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Results Regarding the Valorisation of Pine Buds *(Pinus sylvestris)* in a Honey Based Food Supliment

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Abstract: Population lifestyles and socio-economic trends indicate the need for foods with enhanced health benefits. From this point of view, the demand for functional foods and dietary supplements in the global market has grown rapidly. This research aims to create a food supplement based on pine buds and honey, without thermal treatment, having no impact effect buds biologically active compounds. To obtain the food supplement, were used 2 types of honey and pine buds in 3 stages of development. The method used for sensorial analysis was nine hedonic tests. Food supplements obtained from polyflora honey and pine buds in the three stages of development were more appreciated by consumers compared to the food supplement obtained from acacia honey and pine buds in the three stages of development.

Keywords: colour , food supplement, honey, pine.

Introduction

Food supplements are defined as a way to provide supplementary bioactive compounds through their addition into the food. Madison, (2013) stated that US authorities defined dietary supplements as food, while others classify them as other products or drugs. According to Grace (2013) there are more than 50,000 dietary supplements available on the market. Dietary supplements are concentrated sources of bioactive compounds (eg. minerals, amino acids, vitamins, herbs or other botanicals and other food ingredients)

to supplement the normal diet by increasing the total intake of these substances but are not intended to treat disease (Boggia et al., 2020).

The main EU legislation is the Directive 2002/46/EC on food supplements containing vitamins and minerals. The European Food Safety Authority (EFSA) affirmed that: “Supplements can be used to correct nutritional deficiencies or maintain an adequate intake of certain nutrients. However, in some cases, excessive intake of vitamins and minerals can be harmful or cause unwanted effects; therefore, maximum levels are required to ensure their safe use in dietary supplements” (Eur. Food Saf. Auth., 2015). Specific food supplements are commonly used to treat severe malnutrition or specific nutritional deficiencies, especially in developing countries, and are considered foods for special use (Frank, 2015).

Currently, knowledge on the properties and applications of coniferous components is quite limited, so far, no in-depth studies have been conducted on the use of bioactive components in food. These bioactive compounds could be successfully in the pharmaceutical industry and dietary supplements manufacturing, functional food manufacturing, which currently has one of the fastest growths in the food market (Burdock et al., 2019; Dziedziński et al., 2020).

The use of raw materials to obtain extracts from coniferous shoots can contribute to the development of a functional food sector. Foods enriched with ingredients that contain active phytochemicals might reduce the incidence of several diseases, which could be considered an extremely important factor (Asgary et al., 2018; Górecka et al., 2020; Dziedziński et al., 2020). Coniferous shoots are a particularly rich source in terpenoid hydrocarbons, pinene, in the form of alpha and beta isomers, which belongs to the water-insoluble fraction. Alpha and beta-pinene could serve as precursors of compound flavours in food production; they are also components of renal and hepatic drugs (Salehi et al., 2018).

Studies on mice’s regarding the α-pinene have shown gastroprotective, analgesic and anticonvulsant properties; also exerted therapeutic effects in some types of cancer and allergies (Matsuo et al., 2011; Nam et al., 2014; Pinheiro et al., 2015; Zamyad et al., 2019).

Honey has been widely used as a therapeutic agent for the treatment of numerous diseases (Cianciosi et al., 2018). It is highly appreciated by consumers and plays a significant role in a new branch of alternative medicine called "apitherapy", which emphasizes

the medicinal use of honey (Vandamme et al., 2013). Bioactive compounds identified in honey are amino acids, proteins, phenols, antioxidants and micronutrients. Some of the vitamins found in honey are: ascorbic acid, pantothenic acid, niacin and riboflavin; along with minerals such as calcium, copper, iron, magnesium, manganese, phosphorus, potassium and zinc (Al-Waili, 2004; Ajibola et al., 2012).

Consuming honey provides calcium, which is easily absorbed and strengthens the development of bone mass. This can help reduce the risk of osteoporosis or low bone mass (causal agent of fractures) in elderly people (Ariefdjohan, 2008).

Honey has beneficial effects in many physiological systems, for example, cardiovascular, nervous, respiratory, and gastrointestinal systems (Saranraj et al., 2018). Given that honey contains oligosaccharides, it was hypothesized that these compounds could contribute to the prebiotic effects of honey and therefore has antidiabetic, antihyperlipidemic and hepatoprotective effects (Erejuwa et al., 2014; Cornara, 2017).

Following the studies undertaken by numerous authors, through our research we propose to create a food supplement based on pine buds harvested at different stages of growth and development mixed with two types of bee honey (polyflora and acacia).

Materials and methods

The biological materials used were pine buds *(Pinus silvestrys)* harvested in 3 stages of development. Pine shoots were harvested from Papiu Ilarian location, Mureş County, starting in May. Pine shoots were harvested at 14-day intervals at the three stages of growth and development: stage I at the size of 4 cm, stage 2 at the size of 8 cm and stage 3 at the size of 12 cm (figure 1). Samples were vacuumed and frozen (temp = -18°C). The samples were subjected to the maceration operation for 14 days at room temperature. Acacia honey was purchased from a local producer, in 2022 from Papiu Ilarian location, Mureş County and polyfloral honey was purchased from a local producer, in 2022 in Papiu Ilarian location, Mureş county.

Food manufacturing supplement

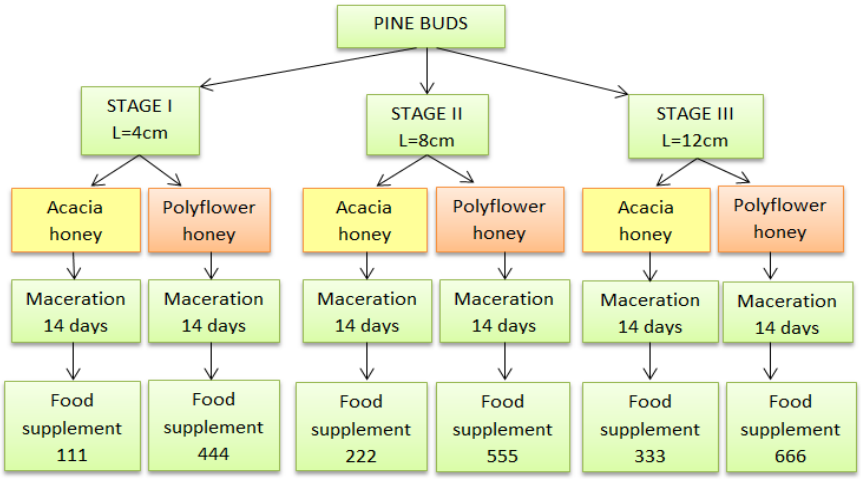

Figure 1. Flow chart for food supplement manufacturing

In order to obtain the food supplement based on pine buds and honey, we performed the following operations: pine buds harvested at the three growth stages were subjected to the shredding operation, samples were individually dosed into glass containers after which they were subjected to the maceration operation for 14 days (figure 1).

The shredded pine buds of the three growth stages were introduced into two types of honey (polyfloral and acacia) for 14 days and following the maturation process we obtained six types of food supplements, which were subjected to the process of consumer appreciation following the hedonic test carried out.

The samples were evaluated in terms of colour, texture, smell, taste, aroma and overall appearance on a 9-point hedonic scale (1 representing extremely unpleasant, 2 representing very unpleasant, 3 representing unpleasant, 4 representing not very pleasant, 5 representing indifferent, 6 representing not very pleasant, 7 representing pleasant, 8 representing very pleasant, 9 representing extremely pleasant). The hedonic test was realized by 35 panellists with the age ranging from 19-23 years old.

Results and discussion

The hedonic test method was used to perform the sensory analysis (figure 2). This analysis has as its main purpose to test the acceptability of the product and its appreciation by the consumer. The hedonic test allows the quantitative measurement of the subjective perception of pleasure. According to the perception of the evaluators, the samples of polyfloral honey with pine buds in the three stages of development: pine buds 4 cm stage I, pine buds 8 cm stage II and pine buds 12 cm stage III scored higher than the samples of acacia honey with pine buds in the three stages of development.

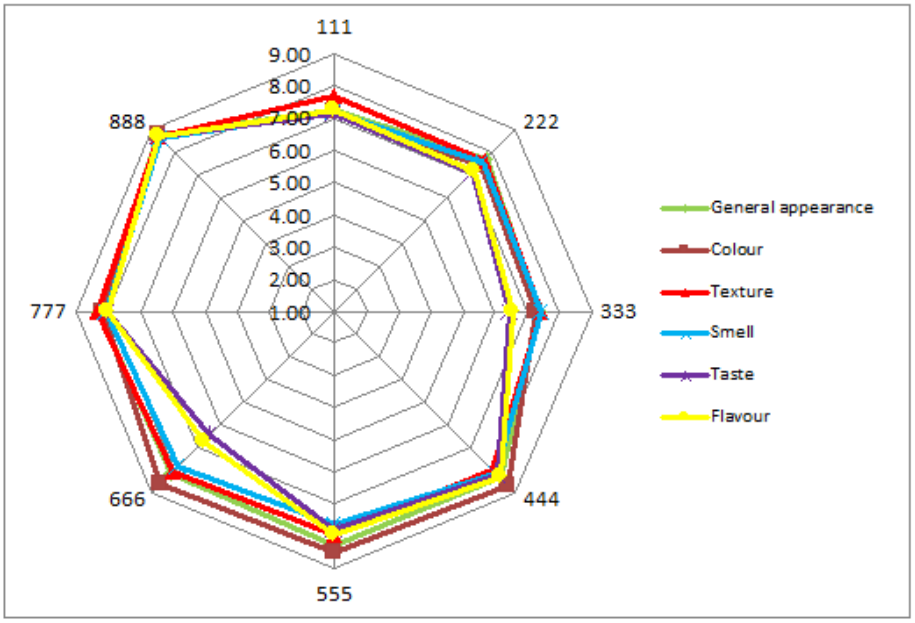

Figure 2. Graphical representation - sensory analysis

The difference between the control sample and the other samples shows that in terms of general appearance the samples with polyfloral honey with first-stage buds (444) scored 8.33 higher than the samples with acacia honey with first-stage buds (111) which scored a final value of 7.27. Samples with polyfloral honey with buds at stage II (555) scored 8.27 higher than samples with acacia honey with buds at stage II (222) with a score of 7.67. Samples with polyfloral honey with buds at stage III (666) scored 8.13 higher than samples with acacia honey with buds at stage I (333) with a score of

7.40. Polyfloral honey is more amber, more viscous compared to acacia honey which is more translucent and fluid.

In terms of colour, the polyfloral honey sample with 4 cm buds at stage I (444) obtained a result of 8.67 compared to the polyfloral honey control sample (888) with 8.73 points. The 8 cm buds polyfloral honey samples at stage II (555) scored 8.47 higher than the 8 cm buds acacia honey samples at stage II (222) with 7.40. Samples with 12 cm buds polyfloral honey at stage III (666) scored 8.60 higher than samples with 12 cm buds acacia honey at stage I (333) with 7.27 points. Honey colour is influenced by antioxidant content, darker honey contains more antioxidants than lighter honey. (Frankel et al., 1998; Ajibola et al., 2012).

In terms of texture, the most appreciated samples for the use of polyfloral honey were polyfloral honey with 12 cm pine buds, stage III (666) with 8.07 points and polyfloral honey with 4 cm buds, stage I (444) with 8.00 points. For the use of acacia honey the most appreciated samples were acacia honey with 4 cm pine buds, stage I (111) with 7.67 points and acacia honey with 4 cm pine buds, stage II (222) with 7.60 points. Compared to the control sample there are small differences, polyfloral honey with 12 cm buds, stage III (666) with 8.07 points and polyfloral honey with 4 cm buds, stage I (444) with 8.00 points had very close results to the control sample, polyfloral honey (888) with 8.67 points.

With respect to the results of the smell evaluation, it was observed that the dietary supplement with polyfloral honey with 4 cm pine buds, stage I (444) scored 8.13, a higher score than the dietary supplement with acacia honey with 4 cm pine buds (111) with 7.13 points.

This is because polyfloral honey has a stronger odour than acacia honey. The score obtained to the control sample, polyfloral honey (888) 8.60 points was obtained by the supplement with polyfloral honey with 4 cm buds stage I (444) with 8.13 points.

The 8 cm shoot polyfloral honey supplement stage II (555) scored 7.60 points higher than the shoot acacia honey supplement stage II (222) with 7.53 points. Samples with 12 cm shoot polyfloral honey at stage III (666) scored 7.87 points, higher than samples with shoot acacia honey at stage III (333) with 7.47 points. In terms of taste, samples with polyfloral honey with pine buds (444, 555, and 666) were more appreciated by the evaluators compared to samples with acacia honey and pine buds (111, 222, and 333). The samples with polyfloral honey with 4 cm pine buds, stage I (444) scored 8.20

higher than the samples with acacia honey with 4 cm pine buds, stage I (111) with 7.13 points. Samples with polyfloral honey with shoots at stage II (555) scored 7.80 higher than samples with acacia honey with buds at stage II (222) with 7.07. Samples with polyfloral honey with buds at stage III (666) scored the same 6.47 as samples with acacia honey with buds at stage III (333). The general taste characteristic of polyfloral honey is sour, sweet taste and caramel aroma, in contrast to acacia honey which is intense sweet taste and candy (sugar syrup) aroma.

In terms of flavour, the samples with polyfloral honey with pine buds in stage I (444) scored higher than the other samples with the closest score to the control sample. The samples with polyfloral honey with 4 cm pine buds, stage I (444) scored 8.33 higher than the samples with acacia honey with 4 cm pine buds, stage I (111) with 7.27 points. Samples with 8 cm buds polyfloral honey at stage II (555) scored 7.93 higher than samples with 8 cm buds acacia honey at stage II (222) with 7.13. Samples with 12 cm buds polyfloral honey at stage III (666) scored 6.73 higher than samples with 12 cm buds acacia honey at stage III (333) with 6.60 points.

Polyfloral honey is more aromatically rich, as it comes from the nectar of several flowers, each contributing its own flavours. None of these flavours is dominant, which is why this honey is not monofloral. Light-coloured honey always has a delicate flavour, while dark honey normally has a strong flavour. Therefore, the assessment of the colour gives information about the flavour. Approximately 60 compounds are responsible for the aroma of honey: aliphatic alcohols, aromatic alcohols, aldehydes, acids and their esters (Aparna, 1999).

Conclusions

- In conclusion, a comparison between the six products obtained from acacia honey with pine buds at different stages and polyfloral honey with pine buds at different stages shows that the dietary supplement obtained from polyfloral honey at stage I was more appreciated by a small distance than the dietary supplement obtained from polyfloral honey at stage III. The differences from the control sample are not very significant. Sensory processing techniques can be very useful for the optimization, monitoring and development of novel dietary supplements.
- The development of new products for consumers brings benefits

including financial benefits to beekeepers. The price difference between 1 kg of plain honey and 1 kg of honey with pine shoots is not huge, 100g of supplement could reach 10-20% more than plain honey. Due to the health benefits this food supplement offers, the price is fair.

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