THE SENSORY EVALUATION OF YOGHURTS WITH CHIA FLOUR, QUINOA FLOUR, NOPAL POWDER, APPLE FIBER AND BAMBOO FIBER

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Abstract: This work deals with sensory evaluation of yoghurt with the addition of fibers and raw materials with natural high fiber content, which brings many positive effects on human health. Chia flour, quinoa flour, nopal powder, apple fiber and bamboo fiber were added to the yoghurt in the amounts of 1%, 3% and 5%. The work shows the evaluation in the first week after production of the yoghurt. Freed whey, acceptability of color, sour aroma, acceptability of aroma, viscosity, texture, stickiness, sandiness, intensity of sourness, acceptability of taste and total impression were used as the descriptors. Very badly assessed were the yoghurts with 5% and 3% quinoa flour and with 5% and 3% nopal powder and very well evaluated in overall impression were the yoghurts with 1% bamboo fiber and nature yoghurt. Therefore, according to this study, the addition of 1% bamboo fiber to nature yoghurt as fiber fortifier are recommendable, but the highest concentrations of quinoa flour and nopal powder to yoghurt cannot be suggested.

Key Words: dietary fiber, health, dairy product, sensory evaluation, yoghurt

INTRODUCTION

Milk and milk products have positive impact on human health, especially as it contains calcium, which decreases the risk of hypertension, colon cancer and osteoporosis. It also contains conjugated linoleic acid (CLA), which protects against obesity, cardiovascular disease, cancer and improves immunity (Miller et al. 1999). Yoghurt counts as a functional food, because it contains probiotics. Probiotics are living microorganisms, which bring health benefits to the consumer are: bifidobacteria, lactic acid bacteria, some yeasts, etc. (Plocková 2012). A functional food must have at least 10⁶ viable microorganisms per gram of food to have a positive effect. Positive effects of probiotics include the restoring of positive microflora in the colon, strengthening the immune system, reducing lactose intolerance, increasing calcium absorption, synthesizing some vitamins, bacteriocins, lowering total cholesterol and LDL cholesterol (Kalač 2003).

Into prebiotics, an indigestible food ingredient (fiber) that promotes growth of the colon microflora, belong indigestible oligosaccharides, e.g. inulin. Inulin is split into oligofructosans with 3 to 8 units of fructose, which were used into non-alcoholic beverages, yoghurts, other dairy products, pastries and marmalades (Kalač 2003). Food fiber that belongs to carbohydrates are not digested and absorbed in the intestine, but are decomposed in the colon by symbiotic microorganisms (Komprda 2009). It is recommended to receive 0.3 g of prebiotics per kilogram bodyweight for men and 0.4 g per kilogram bodyweight for women. This fiber intake contributes to the growth of desirable microflora in the intestines, reducing consumer energy consumption, eliminating constipation, strengthening the immune system, preventing rectal and colon cancer, improving calcium utilization, and lowering cholesterol levels (Kalač 2003). The dietary intake of fiber decreases the occurrence of obesity and disease of cardiovascular system (Slavin and Lloyd 2012). Synbiotics are the products containing both prebiotics and probiotics (Plocková 2012).
Chia seeds are a good source of dietary fiber, omega-3 fatty acids and antioxidants, which protects against cancer, ageing, and liver and heart diseases. Chia does not contain gluten. Chia seed also has a positive effect on hypertension, dyslipidemia, diabetes, depression, immunity and vision and other (Ullah et al. 2016).

Dehulled quinoa flour, a cultivar grown in Colorado, USA contains about 58.1% starch, 2.7% sugar, 15.6% protein, 4.6% fat, 8.9% total dietary fiber (insoluble 7.7%, soluble 1.2%) and 2.3% ash. Minerals included are particularly potassium, calcium, magnesium, phosphorus, iron, from the vitamins B-group vitamins (Ranhotra et al. 1993). Quinoa does not contain gluten and flour of the quinoa is used for example in bakery products (Bavec and Bavec 2007).

The dietary intake of fiber decreases occurrence of obesity and disease of cardiovascular system (Slavin and Lloyd 2012).

Nopal cactus, thanks to contents of vitamins, polyphenols, amino acids and polyunsaturated fatty acids, shows antioxidant, antimicrobial, neuroprotective, hypoglycemic and anti-inflammatory effect (El-Mostafa et al. 2014). In the study (Uebelhack et al. 2014) was found that cactus fiber was binding on the dietary fat and caused fat to be removed from the body, which can reduce the weight of consumer.

In the study (Jensen et al. 2014) was found that fibers from apple peel have an anti-inflammatory and an antioxidation effect. Also apples and apple products protects against asthma, cancer and Alzheimer’s disease (Hyson 2011). Healthy properties were also contributed by the phytochemicals included in apples (chlorogenic acid, catechin, quercetin, phloridzin), which had shown strong antioxidant activity (Boyer and Liu 2004).

In the study (Li et al. 2016) was discovered that bamboo fiber from shoot reduced more effectively weight of mice than the intake of cellulose fiber. Bamboo fiber was absorbed very good in water (Yueping et al. 2009).

MATERIAL AND METHODS

The raw materials were purchased in the Czech Republic. The yoghurts were made at the Department of Food Technology at Mendel University. The milk for preparation of yoghurt originated from the south Moravian region, from Holstein dairy cows. The percentage values of composition was determined lactose to 4.50%, protein to 3.42%, fat to 3.50% and titratable acidity was established to 6.7 SH by the stirred coagulated method. The milk was pasteurized by 85 °C for 5 minutes, then the milk was cooled down to 36 °C, after which it was inoculated with a (0.5% by weight) starter culture of original Bulgarian yogurt (bulgaricus.cz, GENESIS LABORATORIES, Bulgaria) and fermented at 36 °C for 18 hours. Thereafter was yoghurt homogenized for 5 min. Yoghurt was divided into 16 groups, one group stayed plain yoghurt, into the others were added chia flour, quinoa flour, nopal powder, apple fiber and bamboo fiber in amount of 1%, 3% and 5% by weight. The yoghurts were stored at 4 °C.

The sensory evaluation was conducted at the Department of Food Technology at Mendel University, in premises designed for sensory assessment according to ČSN ISO 8589 (560036). The evaluation was done by eleven trained sensory assessors. This descriptors were evaluated: freed whey, acceptability of color (0 = unacceptable,100 = acceptable), sour aroma (0 = unintensive, 100 = very intensive), acceptability of aroma (0 = unacceptable,100 = acceptable), viscosity (0 = sparse, 100 = dense), texture (0 = grainy, 100 = smooth), stickiness (0 = without stickiness, 100 = extreme), sandiness (0 = without sandiness, 100 = very sandiness), taste of sour intensity (0 = without sour, 100 = very sour), acceptability of taste (0 = unacceptable, 100 = excellent), total impression. The scales for sensory evaluation used was a graphical (0–100) and a categorizing scale (for freed whey and total impression). The sensory evaluation was performed weekly for 3 weeks. However, this study included a sensory assessment at the first week, because yoghurts with chia seeds could not assessable at the second week and at the third week yoghurt with 5% quinoa flour could not be assessed either. The statistic comparison of mean values with evaluations in first, second and third week for the description the taste acceptability was detected congruity of mean values (α = 0.05).

The results were evaluated using Microsoft Excel and STATISTICA.
RESULTS AND DISCUSSION

The whey in yoghurt with 5% quinoa flour was evaluated with all 11 assessors as very much loosed, and in yoghurt with 5% apple fiber as without whey. The yoghurts with quinoa flour all three variants was assessed whey as very much loosed. All frequency for description freed whey are shown in Figure 1.

Figure 1 Frequency of description freed whey for yoghurts with chia flour, quinoa flour, nopal powder, apple fiber, bamboo fiber and for natural yoghurt, evaluated 1 week after production

The yoghurts with nopal powder (Table 1 and Figure 2) were badly evaluated for color, which was detected as green, and the yoghurts with white color were determined higher values: nature yoghurt and with bamboo fiber. Aroma was evaluated good by yoghurts with chia flour and bamboo fiber. The densest were yoghurts with nopal powder and the sparsest all yoghurts with quinoa flour. The grainy was discover by yoghurts with chia flour. Sandiness was found typically for yoghurts with bamboo fiber. In yoghurts with chia flour was ascertained low intensity of sour taste. Great taste was evaluated by yoghurts with chia flour and unfavourable by quinoa flour.

Table 1 The yoghurts with the highest and the lowest value for followed descriptors

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>The highest value</th>
<th>The lowest value</th>
</tr>
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<tbody>
<tr>
<td>Acceptability of color</td>
<td>natural yoghurt</td>
<td>nopal powder 5%</td>
</tr>
<tr>
<td>Sour aroma</td>
<td>chia flour 5%</td>
<td>bamboo fiber 3%</td>
</tr>
<tr>
<td>Acceptability of aroma</td>
<td>chia flour 1%</td>
<td>quinoa flour 5%</td>
</tr>
<tr>
<td>Viscosity</td>
<td>nopal powder 5%</td>
<td>quinoa flour 1%</td>
</tr>
<tr>
<td>Texture</td>
<td>quinoa flour 1%</td>
<td>chia flour 5%</td>
</tr>
<tr>
<td>Stickiness</td>
<td>nopal powder 5%</td>
<td>quinoa flour 5%</td>
</tr>
<tr>
<td>Sandiness</td>
<td>bamboo fiber 5%</td>
<td>quinoa flour 1%</td>
</tr>
<tr>
<td>Taste of sour intensity</td>
<td>natural yoghurt</td>
<td>chia flour 1%</td>
</tr>
<tr>
<td>Acceptability of taste</td>
<td>chia flour 1%</td>
<td>quinoa flour 5%</td>
</tr>
</tbody>
</table>

549 | P a g e
Figure 2 Sensory evaluation for yoghurts, divided into groups according to the added raw material, in descriptors: acceptability of color, sour aroma, acceptability of aroma, viscosity, texture, stickiness, sandiness, taste of sour intensity, acceptability of taste

In description total impression (Figure 3) was evaluated very badly the yoghurt with 5% quinoa flour and with 5% nopal powder. Very positive was assessed the yoghurt with 1% bamboo fiber and nature yoghurt.
In the study (Staffolo et al. 2004), which explored the rheological and sensory properties of yoghurts with wheat, apple, bamboo fiber and inulin, it was concluded that yoghurts with bamboo and wheat fiber had a firm texture (too high values of compression force) and that the firm texture caused better evaluation of texture descriptor. However, in our study the densest yoghurts (yoghurts with nopal powder) were evaluated in the total impression as the worst, which was probably caused by the green color or because of the stickiness of nopal yoghurts.

CONCLUSION

The yoghurt, which looked like nature yoghurt (white, similar density) received the best results in total impression - the yoghurt with 1% bamboo fiber. However, the bamboo fiber in higher concentrations caused sandiness. The yoghurt with 5% quinoa flour was evaluated badly, not only for total impression, but also for acceptability of the taste. Besides, the yoghurts with quinoa flours were detected very sparse. The yoghurt with 5% nopal powder, which was evaluated with low total impression, was unacceptable in color, density and had the highest value for stickiness. Low addition of bamboo fiber to yoghurts can be recommended, on the other hand, high concentration of quinoa flour and nopal powder is not very suitable.

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REFERENCES


