

RELISHES – THE NEW PICKLED VEGETABLES

Aleksandra N. Tepić, Biserka L. Vujičić, Aleksandra S. Andrić and Snežana D. Milatović

There have been an increasing interest of consumers for a wide variety of pickled vegetable products worldwide. Regarding the regional vegetable supplies and relatively poor assortment of ready-to-use products, the need to broaden the offer of domestic pickled vegetables at the market came out. In this work recipes for different vegetables, spices and condiments were developed. The best graded samples were analysed for their main chemical composition (dry matter, proteins, oils and fats, total acidity, total sugars, sucrose, starch, cellulose, pH) and energy values.

KEYWORDS: Relish; vegetable; spices; chemical composition; energy value

INTRODUCTION

Relish is a cooked or pickled sauce, usually made of vegetables or fruits, generally used as a condiment. It can be smooth or chunky, sweet or savory, hot or mild. Relish is a product that is a food supplement, like ajvar, pindjur, ketchup, horse radish. A culinary definition is much wider – cut fruit or vegetable in acid, with the aid of spices which emphasize the food flavour. This is an exceptional quality product made by modern technology, which enables keeping the high-valuable compounds. They can be served as cold supplements, coatings, dressing additions. They are eaten in small amounts, along with the main dishes, to stimulate appetite with its contrast texture and palatable flavour.

Indonesian and Malesian “sambal”, Indian “chutney”, Correan “kimchy”, Italian “mostarda di frutta” are some of the worldwide-known relishes.

The main raw materials for relishes are beet root, green beans, cabbage, sweet pepper, hot pepper, carrot, onion, garlic, sweet corn, cellery, cucumber, tomato, along with water, sugar, salt, acid (vinegar, cider), spices (dill, cinnamon, horse radish, clove, turmeric, paprika oleoresin, caraway, mustard, celery seed).

Aleksandra N. Tepić, M.Sc., Assist. tepic@uns.ns.ac.yu, Dr. Biserka Vujičić, Prof., Aleksandra Andrić, B.Sc., Snežana D. Milatović, B.Sc., University of Novi Sad, Faculty of Technology, 21000 Novi Sad, Bulevar Cara Lazara 1, Serbia

In stages of human's life, while the organism is growing and developing, it is very important that two thirds of protein are of animal origin. In adult organisms, the case is vice versa. Cellulose, along with hemicellulose, lignin and pectic substances belong to dietetic fibres. Dietetic fibres are non-digestible part of food. These substances are of a great importance in digestion, despite being non-digestible, as they bind cholesterol and prevent its resorption and influence. Besides they bind water and accelerate discharging of the intestines.

EXPERIMENTAL

Relishes were prepared in laboratory conditions, according to recipes given in Tables 1 and 2. Frozen vegetables (green beans, carrot, paprika, onion, sweet corn, tomato) were defrosted at 10°C for 24 hours. Beet root was cooked and chopped to 3-5 mm thick slices. Cabbage was minced. The components (vegetable, condiments and spices) were mixed and filled into a 0.33l sterile glass jars. The hot brine (water, salt, sugar, acid) was poured to the vegetable mixture, sealed with twist-off lids, and pasteurized at 85°C for 20 minutes, cooled to room temperature and kept in dark and cold place.

Table 1. Relish recipes (%)

Recipe No./Compound	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Cabbage relish			Green beans relish								Beet root relish				
Cabbage	20.9	26.9	36													
Green beans				36.3	36.3	50.8	50.8	53.2	53.2	51.3	51.3					
Beet root												38.8	43.2	43.1	43.1	57.9
Carrot	5.9	5.9	6													
Sweet pepper (red)	3	3	3.6													
Sweet pepper (green)	3	3	6.1													
Mustard seed	0.05	0.05	0.05													
Celery	0.05	0.05	0.05													
Turmeric		0.07	0.07													
Garlic				1.6	1.6	1.9	1.9	1.6	1.6	1.5	1.5					
Dill				0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4					
Oleoresin				0.01			0.05									

Table 1. Continued

Hot pepper								0.1			0.1					
Clove												0.05	0.05	0.05	0.05	0.07
Cinnamon												0.05	0.05	0.05	0.05	0.07
Onion	3.9	3.9	4.1									5.8		14.4		
Horse radish													2.6		3.5	
Caraway																0.05
Salt	1.1	1.1	1.5	3.6	3.6	3.1	3.1	1.6	1.6	0.6	0.6	0.2	0.2	0.2	0.2	0.1
Vinegar	27.9	27.9	28.2	29.1	29.1	14.8	14.8	8.5	8.5	8.2	8.2	27.6	28.2	23.7	23.7	17.9
Water				29.1	29.1	28.9	28.9	34.6	34.6	33.3	33.3	13.7	14.1	11.8	11.8	15
Sugar	28	28	14.2							4.6	4.6	13.7	14.1	11.8	11.8	9

Table 2. Corn relish recipes (%)

Recipe No./Compound	1	2	3	4	5	6	7	8	9	10
Sweet corn	41.85	43.93	39.47	42.44	43.91	44.22	20.20	21.63	35.17	35.15
Sweet pepper (green)	10.68	11.21	10.07	10.83	11.21	11.28	24.87	26.65		
Sweet pepper (red)	10.68	11.21	10.07	10.83	11.21	11.28			17.65	17.64
Tomato							19.88	21.30		
Celery	10.68	11.21	10.07	10.83	11.21	11.28			8.83	8.82
Cucumber							9.94	10.65		
Onion	5.34	5.6	5.04	5.42	5.6	5.64	9.94	10.65	17.65	17.64
Vinegar	11.78	7.4	13.29	14.3	7.39	7.45	13.23	7.11	11.68	
Cider										11.67
Sugar	7.43	7.8	10.51	3.77	7.79	7.85				
Brown sugar									5.87	5.86
Mustard seed							0.32	0.34	0.80	0.81
Ground mustard	0.66	0.69	0.62	0.67	0.69				2.20	2.19
Salt	0.66	0.69	0.62	0.67	0.69	0.7	1.24	1.33		
Turmeric	0.11	0.11	0.1	0.11	0.11	0.12	0.32	0.34		
Celery seed	0.11	0.11	0.1	0.11	0.11	0.12				
Oleoresin					0.046	0.046			0.07	0.10
Garlic flavour									0.07	0.067

The organoleptic evaluation was done according to modified Carlsruher's method (1). The main chemical composition-dry matter, acidity, pH, cellulose, starch, fat and oil, protein, carbohydrates, and energy value was determined for the best marked samples, according to valid regulations (2, 3).

Dry matter content was determined by drying to constant weight in an oven at 105 ± 1 °C (2). Protein content was determined by Kheldahl's method in Kjeltec System, 1003 Di-stilling Unit, Tecator, Tecator AB Digestor 20/40. Fats and oils were extracted by petroleum ether (40-60°) as solvent in Soxhlett extractor (SER 148, Sol-vent Extraction, VELP Scientifica). Total acidity was determined by titration with NaOH standard solution. Sucrose content was determined by the method of Luff-Schoorl, which is based on the reduction of alkaline Cu^{2+} -complex. Starch content was determined by acid hydrolysis. After hydrolysis and cooling, sample was neutralised with NaOH and diluted to 500 ml. In this solution sugar content was determined by the method of Luff-Schoorl, and starch content was calculated by multiplying the sucrose content with 0.9. Cellulose content was determined by cooking the amount of sample in cc HNO_3 : 80% CH_3COOH (5:1), filtering through filter funnel, washing and drying in the oven to constant weight (4, 5). pH value was measured using an Eco Scan pH-meter, Eutech Instruments, PteLtd, Singapur/Oakton Instruments, USA

RESULTS AND DISCUSSION

The results of sensory evaluation of prepared samples are presented in Tables 3 and 4.

Table 3. Sensory evaluation of cabbage, green beans and beet root relishes

Sample	Colour (max 5)	Odour (max 5)	Flavour (max 5)	Appearance (max 5)	Texture (max 5)	Mean
Cabbage relish						
1	3.79	3.89	3.00	3.79	4.21	3.63
2	4.00	4.16	3.26	4.11	4.11	3.82
3	4.31	3.89	3.81	4.08	4.31	4.04
Green beans relish						
4	3.67	3.67	3.11	3.83	4.22	3.64
5	3.58	3.74	3.21	3.68	4.16	3.63
6	4.75	4.39	3.58	4.53	4.25	4.16
7	4.47	4.36	3.69	4.36	4.17	4.11
8	4.61	4.06	4.17	4.56	4.56	4.38
9	4.71	4.29	4.24	4.53	4.65	4.45
10	4.67	4.22	3.06	4.33	4.44	3.96
11	4.22	4.00	3.28	4.11	4.11	3.83
12	4.84	3.74	3.58	4.58	4.58	4.18

Table 3. Continued

Beet root relish						
13	4.94	4.03	3.46	4.39	4.14	4.05
14	4.75	3.92	3.50	4.39	4.25	4.05
15	4.81	4.08	3.64	4.44	4.23	4.19
16	4.83	4.50	4.44	4.56	4.61	4.56

Cabbage relishes gained lower sensory marks, due to sweetness originating from sugar added, which is uncommon for people in our country. Nevertheless, sample No. 3 (the lowest sugar content) gained 4.04 points, and therefore was submitted to further analyses. During the sensory evaluation, the judging board were pleasantly surprised with green beans taking part in relish, since green beans take part mainly in traditionally prepared meals. The highest marked sample was No. 9 (4.45 points). Beet root is worth processing into relishes; along with appropriate spice combining it becomes an excellent product. Sample No.16 was the best among beet root relishes, so it was submitted to chemical analyses and energy value estimating.

Table 4. Sensory evaluation of corn relishes

Sample No.	Colour (max 5)	Odour (max 5)	Flavour (max 5)	Appearance (max 5)	Texture (max 5)	Mean
1	4.5	4.12	3.45	4.37	4.16	3.96
2	4.21	4.21	3.16	4.08	3.79	3.92
3	4.33	3.96	3.42	3.96	3.91	3.85
4	4.12	4.25	3.96	4.12	4.08	4.05
5	4.58	4.41	3.75	4.37	4.13	4.11
6	4.58	4.33	3.71	4.29	4.17	4.08
7	3.96	3.82	3.13	3.91	3.86	3.58
8	4.08	4.04	3.29	4.08	3.71	3.73
9	3.08	3.59	2.43	2.95	3.32	2.91
10	3.62	3.75	2.5	3.12	3.71	2.92

The best corn relishes were No. 4, 5 and 6. Quality differences among corn relishes were due to various portions of vegetables, organic acids and some spices. Pleasant corn relishes were obtained by appropriate varieties and quantities of raw materials (green and red pepper, sweet corn, cellery, onion).

Vegetables are eaten in a variety of ways as part of main meals and snacks. The nutrient content of different types varies considerably. Most vegetables provide little protein and fat. Vegetable contain water soluble vitamins like vitamin B and C, fat soluble vitamins including vitamin A and D, as well as carbohydrates and minerals (7).

Chemical composition of samples No. 3, 9, and 16, as well as their energy values, are presented in Table 5.

Table 5. Chemical composition and the energy value of cabbage, green beans and beet root relishes

Component	No. 3 (with cabbage)	No. 9 (with green beans)	No. 16 (with beet root)
Dry matter (%)	18.55	7.61	14.41
Proteins (%)	0.57	1.14	1.35
Fats and oils (%)	1.05	0.75	0.60
Total acidity (%)	1.97	0.57	0.92
Total sugars (%)	15.03	1.02	10.23
Sucrose (%)	5.11	0.08	6.30
Starch (%)	0.42	0.67	0.41
Cellulose (%)	0.36	0.47	0.46
Cellulose (% per DW)	1.94	6.18	3.19
pH	3.09	3.70	3.79
Energy value			
kJ/100g	325.41	71.55	227.99
kcal/100g	77.77	17.10	54.49

Full flavour of these samples was accomplished by appropriate combination of vegetables and spices. The chemical composition of relishes was as expected, considering the quantity of compounds used. The energy values were quite low, 227.99-325.41 kJ/100g, especially for green beans relish (71.55 kJ/100g), which had no sugar added. Furthermore, the cellulose content in green beans relish was 6.18% per dry matter, which considerably increases the nutritive value of the product.

As regards corn relishes, the results of chemical composition and energy values of three best marked samples are presented in Table 6.

Table 6. Chemical composition and energy values of corn relishes

Component	No. 4	No.5	No.6
Dry matter (%)	23.9	28.7	27.46
Proteins (%)	2.29	2.39	2.19
Fats and oils (%)	0.31	0.3	0.29
Total acidity (%)	0.89	0.52	0.49
Total sugars (%)	6.50	11.06	10.94
Sucrose (%)	4.42	8.65	8.84
Starch (%)	4.23	4.28	4.57
Cellulose (%)	0.93	0.92	0.89

Table 6. Continued

Cellulose (% per DW)	3.89	3.21	3.24
pH	3.78	3.98	4.03
Energy value			
kJ/100g	240.15	314.99	313.43
kcal/100g	57.37	75.25	74.88

Energy values of corn relishes were 240.15-314.99 kJ/100g. The fact that pH values ranged from 3.09 to 4.03, relishes can be assigned to the group of acid products. This justifies the chosen temperature preservation (85°C / 20 min.). Unnecessary use of severe temperature treatment would negatively affect the nutritive value and organoleptic features of the products.

CONCLUSION

Relishes made according to the given recipes could be assigned to reduced energy products, and labeled as “light”, suitable for specific groups of consumers.

Low energy value of these products in respect to mean daily need (6) points out to the exceptional favour of use of relishes in dietetic and low-calorie diets. Moreover, the existing equipment for pickles production can be used for relish production too, with a few corrections.

ACKNOWLEDGEMENT

These results are part of the project “New pickled vegetables products”, BTN-371006B, supported by the Ministry of Science and Environmental Protection of the Republic of Serbia.

REFERENCES

1. Reuter, G.: Modifiziertes Karlsruher 9 - Punkte - Schema für Fleischwaren, BAFF, Kulmbach (1974).
2. Pravilnik o metodama uzimanja uzoraka i vršenja hemijskih i fizičkih analiza radi kontrole kvaliteta proizvoda od voća i povrća, Službeni list SFRJ 29/1983.
3. FAO Corporate Document Respository: Food energy - methods of analysis and conversion factors (1998) Chapter III. Calculation of energy content of foods.
4. Ćirić, D., Vujičić, B., and Ž. Bardić: Priručnik za kontrolu kvaliteta sirovina i proizvoda od voća i povrća, Tehnološki fakultet, Novi Sad (1975) 71-77, 33-38
5. Vračar, Lj.: Priručnik za kontrolu kvaliteta svežeg i prerađenog voća, povrća i pečurki i osvežavajućih bezalkoholnih pića, Tehnološki fakultet, Novi Sad (2001) 70-73, 76-77, 81-82.

6. Tojagić, S., Mirilov, M.: Hrana-značaj i tokovi u organizmu, Tehnološki fakulet, Novi Sad (1998) 66-67.
7. www.en.wikipedia.org.

РЕЛИШИ – НОВИ ПРОИЗВОДИ ОД ПОВРЋА

*Александра Н. Тетић, Бисерка Ј. Вујичић,
Александра С. Андрић и Снежана Д. Милатовић*

У свету влада велико интересовање потрошача за широку палету производа од поврћа као предјела, салата и додатака јелима. С обзиром на богатство сировина поврћа нашег географског порекла, а релативно узак асортиман производа, намеће се потреба да се прошири понуда домаћих пастеризованих производа од поврћа на тржишту. У раду су разрађене рецептуре за релише са различитим доминантним поврћем и комбинацијама зачина и додатака. Најбоље оцењеним рецептурама одређен је основни хемијски састав (сува материја, протеини, масти и уља, укупна киселост, укупни шећери, сахароза, скроб, целулоза, рН и енергетска вредност).

Received 6 June 2006
Accepted 28 July 2006