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EVALUATION OF EXTRACT AND FAT CONTENT IN SELECTED FRUIT AND FRUIT-VEGETABLE YOGURTS (AVAILABLE ON THE MARKET)

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Abstract: Yogurts, mainly due to their sensory and nutrient properties are bought very often by Polish consumers. In 2017, fruit yogurts with the addition of vegetables appeared on the market. The aim of this work was to verify the effect of the addition of vegetables to fruit yogurts on selected quality features of yogurts. The obtained results in the study allowed to state that this supplement increases the content of extract and fat content in yogurt, which has a beneficial effect on the nutritional value of yogurts.They also provide the basis for further research in the field of physicochemical and organoleptic assessment, which will be used to assess their quality and obtain information about consumer preferences.

Keywords: fruit yogurts, fruit and vegetable yogurts, quality estimation, extract, fat.

1. INTRODUCTION

In recent years, there has been a trend for more consumers to be health conscious and seek foods with functional properties additional to their nutritional value. Currently, people have interest in maintaining good health and an excellent body figure, therefore, they have become more careful in the food they choose to consume, looking for food with a high nutritional value, bioactive compounds and antioxidant capacity, such as fruits and vegetables. Yogurt is a fermented dairy product that is produced by fermentation of lactic acid and contains live lactic acid bacteria. Yogurt is a probiotic food that has very important properties about human health. From past to present, the reason of being one of the most widely consumed food is its healing power. Probiotic dairy products are considered to have functional properties because the probiotic bacteria added to the regular fermentation cultures provide therapeutic benefits such as modification of the immune system, reduction in cholesterol, alleviation from lactose intolerance, faster relief from diarrhea, and restoration of a healthy vaginal microbiota. Yogurt has important nutrients such as animal proteins, carbohydrates, lipids, calcium,

potassium, phosphorus, magnesium, zinc and vitamins B. The culturing process makes yogurt more digestible than milk. Many people who suffer from lactose intolerance or protein allergy can consume yogurt comfortably. Yogurt contains lactobacteria which are intestinesfriendly bacterial cultures that foster a healthy colon, and even lower the risk of colon cancer. Yogurt improves the bioavailability of other nutrients [Hekmat and Reid 2006; Mojka 2013; Yildirim et al. 2014].

Yogurt fortification with fruits, seeds and vegetables has high potential to improve the nutrients and health promoting effects of the yogurt [Stankiewicz 2009; Kiros et al. 2016; Palka, Wilczyńska and Flis 2017].

Market participation, and particularly its conscious shaping, requires dairy industry producers to constantly adjust the quality of produced dairy beverages to the requirements of potential consumers. Understanding consumer behaviour, their attitudes affecting shopping decisions and expectations, called consumer preferences, has been the subject of research for many years [Kudełka and Marzec 2004].

Vegetable yogurt became the trendy new food of 2017 year. The report, which was conducted by British supermarket Waitrose, has revealed that a third of people aged between 18 and 34 regularly post pictures of their meals on social media. US product developers have successfully infused flavours such as carrot, beetroot, sweet potato, tomato and avocado into yogurt for a savoury accompaniment that's being touted as a healthier substitute to soured cream. These healthy vegetable yogurts contain less sugar than fruit yogurts and become a huge new healthy dairy product [Anonymous 2016; Bodkin 2016]. Veggie yogurts are tipped to become a new health food. Flavours include, apart from vegetables, apples, kiwi, avocado, matcha tea, pineapple, mango, turmeric, ginger and guarana also. Vegetable yogurts are usually made with small addition of fruits, for example strawberry and carrot, and blueberry and pumpkin [Blake 2017].

Modern cuisine is more often based on interesting combinations of flavours, according to foodpairing. The choice of the right connections between food ingredients, called foodpairing, is a new trend in both food technology and molecular cuisine. The foodpairing hypothesis says that ingredients sharing flavour compounds are more likely to taste well together than ingredients that do not. Foodpairing effect is due to a few outliers that are frequently used in a particular cuisine. Western cuisines show a tendency to use ingredient pairs that share many flavour compounds, supporting the so-called food pairing hypothesis. By contrast, East Asian cuisines tend to avoid compound sharing ingredients [Ahn et al. 2011].

Vegetables added into investigated yogurts have many other advantages than flavouring. Tomato is one of the popular and most consumed, as well as important, vegetable in the world. The chemical constituents are concerned in the quality of tomato fruit in respect to colour, texture, flavour, nutritive value, and wholesomeness. In general, high sugar contents, redness of colour, and firm texture are associated with prominence of rich flavour. It is tasty and easily digestible and its bright colour stimulates appetite. It is rich in nutrients and calories. It is a good source of Fe and vitamin A, B, and C. Consumption of tomato and its products can

significantly reduce the risk of developing of colon, rectal, and stomach cancer. Recent studies suggest that tomatoes contain the antioxidant lycopene, the most common form of carotenoid, which markedly reduces the risk of prostate cancer [Salunkhe, Jadhav and Yu 1974; Sainju, Dris and Singh 2003].

The bell pepper (*Capsicum annum* L) is a fruit well known for its high content in bioactive compounds and strong antioxidant capacity and it is among the most popular of fresh vegetables worldwide due to its combination of colour, flavour, and nutritional value. Fresh peppers have exceptionally high quantities of ascorbic acid and their attractive red colour is due to several carotenoid pigments that include β-carotene with pro-vitamin A activity and oxygenated carotenoids such as capsantine, capsorubin, and cryptocapsin, which are exclusive to these fruits and have proven to be effective at scavenging free radicals. Peppers also contain large quantities of neutral phenolic compounds or flavonoids called quercetin, luteolin, and capsaicinoids. The consumption of these bioactive compounds provide beneficial effects in human health due to their antioxidant properties, which protect against the oxidative damage to cells and thus prevent the development of common degenerative diseases such as cancer, cardiovascular diseases, cataracts, diabetes, Alzheimer's, and Parkinson's. These chemical compounds also prevent the oxidation of essential fats within the cells of the brain that are considered necessary for its optimal functioning [Chávez-Mendoza et al. 2015].

Beta vulgaris (*Chenopodiaceae*) is generally known as beetroot or garden beet. Beetroot is most commonly dark red in colour. It is used in Indian traditional system of medicine, specifically for the treatment of fertility, cancer, hypertension and urinary tract disorders. It makes a wonderful dietary supplement being not only rich in nutrients, minerals, amino acids and vitamins but also has unique phyto-constituents, which have numerous medicinal properties such as anti-oxidant, anti-depressant, anti-microbial, antiinflammatory, diuretic and expectorant. It is an excellent food in pregnancy as it is helpful in the growth of foetus. It is one of the natural food, which boosts the energy in athletes. It is used as natural food colour in dairy and meat products. Traditionally, beetroot was consumed as food. It is now being recognized as a functional food [Chawla et al. 2016].

The combination of fruit and vegetable flavours in dairy products was used in yogurts, available in Poland in one of the supermarket chain. It was a novelty in Poland in 2017. There were 4 variants of these yogurts available:

- cherry-tomato;
- carrot with orange;
- peppers with strawberry;
- beetroot with apple.

Vegetables and fruits were combined on the basis of common features – taste and colour – in accordance with the assumption of foodpairing.

It was recognized that yogurts with fruit and vegetables are an interesting product, which is why it was decided to research the selected quality features of

yogurts. The aim of the study was to verify the effect of the addition of vegetable charge to fruit yogurt on the content of total extract and fat. Estimated fat content was also subjected to comparative assessment with the manufacturer's declaration.

2. MATERIAL AND RESEARCH METHODS

The research was carried out in July 2017. The material for the study consisted of three fruit yogurts and three fruit and vegetable yogurts, the own brand of one of the popular discounters. Three flavours of fruit yogurts were chosen, i.e. apple, cherry, strawberry and three flavours of fruit and vegetable yogurts, i.e. apple-beetroot, cherry-tomato, strawberry and pepper (12cups for each flavour). The products were purchased in one of the supermarket in Gdynia. The newly opened unit packages of yogurts were used for all examinations. Physicochemical determinations were made in a minimum of three, parallel, representative replicates. The determination of the total extract was made by refractometric method, using the Abbe refractometer, while the determination of the fat content was performed using the Gerber method according to PN-75/A-86130. Statistical analysis included the calculation of basic measures (arithmetic mean, standard deviation, ANOVA). Microsoft Office Excel 2007 and Statistica 13 (StatSoft Poland) were used for calculations for $p = 0.05$.

3. DISCUSSION OF RESULTS

The first analysed parameter was the content of a general extract. The extract content determines the health quality and organoleptic characteristics of the product. The obtained results are shown in Figure 1.

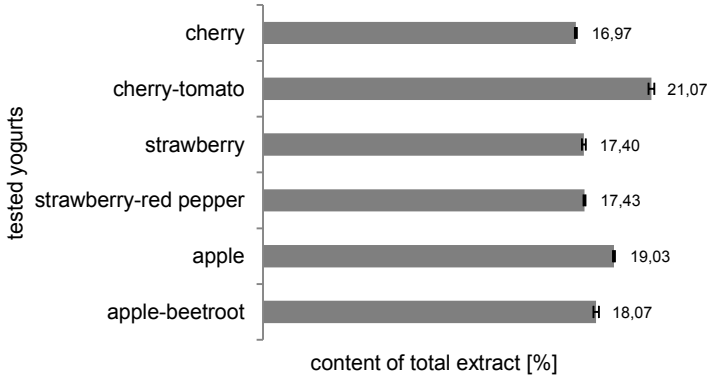

Fig. 1. Total extract content in yogurts

The highest content of the total extract contained cherry-tomato yogurt (21.07%), then apple (19.03%), followed by apple-beetroot (18.07%), strawberry-red pepper (17.43%) and strawberry (17.40%). It was found that cherry yogurt characterized the lowest content of this parameter (16.97%). Cherry-tomato yogurt contained the highest amount of non-volatile substances such as macroelements, antioxidants and dyes, which translates into a high health value of this product, compared to the other known and popular on the market, tested yogurts. Blake claims, that new vegetable yogurt contains significantly less sugar than the store's fruit-only yogurts [Blake 2017]. To evaluate and confirm that statement yogurts with vegetables and without fruits should be taken to evaluation.

The fat content in the investigated products was determined using the Gerber method and was compared with the manufacturer's declaration. The results are shown in Figure 2.

It was found that the fat content in any product did not exceed 3 g, which was a relatively low result compared to the fat content of fruit yogurts of other brands, where the value of this distinctive often reaches over 15 g [Bonczar and Wszolek 2002].

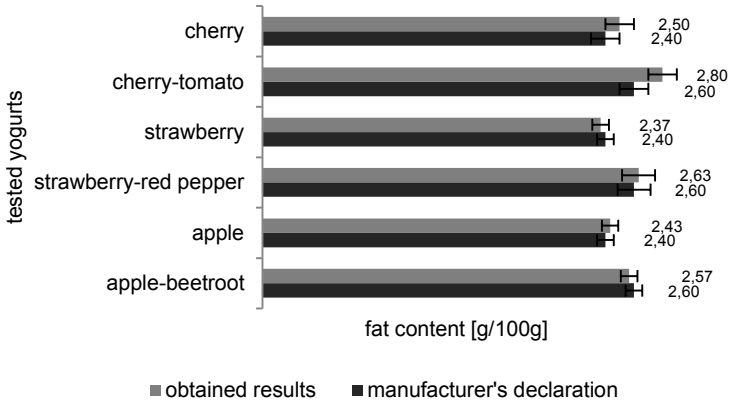

Fig. 2. Fat content in yogurts, in comparison to the manufacturer's declaration [g/100 g]

The highest fat content was found in cherry-tomato yogurt (2.8 g) as well as strawberry-red pepper yogurt (2.7 g). The fat content in apple-beetroot (2.57 g) and cherry (2.5 g) yogurts was a little lower. Apple-flavoured and strawberry-flavoured yogurts characterized the same fat content, at the level of 2.4 g. Differences in the fat content between the tested yogurts did not exceed several tenths of gram. Higher fat content in the fruit-vegetable yogurts is better for consumers due to the presence of a wide range of fat-soluble vitamins (A, D, E, K), while maintaining a safe level of nutritional value. Discrepancies in the fat content may have resulted from the type of fruit or fruit-vegetable used as well as other substances added

during the technological process. Higher fat content in fruit and vegetable yogurts can be natural, related to the nutritional value of the additive used. According to obtained results in this study, fruit-vegetable yogurts should have more nutritive and sensory features than fruit yogurts. Analysis of variance (ANOVA) showed that no significant relation existed between the determined fat content and the declared one ($F = 1.22$, $p = 0.28$).

Januário et al. concluded that the use of organic beet with carrot, cassava or sweet potato juice to flavour yogurt resulted in products with appropriate nutritional, physicochemical, textural and sensory characteristics, and adequate probiotic viability (*Lactobacillus paracasei* ssp. *paracasei*) for 28 days of refrigerated storage. The product had suitable nutritional, physicochemical and textural properties and probiotic culture viability. The acceptance and purchase intent of beet with carrot, cassava and sweet potato yogurts were higher than those of the corn yogurt [Januário et al. 2017].

Food processing steps can influence the matrix structure and therefore the digestion and absorption kinetics of nutrients. In this context, the different steps in the yogurt making process modify the conformation of proteins and other compounds [Morell et al. 2017]. Dal Bello et al. [2015] supplemented yogurts with 5 different vegetable oils obtained from flaxseed, *Camelina sativa*, raspberry, blackcurrant, and *Echium plantagineum* oils. The addition of oil did not influence the growth of lactic acid bacteria and all of the yogurts were accepted by consumers, except for those supplemented with raspberry and *Echium plantagineum* oils due to the presence of off flavours. Although according to Baba et al. [2018] the addition of walnut oil and guar gum significantly affected the quality characteristics of yogurt. Walnut oil was a better option for fortification of yogurts than flaxseed oil.

The fortification of yogurts by grape seed extracts according to Chouchouli et al. [2013] did not affect yogurts' pH and the viability of lactic acid bacteria, while in addition did not cause obvious defects in products' consistency, colour and flavour. Yogurt with added grape seed polyphenols may be a convenient food format to satisfy consumer interest in original yogurt nutrients, beneficiary effects of starter cultures, and health benefits of added polyphenols [Chouchouli et al. 2013].

4. CONCLUSIONS

Based on the conducted research, it was found that the addition of vegetables to fruit yogurts increases the content of total extract and fat. The analysis should be supplemented in the future with evaluation of other quality factorsand the organoleptic evaluation of the tested products in order to find out about consumer preferences.

According to the research results, it can be stated that the next, interesting and valuable nutritionally and sensory product could be vegan vegetable yogurts made from vegetable drinks instead of milk. The vegan diet is an increasingly popular nutritional trend in Poland [Sowa 2018; Wrona 2018]. With a sugar tax on its way [Anonymous 2018], shoppers will be looking for more and more ways to satisfy consumers' sweet needs without compromising their diet.

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