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## ANALYSIS OF THE QUALITY AND BIOCHEMICAL COMPOSITION OF FRESH AND FERMENTED CUCUMBERS

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**Abstract.** Fresh cucumbers of the Asterix variety contain a low content of valuable nutrients. Higher content of biologically active substances was characterized by more formed fruits of the group of greens on average by 30-40%. To prepare high-quality and biologically valuable fermented products, it is advisable to use fresh leaves and underdeveloped inflorescences of dill at the beginning of flowering and fully formed horseradish leaves, which increases the content of ascorbic acid, polyphenols and carotenoids in the finished product. The concentration of nitrates in the finished product is reduced by 3-4 times.

**Key words:** cucumbers, fermentation, biochemical composition, quality.

### Introduction.

Cucumber is the oldest and most common vegetable crop. World production of this vegetable reaches over 85 million tons. The leader in production and export (over 80%) is China, Ukraine ranks 7-8 and is promising [2, 6].

Currently, varieties of cucumber varieties for various purposes (fresh consumption, canning and fermentation) have been bred. Caloric content of fresh fruits, only 15 kcal/100 g of raw material, of which 0.8 kcal - proteins, 0.1 kcal - fats, 3.0 kcal - carbohydrates), while 95 % of fruits consist of water. Cucumbers contain fiber, sugar and a huge amount of vitamins such as C, B<sub>1</sub>, B<sub>2</sub>, P, provitamin A, minerals (magnesium, phosphorus, iron, calcium, potassium, iodine), as well as enzymes that help digest animal proteins, therefore, it is important when combining meat dishes to combine them with a salad containing cucumber. Biochemical



composition and biological value depends on growing conditions, technology and varietal characteristics [4, 5].

One of the promising areas of cucumber processing is fermentation. Preparation of fermented cucumbers is based on obtaining a natural preservative - lactic acid. Due to the osmotic pressure created by the salt solution, sugars, which are food for lactic acid bacteria, diffuse into the filling. During fermentation, a complex of various valuable compounds is formed, which have a positive effect on the stability of the product. The products obtained in this way have special organoleptic characteristics, and altered content of biologically active substances. There is very little data of this kind [5, 7].

The aim of our research was to identify the influence of fruit quality on the quality and biological value of fermented cucumbers.

### Research materials and methods.

The research was conducted at the department of technology of storage, processing and standardization of planting products named after B.V. Lesika, NULES of Ukraine. Fresh and fermented cucumbers and fillings were used to determine the content of: dry soluble substances (DSS), titrated acidity (TA), ascorbic acid (AC), polyphenols (PF), carotene (K), nitrates (N) and organoleptic parameters (8-point system). The experiment used Asterix cucumbers (pickles, gherkins of groups 1 and 2 and greens), and 1 recipe with common spices (horseradish, cherry, tarragon, currant, dill inflorescences, garlic) in same proportions. Raw materials are grown according to standard technology (SSTU 6016:2008) and complied with SSTU 3247:95, processed products – SSTU 8509:2015. The tests were performed according to generally accepted methods [3, 8].

### Results and their discussion.

The content of the main valuable components of the biochemical composition in fresh cucumbers was different and depended on the quality group (table 1).

#### 1. Components of the biochemical composition of cucumber fruit

Biochemical indicators, content	Group by quality (option)			
	Pikuli (1)	Gherkin 1 group (2)	Gherkin 2 group (3)	Zelentsy (4)
Dry matter,%	4.81±0.31	4.90±0.24	5.11±0.16	5.30±0.11
Amount of sugars,%	2.53±0.28	2.82±0.17	3.66±0.25	3.98±0.28
Ascorbic acid, mg/100g	4.21±0.29	4.92±0.31	6.08±0.45	7.02±0.52
Poliphenolic, m/100g	21.12±1.61	23.84±2.95	28.34±2.94	32.22±5.11
Carotenoids, m/100g	2.52±0.26	3.01±0.21	3.42±0.38	3.86±0.39
Nitrates, mg/kg	11.6±0.19	12.6±0.21	13.8±0.35	14.3±0.14

Quality gradation according to the current standard (SSTU 3247-95) fresh cucumbers are divided into quality groups for canned products (pickles, gherkins and greens). But such gradations were considered by us to be expedient for fermented products as well, which promotes quality improvement. The analysis of the obtained data revealed that the content of biologically active substances is higher in greens than in pickles, in particular dry matter by 9.4%, the amount of sugars - by 37.4, ascorbic acid - by 40, biologically active polyphenols - by 3%, carotenoids - by 35 and nitrates - by 21 % [7, 9]. This can be explained by the fact that important



biologically active substances are formed more intensively during seed formation. Cucumber fruits do not form high levels of biologically active substances, but due to their prevalence and presence in daily consumption, they are an important component of nutrition and providing the human body with available nutrients.

As a result of our work, we analyzed the content of ascorbic acid in spicy aromatic raw materials used for pickling and marinades in the forest-steppe zone and found quite different C – vitamin content of some studied objects (table 2). Thus, the content of ascorbic acid is highest in the leaves of horseradish – 394.0-627.0 and currants – 277-264 mg/100 g, 4.7%, and young horseradish leaves contain AA by 37.2 % compared to fully formed. Quite a high concentration of AA contains oak leaves, cherries (160-167 mg/100 g).

## 2. AA content in different types of spices

Culture	Plant organ	Maturity	AK content, mg/100g
Currant	Leaf	healthy, fresh	277.0±5.3
	Leaf	fresh with spot (disease)	264.0±5.1
Tarragon	Leaves with stems	Stem top part	38.0±2.4
	Leaves with stems	Stem middle part	32.0±1.9
Dill	Inflorescence	at the beginning of flowering	124.0±3.7
	Inflorescence	at the beginning of seed formation	112.0±2.5
	Inflorescence	with almost formed seeds	79.0±1.5
	Leaf	fresh	123.0±2.9
	Stem top part	fresh	75.0±1.4
Horseradish	Stem middle part	fresh	40.0±1.1
	Leaf	young (light green, tender)	394.0±8.9
	Leaf	old (dark green, thick)	627.0±9.9
Cherry	Leaf	fresh	160.0±6.5
Oak	Leaf	fresh	167.0±7.9
Garlic	Leaf	fresh	13.2±1.1
	Clove	fresh	11.2±0.9

During the maturation of dill inflorescences there are significant changes in the concentration of AA. It was found that the highest concentration of AA contains dill umbrellas at the beginning of flowering (up to 124.0 mg/100g). Fresh leaves and inflorescences of dill (at the beginning of flowering) contain almost the same amount of AA, and the stem (lower part) 3 times, the upper – almost 2 times lower concentration of ascorbic acid compared to leaves and inflorescences. In the stems of the upper part of tarragon, the content of AA is higher than in the lower part, and in comparison with the inflorescences and leaves of dill 4 times less.

The content of AA in the teeth of fresh garlic is insignificant up to 13.2 mg/100 g, and therefore its presence in the recipe has a greater effect on taste than on the AA of the product. In general, fermented cucumbers of all variants had harmonious taste properties, were fragrant, good in appearance and most importantly with a crispy texture. During fermentation, the chemical composition of cucumbers and fillings changes (table 3). Lactic acid accumulates in all variants, so the acidity has increased and is in the range of 1.07-1.29 %.



### 3. Biochemical parameters of fermented cucumbers

Option of experiment	Kind of product	Content TA, %	Content AA, mg/100g	Content PS, mg/100g	Content carotenoids, мг/100г	Content nitrate, mg/kg	Organoleptic value, point
1	cucumbers	1,23-1,29	12,80	41,41	4,12	3,21	7,6
	brine	1,23-1,29	11,56	39,23	3,94	2,56	-
2	cucumbers	1,07-1,12	12,20	43,2	4,48	5,11	7,7
	brine	1,07-1,12	12,10	40,22	4,13	4,86	-
3	cucumbers	1,03-1,08	12,90	43,45	4,67	4,92	7,9
	brine	1,03-1,08	12,30	41,57	4,28	4,12	-
4	cucumbers	1,10-1,17	14,92	45,82	5,05	6,23	7,8
	brine	1,10-1,17	14,42	43,42	4,34	5,11	-

The concentration of AA, PS and carotenoids in ready-fermented cucumbers is higher than in fresh fruit, this is due to the extraction of these compounds from the leaves of horseradish, oak and other components. The data obtained indicate that fermented products using common traditional spices have increased biological value. The content of nitrates characterizes the safety of raw materials.

During fermentation, the content of these substances is reduced by 3-4 times, so it can be argued that the product is completely safe.

#### Conclusions and suggestions.

Fresh fruits of Asterix cucumber contain a number of biologically active nutrients in small quantities. It was found that the higher content of biologically active substances was characterized by more formed fruits of the group of greens by an average of 30-40%. To prepare high-quality and biologically valuable fermented products, it is advisable to use fresh leaves and underdeveloped inflorescences of dill at the beginning of flowering and fully formed horseradish leaves, which increases the content of AA, PS and carotenoids in the finished product. The concentration of nitrates in the finished product is reduced by 3-4 times. The obtained results should be used in the production of various fermented vegetable products of high quality and biological value.

#### Bibliography:

1. Бараненко В.В. Супероксиддисмутаза в клетках растений. Цитология. 2006. 48.6: 465-474.
2. Логоша Р.В. Світовий ринок овочів та місце на ньому України. Серія: Економічні науки. 2012. 3: 164–169.
3. Методика дослідної справи в овочівництві і баштанництві / [За ред. Г. Л Бондаренка, К. І. Яковенка]. Х. : Основа, 2001: 369.
4. Подпратов Г.І., Скалецька Л.Ф., Войцехівський В.І. Товарознавство продукції рослинництва. К.: Арістей. 2005: 256.
5. Подпратов Г.І., Войцехівський В.І., Кіліан М., Сметанська І.М. та ін. Технології зберігання, переробки та стандартизація сільськогосподарської продукції. К.: ЦІТ Компрінт, 2017: 658.
6. Хареба В.В., Хареба О.В., Фурман В.А. Стан і проблеми розвитку галузі овочівництва. Наук. вісн. НУБіП України. Сер. Агрономія. 2013. 183: 9-14.



7. Amiot M.J., Fleuriet A., Cheynier V., Nicolas J. Phenolic compounds and oxidative mechanisms in fruit and vegetables. *Phytochemistry of fruit and vegetables. Proceedings of the phytochemical society of Europe*. New York, NY: Oxford University Press, 1997. 41: P. 51-85.

8. France J., Thornley J.H.M. *Mathematical models in agriculture*. London: Butterworths, 1984: 335.

9. Tomas-Barberan F.A., Espin J.C. Phenolic compounds and related enzymes as determinants of quality in fruits and vegetables. *J. Sci. Food Agric.* 2001. 81. 9: 853-876.

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