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THE QUALITY OF DIETETIC JELLY PRODUCTS

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The possibility of making low-calorie jams and marmalades of raspberry, peach, blackcurrant, strawberry and blackberry (individually quick frozen fruits and mashes) with low methoxyl amidated pectins was studied. Fructose, sorbitol, cyclamate and saccharin were used as sweeteners. The formulations of jams and marmalades were suggested by pectin producer. Energy value, sensory evaluation and colour (CIE, CIELab, ANLab and Hunter systems) were determined. Correlation between the sensory and instrumental methods for determination of colour was not established. These jams and marmalades belong to the group of low-calorie and they all received high sensory marks.

KEY WORDS: jellies, low-calorie, energy value, sensory evaluation, colour

INTRODUCTION

Reduced-calorie jellies are fruit-based products attracting an increased interest. Dietetic foods are intended for consumers with changed or disturbed assimilation or metabolism of carbohydrates (1). To decrease the energy value of these products, fructose, sugar alcohols and artificial sweeteners (saccharin, aspartame, acesulfame-K, cyclamats, sucralose, etc.) are the most frequently used materials. The advantage of artificial sweeteners is that they provide sweeteness, but not the energy, and the shortage, that they can cause different troubles, in higher amounts than allowed (2-5).

The colour is one of the main caracteristics of food quality. Among a number of instrumental methods, the most known in use are tristimulus photocolourimeters, which give the characteristics of colour in different systems (CIE normal, CIELab, ANLab, Hunter) (6).

In sensory analyses, the caracteristics of food are evaluated with senses. The aim of this work was to establish the correlation between the results of sensory and instrumental analytical measurements.

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EXPERIMENTAL

Fruit mashes (M) (raspberry, peach, blackcurrant, strawberry) and individually quick frozen fruits (IQF) (blackberry, strawberry, raspberry), purchased from the "Srbijanka" Factory, Valjevo, were used to make marmalades and jams. Apple pectins (low methoxyl amidated pectins Purple Ribbon, D-075 and D-075-x, Obipektin AG, Bischofszell, Switzerland), natural sweeteners (fructose, API-Bečej, D-sorbitol, Poljoprivreda-Draksenić), artificial sweeteners (cyclamat and saccharin, Süssina, "Instantina" Gmbh, Wien), preservative (Na-benzoat), calcium citrate and citric acid (food industry grade) were used too.

The main components of chemical composition of low-calorie products (soluble solids, pH value, total acidity, total sugars, oil content, protein content) were determined by usual chemical methods (7).

The energy value of products (kJ/100g) was obtained from the contents (%) of carbohydrates, oils and proteins multiplied by the corresponding factors (17.17 for carbohydrates and proteins, 38.94 for oils) (8.9).

Preparation of samples. According to the formulas, the necessary amount of pectins was dispersed with a part of sweetener (recommended by the pectins producer) and added to defrosted fruit or mixture of defrosted fruit and water. Fruit was heated to 90°C (30 seconds), then the rest of sweeteners was added and the cooking was continued until reaching desired soluble solids, followed by dosage of citric acid (50% solution) up to pH 3.1-3.4 and preservative (Na-benzoat, 100 mg/kg). In the products with pectin D-075-x, calcium citrate (dissolved previously in tenfold volume of hot water) was used. While still warm, the mixture was poured to glass jars of 200 g, closed with Twist-off cups and pasteurized for 15 minutes at 88°C. Formulations for products, obtained according to the recommendation of the pectins manufacturer, can be seen in Table 1.

Sensory evaluation was carried out by a point system (samples were scored with 20 points maximum: 4 for colour, 8 for taste, 2 for odour and 6 for consistency), by a group of 9 qualified board members, and the results are presented in the tables. Chemical analyses of 6 best scored samples (over 18 points) were carried out, and they were also used for the determination of energy value.

Instrumental determination of colour (for six best scored samples and its raw materials) was carried out on tristimulus colorimeter MOM Colour 100, and the results were presented in the CIE, CIELab, ANLab and Hunter systems.

RESULTS AND DISCUSSION

Results of sensory evaluation of jellies produced according to formulations I, II, III and IV are presented in Table 2. The highest score obtained samples number 1 (raspberry mash), 4 (strawberry mash), 5 (raspberry mash), 9 (blackberry IQF), 11 (raspberry IQF) and 12 (strawberry mash). Peach mash samples had low scores, specially for taste, and for consistency too, which was marked as "creamy". Only one board member gave the mark "excellent colour". Product, made from this fruit mash was disqualified. In continuation of the experiment the products from blackcurrant mash were disqualified too, due to strange colour and too sweet taste, as well as the samples from strawberry IQF (too sweet taste and unsuitable colour).

Table 1. Formulations of dietetic jelly products (g / kg)

Formula-tion	I	II	III	IV
Raw material	1 raspberry (M)[1] 2 peach (M) 3 blackcurrant (M) 4 strawberry (M)	5 raspberry (M) 6 strawberry (M) 7 peach (M) 8 blackcurrant (M)	9 blackberry (IQF)[2] 10 strawberry (IQG) 11 raspberry (IQF)	12 strawberry (M) 13 blackcurrant (M) 14 peach (M) 15 raspberry (M)
	970		400	
Fructose	-	40	250	175
Sorbitol	40	-	-	175
Pectin D-075	10	10		
Pectin D-075-N			10	9
Calcium-citrat	-	-	0.6	1
Artificial Sweetener	0.88	0.88		-

[1]M - fruit mashes; [2]IQF - individually quick frozen fruits

Samples number 6 (strawberry mash) and 15 (raspberry mash) failed due to poor sensory characteristics.

Table 2. Sensory evaluation of dietetic jelly products

Sample	Fruit	Formula-tion	Characteristic				Total points
			colour	taste	odor	consistency	
1	raspberry M	I	3.89	7.50	1.94	5.33	18.66
2	peach M	I	3.61	7.28	1.89	4.39	17.17
3	blackcurrant M	I	3.28	7.39	1.44	5.44	17.55
4	strawberry M	I	3.39	7.44	1.72	5.72	18.27
5	raspberry M	II	3.83	7.56	1.83	5.61	18.81
6	strawberry M	II	3.56	7.11	1.67	5.61	17.95
7	peach M	II	3.67	7.44	1.67	4.61	17.39
8	blackcurrant M	II	3.22	7.33	1.56	5.39	17.50
9	blackberry IQF	III	3.83	7.72	1.78	5.67	19.00
10	strawberry IQF	III	3.22	7.39	1.89	5.00	17.50
11	raspberry IQF	III	3.78	7.44	1.83	5.61	18.66
12	strawberry M	IV	3.67	7.00	1.61	5.89	18.17
13	blackcurrant M	IV	3.39	6.72	1.61	5.39	17.11
14	peach M	IV	3.76	6.50	1.83	4.72	16.83
15	raspberry M	IV	3.72	7.00	1.78	5.39	17.89

Results of chemical analysis for selected samples are presented in Table 3.

Table 3. Chemical analyses of selected dietetic jelly products

Sample	Soluble solids	pH	Total acidity (%)	Total sugars (%)	Oils (%)	Proteins (%)
1	17.6	3.37	2.67	11.04	1.66	0.99
2	18.4	3.38	2.21	12.75	1.27	0.84
3	18.3	3.29	2.78	16.76	1.68	1.03
4	32.0	3.50	1.18	28.75	0.97	0.58
5	32.0	3.45	1.49	29.20	0.75	0.56
6	42.6	3.42	1.07	37.95	0.42	0.24

Soluble solids and pH values were within the limits predicted by the prescriptions. Oils and proteins percentage contributions in products were low, because of fruit chemical composition. Total acidity was in accordance with the quantity of used fruits and added citric acid. Content of total sugars in products was as expected because of added sweetener (fructose).

Results of energy values of products, calculated on the basis of chemical analyses, are presented in Table 4. Results are expressed on 100 g of products.

Table 4. Energy values of selected dietetic jelly products (kJ/100g)

Sample	kJ/100g
1	298.70
4	305.55
5	399.50
9	553.52
11	555.52
12	683.09

According to the results of energy value it can be seen that samples 9, 11 and 12 had highest energy values, due to higher content of carbohydrates (added fructose), which contributed to the increase of the energy value.

Results of instrumental determination of colour in starting fruits and jellies producted from them, expressed in the CIE, CIELab, ANLab and Hunter systems are presented in Tables 5 and 6.

The highest brightness (y) was recorded with the strawberry mash and samples 4 and 12 but the lowest with the blackberry IQF, (sample 9) from the same raw material. Dominant wavelenghts of raw materials and jellies (λ) are in the orange-red and redish-orange range of the spectrum. On the basis of values for chromaticity coordinates a (red component) and *b* (yellow component) for all three systems, it can be seen that the lowest portion of red and yellow colour was in blackberry IQF and jam, bearing in mind that this raw material contains mainly blue-violet anthocyans. The highest portion of red colour was observed for the raspberry mash and sample number 12, strawberry marmalade (anthocyans in sample). The highest portion of yellow colour was in strawberry mash and marmalade.

Table 5. Colour of raw materials

System		Raw materials			
		Raspberry (M)	Strawberry (M)	Blackberry (IQF)	Raspberry (IQF)
CIE	y (%)	1.735	2.125	1.685	1.975
	λ (nm)	627	612	633	630
	P (%)	28.00	33.75	16.85	29.84
CIELab	a	14.91	15.59	9.55	16.38
	b	5.44	7.43	3.16	5.95
	L	14.03	16.13	13.73	15.35
	ΔL	-78.22	-76.12	-78.51	-76.90
	ΔH_{ab}	8.99	9.17	7.20	9.42
ANLab	A	14.18	14.93	9.09	15.52
	B	5.09	7.04	2.97	5.63
	L	12.56	14.54	12.28	13.81
	ΔE_{AN}	73.96	72.29	73.24	73.07
Hunter	a_{Hu}	8.93	9.63	5.47	10.08
	b_{Hu}	2.60	3.57	1.57	2.89
	L_{Hu}	13.17	14.54	12.98	14.05
	ΔE_{Hu}	77.68	76.42	77.47	76.98

Table 6. Colour of dietetic jelly products

System		Samples					
		1	4	5	9	11	12
CIE	y (%)	1.87	2.01	1.90	1.577	1.99	2.355
	λ (nm)	633	613	640	627	638	608
	P (%)	24.61	25.15	21.43	16.00	21.81	37.42
CIELab	a	13.65	11.89	12.54	8.60	13.30	16.54
	b	4.78	5.36	4.07	3.02	4.39	8.97
	L	14.78	15.53	14.95	13.07	15.43	17.24
	ΔL	-77.46	-76.71	-77.30	-79.17	-76.82	-75.00
	ΔH_{ab}	8.61	8.01	8.26	6.83	8.50	9.45
ANLab	A	12.97	11.28	11.92	8.19	12.62	15.55
	B	4.52	5.10	3.88	2.81	4.18	8.51
	L	13.28	13.98	13.43	11.66	13.88	15.59
	ΔE_{AN}	72.98	72.00	72.60	73.73	72.30	71.60
Hunter	a_{Hu}	8.18	7.10	7.47	4.84	8.02	10.42
	b_{Hu}	2.35	2.64	2.03	1.48	2.20	4.29
	L_{Hu}	13.67	14.17	13.78	12.54	14.10	15.34
	ΔE_{Hu}	77.08	76.47	76.88	77.85	76.63	75.81

CONCLUSIONS

According to sensory evaluation of jams and marmalades, the most acceptable product was blackberry jam (19.00 points), and the lowest acceptability showed peach marmalade

(16.83 points). The best marked six samples received total scores over 18.00. The energy values of the jellies are in the range from 298.7 kJ/100g to 683.09 kJ/100g, which corresponds to low-calorie and diabetic marmalades and jams of well-known world producers. Sensory methods of evaluation are more acceptable then the instrumental ones, because in instrumental determinations there are still no criteria for evaluation, like, for example, at ground pepper (6). Considering the chemical composition and energy value, the produced jams and marmalades belong to a group of low-calorie products, suitable for diabetics nutrition.

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КВАЛИТЕТ ДИЈЕТЕТСКИХ ЖЕЛИРАНИХ ПРОИЗВОДА

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У овом раду је испитана могућност производње нискоенергетских џемова и мармелада од малине, купине, јагоде и рибизле (роленди и капе) уз додатак нискоестерификованих амидираних пектина. Као заслађивачи коришћени су фруктоза, сорбитол, цикламат и сахарин. Нормативе за џемове и мармеладе предложио је произвођач пектинских препарата. Обављено је сензорно оцењивање добијених производа и боја одређена инструменталном методом у CIE, CIELab, ANLab и Hunter-овом систему. У раду није утврђена корелација резултата добијених сензорном и инструменталном анализом. Добијени џемови и мармеладе припадају групи нискоенергетских производа високог су сензорног квалитета.

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