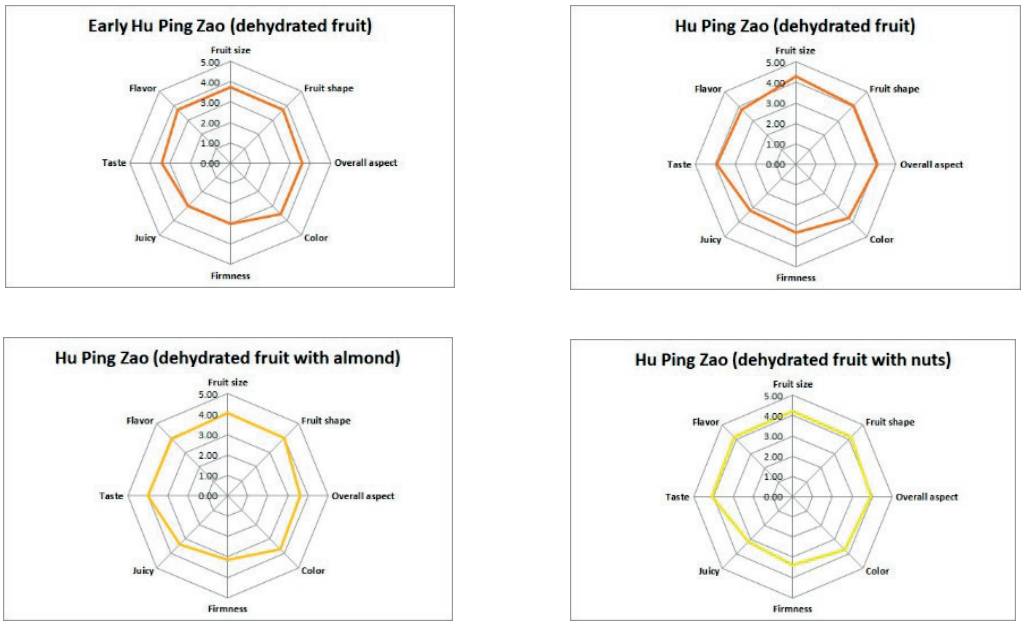


Figure 8. Consumer acceptability scores on a 5-point Hedonic scale for dehydrated jujube

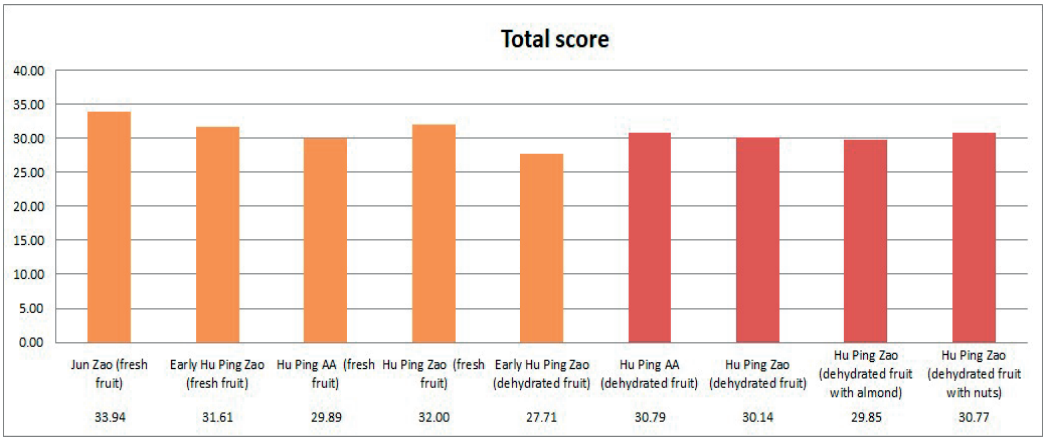


Figure 9. Total score of fresh and dehydrated fruits

The compote was very well appreciated for its overall aspect as for its color, only that its clove aroma was not very much appreciated. Jujube tart was appreciated very well for her overall aspect and for its taste and flavour. Jujube liqueur with plums and rose petals (for colour and flavor intensity) and jujube liquer with plums and honey (for taste and flavor) was the most appreciate from four variants. The results obtained in the present study suggest that sensorial analysis plays an active part in choosing the best variants.

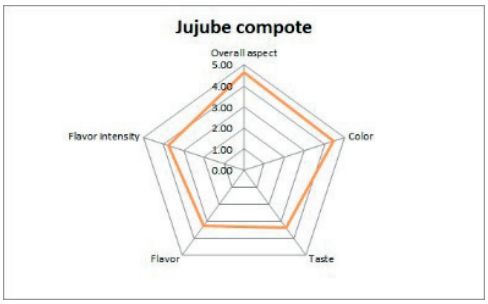


Figure 10. Consumer acceptability scores on a 5-point Hedonic scale for jujube compote

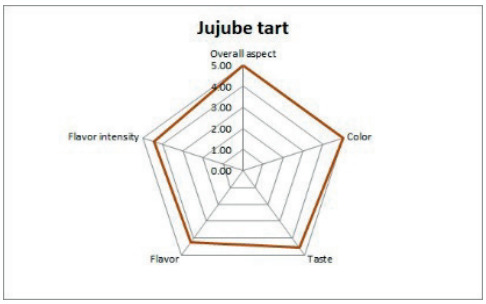
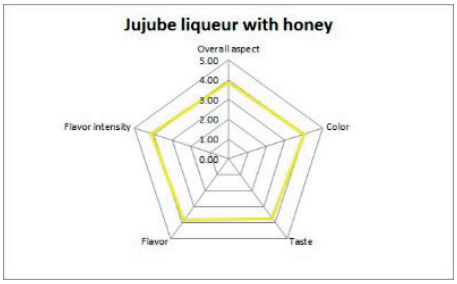
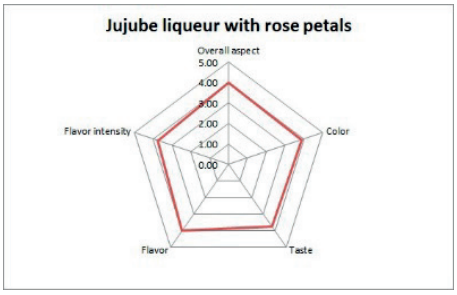
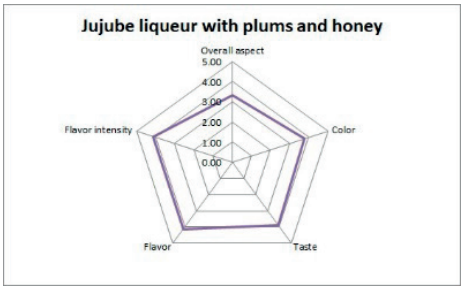


Figure 11. Consumer acceptability scores on a 5-point Hedonic scale for jujube tart







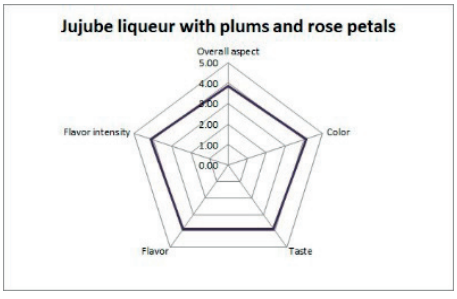


Figure 12. Consumer acceptability scores on a 5-point Hedonic scale for jujube liqueur

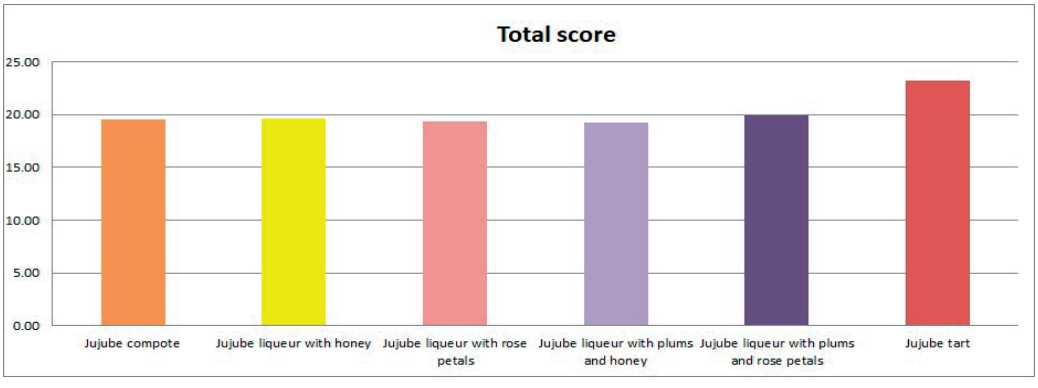


Figure 13. Total score of processed products of jujube fruits

CONCLUSIONS

The consumers' panel for sensory evaluation was represented by farmers, researchers, teachers, specialists and ordinary people.

The results showed that, the consumers perception varied with the age, gender and origin. Fresh jujube fruits and processed jujube products, were positively appreciated by most of the participants.

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