

Improving the quality of natural fruit juice

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Abstract

Natural fruit juice is the unfermented product obtained from ripe and healthy fruit. Natural fruit juices are obtained by pressing and have a short shelf life. To extend the shelf life, they can be kept at refrigeration temperature (maximum 24 hours), they can be frozen or pasteurized, but through pasteurization they lose their nutritional value and change their taste compared to freshly squeezed juice. We take into account the possibility of adding some natural preservatives to the apple juice under certain conditions and a gentler heat treatment. The idea is to increase the shelf life of the juice while maintaining a high quality both in terms of composition and sensory qualities. Different doses of honey and pollen were used to increase nutritional quality and improve shelf life. The following apple varieties were used: Starkrimson, Golden, Ionatan, ReD Topaz, Rozela and Sirius. The juice was extracted using a centrifugal juicer.

Pollen is a protein food, it contains very large amounts of vitamin P, vitamins from the B complex, as well as vitamins A, D, E, C and mineral salts, it contains proteins, free amino acids, various carbohydrates, mucilages, fatty substances. In addition, biological anabolic, antibacterial, antidepressant, anti-inflammatory, anti-parasitic, antipyretic, anti-toxic, dietary biostimulator, anti-anemic, reduces bleeding, lowers cholesterol, euphoric, improves brain functions, etc

Keywords: apple juice, preservation, pollen, honey, nutritional value.

1. Introduction

The demand for natural fruit juice has increased a lot. Consumers want a juice with a good taste, characteristic appearance (clear or cloudy), with a long shelf life and a nutritional value close to that of freshly squeezed juice. Clear juice sells much better than cloudy juice due to the fact that some consumers perceive cloudy juice as juice with impurities. But through the process of obtaining, the process of clarifying the juice, beneficial components for health are removed. Cloudy juice is recommended for consumption because, for example, cloudy apple juice contains a higher amount of polyphenols than clear juice. The polyphenolic substances found in fruits are very important in the characterization of juices, they mostly determine the color of juices and imprint specific organoleptic characteristics.

By their nature, they are reducing substances, with an important role in redox reactions and by the oxidizing capacity they exhibit.

They have the role of vitamin P and bactericidal power on pathogenic microorganisms [4].

In order to have a quality juice, we must take into account the plantation of the trees, use productive varieties resistant to diseases and as varied as possible to make various assortments of juices (with a sweet, sour, fragrant taste or a combination thereof). The trees must be sprayed properly following the spraying schedule. Also, in order to have a quality juice, we must consider the following aspects:

- Harvest period, the fruits used to obtain the 100% natural juice are harvested when they reach maturity, have a characteristic appearance, specific taste and smell. For this we must consider the irrigation of the trees (Figure 1), the use of anti-hail panels that protects so that the fruits are not destroyed due to hail (it is frequent in our country) and protects them from the strong sun. During harvesting, avoid hitting them and store them

in appropriate conditions of temperature (1-3 degrees) and humidity. Otherwise, the fruits are not stored for more than three weeks. Fruits are not stored together with vegetables because they influence the smell and taste of the fruit. In order to preserve the structural-textural firmness, the aroma, the taste and the reduction of losses caused by fungal diseases and physiological disorders of apples during storage, they can be treated with the preparation "Fitomag" [3].

- Sorting and washing apples. During the sorting, apples that have not reached maturity, those that have been attacked by pests are separated from those that are suitable for making juice. Washing is done with water or 3% sodium carbonate aqueous solution then rinsed twice with water.

- The technological process. To obtain a quality juice, we must respect the technological process, have a continuous flow so as not to increase its microbial load, respect the pasteurization temperature.



Figure 1. Irrigated apple orchard (Starkimson) (Voinești/ Dâmbovița area)



Figura 1. Starkimson



Figura 2. ReD Topaz



Figura 3. Rozela



Figura 4. Sirius

The juice was extracted from the fruit using a centrifugal juicer, I used whole fruit. The analyzed fruits were harvested on time, they chose whole apples without defects and were not stored, from the field they were taken directly to the centrifuge. The results are presented in table 1.

Table 1.

No. crt.	Variety	Volume obtained ml/kg
1	Golden	623
2	Sirius	650
3	Starkrimson	617
4	Ionatan	650
5	ReD Topaz	627
6	Rozela	613

We obtained various juices from these apple varieties and identified a recipe appreciated by consumers. The juices were obtained by pasteurization and have a shelf life of up to 2 years, after 6 months a sediment settles but the juice does not change its taste. Pasteurization was carried out at a temperature of 80°C for 1 minute.

I bottled the juices obtained by pasteurization in 3l bags (Bag in Box). The bags contain three layers of special foil, the juice does not oxidize because it does not come into contact with the outside air (figure 2). They have a system that facilitates the preservation of the quality of the unsealed juice until its consumption (but not more than 30 days), without requiring storage at refrigeration temperature, by emptying, the bag contracts and the vacuum remains inside. The bag is filled with hot juice. The hot juice in contact with the packaging pasteurizes it and then it is hermetically sealed and cooled. We made a support to hold the bags when filling and we use special gloves (gloves that protect against high temperatures). The minimum sterilization temperature depends on the duration, microbial load, pH. If the sterilization time is exceeded, the juice acquires a tea taste, it can no longer be sold. When we sell the juice, we put the bag in boxes (figure 3).



Figura 2. Pungă cu suc pasteurizat



Figura 3. Cutie pentru comercializarea pungilor cu suc de măr 100% natural.

We did an analysis among consumers of natural fruit juice. Two samples for analysis were taken from juice obtained only from apple and one sample from juice obtained from apple and quince.

We have combined the fruit varieties so that, in addition to their special appearance and taste, they also offer a good yield.

The samples were brought to the consumers 2 days after obtaining the juice. The interviewees observed the organoleptic indicators of the appearance, taste and smell, color and aroma of the juice samples received as we can see in table 2. The scoring method is used (maximum 5 points).

The following were identified:

- Sample 1: apple juice obtained from the use of 20% Starkrimson, 60% Golden and 20% Ionatan apples. This has been identified as a juice that has an intense sweet taste and a pleasant appearance (no sediment).
- Sample 2: apple juice obtained from apples 20% Sirius, 30% ReD Topaz, 30% Rozela, 20% Starkrimson. This was identified as a juice with a sweet aromatic taste, pleasant appearance (no sediment).
- Sample 3: juice from 10% quince, 10% Starkrimson apples, 30% Golden apples and 50% Jonathan apples. It has been identified as an aromatic sweet and sour juice, highly appreciated by consumers, with a pleasant appearance (no sediment).

Following the analysis, we identified that 70% of them prefer a sweet and sour aromatic taste, 20% want an aromatic sweet taste and only 10% an intense sweet taste.

The combination in sample 3 remained to be produced and marketed.

Table 2.

No. crt	Natural fruit juice	Appearance	Color	Taste and smell	Aroma	Medium
1	Sample 1	5	4,7	4,4	4,4	4,63
2	Sample 2	5	4,5	4,3	5	4,7
3	Sample 3	5	4,8	5	5	4,95

2. Natural preservatives: honey and pollen

Since pasteurization reduces the nutritional value of natural fruit juice, I will try to preserve the juices by adding natural preservatives, namely honey and pollen, which have a high nutritional value.

Honey and pollen, in addition to being natural antimicrobials, also help in various diseases such as wound healing, intestinal diseases, coughs, sore throats, earaches and provide the body with necessary energy.

The antimicrobial properties of honey are characteristic of natural honey, honey that has not undergone heat treatment. Some traders apply the thermal pasteurization process to natural honey to destroy pathogenic microorganisms and especially the botulism agent - *Clostridium botulinum*. The thermal pasteurization intervals used for honey (60-65.5 °C for 30 min or raising to a temperature of 77 °C) destroy flavor substances, bioactive phytochemical substances, useful microflora (bifidobacteria), but do not destroy *Clostridium botulinum* spores.

These spores can only be destroyed by heat sterilization at 121°C for several hours or by normal boiling for several hours. Pasteurization at high temperatures damages the structure and properties of phytonutrients, which ensure the therapeutic value of honey, affects the structure of polyphenols, which have antibacterial and anticancer activity, of glucose oxidase, which determines the formation of hydrogen peroxide as an antiseptic agent. Thanks to these transformations, honey loses its flavor and turns into a mixture of simple sugars. Thus, honey loses its therapeutic properties, aroma and turns into a mixture of simple sugars [1].

Pollen is a protein food, it contains very large amounts of vitamin P, vitamins from the B complex, as well as vitamins A, D, E, C and mineral salts, it contains proteins, free amino acids, various carbohydrates, mucilages, fatty substances. In addition, pollen is an aphrodisiac, biological anabolic, antibacterial, antidepressant, anti-inflammatory, anti-parasitic, antipyretic, anti-toxic, dietary biostimulator, anti-anemic, reduces bleeding, lowers cholesterol, euphoric, improves brain, gastric, large intestine, liver, sexual, of the thyroid, intervenes in the process of growth, birth, improves the structure of the skin, rejuvenates the mind and brain, strengthening blood capillaries, the heart and the immune system. Enzymes and hormonal substances, natural antibiotics and believed to be other active ingredients, still unknown to this day, have been found in pollen [2].

3. Research

The juice obtained by pasteurization at 80 °C from ReD Topaz 50% apples (apples with the lowest sugar content) and Ionatan apples 50% has a pronounced sour taste and a low nutritional value due to the necessary heat treatment. Honey can improve its taste and nutritional value if we do not apply a treatment higher than 60°C.

By mixing this juice with 5% honey. I obtained a juice that tasted good but that stood at a temperature of 15 °C for 48 hours, after which it started to ferment.

After pasteurizing the apple juice from the recipe above at 60°C and adding honey to bottling, it fermented after 3 days.

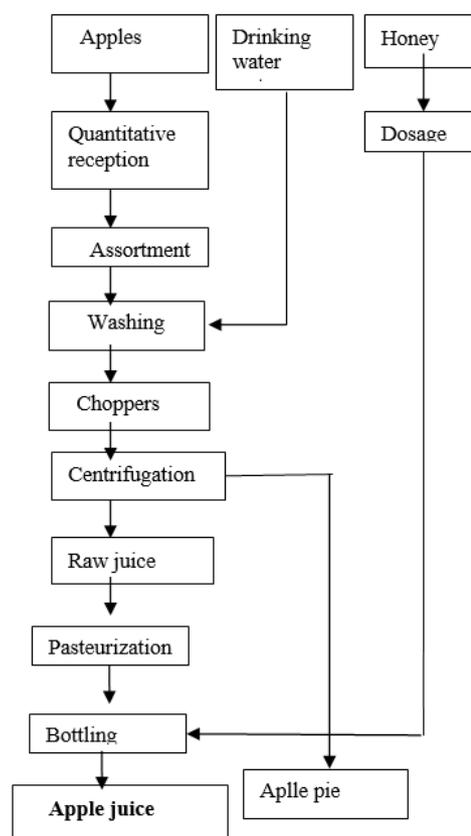


Figure 5. Technological scheme for obtaining apple juice with honey

If we obtain the juice according to the technological scheme for obtaining apple juice with honey (Figure 5), that is, we pasteurize the juice from the given recipe at 80°C for 1 minute, then when bottling (60°C), we add honey, it is kept for 1 year and has higher nutritional value, thanks to the added honey.

Three samples were made with different amounts of honey (figure 6, acacia honey), namely 10%, 5%, 2.5%.



Figure 6. Acacia honey

The samples were brought to the consumers 2 days after obtaining the juice. The interviewed persons observed the organoleptic indicators, the appearance, taste and smell, color and aroma of the received juice samples as we can see in table 3.

The scoring method is used (maximum 5 points).

Following the analysis, we identified that 90% of the people who tasted the 3 juice samples preferred the juice with 2.5% honey (Table 3).

Table 3.

No. crt	Natural fruit juice	Appearance	Color	Taste and smell	Aroma	Medium
1	Sample 1	5	5	4	4,4	4,6
2	Sample 2	5	5	4,3	5	4,82
3	Sample 3	5	5	4,8	5	4,95

By mixing the pasteurized juice obtained from 10% Red Topaz apples, 10% Starkrimson apples, 30% Golden apples and 50% Jonathan apples, with 0.5% pollen (figure 7, polyfloral pollen). After pasteurizing the apple juice according to the above recipe, pollen is added to the bottling (when the juice comes into contact with the pollen it is 60 °C). We obtained a juice with a good taste and increased nutritional value thanks to the added pollen, which resists storage at temperatures below 15 °C. When consuming, it is recommended to shake because the pollen settles on the bottom of the container used for bottling.

Apple juice (10% Red Topaz, 10% Starkrimson, 30% Golden and 50% Jonathan) mixed with pollen (0.5 %) without bottling lasts 48 hours at temperatures below 15 °C. If the amount of pollen is exceeded, apple juice changes its taste very much, it is no longer accepted by consumers.



Figure 7. Polyfloral pollen

4. Conclusion and future perspective

1. By adding honey, the shelf life is not extended by adding honey to freshly squeezed juice. In pasteurized apple juice with a low sugar content, it improves the taste and increases the nutritional value.
2. By adding pollen to apple juice pasteurized at 80 °C, its nutritional value is improved. The amount of pollen should be 0.5%, if a larger amount is added, it changes the taste of the juice.

In the future I want to analyze more precisely the benefit of adding honey and pollen to fruit juice.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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