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SENSORY QUALITY OF STRAWBERRY JAMS WITH A PARTICULAR FOCUS OF KASHUBIAN STRAWBERRY JAM

Key words: agricultural retail trade, strawberry jam, Kashubian Strawberry

ABSTRACT. Applicable legal regulations allow Polish farmers to sell agricultural produce and products made from them. This activity enables the creation of a new market of natural food, which is competitive in relation to industrially produced food. The aim of the research was to compare the quality of strawberry jam available on the market with its counterpart produced on farms. The studies compared the extract content and sensory quality of 11 strawberry jams available in retail with jam from the Kashubian Strawberry certified with EU PGI. The content of the extract and intensity of 17 sensory markers characterising the appearance, consistency, taste and aftertaste of strawberry jam were assessed. The study was conducted using quantitative descriptive analysis – QDA. The strawberry jam which was compared was characterized by a very large diversity of sensory characteristics in terms of brightness, opacity, colour intensity of red and softness. The smaller variation was characterised by an intensity of features relating to elasticity, acidic and chemical taste as well as sweet, dry and fruity aftertaste. Industrial jams were similar in terms of quite a perceptible sweet taste and viscosity and average perceptible fruit taste. The jam obtained from the Kashubian Strawberry was not inferior to the quality of industrial-grade jam. It stood out in comparison with a high content of extract, attractive red colour and greater softness. Compared to commercial jams, it had a higher intensity of fruity, sweet and sour taste, and a distinctly fruity aftertaste, with no foreign notes.

INTRODUCTION

Agricultural retail trade is possible thanks to the Act on Food Safety and Nutrition dated August 25th, 2006, as amended [OJ L 2015. 594] and the Ordinance of the Minister of Agriculture and Rural Development dated 16th December 2016 [OJ L 2016. 2159]. These regulations allow for sale and regulate the scope of documentation as well as determine the amount of raw materials and products sold. Agricultural retail trade can also be carried out by brokers during fairs, exhibitions, markets or festivals. Production activity carried out on agricultural farms restores the traditional role of the farmer as a food producer. It also enables the creation of a new natural food market with direct traceability of its producer.

Authenticity of regional food is an advantage. It is produced on a small scale and based on local raw materials, thus shares unique sensory characteristics. For traditional food production very small amounts of additives are added or not applied at all. Simple manufacturing technologies are used. Among the advantages of this food, consumers most

often mention: tradition, authenticity, original taste, and also point to sensual connotations with the family home [Grębowiec 2010, Śmiechowska 2014]. From the perspective of buyers, original regional and traditional products are products considered to have unique functional values, which are also safe for health [Grębowiec 2017].

Food traditionally produced in the region can reach the consumer directly due to short supply chains, without unnecessary storage and long-distance transport. The sale of these products may take place through restaurants, marketplaces, fairs, and small shops consisting of agricultural stands, which are appropriately adapted to the nature of the product [Kiss 2017]. Production of traditional food is a new form of added value that farmers can generate by increasing the value of their products. By selecting products and raising prices based on identity by including local, geographical or ecological designations [Kania, Musiał 2018].

An additional asset that accompanies the production and sale of traditional and regional food is the educational aspect that leads to increased awareness within the cultural heritage. As research conducted in many research centers shows, knowledge of the range of regional and traditional products among consumers, especially young consumers, is small [Minta et al. 2014, Borowska et al. 2012].

The sale of food produced on farms gives farmers the opportunity for additional income and enables the development of activities in rural areas, especially among holders with small and medium-sized farms, in regions such as, Kashubia. Production activity carried out on agricultural farms restores the traditional role of the farmer as a food producer.

Such production also allows for the creation of a new natural food market with direct traceability of the producer. The Kashubia region is characterized by a large number of farms with an area not exceeding 5 ha. In the Kartuzy, Wejherowo and Kościerzyna poviats, small farms constitute nearly 30% of all farms [Wesołowska 2014]. In addition, these areas are mostly characterized by poor quality soil classified as IV and V bonitation class with low production potential [Pomorskie.eu].

These farms often cultivate strawberries, which in a specific microclimate of Kashubia yields fruits of very high quality. Fresh strawberries and processed strawberries in the form of jam are very popular among consumers.

The Kashubian Strawberry is a traditional fruit of the Pomeranian Region. As of November 27th, 2009, it has been added to the register of Protected Designations of Origin and Protected Geographical Indications of the European Union as Truskawka Kaszubska (kaszëbskô malëna) [OJ L 313/57, 28.11.2009]. It is characterized by an intense red colour, firmness and stronger aroma and sweetness in comparison to fruits grown in other regions. It owes its specific features to the agro-climatic conditions of Kashubia. Only strawberries from the following varieties: Elsanta, Honeoye and Senga Sengan can be grown under the name Kashubian Strawberry.

The permit for the cultivation and use of the name “Kashubian Strawberry” means that planters from the entire Kartuzy, Kościerzyna and Bytów district and the Przywidz commune from the Gdańsk district; Wejherowo, Luzino, Szemud, Linia, Łęczyce commune from the Wejherowo powiat and the Cewice commune from the Lębork district [Kulka 2014] have a quality certificate.

MATERIALS AND METHODS

The aim of the study was to compare the extract content and sensory parameters of strawberry jam received from Kashubian Strawberries with jam available in the retail trade network. Eleven jams from various Polish producers and brands (Łowicz, Pińczów, Vortumnus, Dawton, Spizarnia Natury, Symphatica, Stilla Dolce, Aro, Słoneczny Ogród, Owocowa Rapsodia, Owocowa Rozkosz) available in the commercial network were used for research. Ten jams were low-sugar and one jam was high in-sugar (table 1).

Table 1. The composition of strawberry jam obtained by the industrial method declared by producers

Code*	Low sugar	Highly sweetened	Ingredients except strawberries								Amount of fruit per 100 g of jam [g]
			water	sugar	glucose-fructose syrup	pectin	guar gum	citric acid	trisodium citrate	vitamin C	
A	+		+	+		+	+	+	+		40
B	+		+	+	+	+	+	+	+		35
C		+	+	+	+	+		+			40
D	+		+	+	+	+	+	+			35
E	+		+	+	+	+	+	+			35
F	+		+	+	+	+		+			40
G	+		+	+	+	+	+	+	+	+	40
H	+		+	+	+	+	+	+	+	+	40
I	+		+	+	+	+	+	+	+	+	40
J	+		+	+		+	+	+	+		40
K	+		+	+		+	+	+			40

* A-K – strawberry jam produced in industrial conditions

Source: own research

According to the labels on jars of jam, 35 or 40 g of strawberries were used for the production of 100 g of commercial jam. Apart from strawberries, the composition of raw material was water, sugar, glucose-fructose syrup, the gelling substance – pectin, the thickening substance – guar gum, acidity regulators – citric acid and trisodium citrate, as well as in the case of three jars, ascorbic acid (table 1).

Kashubian Strawberry jam was made according to the recipe on the packaging of Gellwe Konfiturex 2:1 gelling agent [Gellwe.pl]. The fruit was washed, the stalks removed, and then the strawberries were ground to a homogeneous pulp. Strawberries were

obtained from plantations in Kamienica Szlachecka, in the Stężycza commune holding the certificate of cultivating Kashubian Strawberries of the Senga Sengana variety No. PI-OZ/04-000038/16/1 issued by the Kashubian Association of Strawberry Producers.

As a gelling agent, “Konfiturex 2:1” was used having the following composition: sugar, acidity regulator – citric acid, pectin and potassium sorbate. In the raw material composition strawberries constituted 64.7%, sugar 32.6% and gelling substance 2.6%. To produce 100 g of jam, 68 g of strawberries were used.

The extract was determined using the refractometric method at 20°C. The Abbe type ATAGO 1T refractometer was used with the digital thermometer ATAGO DTM-1. The degrees of refraction read in the refractometer were converted to °Bx. This parameter indicates sugar content. One °Bx (Brix grade) is equivalent to the content of 1 g of sugar (derived from raw material and added in the form of sucrose or glucose-fructose syrup) in 100 g of the product.

The study of sensory characteristics was performed using quantitative descriptive analysis [Baryłko-Pikielna, Matuszewska 2009]. It was carried out by a team of 30 assessors with a proven sensory sensitivity and adequately trained [Baryłko-Pikielna, Matuszewska 2009]. Apart from the evaluation of appearance descriptors, tests were carried out on posts isolated from external factors, lit with a red light to eliminate the phenomenon of suggestion.

Samples of jam weighing 10 g were coded with a three-digit code number and placed on identical glass vessels. Each time evaluators conducting analysis received three different jams. Each jam was evaluated five times in a different set. To determine the intensity of individual discriminants, a 10-degree structured graphic scale was used. The descriptors of appearance, consistency, taste and aftertaste proposed by Jerome Gimenez et al. [2001] were used to assess the sensory characteristics of strawberry jam.

RESULTS

The extract content in commercial jams was between 29.84 °Bx and 65.34 °Bx. Jam C was the only jam with a high sugar content and the highest extract content 65.34 g (figure 1). The Kashubian Strawberry jam had an extract content of 44.84 °Bx, which was due to the higher proportion of fruit in the raw material composition compared to commercial jams. In the sensory assessment of appearance, the following features were compared: intensity of red colour, intensity of brown colour, turbidity and brightness.

The appearance of jams depends mainly on the quantity and species of strawberries, their maturity and fragmentation as well as amount of added water and acidity. It is desirable that jams are red not brown in colour. The red colour, resulting from the content of strawberries with anthocyanin colourants, stabilizes higher acidity. As a result of storage and other factors, anthocyanins oxidize to the undesirable brown colour [Korzeniowska-Ginter et al. 2017]. The best colour was shown by commercial jams D, C, A and K. Acidifying additives were used in their production. The worst colour was characterized by jams B, G and I. Jam from the Kashubian Strawberry had a good intensity of red (6.7) and medium brown colour (4.7) (table 2). Opacity at a level of 5.9 placed TK at a higher

Figure 1. The extract content in tested strawberry jam [°Bx]

A-K – strawberry jams obtained in industrial conditions

TK – jam from the Kashubian Strawberry

Source: own research

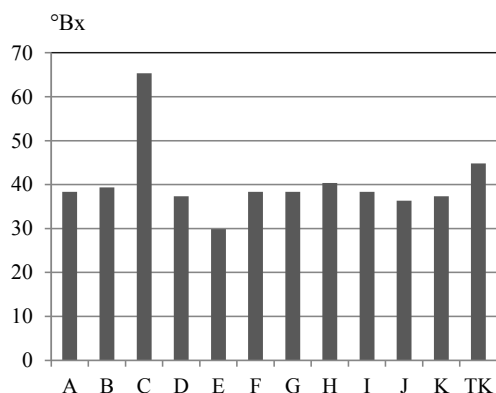


Table 2. Intensity of sensory features of strawberry jam determined by the QDA method according to the 10-degree scale

Descriptive		Code of jams*											
		A	B	C	D	E	F	G	H	I	J	K	TK
Appearance	red	8.4	5.0	9.2	9.3	6.4	6.5	3.3	6.4	4.9	7.3	7.4	6.7
	brown	3.5	8.0	3.3	2.1	4.4	3.6	7.9	4.4	6.2	3.0	5.1	4.7
	opacity	5.6	9.2	2.5	2.7	5.7	5.2	4.9	5.0	6.1	4.8	6.0	5.9
	brightness	3.2	1.3	1.7	8.4	5.3	5.3	5.4	3.7	3.3	5.6	4.4	2.0
Texture	viscosity	6.2	7.3	5.8	7.0	7.8	6.6	5.9	6.1	7.2	6.6	4.7	6.6
	elasticity	4.8	5.2	6.7	7.5	6.1	6.2	5.6	7.7	3.8	4.9	4.6	2.1
	soft	5.4	7.6	3.2	6.9	5.8	5.8	6.0	5.6	8.3	6.8	6.9	8.1
Taste	sweet	6.9	5.8	8.3	6.7	6.5	7.1	6.6	6.8	5.5	7.4	6.4	6.7
	Sour/acid	3.1	5.9	3.5	6.4	3.7	5.5	5.1	2.8	5.3	5.4	5.7	4.2
	fruity	6.1	6.8	6.2	6.9	4.3	6.8	6.6	6.3	6.3	6.9	5.7	7.0
	chemical/soapy	2.0	2.5	2.6	1.5	3.2	1.9	1.9	4.1	2.1	1.9	2.5	0.5
	bitter	1.3	1.4	0.7	0.6	2.0	1.7	0.4	1.3	0.7	0.3	0.4	1.6
Aftertaste	sweet	4.7	5.5	9.1	6.4	4.6	5.8	5.6	6.3	4.5	6.7	6.1	7.1
	dry	3.4	2.2	2.5	2.1	3.2	3.1	2.6	5.1	3.1	3.3	0.5	1.1
	sour	4.6	4.0	4.5	3.2	4.0	5.1	3.3	3.4	2.7	5.8	2.7	4.6
	fruity	4.6	5.0	5.6	5.6	4.0	5.1	6.8	4.9	3.2	5.7	5.2	7.3
	musty/mouldy	0.4	0.3	0.2	0.1	0.9	0.2	0.1	0.3	0.2	0.4	0.4	0.1

* A-K – strawberry jam obtained in industrial conditions, TK – jam from the Kashubian Strawberry
Source: own research

level compared to others and resulted from fragmentation, high fruit concentration and lack of water addition. These factors also caused a low, desirable assessment of brightness of Kashubian Strawberry jam.

In terms of jam texture the following parameters were evaluated: homogeneity, viscosity, elasticity and softness. The texture of jam depends on the quantity and quality of strawberries (juiciness, softness, size, fragmentation), amount of pectin, guar gum, sugar and water added [Kopjar et al. 2009]. The viscosity of the tested jams was similar and ranged from 4.7 to 7.8.

Elasticity of commercial jams ranged from 3.8 to 7.7 thanks to gelling additives. Jam made of the Kashubian Strawberry had an elasticity of 2.1, which resulted from a small amount of pectin and no water added. The presence of added water results in the formation of jelly with pectin. The softness of the tested jams was between 3.2 and 8.3. The highest softness was characterized by jam I and the lowest by jam C. Jam from the Kashubian Strawberry was characterized by low elasticity and high softness.

The taste of jam is mainly dependent on the amount of added sugar and citric acid as well as the natural aroma and juiciness of the strawberry. Flavour descriptors include: sweet, sour, fruity, chemical and bitter. The sweetness of the jams tested was between 5.5 and 8.3. The highest sweetness was characterized by high-sugar jam C and the lowest-sugar jam I. The acidity of the tested jams was between 2.8 and 6.4. The most acid-flavoured jam was jam D, and the least – H. The jam from the Kashubian Strawberry had a moderately sensory sweetness and acidity, but it was rated highest in terms of fruit taste. The chemical flavour was least noticeable in jam prepared on farms while in industrial products its intensity was felt at a level between 1.9 to 4.1. The intensity of bitter taste in the tested products was from 0.3 to 2. The most bitter was product E and the least – J. The bitter taste can be associated with astringency and acidity resulting from a large amount of salicylates. In TK jam, the fruit concentration was the highest, which may explain why the perceptibility of the bitterness note was measured to be 1.6.

Aftertaste is the taste impression that appears after ingestion or the removal of the product from the mouth and differs from the impression received at the time the product was in the mouth [Brylko-Pikielna 2009]. The following descriptors were rated: sweet, dry, sour, fruity and musty. In the tested jams, the sweetest aftertaste was most noticeable and remained between 4.5 and 9.1. High-sugar jam C and TK with the highest extract content obtained the highest value of this feature. The dry aftertaste took on a wide range from 0.5 to 5.1 whereby TK had a low value of 1.1. The sour aftertaste of the tested jams was between 2.7 and 5.8, whereas the fruity aftertaste was between 3.2 and 7.3 with the highest value for the product being from the Kashubian Strawberry. Parts of industrial jams were accompanied by a musty aftertaste of up to 0.9. In the Kashubian Strawberry jam obtained on the farm, no musty or mouldy aftertaste was found.

SUMMARY

The strawberry jam available in trade showed quite large variations in sensory characteristics assessed on a 10-degree scale. The largest variation (reaching 7.1 points) was found in the range of brightness of colour, opacity (6.7), intensity of red (6.0) and softness (5.9). The smaller variation (from 3.6 to 4.6 points) concerned elasticity and acidic and chemical taste as well as descriptors of sweet, dry and fruit aftertaste. Industrial jams are characterized by a large similarity in the range of a poorly perceptible bitter taste and acid flavour, medium palpable fruit flavour and a fairly perceptible sweet taste of an average level of 6.7 points, and quite noticeable viscosity at the average level of 6.5 points.

In light of the conducted research, it was found that jam obtained from the Kashubian Strawberry had a very good sensory quality. They distinguished it from industrially obtained jams: a saturated red colour, a distinct fruity, sweet taste, a fruity aftertaste and a fairly soft and sticky consistency. It had no undesirable notes of taste or aftertaste present in jams produced on an industrial scale.

Allowing farmers to sell their agricultural products may contribute a very good quality of food, produced from native, raw materials of known origin with a lower content of functional additives to consumers.

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JAKOŚĆ SENSORYCZNA DŻEMÓW TRUSKAWKOWYCH ZE SZCZEGÓLNYM UWZGLĘDNIENIEM DŻEMU Z TRUSKAWKI KASZUBSKIEJ

Słowa kluczowe: rolniczy handel detaliczny, dżem truskawkowy, Truskawka Kaszubska

ABSTRAKT

Obowiązujące przepisy prawne umożliwiają polskim rolnikom sprzedaż płodów rolnych i produktów z nich wytworzonych. Działalność ta pozwala tworzyć nowy rynek naturalnej żywności, konkurencyjnej w stosunku do żywności produkowanej przemysłowo, cechującej się krótkim łańcuchem dostaw i łatwą identyfikowalnością wytwórcy. Celem badań było porównanie jakości dżemów truskawkowych dostępnych na rynku z ich odpowiednikiem wytworzonym w gospodarstwie rolnym z Truskawki Kaszubskiej. W badaniach porównano zawartość ekstraktu oraz jakość sensoryczną 11 dżemów truskawkowych dostępnych w handlu detalicznym z dżemem z Truskawki Kaszubskiej opatrzonej certyfikatem ChOG UE. Oceniono natężenia 17 wyróżników sensorycznych będących deskryptorami wyglądu, konsystencji, smaku i posmaku dżemów truskawkowych. Badanie przeprowadzono metodą ilościowej sensorycznej analizy opisowej QDA. Porównywane dżemy truskawkowe charakteryzowało bardzo duże zróżnicowanie cech sensorycznych w zakresie jasności, mętności, natężenia barwy czerwonej oraz miękkości. Mniejsze zróżnicowanie natężenia cech dotyczyło elastyczności i sprężystości, smaku kwaśnego i chemicznego oraz posmaku: słodkiego, wytrawnego i owocowego. Dżemy produkowane przemysłowo były zbliżone pod względem wyczuwalnego słodkiego smaku i lepkości oraz średnio wyczuwalnego owocowego smaku. Dżem otrzymany z Truskawki Kaszubskiej nie ustępował jakością dżemom produkowanym przemysłowo. Wyróżniał się w porównaniu do nich wysoką zawartością ekstraktu, atrakcyjną czerwoną barwą i większą miękkością. W porównaniu do dżemów handlowych miał wyższe natężenie owocowego, słodko-kwaśnego smaku oraz wyraźny owocowy posmak, bez obcych nut.

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