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Evaluation of the Nutrient Content of Ordinary and Functional Yogurts

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Abstract

Evaluation of the nutrient contents of yogurt products available in Kosovo supermarkets was done as a survey of yogurt products available in the Kosovo's supermarkets in November 2022. Data were collected from supermarkets and yogurts were grouped into four categories: drinks, probiotic, fruit, natural/Greek. Database of product information for 66 unique products was created and analyzed. The fat, protein and carbohydrate content differed greatly within and across our product categories. Fat content median (range) were in drinks (yogurts) (2.8 g/100 g (0.5, 3.2)), probiotic (2.95 g/100 g (1, 3.4)), fruit (0.9 g/100 g (0–8.2)) and natural/Greek (3 g/100g (2 – 8)). Yogurts were characterized by total sugar content. Drinks (yogurt) and natural/Greek had lowest sugar content median (4.35 and 4g/100g). Yogurt categories provide customers with a range of protein and fat content, although the yogurt market is distinguished by high sugar level. Reformulation of products to make full-fat yogurts and to add more protein rather than sugar is recommended.

Keywords: yogurts; nutrient; functional yogurt; sugar.

1. Introduction

Yogurt was defined as the product from fermentation of milk with mixed starter culture consisting only of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* [1]. Yogurt is a healthy, low–energy dense, high–nutrient dense food that may be viewed as a signature of a healthy lifestyle [2]. Lactic acid bacteria are the major microbes used in yogurt and dairy fermentations [3]. As starter cultures for yogurt production, lactic acid bacteria (LAB) species display symbiotic relations during their growth in milk medium [4].

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Other LAB species can be combined with *L. bulgaricus* and *S. thermophilus*, in the finished product, the LAB must be alive and in substantial amounts [5]. One of the most scientifically recognized health effects delivered by yogurt cultures is the reduction in symptoms caused by lactose maldigestion, which requires the presence of viable cells at ingestion but not during intestinal transit [6]. Diet quality is improved by consumption of dairy products such as yogurt. A standard portion (175 g) of plain yogurt (1–2% milk fat), the relative content of phosphorus (261 mg), zinc (1.6 mg), riboflavin (0.39 mg), and vitamin B-12 (1 mg) largely exceeds its contribution to energy intake, but greatly contributes to dietary requirements in both men and women [2]. Milk and dairy products (such as cheese and yogurt) are depicted as one of these four main food groups as they are an important provider of protein and calcium, as well as contributing a variety of other micronutrients [8].

Based on the [9] about 90 percent of the U.S. population does not meet dairy recommendations. Despite the fact that the most nutrient-dense food options are already grossly underutilized globally, food-based dietary guidelines (FBDGs) frequently overlook the fact that some of the precise nutrients that these foods provide—such as calcium, iodine, potassium, protein, and vitamin D (in products fortified with vitamin D)—are deficient globally [10].

In general, given that yogurt is made with milk, it is a good source of high-quality protein and calcium [8]. For example, low-fat yogurt contains approximately 50% more potassium, calcium, and magnesium per 8-oz serving than low-fat milk [11]. Calcium is better absorbed from fermented dairy products than from unfermented milk [12]. As preferences for yogurt products are principally influenced by texture, aroma, and taste [13].

The quality and overall sensory consumer acceptance of yogurts is based on he physical attributes like the lack of visual whey separation and perceived viscosity [14]. From among the different product sectors, the dairy sector is the one that has undergone greatest change, with many new products claiming healthy characteristics, not all of which are equally successful [15]. Consumption of functional foods by consumers and their acceptance is linked to their knowledge of the associated health benefits of these foods [16]. Fermented dairy products such as yogurt and yogurt drinks have been marketed and modified successfully to fit the target populations [17]. Similar to stirred or set yogurt a growing area of interest is the drinkable yogurt, categorized as stirred yogurt with a low viscosity because of its convenience, portability, and ability to deliver all of the health and nutritional benefits of stirred or set yogurt [18]. Greek yogurt is one of the fastest growing products in the dairy industry [19]. When the solids content is increased in the formulation before fermentation, it is necessary to fit the type of culture, dosage, fermentation time, among other parameters [20]. After a starter culture is inoculated, the yogurt gets a thicker texture through a concentration step, this “concentration” step can increase protein content to be around 9–10% and give Greek yogurt a hard texture [21]. Probiotic bacteria are microorganisms that provide health benefits to the host when present in sufficient quantities. [22], by improving the composition of intestinal microflora [23]. Probiotic yogurt is expected to contain multiple bacteria, including *Lactobacillus acidophilus*, *Bifidobacterium bifidum, Bifidobacterium lactis, Lactobacillus casei, and/or Lactobacillus rhamnosus* among others [24]. The beneficial effects of probiotics on regulating immune system function and preventing diarrhea have been demonstrated [25].

Use of fruit in yogurt by addition of different fruit in yogurt manufacture, makes its more delicious, this product contains both the refreshing flavor of fruit and beneficial effect of yogurt [26]. FAO and WHO recommend 5-15% of fruit concentration to use in making value-added yogurt [27]. Adding fruity flavorings generally increases the sensory acceptance of yogurt by consumers [13]. The 20 most popular flavors include strawberry, peach, vanilla, blueberry, raspberry, banana, mango, apple, cherry, pineapple, apricot, chocolate, orange, lemon, pear, honey, passion fruit, coconut, cereal, and blackberry [20]. Dairy products are not the main of sugar however nutritional recommendations suggest reducing sugar intake to below 10% of energy intake [28]. As yogurt is a commonly recommended and consumed food in childhood, sweetened yogurts are a significant source of free sugars for children in many countries [29]. Yogurt health benefits were confirmed by many studies. A daily dose of ≥200 g yogurt intake might be associated with a lower incident risk of cardiovascular disease (CVD) [30]. It was determined that feeding yogurt-supplemented diets to rats with spontaneously hypertensive blood pressure had antihypertensive and hypocholesterolemic effects [31]. According to the meta-analysis of [32], probiotic fermented milk lowers blood pressure in both pre- and hypertensive individuals. The nutritional makeup of yogurt, lactic acid bacteria that may impact gut microbiota, and the food matrix that may play a role in appetite and glycemic control are just a few of the special qualities it possesses [33]. Calcium and other nutrients (eg, whey and casein proteins, bioactive peptides, amino acids, and fatty acids), which are abundant in yogurt, have been shown, or have been proposed, to facilitate loss of weight and fat mass [34]. Based on the meta-analyses of [25] consuming probiotics could reduce body weight and body-mass index (BMI), with a potentially greater effect when multiple species of probiotics were consumed, (the duration of intervention was ≥8 weeks, or the objects were overweight). Studies with different bacterial strains have demonstrated positive effects on obesity in several aspects, such as reduction of adipose tissue inflammation, endotoxemia, adiposity, body mass, leptin levels, and energy intake, with the probiotic species *Bifidobacterium* and *Lactobacillus spp.* are the most evidenced [35]. Reduction of fat measured as subscapular skinfold thickness and overall fat intakes was reduced by yogurt consumption. The positive effects of probiotic yogurt have been shown across various studies: Probiotic yogurt improved total cholesterol and LDL-C concentrations in type 2 diabetic people [23], statistically significant effects of probiotics on total cholesterol and LDL when the medium was fermented milk or yogurt compared to capsule form, consumption was at least 8 weeks in duration and the probiotics consisted of multiple strains rather than a single strain [37]. Meta-analysis of probiotic yogurt [24] showed were no effects on fasting blood glucose, fasting insulin, or insulin resistance (estimated by homeostatic model assessment of insulin resistance (HOMA-IR)) in either T2D or obesity, however, the findings of the meta-analysis of [38] revealed that taking a probiotic supplement could significantly lower total cholesterol, HOMA-IR, fasting blood sugar, serum insulin concentration, and all of the above in people with type 2 diabetes (T2DM).

2. Methodology

Yogurts were purchased in local supermarkets in Kosovo for data collection (November 2022). Yogurt were grouped in four categories (drinks, probiotic, fruit, natural/Greek). The grouping was made as described by [39] with some modifications. Ordinary yogurt and yogurt-based products with low viscosity were grouped as drinks, whereas natural/Greek were grouped ordinary yogurts with high-viscosity. Functional yogurts with probiotic bacteria with/without fruits were grouped as probiotic. As fruit yogurts were grouped yogurts with fruits or fruit

derived products. Data were collected form nutrient labels of purchased yogurt. Nutrient information on macronutrients, including energy, fat, protein, carbohydrates and salt was collected. Macronutrients were expressed as g/100 g product and energy was expressed as kcal/100g. All data were checked and verified.

2.1. Data analysis

The product database was made in Excel and statistical analyses were done using Origin (Pro) 2021b (trial version). Normality was examined using the D'Agostino-Pearson omnibus normality test and comparisons across all categories were made using the non-parametric Kruskal-Wallis test with Dunn's multiple comparisons [39].

3. Result & Discussion

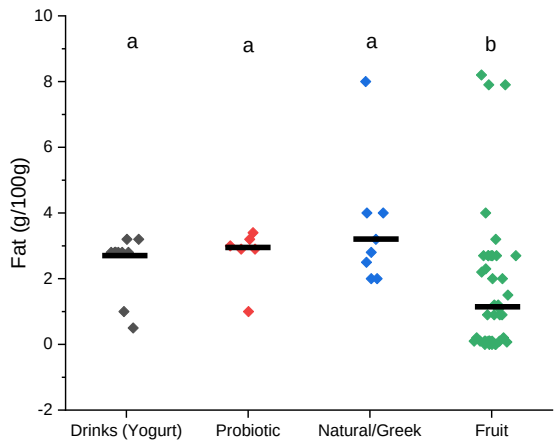
Yogurt products sold in Kosovo supermarkets in November 2022 were examined for nutrient contents across categories of the assessed products. Sixty-six products purchased during the period of the survey were included in the analysis. Products were grouped as: drinks (yogurt) (n=11), probiotic (n=6), fruit (n=41), natural/Greek (n=8). Drinks (yogurt) were full-fat (n=10) and low-fat yogurt (n=1). Probiotic yogurt was without fruit/cereals (n=1) and with fruit/cereals (n=5). Fruit yogurts (62.12%) were with added fruits or fruit derived products while 81.81% were low-fat (<3g/100g) and 18.19% were full-fat yogurts. The most common fruits were strawberry (32.55%), blueberry (18.6%), forest fruit (9%), and peach (9%). Natural/Greek yogurts were 50% low-fat (<3g/100g) and the rest full-fat (Table 1). The fat, protein and carbohydrate content differed greatly within and across our product categories (Figure 1 (a,b,c)). Fat content, as seen in figure 2a, had low median levels in yogurt categories (drink (yogurt), probiotic, natural/Greek, fruit). While drinks (yogurts) and probiotic had similar medians and range for fat of 2.8 g/100 g (0.5, 3.2) and 2.95 g/100 g (1, 3.4), whereas, the fruit category contained the lowest median amount of fat but the broadest range at 0.9 g/100 g (0–8.2) (figure 2a). Fruit yogurts with zero-fat had higher protein content. Natural/Greek had average fat contents similar to drink and probiotic yogurt categories with a broader range at 3 g/100g (2 – 8). Most of the drinks (yogurts) and fruit were in the low-fat category <3 g/100 g. Regarding fat content in yogurt categories there was no difference between drinks, probiotic and natural/Greek ($p > 0.05$), however between drinks (yogurt), natural/Greek, probiotic and fruit category there was significant difference ($p < 0.05$).

Table 1: Nutrients in yogurt categories.

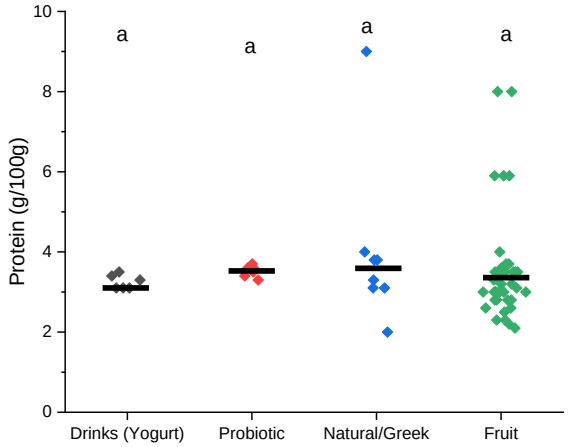
		Fat (total)		Carbohydrates (total)		Protein	
N		Median (g/100g)	Range	Median	Range	Median	Range
Drinks (Yogurt)	10	2.8	0.5 - 3.2	4.35	3.1 - 5.5	3.2	3.1 - 3.5
Probiotic	6	2.95	1 - 3.4	12.7	4 - 13.5	3.55	3.3 - 3.7
Natural (Greek)	8	3	2 - 8.0	4	3 - 5.2	3.55	2 - 9.0
Fruit	41	0.9	0 - 8.2	12.7	8.4 - 16.5	3.1	2.1 - 8

The natural/Greek and the probiotic categories had the highest median protein contents at 3.55 (2, 9.0) and 3.55 (3.3, 3.7) g/100 g yogurt (figure 2b). The higher protein median for the natural/Greek category was influenced mainly by full-fat milk. The drinks (yogurt) and fruit categories had similar median protein contents at 3.2 (3.1, 3.5) and 3.1 (2.1, 8) g/100 g. Most of the fruit yogurts and one natural/Greek yogurt having low-fat content had very high protein content. There was no significant difference between yogurt categories regarding protein content ($p > 0.4$). The drinks (yogurts), natural/Greek category and probiotics without fruits had the median total sugar contents below 5 g/100 g which based on regulation is considered low-sugar. Most of the products 72.72% are categorized as high-sugar content (≥5 g/100 g). Fruit category had the highest median 12.7 g/100g (figure 2d).

Probiotic yogurts category had the same total sugar content to fruit category 12.7g/100g. Drinks (yogurt) and natural/Greek category were similar in nature thus except the viscosity difference. They were in low-sugar category having the lower median content of sugars (4.35g/100g and 4g/100g) these were still significantly lower than the fruit and probiotic categories median (range) of 12.7g/100g (8.4-16.5) and 12.7g/100g (4 – 13.5). Our results highlight that the total sugar content of yogurts is relatively high in probiotic and fruit categories. Drinks (yogurt) and natural/Greek yogurt categories had lower sugar content. While there was no difference in the sugar content of drinks, probiotic and natural/Greek ($p > 0.05$), there was significant difference between drinks (yogurt), natural/Greek and fruit category ($p < 0.0001$). Sugars content in carbohydrate was reported in 92.42% of the products. The majority of carbohydrates in yogurt products were derived from sugars. In some products of categories natural/Greek and drink (yogurt) the carbohydrate content was lactose only. Fiber content was reported in most probiotic yogurts, 7.57% of the all-product categories. Median of fiber content was 0.5 g/100g (range 0.3 to 0.6 g/100g). The probiotic category contained more energy/100 g (figure 2d). The drinks (yogurt) category had the lowest median of energy/100g (figure 2d) due to low-sugar content. When expressed as kcal/100 g, the median energy of fruits was similar to products in natural/Greek category (ranging from 77 to 137kcal/100 g and 69.5 to 160kcal/100g), but were significantly lower higher than the median of the drinks (yogurt) category (55.75 g/100 g). Significant difference on Energy/100g was reported between drinks/yogurt and probiotic ($p < 0.01$) and drinks/yogurt and fruit ($p < 0.001$).



(a)



(b)

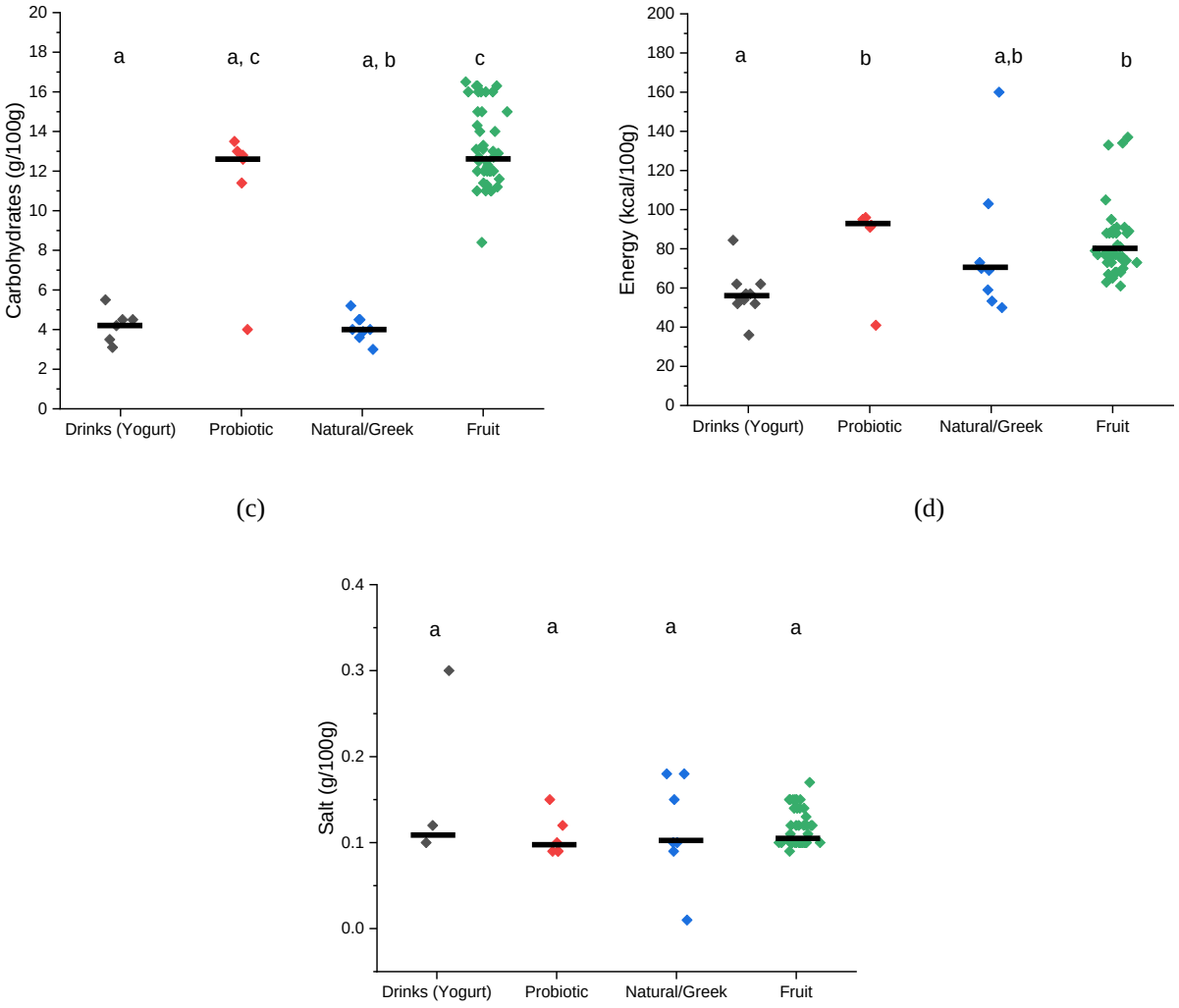


Figure 1: Contents of energy and nutrient of Kosovo yogurt products in categories. (a) Fat. (b) Energy. (c) Protein. (d) Carbohydrates. (e) Salt. Data were tested for normality and analyzed using the Kruskal-Wallis and Dunn's multiple comparison tests; categories with different letters were significantly different. Median is indicated by the black line.

Salt values were reported (84.84%) and median values between yogurt categories were similar ranging from 0.095 to 0.12 g/100 g (figure 2e). Drinks (yogurt) and fruit categories had the higher median (0.12g respectively 0.11 g/100g) however the highest values on individual product was reported on an natural/Greek yogurt (0.18g/100g). There was no significant difference between yogurt categories regarding salt content ($p > 0.7$).

Calcium values were less frequently reported (28.78%). Median of drinks (yogurt), natural/Greek and fruit categories was 120mg/100g higher than probiotic yogurt calcium content 101 mg/100g. Range among yogurt categories was from 0.05 to 121 mg/g. One natural/Greek product had mineral content on label (0.4 g/100g).

It is notable that evidence is accumulating that higher fat, rather than low-fat, dairy is associated with a lower risk of obesity and diabetes, including several studies that suggest full fat milk is associated with reduced risk of overweight and obesity in children [39].

4. Conclusions

Surveyed yogurts sold in Kosovo markets were based on four categories and showed differences in the ranges of nutrient content. Categories of drinks (yogurts) and probiotic had fat content medians 2.8 and 2.95 g/100 g which was higher than the fruit category 0.9 g/100 g. Fruit yogurts were mostly low-fat without added proteins. However, no-fat fruit yogurts had very high protein content. Protein contents in natural/Greek and the probiotic categories had median 3.55 g/100 g compared to drinks (yogurt) and fruit 3.2, 3.1 g/100g. Carbohydrate content was high in most products as 72.72% were categorized as yogurts with high-sugar content. Carbohydrates in drinks (yogurt) and natural/Greek categories had median ≤5 g/100 g (mostly lactose). Energy from yogurts was similar in categories of fruit and natural/Greek. Salt content was similar among product categories ($p > 0.7$). Calcium content was declared in some products only with a median 120 mg/100g. In conclusion, yogurt categories offer consumers a variety of protein and fat content but were characterized with high-sugar content. It is recommended to produce full-fat yogurts and to increase content of protein instead of sugar.

5. Limitation and Further Study

Limitation of the study are as follows. Most of the products sold on supermarkets were included. Some yogurts didn't have labels in their containers. There are few products that are sold only locally in certain regions of Kosovo which were not included. Further studies which would include not only labeled macronutrients but also essential minerals, vitamins and antioxidant activity of yogurts.

References

[1]. A.Y. Tamime and H.C. Deeth. "Yogurt: technology and biochemistry". *Journal of food protection*, 43(12), pp. 939-977, 1980.

[2]. A. Tremblay and S. Panahi. "Yogurt consumption as a signature of a healthy diet and lifestyle". *The Journal of Nutrition*, 147(7), pp. 1476S-1480S, 2017.

[3]. D.A. Savaiano and R.W. Hutkins. "Yogurt, cultured fermented milk, and health: A systematic review". *Nutrition reviews*, 79(5), pp. 599-614, 2021.

[4]. O. Adolfsson, S.N. Meydani and R.M. Russell. "Yogurt and gut function". *The American journal of clinical nutrition*, 80(2), pp. 245-256, 2004.

[5]. S.N. Meydani and W.K. Ha. "Immunologic effects of yogurt". *The American journal of clinical nutrition*, 71(4), pp. 861-872, 2000.

[6]. L. Morelli. “Yogurt, living cultures, and gut health”. The American journal of clinical nutrition, 99(5), pp. 1248S-1250S, 2014.

[7]. W.A.D.V. Weerathilake, D.M.D. Rasika, J.K.U. Ruwanmali and M.A.D.D. Munasinghe. “The evolution, processing, varieties and health benefits of yogurt”. *International Journal of Scientific and Research Publications*, 4(4), pp. 1-10, 2014.

[8]. E.B. Williams, B. Hooper, A. Spiro and S. Stanner. “The contribution of yogurt to nutrient intakes across the life course”. *Nutrition Bulletin*, 40(1), pp. 9-32, 2015.

[9]. US Department of Health and Human Services. "*US Department of Agriculture. Dietary Guidelines for Americans, 2020–2025. 2020*.", 2021.

[10]. K.B. Comerford, G.D. Miller, A.C. Boileau, S.N. Masiello Schuette, J.C. Giddens and K.A. Brown. “Global review of dairy recommendations in food-based dietary guidelines”. *Frontiers in Nutrition*, 8, 671999, 2021.

[11]. H. Wang, K.A. Livingston, C.S. Fox, J.B. Meigs and P.F. Jacques. “Yogurt consumption is associated with better diet quality and metabolic profile in American men and women”. *Nutrition Research*, 33(1), pp. 18-26, 2013.

[12]. S. Hekmat and G. Reid. “Sensory properties of probiotic yogurt is comparable to standard yogurt”. *Nutrition research*, 26(4), pp. 163-166, 2006.

[13]. M. Chollet, D. Gille, A. Schmid, B. Walther and P. Piccinali, “Acceptance of sugar reduction in flavored yogurt”. *Journal of dairy science*, 96(9), pp. 5501-5511, 2013.

[14]. W.J. Lee and J.A. Lucey. “Formation and physical properties of yogurt”. *Asian-Australasian Journal of Animal Sciences*, 23(9), pp. 1127-1136, 2010.

[15]. S. Bayarri, I. Carbonell, E.X. Barrios and E. Costell. “Impact of sensory differences on consumer acceptability of yoghurt and yoghurt-like products”. *International Dairy Journal*, 21(2), pp. 111-118, 2011.

[16]. M.T. Baker, P. Lu, J.A. Parrella and H.R. Leggette. “Investigating the Effect of Consumers’ Knowledge on Their Acceptance of Functional Foods: A Systematic Review and Meta-Analysis”. *Foods*, 11(8), pp. 1135, 2022.

[17]. N.J. Gonzalez, K. Adhikari and M.F. Sancho-Madriz. “Sensory characteristics of peach-flavored yogurt drinks containing prebiotics and synbiotics”. *LWT-Food Science and Technology*, 44(1), pp. 158-163, 2011.

[18]. L.C. Allgeyer, M.J. Miller and S.Y. Lee. “Sensory and microbiological quality of yogurt drinks with

prebiotics and probiotics". *Journal of dairy science*, 93(10), pp. 4471-4479, 2010.

[19]. R. Gyawali, X. Feng, Y.P. Chen, J.M. Lorenzo and S.A. Ibrahim "A review of factors influencing the quality and sensory evaluation techniques applied to Greek yogurt". *Journal of Dairy Research*, pp. 1-7, 2022.

[20]. R.C. Chandan. "An overview of yogurt production and composition" in *Yogurt in health and disease prevention*, 1st ed., N. Shah, Academic Press – Elsevier, pp. 31-47, 2017.

[21]. S.Y. Yang and K.S. Yoon. "Effect of Probiotic Lactic Acid Bacteria (LAB) on the Quality and Safety of Greek Yogurt". *Foods*, 11(23), pp. 3799, 2022.

[22]. R. Nyanzi, P.J. Jooste and E.M. Buys. "Invited review: Probiotic yogurt quality criteria, regulatory framework, clinical evidence, and analytical aspects". *Journal of Dairy Science*, 104(1), pp. 1-19, 2021.

[23]. H.S. Ejtahed, J. Mohtadi-Nia, A. Homayouni-Rad, M. Niafar, M. Asghari-Jafarabadi, V. Mofid and A. Akbarian-Moghari. "Effect of probiotic yogurt containing Lactobacillus acidophilus and Bifidobacterium lactis on lipid profile in individuals with type 2 diabetes mellitus". *Journal of dairy science*, 94(7), pp. 3288-3294, 2011.

[24]. E. Barengolts, E.D. Smith, S. Reutrakul, L. Tonucci, and T. Anothaisintawee. "The effect of probiotic yogurt on glycemic control in type 2 diabetes or obesity: a meta-analysis of nine randomized controlled trials". *Nutrients*, 11(3), pp. 671, 2019.

[25]. Q. Zhang, Y. Wu and X. Fei. "Effect of probiotics on body weight and body-mass index: a systematic review and meta-analysis of randomized, controlled trials". *International Journal of Food Sciences and Nutrition*, 67:5, pp. 571-580, 2016, DOI: 10.1080/09637486.2016.1181156.

[26]. A. Amal, A. Eman and S.Z. Nahla. "Fruit flavored yogurt: Chemical, functional and rheological properties". *International Journal of Environmental and Agriculture Research*, 2(5), pp. 57-66, 2016.

[27]. D.K.D. Roy, T. Saha, M. Akter, M. Hosain, H. Khatun and M.C. Roy. "Quality evaluation of yogurt supplemented with fruit pulp (banana, papaya, and water melon)". *International Journal of Nutrition and Food Sciences*, 4(6), pp. 695-699, 2015.

[28]. I. Rybicka, and A. Gliszczyńska-Świgło. "Sugars in dairy products of different flavours". *International Dairy Journal*, 114, pp. 104933, 2021.

[29]. J.B. Moore, E.H. Sutton, N. Hancock. "Sugar Reduction in Yogurt Products Sold in the UK between 2016 and 2019". *Nutrients*, 12(1), pp. 171, 2020.

[30]. L. Wu and D. Sun. "Consumption of yogurt and the incident risk of cardiovascular disease: a meta-

analysis of nine cohort studies". *Nutrients*, 9(3), pp. 315, 2017.

[31]. L. Ramchandran and N.P. Shah. Yogurt can beneficially affect blood contributors of cardiovascular health status in hypertensive rats. Journal of food science, 76(4), pp. H131-H136, 2011.

[32]. J.Y. Dong, I.M. Szeto, K. Makinen, Q. Gao, J. Wang, L.Q. Qin and Y. Zhao. "Effect of probiotic fermented milk on blood pressure: a meta-analysis of randomised controlled trials". *British Journal of Nutrition*, 110(7), pp. 1188-1194, 2013.

[33]. S. Panahi and A. Tremblay. "The potential role of yogurt in weight management and prevention of type 2 diabetes". *Journal of the American College of Nutrition*, 35(8), pp. 717-731, 2016.

[34]. P.F. Jacques and H. Wang. "Yogurt and weight management". *The American journal of clinical nutrition*, 99(5), pp. 1229S-1234S, 2014.

[35]. C.G. Marques, A. de Piano Ganen, A.Z. de Barros, R.V.T. Dos Santos and M.V. dos Santos Quaresma. "Weight loss probiotic supplementation effect in overweight and obesity subjects: A review. *Clinical Nutrition*, 39(3), pp. 694-704, 2020.

[36]. D.R. Keast, K.M. Hill Gallant, A.M. Albertson, C.K. Gugger and N.M. Holschuh. "Associations between yogurt, dairy, calcium, and vitamin D intake and obesity among US children aged 8–18 years: NHANES, 2005–2008". *Nutrients*, 7(3), pp. 1577-1593, 2015.

[37]. J. Sun and N. Buys. "Effects of probiotics consumption on lowering lipids and CVD risk factors: a systematic review and meta-analysis of randomized controlled trials". *Annals of Medicine*, 47(6), pp. 430-440, 2015.

[38]. Y.M. Hu, F. Zhou, Y. Yuan, and Y.C. Xu. "Effects of probiotics supplement in patients with type 2 diabetes mellitus: A meta-analysis of randomized trials". *Medicina Clínica (English Edition)*, 148(8), pp. pp. 362-370, 2017.

[39]. J.B. Moore, A. Horti and B.A. Fielding. "Evaluation of the nutrient content of yogurts: a comprehensive survey of yogurt products in the major UK supermarkets". *BMJ open*, 8(8), e021387, 2018.