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EFFECTS OF FLORAL HONEY AND PRESSED FLAX SEEDS ON INTENSITY OF YOGURT AROMA, SWEETNESS AND SOUR TASTE OF YOGURTS DURING STORAGE

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ABSTRACT

The aim of this study was to evaluate chosen sensory properties of yogurts without any additions of honey and pressed flax seeds (K) and with the different addition of floral honey (1, 3 and 5%) and with the same addition (0.5%) of pressed flax seeds (PA, PB and PC) during storage. These samples were analysed during 14 days of storage at cooling temperature (6 ±1 °C). Sensory properties – intensity of yogurt aroma, sweetness and sour taste were evaluated. Sensory evaluation was carried out in the 1st, 7th and 14th day following the yogurts production. The control samples had the most significant yogurt aroma this sample had also the highest sour taste and the lowest sweet taste throughout the storage. In all of analysed samples, the sourest taste was observed 14th day of storage. The sweet taste of yogurts with honey addition increased compared to control samples however the sweetest taste of samples with addition of honey was 1st day following the yogurt production. Optimum sweetness was determined with the samples of yogurts containing 5% of floral honey. Floral honey added into the yogurts has positive effect on their sensory properties. The pressed flax seeds have no effect on sensory properties of yogurts. The enrichment of yogurts with honey and pressed flax seeds is high recommended because they have a lot of beneficial nutritional properties and improve the sensory quality of the final product.

Keywords: Yogurt; floral honey; pressed flax seeds; sensory properties

INTRODUCTION

Yogurt is fermented dairy product procured through of the action lactic acid bacteria *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*. Lactic acid is produced in the process of fermentation of lactose by yogurt culture. Lactic acid acts on milk protein, it forms the characteristic structure and sensory properties of yogurt. The content of milk fat in yogurts directly influences the final hardness of the gel structure. The reason for less desirable structure, taste and flavour can be the low content of milk fat in yogurts **(Serafeimidou et al., 2013; Caleja et al., 2016; Yu et al., 2016)**.

The presence of a high number of lactic acid bacteria may causes therapeutic effects of yogurt on health, such as digestion enhancement, appetite enhancement, anticarcinogenic activity, and decrease of cholesterol. In addition, yogurt contains many proteins, minerals and vitamins, for instance, riboflavin, vitamins B_6 and B_{12} and calcium **(O'Sullivan et al., 2016; Yu et al., 2016)**.

Williams et al. (2015) found that the consumers of dairy products have higher intakes of protein, calcium, magnesium, phosphorus, and vitamin D, which all have a provable benefit for bone health. Dairy products such as yogurts can help to prevent the lower risk of emergence of hypertension, coronary heart disease, type 2 diabetes mellitus, and obesity. Calcium in dairy products may increase weight loss in obese but only when energy intake is restricted and calcium intake is increased from inadequate to adequate level.

The ambition to provide nutritive rich food foodstuffs with appetizing flavour increased with the development of technologies and the growing competition. The flavour of yogurts may increase its demand by consumers. The flavor and structure of yogurts may vary depending on the type of milk and culture, fermentation process and temperature. The flavour of yogurts is characterful but also popular. The sweeteners, flavourings and other ingredients are added in order to modify the flavour of yogurts **(Routray and Mishra, 2011)**. Yogurts with honey and pressed flax seeds are not widely available in trade network.

According to the definition set by Codex Alimentarius "Honey is the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature" **(Codex Stan, 2001)**. Honey is the nutritionally

valuable substance, which contains a mixture of fructose and glucose (65%), water (18%), proteins, organic and amino acids, lipids, vitamins, minerals, enzymes, phenolic acids, flavonoids and pollen grains. The type of flower, honey bees, climate, weather conditions, zone, as well as processing, manipulation, packaging and storage have an impact on properties of honey such as the composition, flavour, aroma and colour. Many substances found in honey, for instance flavonoids, phenolic acids, ascorbic acid, some enzymes, carotenoids, organic acids, have antioxidant properties, which are effective in lowering the risk of cancer, heart disease, inflammation, asthma and cataract. Ripe honey is considered to be relatively sterile foodstuff. High sugar content, low water activity and hydrogen peroxide and some other components of honey have antibacterial effects against pathogenic bacteria, antifungal, antiviral, antitumor activities and some of them have the positive effects on the wound healing and various skin diseases. Honey is incorporated into food products, because it improves their taste and increases their nutritional value **(Kňazovická et al., 2015; Solayman et al., 2015; Yousuf et al., 2016; Kadri et al., 2017)**.

Flax (*Linum usitatissimum* L.) is deemed as multipurpose plant because the fibers are processed to manufacture of textiles and the seeds are pressed to extract linseed oil. Linseeds are the source of oil with the content of omega-3 fatty acids, which are interesting for human nutrition, cosmetic and pharmaceutical industry. Linseeds contain many bioactive substances, so have a positive effect on prevention against cardiovascular diseases, hypertension and cholesterol levels. During of pressing of the linseed is created the seedcake as by-product. It contains nutritional valuable compounds which have antimicrobial, antifungal, antitumor and anti-inflammatory activities. Linseeds in one of their many forms may be incorporating into bakery products, pasta or dairy products **(Edel et al., 2015; Zuk et al., 2015)**.

Addition of natural products into some food products affects their taste, aroma and structure, so sensory quality plays a key role for food acceptance. Taste and aroma are characteristic properties of food, which determine consumer acceptance of products. Taste sensation is dependent on the taste receptor cells located in the mouth. The sensation can by described as sweet, salty, sour, bitter, and umami. The sensation aroma is the result of the interaction of the volatile food components with the olfactory receptors. Before any new food innovation, sensory evaluation with using different sensory analysers is encouraged **(Routray and Mishra, 2011)**.

The aim of this study was to evaluate chosen sensory properties of yogurts with addition of pressed flax seeds and honey and compare them with a control samples without any additions of pressed flax seeds and honey.

MATERIAL AND METHODOLOGY

Yogurts were made and assessed in Department of Evaluation and Processing of Animal Products, Slovak University of Agriculture in Nitra. Semi-skimmed milk with fat content of 1.5% obtained from trade network was used for yogurts production. The milk was heated on a temperature 40 – 42 °C, mixed with skimmed milk powder and then again heated on 80 – 82°C during two minutes. Then the cooled milk was inoculated with yogurt culture (Laktoflora®, Milcom a. s., Czech Republic) and inoculated milk was dosed into sealable glasses. This product was marked as control sample (K). To all experimental samples (PA, PB, PC) were added 0.5% of pressed flax seeds Raciol 4A (Šumperk, Czech Republic). These experimental samples of yougurts were divided to three groups: first group of samples (PA) additionally contain of 1% of honey, second groups of samples (PB) additionally contain of 3% of honey and third groups of samples (PC) additionally contain of 5% of honey. The fermentation of milk was carried out at temperature 42 – 43 °C during three hours. The final products were stored at 6 ±1 °C during 14 days.

Sensory properties – intensity of yogurt aroma, sweetness and sour taste, were evaluated. Sensory analysis was performed by four-member committee of assessors who evaluated selected parameters by five point scale. Evaluation was carried out in the 1st, 7th and 14th day following the yogurts production. Experiment was carried out at three times.

The data were analysed using software Microsoft Office Excel 2007. The results were represented by graph. Each experiment was evaluated at least three times and the resulting curve was calculated as the mean value of these evaluations. Obtained results were processed by variation-statistical methods in ANOVA. The differences between groups were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

The flavour of dairy products is characterized by numerous volatile bacterial metabolites, some of which are by-products of fermentation. Lactic acid is one of the major compounds significantly contributing to yogurts flavour. The aromatic components, such as acetaldehyde, acetone, acetoin, diacetyl, acetic acid, formic, butanoic and propanoic acid have significant influence on the final yogurt flavour **(Pinto et al., 2009; Routray and Mishra, 2011)**. The most intensive yogurt aroma durig the storage period was found in samples of control yogurts (K) while the lowest intensive of yogurt aroma durig the storage period was determined in the samples of yogurts with highest addition of honey (PC) (Figure 1). The differences among control sample and PC sample in yogurt aroma were statistically significant ($p < 0.05$). These findings may be probably caused by the strong characteristic aroma of honey, which suppresses the characterful aroma of yogurts samples. No undesirable aroma was detected in all of analysed samples during storage.

The most intensive sour taste was observed in the samples of yogurts without honey addition (K). The sour taste decreased gradually with increased addition of honey (Figure 2). The samples with the highest addition of honey had the lowest intensity of sour taste (PC). Statistically significant differences ($p < 0.05$) were found between control sample and PC sample in sour taste. The highest intensity of sour taste in all analysed samples of yougurts was observed after 14 days of storage.

Mercan and Akin (2016) reported that one reason of flavourings or sweeteners addition is increase its flavour because yogurts have a sour taste. They found that, yogurts with honey addition had higher sweetness than the control samples. The aroma and sweetness points decreased in all of yogurts with pine honey during storage. The addition of

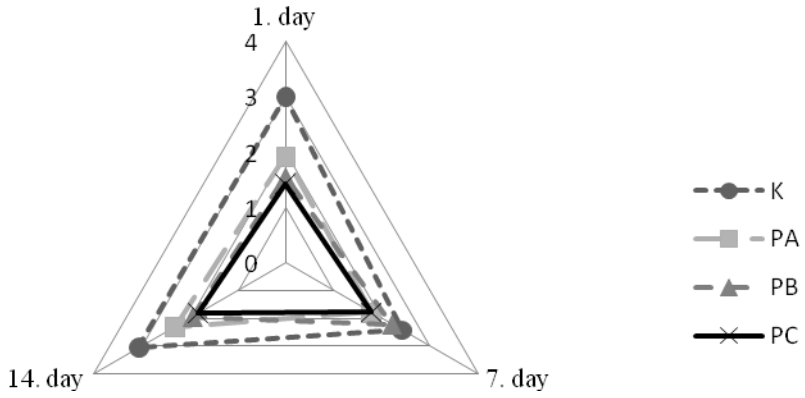

Figure 1 Sensory evaluation of yogurt aroma in yogurts stored at 6 ±1 °C during 14 day.

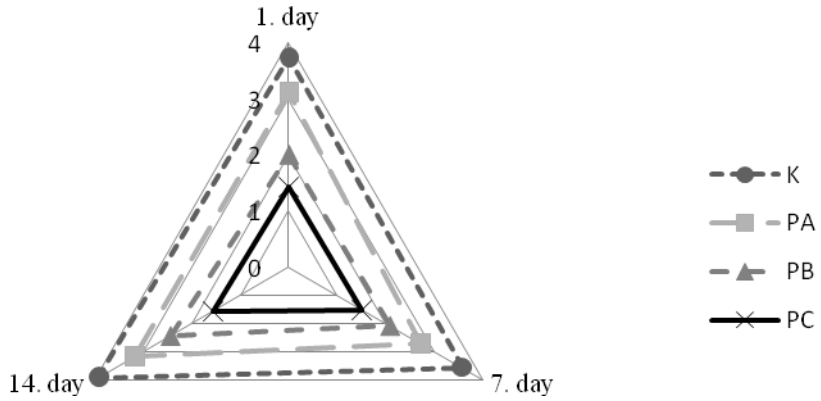

Figure 2 Sensory evaluation of sour taste in yogurts stored at 6 ±1 °C during 14 day.

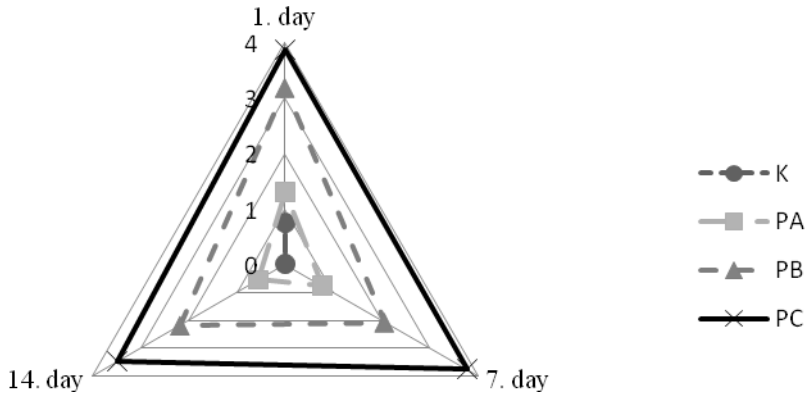

Figure 3 Sensory evaluation of sweet taste in yogurts stored at 6 ± 1 °C during 14 days.

pine honey had no negative effect on sensory properties. Pine honey has no incisive aroma or taste, has a low tendency to crystallize and also a significant antioxidant activity.

Popa and Ustunol (2011) prepared the low-fat strawberry yogurt with five alternative sweeteners in the dose 7%: sucrose, high-fructose corn syrup, sage, alfalfa, and sourwood honeys. Sage honey is light with the predominant sweet taste, clover-like flavour and floral aftertaste. Alfalfa honey is white with a mild taste and its aroma is similar beeswax. Sourwood honey has a sweet, spicy, anise aroma and taste. They found that the taste of the sucrose-sweetened samples were rated higher than the next samples with the addition of sage honey, high-

fructose corn syrup, alfalfa, and sourwood honey, respectively. Sourwood honey was least preferred sweetener and the main reason was probably an anise flavour.

The sweetest taste had the samples with the highest addition of honey (PC), while the lowest sweet taste had the samples without honey addition (K) (Figure 3). The differences between PC sample and control sample in sweet taste were statistically significant (p <0.05). The sweetest taste of all analysed samples was determined at the first day after yogurts production. The sweet taste of all samples with honey addition decreased during storage. The control samples had no sweet taste as early as after 7 days of storage.

Varga (2006) studied 1, 3 and 5% presence of acacia honey in yogurt during storage at 4 °C and found that the samples of yogurt containing of honey 3% had optimum sweetness. The samples with the lowest concentration of acacia honey (1%) were weak in flavour and the samples with 5% were too sweet and too strong in honey flavour.

Sert et al. (2010) studied the effect of sunflower honey addition (2, 4 and 6%) on the properties of yogurt during storage at 4 °C. The flavour intensity of yogurt with the lowest concentration of honey was similar to control samples without honey addition. The sample with 6% honey addition had the highest sweetness. Finally, the optimal addition of honey was determined as 4% sunflower honey.

It was found that in all of analysed samples were not any undesirable tastes. The pressed flax seeds had no effect on sensory properties of yogurts.

In general, the scores for overall acceptability of yogurt containing added floral honey and pressed flax seeds were greater (p <0.05) than those for yogurt without added honey and pressed flax seeds.

The comparable findings of sensory evaluation of goat yogurts with addition of honey were found by **Machado et al. (2017)**.

CONCLUSION

The aim of this study was to determine whether the addition of pressed flax seeds and honey has effect on chosen sensory properties of yogurts. Yogurts with occurrence of pressed flax seeds and honey produced in our experiments and stored at 6 °C were positively perceived by assessors till 14th day of storage. The control samples had the most intensity of yogurt aroma, the sourest taste and the lowest sweet taste during the storage. The sweetest taste had the sample with the highest addition of honey. The sweet taste of all anylysed samples decreased in the storage period. No undesirable aroma and taste were found in all of analysed samples. This research has shown that honey added into the yogurts has positive effects on their sensory properties. The pressed flax seeds have no effect on sensory properties of yogurts however they increase nutritional value of yogurts. Optimum sweetness was determined with the samples containing 5% honey.

Yogurt with addition of pressed flax seed and honey can have beneficial effects on human body. These products may be more attractive for consumers, because many consumers are interested in healthy lifestyle and also want to eat delicious food.

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