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CONSUMER ASSESSMENT OF YOGURTS MADE FROM SHEEP'S, GOAT'S, COW'S AND MIXED MILK

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Abstract. The main objective of the study was a comparison for cholesterol in yogurts made from sheep milk, goat milk, cow milk, and their 1:1 mixures. The products were also subjected to consumer sensory evaluation of flavour, colour, and consistency. The sensory analysis was carried out by a group of 30 people (3rd year students of the Agriculture and Biotechnology Department at the University of Technology and Life Sciences, Bydgoszcz). The type of milk was a decisive factor in the organoleptic assessment of the quality of given yogurt. As regards the best taste and smell, respondents selected sheep, cow, and mixed cow-ship milk yogurts. Goat yogurt had the brightest colour, said to be snow-white, whereas the cow yogurt colour was creamy yellow. Yogurt made of goat, cow and mixed (cow and sheep) milk was characterised by the highest stability of curd.

Key words: milk, yogurt, cholesterol, sensory traits

INTRODUCTION

Global production of milk from small ruminants, i.e. sheep and goats, is small compared to the production of cow's milk; however, in the Mediterranean and the Middle East regions, it constitutes a vital component of human diet. Goat's, sheep's and cow's milk is used in such products as cheese, butter and numerous milk drinks, with or without lactic bacteria cultures responsible for fermentation processes [Rasom and Juarezs 2004, Górecka and Flaczyk 2011, Tamine et al. 2011].

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In the recent years, there has been a growing interest in the so-called 'health food', meaning that consumers more frequently buy fermented milk drinks, to which they attribute health properties and which are labelled as functional food. Functional food are food products containing ingredients which positively affect physiological processes which take place in the human body and lead to maintenance of optimum health and decreased risk of typical modern day diseases [Pisulewski et al. 1999, Barłowska and Litwińczuk 2009, Bernacka 2011].

The quality of processing milk, which includes the content of nutritional ingredients and the possibility of increasing their bioavailability through fermentation, has direct influence on the high nutritional value of fermented milk drinks.

Yogurt is the most popular fermented milk drink among consumers. It is characterised by high nutritional and dietary value. It is good for the human body, because it is digested 2–3 times quicker than milk, has a positive effect on the secretion of bile and digestive juices in the digestive cord, and on intestine peristalsis. Stimulates the appetite by helping to rebuild the natural bacterial flora. Supports the immune system, removes toxins from the body, helps in constipations, flatulence, stomach hypoacidity and inflammations [Jakubczyk and Kosikowska 2000, Danków and Pikul 2010, 2011, Goetsch et al. 2011].

Sensory traits of ready-made products are the basic criterion for their assessment and the decision on whether to choose them over other available milk products.

The major objective of the study was a comparison of yogurts made from sheep's, goat's, cow's and mixed milk (1:1 ratio), in terms of their cholesterol content as well as sensory traits, such as taste and smell qualities, colour and consistency.

MATERIAL AND METHODS

As our research material we used yogurts produced from bulk sheep's, goat's, cow's and 1:1 mixed milk. The milk came from sheep, goats and cows from a conventional farm in the Kuyavian-Pomeranian Province, Poland. It was the 2nd lactation of the animals, and each group consisted of 5 animals. Ruminant feeding was based on farm-produced feeds: silage, root vegetables, hay, and concentrate additive. The milk came from the morning milking in April. Upon completion of milking, goat's, cow's and sheep's milk was cooled to 4°C and transported to the Examination Centre in Kołuda Wielka, where yogurts were produced. Plain yogurts were made using the technology developed for sheep's milk by the Animal Husbandry Institute, National Research Institute, Examination Centre in Kołuda Wielka (Company Standard: KW 1/98). Additionally, we determined the choleste-

rol content in both milk and yogurts on a Shimadzu spectrophotometer (UV-VIS 3100), applying the Röse-Gottlieb method.

Products were tasted by a group of 30 people (3rd year students of the Agriculture and Biotechnology Department at the University of Technology and Life Sciences, Bydgoszcz). The yogurts underwent organoleptic assessment with regard to their taste and smell qualities as well as colour and consistency, with each trait receiving a score of 1 to 5. Each trait was assessed according to the adopted guidelines:

- taste, from sour, fermenting (1 pt) to sweet (5 pts);
- smell, from unpleasant (1 pt) to natural (5 pts);
- colour, from the darkest (1 pt), through creamy, to snow-white (5 pts);
- consistency, meaning curd thickness, from liquid (1 pt) to compact and stable (5 pts).

RESULTS AND DISCUSSION

Cholesterol content in milk and yogurts

As results show (Table 1), cholesterol content in each yogurt increased according to the material from which it was made. The highest cholesterol content was observed in the sheep's yogurt (37.84 mg/100 g), and mixed sheep's and goat's yogurt (36.9 mg/100 g). Sheep's milk was found to have the highest cholesterol content (29.27 mg/100 g), whereas pure goat's milk had the lowest, at approx 15.8 mg/100 g, only slightly less then when mixed with cow's milk, where the examined lipid fractions constituted 15.9 mg/100 g of milk. At the same time, the mixed cow's and goat's yogurt included the lowest cholesterol amount (18.78 mg/100 g). A comparison of cholesterol content in milk and the ready made fermented drink, shows that the least visible increase of its level occurs for mixed cow's and sheep's milk and yogurt, namely from 23.41 mg in 100 g of milk up to 24.10 mg in 100 g of yogurt (Table 1).

As studies of numerous authors confirm [Keenen et al. 1983, Cerutti et al. 1993, Grega et al. 2000, Juśkiewicz and Panfil-Kuncewicz 2003], cholesterol content in milk and its products depends on many factors, but mainly thermal treatment, fat content, type of starter cultures and milk homogenisation. We observed various cholesterol levels in milk products with identical fat content but which underwent thermal treatment at different temperature ranges. This is particularly visible with the 3.2 and 2% drinking milk as well as UHT milk with the same fat content. Based on research conducted by Grega et al. [2000], it may be concluded that raw milk fat contains less cholesterol as compared to both pasteurised and sterilised milk fat; while the fat of sterilised milk contains more cholesterol

Table 1. Cholesterol content in milk and yogurts

Tabela 1. Zwartość cholesterolu w mleku i jogurtach

Milk Mleko	Cholesterol Content Zawartość cholesterolu [mg · 100^{-1} g]	Yogurt Jogurt	Cholesterol Content Zawartość cholesterolu [mg · 100^{-1} g]
Goat's Kozie	15.74	Goat's Kozi	27.79
Sheep's Owcze	29.27	Sheep's Owczy	37.84
Cow's Krowie	16.93	Cow's Krowi	26.74
Cow's and goat's Krowio-kozie	15.90	Cow's and goat's Krowio-kozi	18.78
Cow's and sheep's Krowio-owcze	23.41	Cow's and sheep's Krowio-owczy	24.10
Sheep's and goat's Owczo-kozie	20.33	Sheep's and goat's Owczo-kozi	36.93

than that of pasteurised milk. For example, pasteurised milk (3.2% of fat) contains cholesterol in 242 mg/100 g of fat, and sterilised milk with the same fat content contains as much as 355 mg/100 g of fat. Whereas Cerutti et al. [1993] have proved that the fat in UHT milk has more cholesterol than that of thermized milk. Keenan et al. [1983], analysing the effects of homogenisation on cholesterol level, established that it causes the content of fat globules to change. Furthermore, it leads to increased percentage of proteins, while at the same time decreasing the level of phospholipids, total lipids and cholesterol, as compared to fat globules of non–homogenised milk. Research by Juśkiewicz et al. [2003] confirmed that when cultures containing *Bifidobacterium bifidum*, *Streptococcus thermophilus* and *Lactobacillus acidophilus* are introduced, this has a smaller effect on reducing the cholesterol level in the yogurt than in the case of cultures containing *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*; whereas it must be noted that the higher cholesterol level drop was observed with the lower fat content in the yogurt.

Organoleptic assessment of yogurts

During sensory assessment, yogurts from goat's, sheep's, cow's, as well as mixed cow's and goat's, cow's and sheep's, and sheep's and goat's milk were differentiated by taste, smell, colour and consistency (Table 2).

In terms of taste (Table 2, Fig. 1), three products were the most popular among the respondents, namely the yogurt from mixed cow's and goat's milk – which received 100% of 5 points – and sheep's as well as cow's yogurts, where results

were spread between scores of 4 and 5 points. In both cases, 4 points were given by 10% of respondents, while the remaining 90% opted for the top score. The taste of the goat's yogurt proved to be the least attractive, receiving only 1.8 points on average. Similar, though slightly higher scores, were achieved by mixed yogurts with an addition of goat's milk. Despite a high assessment of sheep's yogurt, an addition of goat's milk caused radical decrease of taste satisfaction in consumers, with 70% of respondents awarding 3 points, and 30% declaring it does not deserve a score of more than 2. Yogurt made from mixed cow's and goat's milk proved to be slightly tastier, obtaining 3.5 points on average (Table 2, Fig. 1).

Table 2. Organoleptic assessment of yogurt

Tabela 2. Ocena organoleptyczna jogurtów

Yogurt Jogurt	Organoleptic Traits (ps) Cechy organoleptyczne (pkt)											
	Taste Smak			Smell Zapach			Colour Barwa			Consistency Konsystencja		
	$\bar{x}$	min.	max. maks.	$\bar{x}$	min.	max. maks.	$\bar{x}$	min.	max. maks.	$\bar{x}$	min.	max. maks.
Goat's Kozi	1.8	1	2	1.4	1	2	5.0	0	5	2.0	0	2
Sheep's Owczy	4.9	4	5	4.9	4	5	3.9	3	4	5.0	0	5
Cow's Krowi	4.9	4	5	5.0	0	5	1.2	1	2	4.9	4	5
Cow's and goat's Krowio-kozi	3.5	3	4	3.1	3	4	2.0	0	2	2.9	2	3
Cow's and sheep's Krowio-owczy	5.0	0	5	5.0	0	5	2.0	0	2	5.0	0	5
Sheep's and goat's Owczo-kozi	2.7	2	3	3.1	3	4	4.0	0	40	4.0	0	4

Smell scores were close to those given for taste. This is because taste and smell are closely related to each other, and together they create a new phenomenon, called palatability. In our own research (Table 2, Fig. 2), we found that there were three yogurts with the most pleasant smell: mixed cow's and sheep's yogurt, cow's yogurt, and sheep's yogurt. All of them almost always received the highest score of 5 points. In 90–100% , opinions were the same. The least desirable, sour and fermenting smell was found in the case of the goat's yogurt. Sixty percent of the 30 respondents gave its smell the scores of 1, the other 40% gave 2 points. Fermented milk drinks, in which sheep's or cow's milk was combined with goat's milk, caused a slight improvement of the results, with the average score reaching 3.1 points. The yogurt from mixed cow's and goat's milk received 4 points from 90% of respondents, whereas 10% of respondents opted for 3 points. The asses-

sment of the yogurt from mixed sheep's and goat's milk, on the other hand, was quite the opposite (Table 2, Fig. 2).

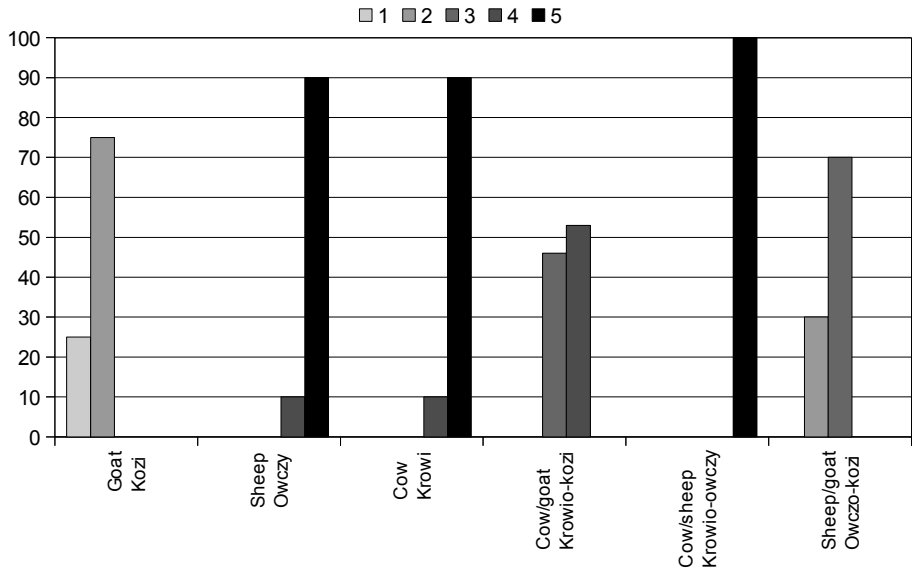

Fig. 1. Repeatability of scores given (%) for yogurt taste

Rys. 1. Powtarzalność przyznawanych punktów (%) dla smaku jogurtów

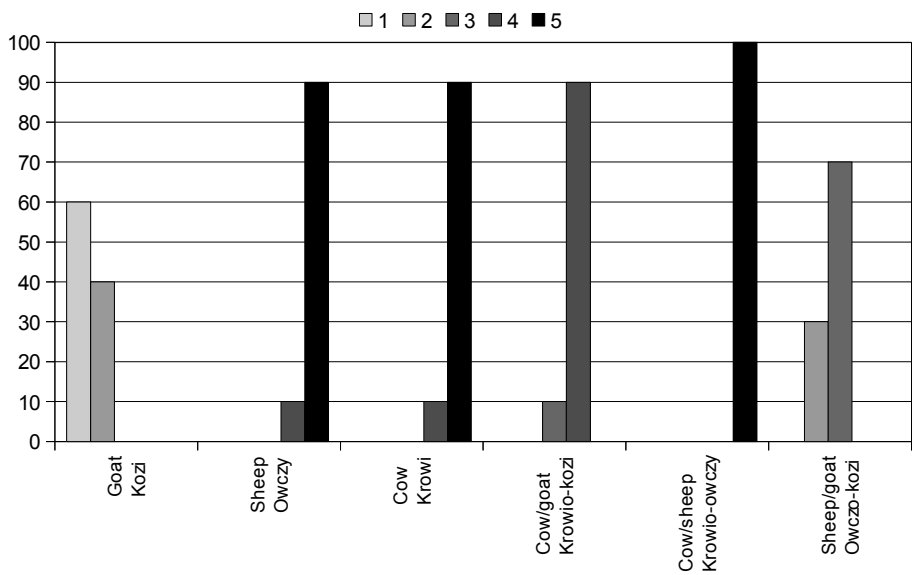

Fig. 2. Repeatability of scores given (%) for yogurt smell

Rys. 2. Powtarzalność przyznawanych punktów (%) dla zapachu jogurtów

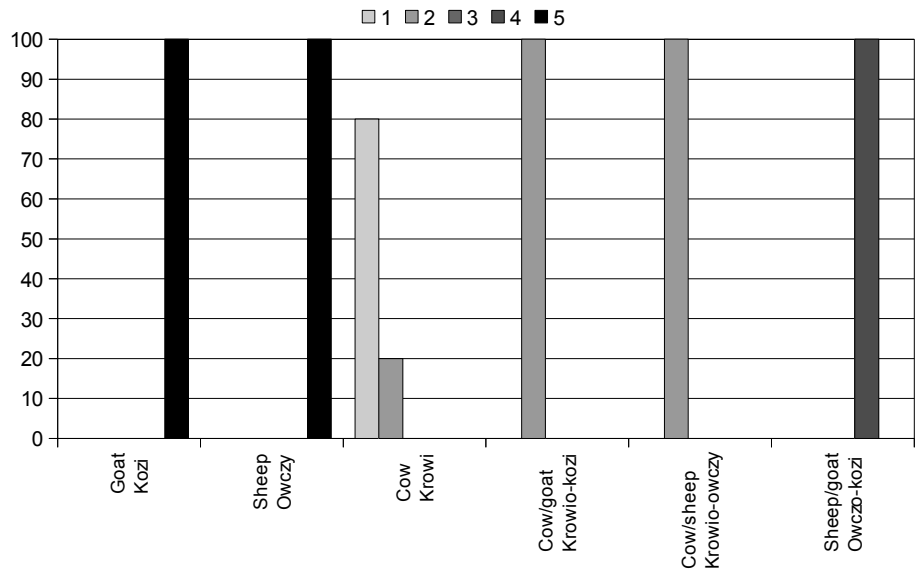

Fig. 3. Repeatability of scores given (%) for yogurt colour

Rys. 3. Powtarzalność przyznawanych punktów (%) dla barwy jogurtów

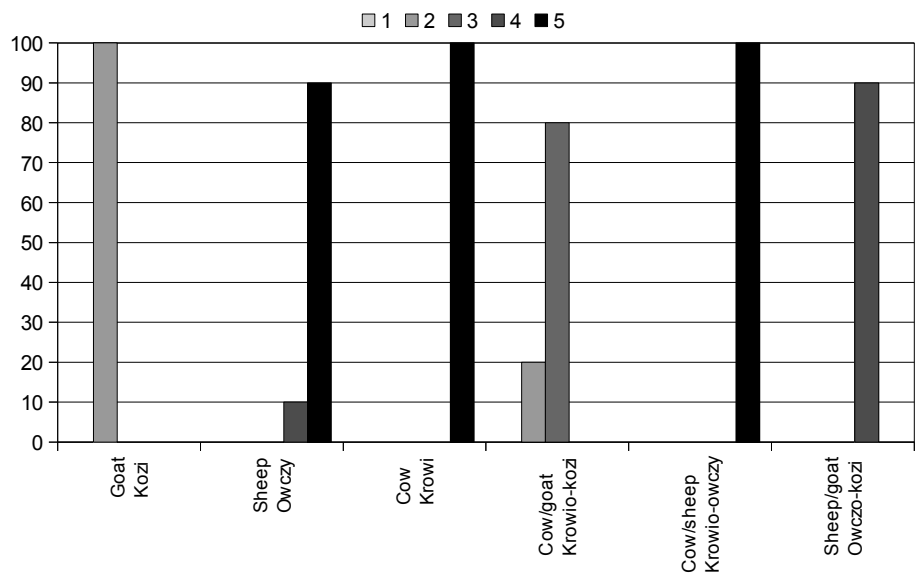

Fig. 4. Repeatability of scores given (%) for yogurt consistency

Rys. 4. Powtarzalność przyznawanych punktów (%) dla konsystencji jogurtów

Colour is determined by a number of factors; mainly the presence of fat, riboflavin and carotene in milk. Moreover, this trait may be influenced by the qu-

ality and type of feed which the animals eat, as well as (very rarely) the activity of micro–organisms, or administration of pharmaceuticals if animals had a disease, e.g. mastitis [Danków and Pikul 2010, 2011]. As the data shown in Table 2 and on Figure 3 indicate, respondents were unanimous in their assessment of yogurt colour, with 100% giving the top score for the goat's yogurt, describing it to be snow–white. An addition of sheep's milk decreased the average assessment as compared to a purely goat's milk product, and 100% of respondents gave the score of 4. Yogurts made from mixed cow's and sheep's milk and mixed cow's and goat's milk took the third place, with the average score of 2 points, which indicates a creamy colour. The darkest – yellow creamy – colour was found in the yogurt made from cow's milk, for which 80% of respondents chose 1 point. The remaining 20% of respondents decided that 2 points were the appropriate score (Table 2, Fig. 3).

Consistency, meaning the thickness of the curd, was the final parameter examined during the organoleptic assessment. The yogurts from sheep's milk as well as mixed cow's and sheep's milk were unanimously selected as the best in terms of form stability, with all respondents giving them the score of 5 (Table 2, Fig. 4). A slightly lower total average result of 4.9 points was achieved by yogurt made from cow's milk. All of the respondents decided that the yogurt from mixed sheep's and goat's milk deserves 4 points, and the one from only goat's milk 2 points. The latter was the most liquid, slightly stringy, and did not hold its shape when put on a flat dish. The fermented drink made of combined cow's and goat's milk was given 3 points by 80% of respondents, and the other 20% of respondents chose 2 points (Table 2, Fig. 3).

CONCLUSIONS

The type of milk was a decisive factor in the organoleptic quality of given yogurt. The production process used for fermented milk drinks increases their cholesterol content, which depends on the type of milk used. As regards the best taste and smell, respondents selected sheep's, cow's, and mixed cow's and ship's yogurts. The goat's yogurt had the lightest colour, said to be snow-white, whereas the cow's yogurt colour was creamy yellow. Yogurt made of goat's, cow's and mixed (cow's and sheep's) milk was characterised by the highest stability of curd.

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OCENA KONSUMENCKA JOGURTÓW Z MLEKA OWCZEGO, KOZIEGO, KROWIEGO I MIESZANEGO

Streszczenie. Głównym celem pracy było porównanie jakości jogurtów produkowanych z mleka owczego, koziego, krowiego i mieszanego (w stosunku 1:1), na podstawie zawartości cholesterolu oraz ocena konsumencka na podstawie cech sensorycznych uwzględniających walory smakowo-zapachowe, barwę i konsystencję. Degustację produktów przeprowadzono w grupie liczącej 30 osób (studenci III roku Wydziału Rolnictwa i Biotechnologii UTP w Bydgoszczy). Rodzaj mleka w zdecydowany sposób wpłynął na jakość organoleptyczną wyprodukowanego z niego jogurtu. Pod względem smaku i zapachu najlepszym według respondentów okazał się jogurt owczy, krowi oraz krowio-owczy. Jogurt kozi charakteryzował się najjaśniejszą barwą, określona jako śnieżnobiałą, natomiast z mleka krowiego kremowo-żółtym odcieniem. Jogurt wyprodukowany z mleka owczego, krowiego i mieszanego (krowio-owczego) odznaczał się największą stabilnością skrzepu.

Słowa kluczowe: mleko, jogurt, cholesterol, cechy sensoryczne

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